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A Growing Town: Developing a Local Food System in Orono, Maine

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A GROWING TOWN: DEVELOPING A LOCAL FOOD SYSTEM IN ORONO, MAINE

by

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ABSTRACT

Local food systems are different from industrial agriculture systems in their social interaction, economic size and stability, political support and assistance, and environmental impacts. Industrial agriculture has flourished, while the ability of widespread local food systems to survive for the long term has yet to be determined. Research of local food systems reveals that dedicated and involved communities, motivated and knowledgeable managers, and political and financial support are the most essential determinants of successful systems. This research explores three existing local food system models and examines the extent to which Orono, Maine could support these models. A suitability analysis of Orono was used to identify possible locations that could contribute to a new agricultural infrastructure. Prospective locations were identified that would be useful in the infrastructure of a local food system, and possible distribution locations were identified through GIS analysis. It is important for any local food system to properly plan and map out the system, since the connection between the community and local food systems is so strong.

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I. INTRODUCTION

A. Definition

The uniqueness of local food systems is determined by many factors, but in broad terms a local food system can be defined as, "a commitment to an economically, environmentally and socially sustainable system of agriculture and food production that is reliant on local resources and serves local markets and consumers" (Bean & Sharp, 2010). Another definition of a local food system is, "collaborative effort to build more locally based, self-reliant food economies—an effort in which sustainable food production, processing, distribution and consumption are integrated to enhance the economic, environmental and social health of a particular place" (Feenstra, 2001). Some identifiers that are believed to make local food systems unique are: "1. they redistribute value through the network in the opposite direction of the bulk commodity system; 2. they re-instill trust between the producer and the consumer; and 3. they articulate new forms of political association and market governance" (Follett, 2008). In considering these definitions it is clear that local food systems are not just a collection of small, profit-driven farms, but involve the community in both economic and social aspects (Morgan et al, 2006). Even though these definitions are effective in guiding the discussion about local food systems, there is no universal definition of such systems.

The locations, people, and events that are common between producers and consumers in local food systems contribute to a social interaction that is not felt in our

current food system where the two groups can be separated by thousands of miles and many levels of processing (Hinrich, 2000). Direct agricultural markets provide the foundation for increased community participation and create a unique sense of belonging for all involved (Lee, 2011). Due to the numerous and diverse factors that must be included, the definition of a local food system is far from agreed upon. Each word in the phrase can be used as kindling for debate, and together they create an inferno of visions. To start simply, the idea of "local," the options for "food," and the interactions that have been identified as different "systems" will be discussed.

B. Local

There are many ways to frame the idea of "local." For some of its loan programs, the United States Department of Agriculture (USDA) defines as local anything within a 400 mile (644 km) radius (Martinez et al, 2010). Alternatively, with the acceptance of the word "locavore," the *New Oxford American Dictionary* limits the range of someone who only eats locally to 100 miles (Oxford University Press, 2010). This 100 mile distance was supported in a consumer survey by The Hartman Group (2008). Empirical research also supports a definition of 100 miles (Durham et al, 2009). Some definitions of the term "local" can be derived from boundaries, whether urban, country, or state (Duram & Oberholtzer, 2010). Another popular, more subjective definition of "local food" may be determined by what is described as a foodshed, or "the area defined by a structure of supply" (Thompson et al, 2008). The boundary of this area is drawn around the agricultural sources that provide all the food products required. The limits of this definition go as far as the farthest producer that supplies the community.

Research has been conducted on the difficulty of defining "local." One such study determined that the differences between large geographical regions as well as varying consumer opinion were two main causes of difficulty (Durham et al, 2009). The results of a survey question posed in three regions of the country, demonstrated that consumers defined "local" vegetables as those grown within a 60 mile radius. In each of these three regions, 60% of the respondents believed that 60 miles was the limit for considering a vegetable local (Durham et al, 2009). These studies suggest that households consider geographical, physical, psychological, and cultural factors in defining local; moreover, no matter how people define its origin, food can be made up of many things (Blake et al, 2008; Durham et al, 2009).

C. Food

Food is such a simple word, but when it comes to food systems there are many different factors influencing their food content. What types of food do people want? What food do people need? What can people afford? And what food can the local climate produce? All these questions must be asked when establishing a local food system (Bean & Sharp, 2010). The food included or excluded from a traditional system is based on what can be obtained and what is in demand. In a local food system, food is included or excluded because of consumer demands but more importantly by the products that can be grown in the local climate (Li & Li, 2011).

What do people want for food? The answer to this question is situation specific, and each demand guides how a local food system will be constructed (Bean & Sharp, 2010). In short, people want to be satisfied nutritionally while experiencing good flavors

and textures (Rose et al, 2008). What food do people need? Nutrition is something that should be prioritized in the community, and supplying staple goods allows people to maintain their health, feel secure that their basic needs are being met, and focus on other aspects of their lives (Lee, 2011). Staple goods can and are being supplied by our current food systems, but there are cases in which communities are being abandoned because of low market sales (Fulton & Giannakas, 2001). Specialty products are also in demand alongside staples and are more often entrenched in a certain location to which they are restricted because of climate or economic reasons (Dixon, 1999). Depending on the climate they are grown in, both staple and specialty goods may be difficult to produce (Li & Li, 2011; Rose et al, 2008).

Some characteristics of the food being grown depend more on its production than on its consumption. It would be nice to say that healthy food could be supplied free or at a minimal price but neither producers nor consumers have that luxury. A common generalization is that local food systems have marginally higher priced products, and recently, local food systems have become associated with the popularity of organic products (Hinrichs, 2000; Tropp, 2008). While local food systems are not defined by organic products, the two have become synonymous. Many consumers have also come to expect organic products from local food systems, sometimes driving prices up and participation down in certain settings (Selfa & Qazi, 2005). While the wide variety of organic products is currently a unique factor of local food systems, grocers are again catching up and attempting to offer more organic products (Martinez et al, 2010). People are physically connected to food, and ultimately to the system that supplies them (Dixon, 1999; Lyson, 2004).

D. System

The system is the backbone of a local food system and can determine its success or failure. A food system can generally be defined as the interaction of "production, distribution, processing, consumption, and waste" activities (Unger & Wooten, 2006). While there are differences between types of local food systems, there are some generalizations that can be made. Local food systems contain the unique feature of direct to consumer marketing and sales, and many local food systems are based around smaller operations than regional food retailers or conglomerates (Freedman & Bess, 2011; Lyson, 2004; Varner & Otto, 2008). Also, when organizing a local food system, participants usually have more say in the actions of a system than they have with a standard grocery supplier (Thompson et al, 2008). For example, they are influential in deciding when a farmer's market will meet, or suggesting what crops should be supplied through community supported agriculture (CSA) or food cooperatives (co-ops) (Fulton & Giannakas, 2001).

Many times local food systems and other alternative systems are developed to fill specialty needs in a community that cannot be met by regular grocers (Schmit & Gomez, 2010; Varner & Otto, 2008). However, many recent iterations of local food systems in urban settings are in response to food deserts, situations in which supermarkets and grocers leave an area because of low demand or poor management factors (Voigt, 2011; Setala et al, 2011; Sibley, 1999; USDA, 2009). In this case, alternative systems such as CSA and co-ops provide a great service by supplying people with a means of survival and returning to them the control of their food supply (Smith & Miller, 2011). In this

situation, true market settings such as farmers' markets still limit who can afford the products (Voigt, 2011).

Generally, local food systems establish the shortest chain of people involved from production to consumption, allowing the connection between producer and consumer to be as free and natural as possible (Schmit & Gomez, 2010). The flow of farm products through local farm systems differs from industrial systems (Figure 1). Specifically local food systems eliminate many of the intermediate steps, and often the costs, miles traveled, and energy consumed are reduced (Bean & Sharp, 2010). Many people believe that the direct transfer of goods from producer to consumer is healthier, more environmentally friendly, and more sustainable (Bean & Sharp, 2010; Durham et al, 2009).

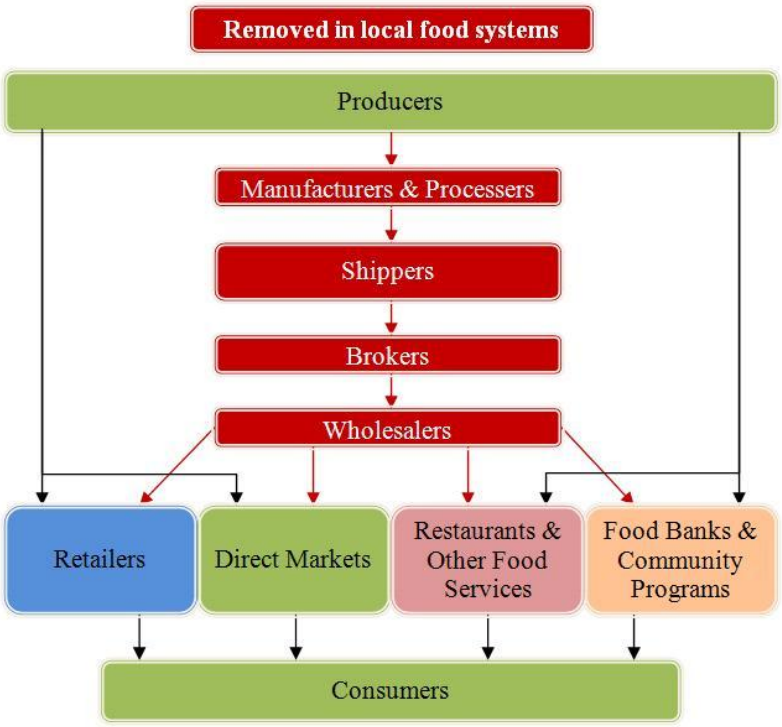

Figure 1: This figure displays the aspects of a traditional agriculture system that are removed in a local system.

However, without efficient management it can be difficult for local food systems to market themselves effectively enough to compete with the prices of goods in grocery stores (Stephenson et al, 2008).

From the review of these three words, it should be obvious that there is great variety among local food systems, but there are underlying traits that allow us to define this cultural method of obtaining food. Whatever process is applied and whatever the outcome, one factor that remains constant is that these systems are developed, implemented, and supported by communities of interactive people, not by integrated corporations (Lyson, 2004). There are benefits outside of the profit margin, but there are also unique challenges in local food systems that change how production, marketing, and distribution techniques are applied (Selfa & Qazi, 2005). In addressing these challenges, local food systems may provide new vigor to the agricultural industry.

II. HISTORY OF LOCAL FOOD SYSTEMS

Although they are a recently expanding market, local food systems are not a novel idea. Long periods of history have been dominated by the self-sustaining production of crops and community trade for specialty goods or services (Hurt, 2002). Two factors of production that have fluctuated through the centuries are the organization of production and the value level of the goods being produced (Thirsk, 1997). Crops choices have changed as individual and cultural palates have wavered, but market and political motivations have been the most influential reasons for shifts in production in the history of food systems (Albrecht & Murdock, 1990).

Interestingly, agricultural research points to a cycle of production and management that could be repeating itself (Hurt, 2002; Thirsk, 1997). One particular analysis of agricultural history states that, beginning in the 13th century, agriculture periodically drifted from the production of staple crops to the production of specialty foods. When the markets for these specialties dried up agricultural production returned to staple crops (Thirsk, 1997). Throughout history these spikes in specialty products have been stimulated by the wealthy while the lower class peasants were forced to modify their livelihoods to meet demands and to survive (Mazoyer & Roudart, 2006).

Along with these changes in demands came changes in cycles of production. Community farming was a way of life for peasants and serfs in the 12th and 13th centuries. They served their lord and provided for him. Following the large loss of life due to the Black Death, lords were forced to divide land and give it away because the cost of accruing the remaining laborers was too great (Thirsk, 1997). Historically these laborers would join together and farm communally in what today could loosely be considered a CSA (Mazoyer & Roudart, 2006). This communistic farming did not consist of one farmer who was paid by the community; rather, it was a collective effort by all to farm the land and trade goods around the community (Mazoyer & Roudart, 2006). With the recovery of monarchies and large government's, farmers producing for trade were also subject to the demands of the Crown, and could be called on at any time to supply the sovereign with goods (Mazoyer & Roudart, 2006; Thirsk, 1997).

The cycle of consolidation and division has continued up to this century, but now the unique factor that must be accounted for is the power of private entities. Unlike the 14th and 17th centuries, in which the consolidation of farmland was undertaken by

individuals or governments, the 20th century saw the rise of private corporations with the financial resources to integrate vertically and horizontally as never before (Gardner, 2002; Hurt, 2002). This integration was a direct effect of the drive for profits and allowed companies to cut costs within their chain of supply, transportation, processing, and sales (Kohls & Schneidau, 1962; Lyson, 2004). Integration has been effective in lowering costs for both consumers and some producers while driving some independent farmers to find other outlets or other means of making a living (Kohls & Schneidau,1962).

When it comes to transport, the 20th century was also a time of incredible change. More distinctly, markets have forever been limited to the travel range of the producers and their ability to keep their products fresh (Hurt, 2002). During the late 19th and very early 20th centuries, the goods that were available at a decent price were those supplied locally, and producer/consumer interaction was romantically based in "the fruit of familiarity, habit and sentiment, seasoned by the perception of value on both sides" (Hinrichs, 2000). Traditionally, products grown and raised by the people of the community were all that were available, and the community contained small supporting industries such as textiles (Lobao, 1990; Thirsk, 1997). Refrigeration, mass production, and fast shipping industries allowed for market regions to expand and the production of foods to be centralized where they grew best (Mazoyer & Roudart, 2006). As the United States adopted this centralization and shipping model, the small production farmer found that he was out-produced and underpriced and could no longer compete. Because of new transportation efficiency, products could be identified and marketed by their region of origin. Americans bought these goods because they were available consistently year round, and in some cases the products appeared superior. Superstores and customers

began to replace local goods with those that could be traced back to these identifiable locations, such as Florida Oranges, or Idaho Potatoes (Hurt, 2002; Thompson et al, 2008).

With the widespread acceptance of farming as a heavy industry no different than manufacturing, and the increase of mechanical and chemical assistance, production exceeded demand (Mazoyer & Roudart, 2006). In all parts of the country farmers were forced to take out larger loans to cover the costs of new equipment and fertilizers as their profits dwindled away (Albrecht & Murdock, 1990; Hallberg, 2001). Many farmers were forced to sell their land when the loans became too much, and most of the time there was a willing buyer (Hurt, 2002). Over the course of the 20th century, corporations continued to buy up land or hire farmers under contract (Gardner, 2002). The development of corporate farms has been referred to as the emergence of "factories in the field" (Hurt, 2002). But, industrial farming's qualities of modern technology and specialization made affordable plentiful food possible while lowering the amount of land used for production (Feenstra, 2002; Gardner, 2002). Once companies had plentiful cheap supplies of raw goods, they began to process and market foods. These "Agribusinesses" had the wealth to integrate both vertically and horizontally in all aspects from production through sales to consumers, which allowed the introduction of cheap processed foods (Gardner, 2002; Hallberg, 2001; Hurt, 2002; Lobao, 1990). The combination of these factors increased pressures on small and moderate farms, and their numbers continued to decrease (Gardner, 2002; Hallberg, 2001). Corporations wielding this powerful integrated structure today are able to prevent prospective farmers from purchasing land by forcing the competitive purchase price higher (Lyson, 1994).

When looking at the modernization of agriculture across the United States, New England communities in particular, with their dense population and scattered small farms, have been able to support some local farmers through the course of agricultural consolidation and industrialization (Hurt, 2002). In a recent study on the location of farmers markets and CSAs, the highest concentrations of these systems were found in the Northeast (Martinez et al, 2010). It has been established that large farms thrive when they are far from urban centers because of decreased alternative land use pressures. The lower cost of the land is enough to cover the increased cost of transport to distribution locations. Alternatively, small farms do best on the fringe of urban environments where they are appreciated for the service they provide and can sustain themselves in a more expensive market (Selfa & Qazi, 2005). New England has been described as the "vanguard of relocalization efforts" and seems primed to lead the way for the local food system initiatives regardless of their defining goals (Lyson, 2004). Whatever the location, history has shaped the culture of the food system and will continue to do so (Selfa & Qazi, 2005).

By defining the analytical pieces of local food systems and reviewing how we have arrived at the current agricultural position, we are better able to understand how local food systems may change the agricultural landscape. Local food systems are unique and built around the community in which they are based. Because of this, individuals have a unique influence on how local food systems are structured and what they provide. There is not a uniform definition of local food systems and what they include, but an analysis of current local systems can provide clarification as to their common traits.

III. MARKET DYNAMICS

With the proliferation of technologically driven agriculture, it is becoming increasingly difficult to produce in a way that is not consistent with market pressures. As local food systems continue to try to establish themselves they face unique market and political pressures. The widespread acceptance and availability of current agricultural products means that the smaller initiatives must develop techniques for attracting patrons (Bean & Sharp, 2010; Feenstra, 2002). Currently local food is a niche market for many people and regions, but just as organic has adapted to and been adopted into the mainstream market, local food is beginning to do the same (Alroe & Noe, 2008). Because local food has been associated with certain characteristics, local food systems have to uphold the expectations of the market that they serve (Lyson, 2004). In order to expand local food system participation and production, people must be drawn away from the current effective agricultural practices (Alroe & Noe, 2008).

The amount of national finances that are dedicated to the support of technological agricultural practices makes it difficult for local food systems to gain support. While there are some funds being allocated for the development of local food systems, the amount is miniscule in comparison (Alroe & Noe, 2008; USDA, 2009). The fact that smaller systems with direct marketing do not contribute as much to the national economy may be a factor for reduced funding (Dixon, 1999; Follett, 2008; Hallberg, 2001). Because of the financial influence of the agricultural industry, there is vast political power in support of the current agricultural structure (Alroe & Noe, 2008). This is not to say that there are people fighting the development of local food systems, but they may

not be as supported as they would have been at the beginning of the 20th century for example (Lyson, 2004).

If local food systems begin to attract a large number of people, it will be interesting to see how larger agricultural corporations react. Will they try to incorporate local food as they have done with organic? Or will they try to discredit the practice of local food systems and gain back consumers through some market strategy? Whatever tactic they take to continue to make profits, local agricultural faces an uphill battle in its attempt to become a staple on the American landscape (Lyson, 2004).

IV. LOCAL FOOD INITIATIVES

Looking at other local food systems can be helpful when trying to define what a local food system is, what the essential pieces are, and how a local food system would be structured in Orono. Many different initiative s from around the country have been analyzed in research, and some examples are presented below. Along with this variety, it may be helpful to review systems currently in the state of Maine that may be similar to what could be developed in Orono.

A. NATIONALLY

On a national scale there are many different projects that are fulfilling a variety of demands. Farmers' markets are springing up all over the country as people are looking for healthier alternatives to traditional agriculture (Martinez et al, 2010). A few cities that are epicenters for established farmers markets are: Philadelphia, San Francisco, New York, Los Angeles, Minneapolis, Chicago, and Boston (Agricultural Marketing Service,

2012; Hoffman, 2011; Kremer & DeLiberty, 2011; Martinez et al, 2010; Nordahl, 2009; Sibley, 1999; Thomas, 2009; Unger & Wooten, 2006). However, not all local food systems are centered in cities. Some states that have a high number of alternative food systems when compared to the rest of the country are: Massachusetts, Vermont, New York, Washington, Illinois, California, Pennsylvania, Michigan, Maryland and Iowa. (Agricultural Marketing Service, 2012; Hoffman, 2011; Kremer &DeLiberty, 2011; Martinez et al, 2010; Nordahl, 2009; Sibley, 1999; Thomas, 2009).

One of the largest and most well known local food systems in the country is the Farm Fresh to You CSA in Capay Valley California, with over 13000 members. It is a privately run farm that is owned by one family, with an intensive network of distribution locations and methods. By accommodating the consumer they are able to maintain a large farm and a large demand, and provide fresh high quality goods to a vast number of people. By providing products that comes from within a 10 mile radius, the customer knows that they are purchasing goods and a service that supports a person and not a national corporation. Farm Fresh to You is also supported by the fact that they are situated in a very fertile and friendly climate to farming (Barsotti, 2011).

B. MAINE

The state of Maine has many groups that have developed or are participating in local food systems. Local food systems have been developed across the state, but the majority of them are located in the south central portion of the state and along the coast (Agricultural Marketing Service, 2012). In total, Maine has 84 farmers markets recognized by the USDA, and a number of other food systems (Agricultural Marketing

Service, 2012; Eat Local Food Coalition of Maine, 2012). Some specifically successful markets are the Portland Farmers Market, the Lewiston Farmers Market, the Crown of Maine Organic Cooperative, and the Rising Tide Co-op (Eat Local Food Coalition of Maine, 2012). There are numerous other supply systems and networks, but describing all of them would be near impossible.

One particularly historical and successful farmers market is the Portland Farmers Market. The Portland Farmers market has been around for 244 years, and has always been a landmark of the local community. With 42 vendors there is ample supply of vegetables, dairy and meat products, flowers, grains, and other goods. The market is held on Wednesday and Saturdays throughout the year, and a token program has recently been implemented to allow for debit and credit card purchases as well as the acceptance of snap stamps. Travel and Leisure Magazine recently ranked the Portland Farmers Market as the 9th best farmers market in the country based on consumer reviews (Gold, 2010). The vendors of the Portland Farmers Market, and those that participate feel that the market is important because it supports the local economy, reduces the consumption of fossil fuels, and because the "terroir", or the local flavor and feel of the food, is presented more fully with locally grown products (Girard, 2011).

Another local food system that has been successful is the Crown of Maine Organic Cooperative (COMOC). This cooperative is also based around organic products, but is mostly known for its incredible network of local growers that supply a number of initiatives throughout the state of Maine, and even down to Boston, Massachusetts. With over 100 participating farms, there is almost no limit to the number of products that COMOC can supply. Although this system is not as local as one community, the regional

network that it has established is certainly within the bounds of the local definition. By maintaining a incredible network of suppliers, COMOC has managed to continually collaborate with distribution markets where no products may be directly available. The goal of COMOC is to establish a state economy that breaths life back into the farming and fishing heritage of Maine. The idea that co-ops are limited to the number of contributing members is rejected by COMOC, and the continued integration of new farms and co-ops as producers and consumers. While COMOC may be a middle man in the series of steps between local producers and consumers, they are serving the region as the limited transport that is sometimes necessary to bring fresh local goods home.

CHAPTER 2: NECESSARY PIECES OF A LOCAL FOOD SYSTEM

Local food systems are made up of pieces that fit together to define the system as local and make it successful. By researching these individual aspects, those that are essential to the success of a local food system can be identified. By building models around these essential aspects, planners and developers provide the local food system with the best tools to thrive. Some of the most popular models in the resurgence of local food are: farmer's markets, CSA, and food cooperatives (Lyson, 2004). These models have proven to be effective and have been studied extensively (Hinrichs, 2000; Lee, 2011; Lyson, 2004; Varner & Otto, 2008). When determining the different aspects that make up a generalized local food system, these three systems were used as a starting point and were investigated further to find the most basic overlapping characteristics (Figure 2). When looking at the research that has been done on local food systems, some studies have analyzed farmer's markets in an attempt to establish the management practices that are most successful for local food systems. Others have asked producers and consumers to define what works well in the systems (Schmit & Gomez, 2010; Stephenson et al, 2008; Thilmany et al, 2008). The results of these studies will be explored later.

In the Town of Orono, Maine, local food systems have been discussed and two are currently being operated. The research in this thesis is intended to provide a more detailed definition of local food systems and apply these important characteristics to the Town of Orono in order to expand the discussion of local food systems to include possible new models that could better serve the community. Specifically, research was conducted by performing keyword searches in online databases along with identifying

books at Fogler Library. From these references, associated sources that presented useful information were identified. Differing opinions were searched out for many of the topics, in an attempt to eliminate bias. When determining different types of local food systems, the three examples of farmers' markets, CSA's and co-op were the most common and were repeatedly discussed in the research found. Most of the studies done on local food system dynamics were performed on one of these three models, and questions to consumers about local food were many times connected to one of these models. Therefore, it was determined that it would be most efficient to focus on these three models and carry them throughout my thesis. While there are unique expressions of local food systems, the most successful ones have adopted a model similar to one of these three and the pieces that they contain.

As I am an Ecology and Environmental Science major with a concentration in Land Use Planning, I have focused my research focuses on the infrastructure that is important to local food systems. While all of the aspects that are essential to local food systems are identified here, the focus for the Town of Orono is on whether or not the town can support the infrastructure demands of an expanded local food system.

I. ASPECTS OF LOCAL FOOD SYSTEMS

As local food systems have evolved over time, some consistent features seem to influence system success or failure. No matter the system's organizational structure, the consensus from the research is that communities need producers, management, consumers, funding and political support, and infrastructure in order to support a local food system (Lyson, 2004). While these traits cannot be overlaid identically from one

local food system to another, successful systems will contain corresponding traits (Varner & Otto, 2008). Almost all local food systems operate with basic economic principles that are important to any business endeavor, and the following aspects must interact effectively for the system to be economically sustainable.

	Community Supported Agriculture (CSA)	Farmer's Markets	Cooperative Initiatives
Producer	-A single up to a few producers who contribute	-Independent producers	-Independent producers
Consumer	-Those who buy shares in the CSA	-Any individual who is able to attend the Farmer's Market	-Whoever contributes to the Co-op
Management	-Community leader who collects share payments OR Farmer who managers distribution	-Designated managers or a Managerial Committee	-Managed by a consensus of the participants
Infrastructure	-Private or public farms that contribute	-Privately owned farms -Farmer's Market location owned by the market itself or the community	-Private or public contributing farms -Some designated community space
Funding	-Sales from CSA shares	-Funded of market by sale of booths -Producers funded by consumers	-Whoever contributes to the Co-op
Political Support	-Land for agriculture -Community support	-Laws that allow for public sale of fresh products and assembly at market location	-Land for agriculture -Community support

Figure 2: This figure displays the most common and effective local food system structures.

A. Producers

Producers play a key role in local food systems. The only feature common to all local food system producers is the fact that none of them are large corporations, with integrated systems of production, processing, and supply (Gardner, 2002). This does not mean that local food systems are the only outlets for independent producers. On the contrary, farmers' markets are usually secondary income for larger producers (Varner & Otto, 2008). However, if a producer is growing specialty goods for a community or is a small producer there may be little demand for the food outside of a farmers' market or CSA (Cox et al. 2008; Kremer & DeLiberty, 2011; Selfa & Qazi, 2004). In this other popular local food system (CSA), farmers supply produce to those who pay in advance for a share of the harvest. While most people do not rely solely on the CSA for their food, they do expect a certain level of quality and hopefully an equal level of quantity during the season. Producers growing unique commodities are usually not in competition with national suppliers, but those offering staple goods must attach some value to their products that elevates them above those of chains and national markets (Blake et al, 2010; Hallberg, 2001).

In a co-op producers are working directly with each other to meet the needs of the co-op (Huang, 2011). The challenge in a co-op is that the producer has little say in the management of the co-op unless they are a member (Martinez et al, 2010). This type of local food system is more in line with a typical grocery setting but is only open to members whether they pay the full fee or receive a discount by working at the store (Martinez et al, 2010). Recently as alternative small markets have become popular,

grocery chains have realized the value of supplying unique local products in order to compete in this niche market. (USDA, 2009).

Whether a producer is supplying a local food system to obtain supplemental income, or as his or her primary source of income, there are many factors that affect how much money is made (Varner & Otto, 2008). In the 1960's farm income was above the average income of U.S. households, and by 1998 farms on average only made 75% of the national average income (Hallberg, 2001). Why did this happen? It has been suggested that mass production, monocultures, and government involvement led to the income decline; and that by reverting to direct sales some of this profit deficit from agricultural sales could be made up (Gardner, 2002). When supplying a local food system, some factors that determine profits are: the city or town's population, the number of vendors, the per capita income of the community, and the distance to the closest market (Varner, 2008). The belief that turning to direct sales will be a quick fix to negative profit margins is farfetched in consideration of the number of inputs affecting sales and revenues. Though, in local food systems, demand generally dictates supply (Cox et al, 2008). Because of the small market setting and the lack of options for some producers, there may not be enough financial benefit for farmers to participate.

B. Management

The presence of a strong manager to administer the local food system, market it the public, and keep it organized is important to the system's success. Depending on the specific structure of the system, whether it is a farmers'market, CSA, specialized agricultural district, or consumer co-op, it has to be organized effectively (Lyson, 2004).

Research on farmer's markets has established that full time managers are much more effective than volunteer managers, and that farmers are much more comfortable participating in a market with an experienced manager (Stephenson et al, 2008). A full time manager is able to keep track of vendors participating in the market, schedule events and meetings, and track how other markets are doing and the techniques they are implementing (Stephenson et al, 2008; Varner & Otto, 2008). In this same study it was determined that there may be a limit to the number of vendors that volunteer managers can handle; however, the effects of an increase in the number of vendors were not investigated (Stephenson et al, 2008). Manager turnover was determined to be a possible factor, but specific reasons for turnover are difficult to determine. Whatever the reason, the removal of the manager causes strain on the entire system, degrading the trust of the vendors and consumers who frequent the market (Stephenson et al, 2008).

The organization of producers in co-ops may be somewhat similar but the managerial structure is very different. Whoever pays the co-op membership fee has a say in what products are supplied and are essentially the managers (Martinez et al, 2010). There are designated managers who decide which producers will supply the co-op, and manage the collection of fees and how the store is run (Fulton & Giannakas, 2001). While the consumers do not shoulder the farmers workload, they have an increased influence in how the system in managed (Martinez et al, 2010).

Many times the manager for a CSA will be the farmer growing the produce, or one individual who is in charge of collecting fees and distributing the food during the season (Hinrichs, 2000). This organizational structure has been identified as the most divergent from the commodity producer/consumer market because it transfers the value

from a specific piece of product that is being bought and places direct value on the hours that the farmer has contributed and the yield of many products over a season (Follett, 2008; Hinrichs, 2000). By supporting the actions of the farmer directly, the members of the community who support the CSA take on some of the producer's risk, eliminating the sharp economic distinction between the two parties (Cox et al, 2008; Hinrichs, 2000; Martinez et al, 2010).

C. Consumers

A third aspect of a local food system is the involvement of a stable and contributing consumer base. There are a few factors that have contributed to increased consumer interest in local food systems. First, environmental concerns resulting from an integrated and profit driven agricultural industry have led to the desire for a more sustainable system of production (Bean & Sharp, 2010; Freedman, 2011). In addition to calling for this more sustainable system, consumers are changing their opinion about what qualities a product must have to be desirable. Qualities such as organically grown and freshness are replacing the qualities of perfection and availability (Bean & Sharp, 2010; Lyson, 2004; Selfa & Qazi, 2004). Third, an appreciation for food security and trust in the producer has increased the desire for a closer relationship with the producer (Blake et al, 2010).

Whoever the consumers are, they need to have a demand for what is produced. Staple products are in demand everywhere, but the ability of individuals to buy them and the standards they have vary between locations. In some urban environments, vacant lots have been converted in order to supply staples to the community at cheap prices (Lee,

2011; Thomas, 2009). Consequently people come together and get involved, promoting other positive effects throughout the community (Bean & Sharp, 2010; Feenstra, 2002; Lee, 2011). Consumers who demand specialty goods are usually in wealthier communities where individuals have more money to spend and are looking for items that are difficult to grow or unique (Blake et al, 2010; Selfa & Qazi, 2005).

Interestingly, staples and specialties are both in highest demand in the same locations (Smith & Miller, 2011). The diversity that exists between urban environments has not been explored fully, but research has determined that both staples and specialty goods are in the highest demand in urban settings (Bean & Sharp, 2010; Selfa & Qazi, 2004). While farmers are able to market staples to consumers in rural settings those consumers are not as willing to pay higher prices for organic foods, and most often have little demand for specialty products (Cox et al, 2008; Selfa & Qazi, 2004). Some urban environments are larger consumers of organic and specialty products because they are able to absorb the higher prices (Selfa & Qazi, 2004).

In a consumer survey by Bean & Sharp (2010), respondents' perceived the importance of labeling the organic or local qualities of goods. Participants were categorized based on what labeling they deemed was important. Respondents who replied that the labeling of both characteristics was mutually important were characterized as "super inclined," while those that considered neither one important were described as "disinclined" (Bean & Sharp, 2010). It is interesting that the number of participants who believed that it was important to label food both "local" and "organic" (19%) were more than three times higher than those who called only for organic labels (6%) and almost as high as those who were strongly supportive of local labels only (20%). While the largest

number of people (36%) were only moderately inclined to have organic and local food labeled, they could possibly be connecting these labels with higher prices (Varner & Otto, 2008). If this connection with higher prices were to be removed they might be more supportive (Martinez et al, 2010).

In a study of the health benefits of eating locally, participating consumers were asked to limit their diet to locally available food for four weeks (Rose et al, 2008). There were many foods that were unavailable to the participants, resulting in conflicting health benefit results. By restricting their diet, participants consumed more fruits and vegetables but also had a higher fat intake as unavailable low fat oils were replaced by butter and lard (Rose et al, 2008). Changes in health were not monitored, but the limited availability of some products may make consumers reluctant to switch to a completely local diet. Rose et al (2008) consisted of a limited sample size that was aware of local food systems, suggesting that people who knew less about local food systems would be even less inclined to participate. This finding reinforces the idea that markets and alternative food networks need to be visible to the community (Martinez et al, 2010).

In a study on food co-ops, a survey was conducted to determine the reasons for participating in the co-op (Goldman & Clancy, 1991). The main reason for joining and purchasing from the co-op was food safety. The respondents to this survey were very motivated to pay more for organic products, and income did not factor into the purchase of organic products (Goldman & Clancy, 1991). In another study on factors of participation, nutrition information and education were two functions driving membership (Ehlers & Fox, 1982). While all people participating in local food systems

have their personal reasons for participation, the members of the co-op system seem to be the most similar to each other in other aspects of their lives (Ehlers & Fox, 1982).

Some other factors that were found to influence participation in local food systems were higher education, awareness of alternative systems, inconvenience of transportation to local food system distribution locations, or the limited distribution of products (Martinez et al, 2010). Without consumers there is no demand and inventories build up. There are many reasons why people purchase goods, and they are affected by changes in the characteristics of these goods. In a local food system consumers are such an integral part that any changes in support have a great effect. In any local food system, particularly co-ops and CSA's, if consumers do not feel that the system is acting in their best interests they will not support the system (Fulton & Giannakas, 2001; Hayden & Buck, 2011).

D. Funding and Political Backing

Funding is necessary for running any business. Local food systems are no different. Based on the integration of the local food system into the community structure funding can be difficult or easy to obtain. Sources of revenue vary depending upon the system being funded. CSA funding comes from prepaid fees, based on the number of participants and the expected costs (Lyson, 2004). These fees go directly to the farmer or farmers in exchange for goods throughout the season (Martinez et al, 2010). In this case funding directly correlates with participation. More customers translates into more money going to the farmer(s) and more crops being grown. The challenge in this situation is that before the season begins the farmer(s) must estimate how many participants will be

paying, and there is always the possibility that the farmer(s) will accrue unforeseen costs during the course of the season (Varner & Otto, 2008; Martinez et al, 2010). If the produce grown does not meet the expectations of the consumer there is always the chance that the farmer(s) will lose consumers and financing in the next season (Bean & Sharp, 2010).

In a farmers' market, vendor fees are collected for permitting an individual to sell goods, and occasionally on the percentage of goods sold at the market (Stephenson et al, 2008; Ragland & Tropp, 2009). This situation differs from that of CSAs because it is more like a traditional market system in which the profits are determined by sales-expenses after the products have been sold (Follett, 2008). Co-ops have a unique funding system in that the sum of their profits is divided among the participating producers, or the producers can receive the money that comes directly from the sale of their goods (Fulton & Giannakas, 2001).

One shared trait between local food systems and traditional agricultural systems is that they both receive federal funding (Lyson, 2004). Traditional agriculture has received federal subsidization over the last century in an attempt to stabilize markets (Hallberg, 2001). It is only in recent years that the government has started to provide grants for local food systems and community markets. Some urban renewal programs have received grants of up to $80,000 to develop farming practices (Sibley, 1999). In 2009, "the USDA launched its Know Your Farmer, Know Your Food initiative to link small farmers with the growing number of federal local food programs, including $10 million a year in grants in 2011 and 2012 to expand markets, roadside stands, and community-supported agriculture" (Hoffman, 2011).

The political landscape surrounding local food systems is as diverse as the systems themselves (Voigt, 2011). Aside from national laws limiting local food systems, such as sanitation requirements, regulations that affect local food systems vary from state to state and town to town (Voigt, 2011). In 2008-2009 13 state legislatures passed bills encouraging farmers' markets. Some other federal policies that support local agriculture include: Supplemental Nutrition Program for Women Infants and Children (WIC), Farmers' Market Nutrition Program, Senior Farmers' Market Nutrition Program, Federal State Marketing Improvement Program, National Farmers' Market Promotion Program, Specialty Crop Block Grant Program, and the Community Facilities Program (Martinez et al, 2010). Many states are finding farm-to-school programs favorable (Hoffman, 2011). Some are also loosening their restrictions on the products that can be sold from private homes, roadside stands or farmers markets. However, there are still concerns over fresh goods becoming spoiled, and some policy options are facing stiff opposition (Hoffman, 2011).

More specific problems arise when discussing urban agriculture. In traditional Euclidian Zoning, sections of a town are designated for one purpose and there is generally little mixing of uses (Smith & Miller, 2011). Historically, farming practices have been forced out of cities as planners looked to clean up urban environments (Voigt, 2011). Multiple-use zoning for business and residential uses is fairly common, but when agriculture is introduced into an urban setting people can be hesitant (Nordahl, 2009). The idea of farm animals, fertilizers, and pesticides in a residential settings is not easily supported (Voigt, 2011). Also, many structures and equipment necessary for agriculture do not comply with urban zoning or design laws, or the microclimates of cities do not

favor produce growth (Nordahl, 2009; Voigt, 2011). Land that is available for development may not initially be suitable for farming, and may have to be remediated before it can be utilized (Nordahl, 2009). As populations in cities rise, land that could possibly be used for agriculture is sold at a much higher price to developers (Nordahl, 2009; Smith & Miller, 2011, Voigt, 2011). This competition for development and increases in competitive alternatives to agriculture generally occur in larger cities (Kremer, 2011).

As new laws concerning acceptable land uses are developed, officials need to make sure that the laws promote general well being and not single locations or certain groups (Smith & Miller, 2011). If laws are able to be developed fairly they can lead to many social and economic benefits and contribute to an areas overall sustainability (Smith & Miller, 2011). But without strong support from the local governing body any laws passed will not result in the development and acceptance of local food systems (Nordahl, 2009). Five steps that communities can take to foster the development of a local food system are:

> "(1) Encourage local economic development efforts to support community-based food-processing activities;(2) [Foster] land use policies that protect active farm areas from random residential development; (3) [Enact] and enforce zoning codes that allocate land into areas of nonfarm development, areas of natural preservation, and areas for agricultural production; (4) [Institute] institutional food acquisition practices that integrate local food production directly into the community: and (5) [Develop] educational programs to increase agricultural literacy among both children and adults including school and community gardens, summer internships programs, and community-farm days" (Lyson, 2004).

By developing laws and policies that are consistent with these five steps, communities can set the stage for those interested in developing local food systems to pursue their

goals for the benefit of the community. The question then becomes, can the community support such a system?

E. Infrastructure

In order for the other aspects of a local food system to fit together there must be a strong base for the local food system. This base can be called the infrastructure, and it is necessary to support an agriculture system (Feenstra, 2001). Not every local food system is made up of the same infrastructure, but there must be enough suitable land to grow products to supply to the community. Each of the three models identified as the most popular require different infrastructure, and certainly the differing definitions of "local" have specific needs. Whether this land is a network of distributed small parcels throughout the community, or a few larger plots that are farmed outside of the community, it is necessary for both established and upstart local food systems to have locations of production and distribution that can meet the needs of the community (Eckert & Shetty, 2011).

Local food system infrastructure can be defined as the natural resources, the land for production, the equipment, and the site(s) for distribution. Some zoning laws can restrict the development of land for agricultural purposes and can make it difficult to establish local food systems (Voigt, 2011). Generally this occurs in urban locations that have banned most agricultural practices from the city limits for health reasons (Ehlers & Fox, 1982). In an urban CSA developed to eliminate a food desert, small vacant lots may be desired for infrastructure, and dedicated volunteers may be needed because of low funds. However, for a large commercialized farmers' market in the same city, production

locations outside the city are necessary, and shipping networks are required to get the diverse range of goods to the market.

The two models whose infrastructure overlaps most are the farmers' markets and co-ops (Bean & Sharp, 2010). Both require a wide variety of producers whose goods are shipped to a common distinct distribution location. Much of the infrastructure of these systems can be help privately, and the source of products can range from the local producers in the community to farmers of the surrounding towns. The range of the infrastructure is directly related to the distance that is used when considering the limits of a local food system.

When discussing the infrastructure needed in a local food system, it is quickly realized that not all local food systems can be supported in the same way. As a local food system in being planned, many factors have to be considered relating to infrastructure (Bean & Sharp, 2010; Cather, 2008; DeLind, 2010). Once consumers are identified, needs must be considered, and the producers necessary to fulfill these needs must be identified. In a real world situation the possibilities for infrastructure in different systems can be exponential or severely limited based on the resources in the community and surrounding region (Cather, 2008; Stephenson et al, 2008).

An expanded definition of local food system infrastructure includes social, political, and intellectual space. While not always identified, these spaces make up the important social aspect of local food systems (Feenstra, 2001). These spaces may be contained in a place for distribution. The distribution location can be the same as the production location, as is the case with some CSAs, or it can be a separate location such as a farmers market (Varner & Otto, 2008). Effective land use planning and analysis of

suitable sites are essential in the process of establishing the production and distribution methods in any local food system. Many times private producers supply the land component of the infrastructure, but when the community members choose to farm for themselves, land must be set aside as a commons (Donahue, 1999).

II. INTERACTION OF ASPECTS

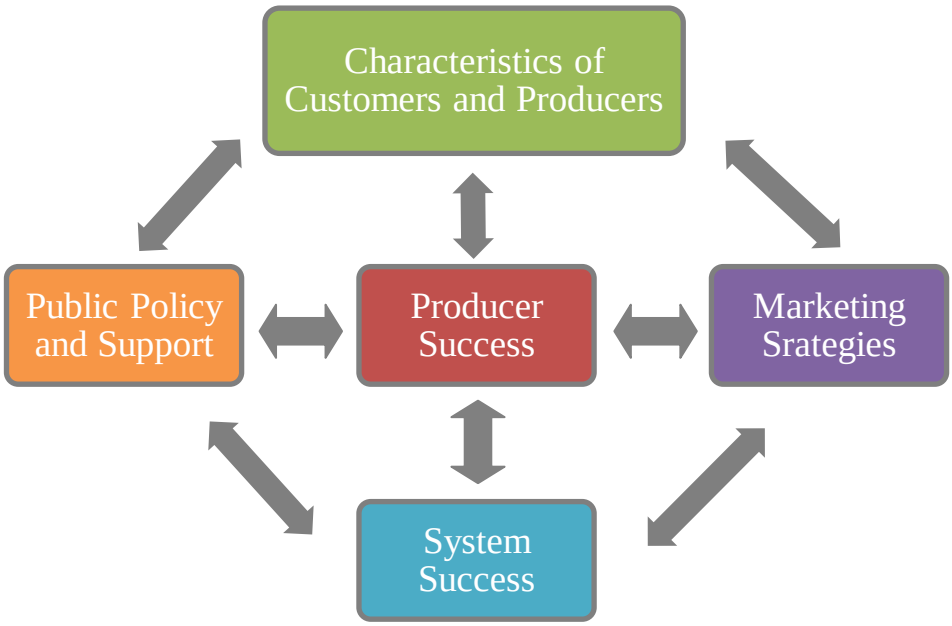

Figure 3: Displays the interaction of different system factors (Schmit & Gomez, 2011).

The individual characteristics of producers, managers, consumers, funding, political backing, and infrastructure contribute to the success of local food systems (Figure 4). However, the identifiers of redistributing value through the network in the opposite direction of the bulk commodity system; re-instilling trust between the producer and the consumer; and articulating new forms of political association and market governance are important to understanding the interactions that take place within a local

food system (Follett, 2008; Morgan et al, 2006; Schmit & Gomez, 2011). Some interactions that occur involve balance of supply and demand, community support and commitment, and funding within the system. If for some reason any of these interactions are not supported it is possible that the system will not be successful (Bean & Sharp, 2010; Stephenson et al, 2008).

Personal interaction is one of the identifying features of a local food system. Although there is a community involvement component of many local food systems, community members do not always participate or organize at the level that might be expected (Hinrichs, 2000). Farmers markets offer the location and the time for consumers and farmers of the community or region to come together and form personal relationships (Cox et al, 2008; Lee, 2011). A longer period of connection at weekly gatherings can further stimulate friendship and respect (Lee, 2011). In a CSA the transfer of food can be relatively brief in comparison, only occurring on pickup days. Some members of CSAs work to build connections between people; however, the directors or members of a CSA do not always establish authority and the organization of events outside of a pickup day may be left to the farmers (Hinrichs, 2000). Many analyses of CSAs indicate that in order for this type of food system to be successful consumers need to show more commitment, rather than reducing the entire system to the box of food they receive each week (Dunn, 1999; Hinrichs, 2000). The personal interaction present in local food systems is only currently being recognized as a rarity; however, in order for local food systems to have a unique identity consumers must participate and be involved as much as the producers are (Delind, 2010; Hinrichs, 2000; Schmit & Gomez, 2010).

Although they may not be as supportive as they should be, this lack of involvement does not mean that consumers do not appreciate the producer or do not feel an increased sense of trust in the CSA system. The simple fact that the consumer can travel and view the farm is enough to increase their confidence, but this trust does nothing for the producer when it comes time to pay the bills (Lee, 2011; Martinez et al, 2010).

New thinking has led to the conclusion that local food systems are based on an entirely different economic underpinning than the standard agricultural system. Local food systems are based in economic sociology, which focuses on "the context, process, and outcomes of exchange" (Hinrichs, 2000). Social participation has always been a feature of economic evolution, but in local food systems, social interaction lies at the center of the structure (Feenstra, 2002; Lyson, 2004; Martinez et al, 2010). For all the emphasis placed on removing the middle man and the chain of processors that have overrun the widespread agricultural system, costs and revenues are still important and all parties involved may still look out for their self-interests (Follett, 2008; Hinrichs, 2003). In fact, an understanding of good market practices and the ability to balance profits are still required if a local food system is to be successful (Gardner, 2002), the exception being those local food systems that provide free food to those who do not have means to purchase fresh goods. These charitable systems are not free of costs however, and are usually sponsored or supported by other means (Gardner, 2002; Lyson, 2004). Even with these pieces in place, many local food systems act in such a way as to only challenge "monoculture markets," not doing enough to resist the "commodification of food," one of the identifying traits of a local food system (Follett, 2008; Hinrichs, 2000;).

III. ESSENTIAL CHARACTERISTICS

In this analysis of the aspects of a local food system, certain factors stand out as invaluable to the success of the system. To identify the specific pieces that make up a successful local food system, research on the three most successful models was referenced heavily. Other research pertaining to specific instances of local food systems was considered and included in the analysis to identify the following aspects that will be discussed. The most important characteristics were chosen by comparing different models of local food systems and identifying the most common areas of overlap. Characteristics that were repeatedly referenced as important, key to success, or influential in the development of the system were considered essential. Through research and investigation, it has been determined that the characteristics of a dedicated and involved community, motivated and knowledgeable managers, and political and financial support are pivotal to the success of a local food system (Cox et al, 2008; Follett, 2008; Hinrichs, 2000; Nordahl, 2009; Schmit & Gomez, 2011; Stephenson et al, 2008). These characteristics cannot be excluded from any discussion, model, or application of a system without its being severely hindered or failing. Other factors have been identified in this thesis that are important to the success of a local food system, but, all of them can be derived from these three keystones. These keystone features work in tandem to develop the local food system, support it, and sustain it whatever its function (Lee, 2011; Nordahl, 2009; Schmit & Gomez, 2011).

Political and financial support allow the basic process of developing a local food system to occur. Land must be available and must not carry with it zoning restrictions that would limit development (Dixon, 1999; Duram & Oberholtzer, 2010; Thomas, 2009; Voigt, 2011). Funds must be available from a federal, state, local, or private source in order to establish the system and sustain it until a large enough proportion of the community supports it. In order for these initial costs to be validated the community must desire a local food system, understand the process and its requirements, and be dedicated to the hard work and minor sacrifice that it involves (Hinrichs, 2003). Once it is established the community must continue to support and drive demand for the unique economic and social interactions that are involved in a local food system (Dixon, 1999; Ehlers & Fox, 1982). However, in order to keep the balance between supply and demand there must be efficient and dedicated managers who are impartial to either side. Managers of local food systems must stay one step ahead of the community in identifying its needs, and must bring in producers who are capable of fulfilling those needs (Ragland & Tropp, 2009; Varner & Otto, 2008; Stephenson et al, 2008). While our natural social nature will facilitate direct interaction, managers must understand the intricacies of the free market setting and help both producers and consumers to connect with the appropriate parties (Ragland & Tropp, 2009). Through political and financial support the proper infrastructure will be developed to serve the community, and when the needs of the community are identified, managers can, successfully identify producers to bring into the local food system.

CHAPTER 3: ASSESSING COMMUNITY SUITABILITY FOR A LOCAL FOOD SYSTEM

I. INTRODUCTION

A. GIS Analysis

It is difficult to consolidate all of the factors that make a location suitable for use in a local food system. One useful tool for analysis is the Geographic Information Systems (GIS) (Malczewski, 2004). A GIS is computer hardware and software that are "capable of capturing, storing, analyzing, and displaying geographically referenced information" (USGS, 2007). For this project, the GIS software produced by ESRI, ArcGIS was used. Interested individuals, local governments, and community groups can all use GIS to identify land that could produce high yields, or central sites in the community that are ideal for distribution (Klosterman, 1995). Each area that intends to develop a local food system has its unique demands, geography, development, and zoning regulations that make a "one-size-fits all" equation for suitability impossible to construct (Bean & Sharp, 2010). A GIS analysis provides the tools necessary to integrate existing data with original data and produce an output that presents multiple options in a particular community (Klosterman, 1995).

Before applying any model of a local food system to the landscape of Orono, the ability of Orono to support the infrastructure of any system needs to be determined (Stephenson et al, 2008). While Orono contains a farmers' market and CSA, this research is focused on identifying infrastructure that would be a part of a new, larger, and more integrated system. Common infrastructure needs for all local food systems are a site for

distribution and a location for production, which can either be large enough to support the system or can be made up of multiple scattered suppliers (Eckert & Shetty, 2011). In addition to these requirements, specific factors included in this analysis were: land ownership, proximity to the downtown, how the land is oriented to the center, and how the land is oriented to conservation land (Vernez Moudon et al, 2006). In general these can be categorized as the zoning of the town. Combining these factors can determine the suitability of possible locations for inclusion in a particular local food system.

B. Study Area

Incorporated in 1806, Orono is approximately 20 square miles situated on the Penobscot and Stillwater rivers (Town of Orono, 2011). Since its establishment in 1865 the University of Maine has changed step for step with the community of Orono. Much of the expansion occurring in Orono is directly related to the growth of the school and the number of seasonal students who call Orono home. According to the 2010 U.S. Census the population of the town is just over 10,000 (Census Bureau, 2012). Much of the western half of the town is zoned for forestry and agricultural practices with the eastern portion being zoned for residential and commercial uses (Richert, 2011). Some land has a specialty zoning designations such as economic development or conditional.

Situated on the Stillwater River, Orono's downtown has been extensively developed leaving little open space and a continuous mix of businesses alongside residences. There are a number of eating and drinking establishments that are the backbone of the commercial development, while most basic needs are met by a few retailers, professionals and tradespeople. However, there is no source of grocery items,

besides the limited items that are available in the pharmacies or the local gas stations and convenience stores. Hannaford's Supermarket on Stillwater Avenue in Old Town, along with the Bell's IGA in the northern part of the town are the closest supply of food. These corporations do a good job supplying the community with necessary nutrition and some products from the state of Maine, but, there is little representation of more local producers, if any at all.

The University of Maine has attempted to establish local food initiatives and at the University-run Rogers Farm, students learn the concepts and skills of farming. Since 1994, a few students, faculty and others have been participating in a small CSA. The Black Bear Food Guild has been supplying a small harvest of food to approximately 60 CSA members. By managing two acres for organic vegetable production and 1 acre in cover crop, this courageous group has been able to supply some members of the university community but has not been able to expand production to supply the greater Orono area (Fernandez, 2011).

In the community of Orono there are already a good number of people who believe in wholesome food. In its 17th year, the Orono Farmers' Market has more than 25 member suppliers (Robert, 1998). A temporary farmers market is set up every Saturday from May to October in the Steam Plant parking lot at the university, and during the winter months (December to April) the market moves to the Pine Street parking lot in downtown Orono. While the winter market is only held on the second and fourth Saturday of each month, there is still a good turnout of farmers (Robert, 1998). The Orono Community Garden is another current local food system development that is supplying local food to part of the community. The Community Garden is reaching out

through education, by supplying products to low income seniors, and by building connections between people in the community (Jemison, 2011).

In 2008, two surveys were conducted by the Office of Institutional Studies at the University of Maine to determine the perceived needs of the U Maine community based on what services were already available (University of Maine OIS, 2008). One survey polled students, and another polled faculty and staff. Some students who responded to the survey identified the presence of a "Health Food Store" as a characteristic that was *somewhat important* or *important* to them. When they were asked how satisfied they were with the current access to a "Health Food Store," they most often responded that they were somewhat *dissatisfied* or *neutral*. Of all the services that were in question, "Health Food Store" was the only one that resulted in a negative difference between satisfied and not satisfied of -13. This difference indicates that there are more people unsatisfied than satisfied. When they were asked what would make them more satisfied with this business, 55% of respondents chose *closer to campus*.

Faculty and staff were asked the same questions with similar results. When they were asked how important a "Health Food Store" was, each of their four potential options received around a quarter of the responses. Like the students, faculty and staff felt *neutral* or *somewhat dissatisfied* most often. Faculty and staff also believe that having a health food store *closer to campus* would increase their satisfaction, but having a *better selection* of products was another important factor. Similar to the students, there was a negative difference between satisfied and not satisfied of -12 (University of Maine OIS, 2008). The statistical significance of these results was not determined and the identifier "Health Food Store" does not necessarily connote local. Also, the question that was

presented was specific to a “Health” food store and a question was not presented whether a general grocery store (non health food store) was desired. Therefore these studies do not carry enough weight to justify the creation of a local food system. However, they do serve as a starting point for determining faculty and student interest in and support for a location where they might purchase healthy products that, potentially, could be supplied from a local source. More research needs to be conducted about the U. Maine community to determine if they support some of the ideals of a local food system, or if they are only interested in having any supply of food closer.

II. METHODS

GIS was determined to be the most inclusive and effective for analysis for analyzing the suitability of Orono to support the infrastructure of a local food system (Klosterman, 1995). GIS serves both functional and communicative goals, where options have to be both identified and options have to be explained. It is a tool that is ideal for developing plans with the public rather than for the public (Malczewski, 2004; Klosterman, 1995). Other suitability analyses have utilized GIS, and it has been used extensively in other types of analysis (Eckert & Shetty, 2011; Kalogirou, 2002; Li& Li, 2011).

The specific type of analysis conducted was a site search, which is specifically used when no possible sites have been pre-determined (Malczewski, 2004). This type of analysis was also chosen based on the types of data that were to be used, its ease of use, and the outputs that can be developed from it. There are challenges when using GIS to create a ranked analysis. Many times it is difficult to weight subjective traits in a fair

manner (Malczewski, 2004). However the contributing factors are weighted, there must be a logical reasoning behind the process. Each GIS analysis is unique in that the rating system for any vector or raster development is based on the questions being asked, the data available, and the importance of each of the factors involved. Rating for any weighted GIS analysis should be based on thorough research (Kalogirou, 2002; Klosterman, 1995; Li &Li, 2011).

In this analysis, several types of data were combined from diverse data sources to complete the local food system suitability assessment. Data collection plans were based on prior research suggesting relevant characteristics (Cather, 2008; Blake et al, 2010; Feenstra, 2001; Hayden & Buck, 2011; Smith & Miller 2011; Vernez Moudon et al, 2006; Wiebe, 2003). Selecting the traits of the land to include in this analysis was an important step. The following characteristics were included and constituted the different layers developing in the GIS analysis: soil type, soil grade, property ownership, current zoning designation, present structures, and proximity to the downtown. Combined, these data sets serve as inputs to the suitability analysis whose output is the identification and ranking of land that could be used for a local food system.

A. Data Sources

This analysis uses several data layers from the Maine Office of GIS (MEGIS), USDA and NRCS. Specifically, it includes the following data layers from the MEGIS website (Maine Office of GIS, n.d.): town boundaries (METWP24), state conserved land (conserved_lands), 2ft soil contours (contours), Orono parcel data (parcels), and roads data (e911). The study also made use of the newest 1M resolution orthophotos (NAIP

orothophotos 2009), and soil data for Penobscot County from the USDA's Natural Resource Conservation Service (NRCS) (soil_me614) (NRCS, 2009). The newest orthophotos (2011) were not available at the time this study was initiated.

In addition to these national and state data providers, data was acquired directly from the town planner of Orono, Evan Richert. Parcel data (zoning_Union_parcels), zoning data (Zoning2009), and vernal pool (svpcenterpts) data were acquired. The parcel data includes extremely useful information such as primary and secondary ownership, that was not included in the state-supplied data layer. Based on the infrastructure demands of a local food system and the community factors that were identified in the research, the selection of data sets was narrowed down.

B. Processing

Files that contained data beyond the Town of Orono boundary were clipped to make the files easier to manage and increase the speed of the analysis. The first data analysis was performed on the zoning layer. This was done by taking the "zoning2009"' shapefile provided by the town planner and performing a simple search using search query language (SQL). Based on the fields of the attribute table, a simple SQL of (type = "forestry/agriculture") was run, and the resulting selection was saved. Another search was performed on this layer looking for land that is under conservation easement and the results of the SQL were saved.

The second layer analyzed was the soils layer. Originally, the soils layer did not contain full soil names, but all included soil names are found on a separate USDA NRCS page (NRCS, 2009). This spreadsheet was then joined to the soils layer based on the

abbreviations field. Research into what makes up a quality agricultural soil was conducted, and it was determined that loamy soil is best (NRCS, 2011). Also, because of the historically wet soil conditions around Orono, sandy soils may be preferred for good drainage. In addition to classification, the soils data also contains a slope aspect and was ranked by the "percent grade." The steepest range in the data is 8-15% and is not desired. For this reason, loamy or sandy soil with a slope grade below 8% was chosen because it is not overly rocky, drains well, contains a good amount of organic matter, and is more easily managed than steeper ground (Cather, 2008). Another simple SQL was performed and the selected features were saved.

Parcels were the next variable analyzed. Two SQLs were run as there were two different types of parcels to be identified. The first parcels those owned by the town of Orono and its affiliates, and the second set of parcels are those owned by possible partners. While no investigation has been made into possible land contributors, the decision was made to include in the analysis real estate agencies and farms, as well as some non-personal trusts and some businesses (Nordahl, 2009; Schmit & Gomez, 2011; Smith & Miller, 2011).

In order to identify the parcels owned by the Town of Orono and its affiliates, an attribute SQL was performed utilizing the primary owner fields. The resulting selection was saved as its own layer so that the original data could be used to identify the next set of parcels. Utilizing the same parcel layer a second SQL was performed, again utilizing the primary owner fields. As with the first parcel selection the results were saved as their own shapefile.

After the soils and the parcels were identified the next step was to verify the selections that the program had made. This was done by loading the orothophotos and manipulating the transparency of the parcels selections so that the image could be seen through them. Then in an editing session, any parcels that contained structures or were obvious areas of conflict (such as the school complex) were deleted from their respective layers (Li & Li, 2011).

Some possible distribution sites were selected based on communication with community experts and other knowledgeable members of the community (19 Mill Street and 74 Mill Street) and a multi-layer buffer was created originating at these sites. The parcel boundaries of these locations were selected and copied into their own shapefile. Then using the multi-layer buffer tool, a buffer was created with intervals every 250m up to 1.75km (Vernez Moudon et al, 2006). This layer was used primarily to develop the raster.

Once the soils, parcels, and land designations were chosen, the soils layer and the contour layer were clipped to the parcel selection. The remaining data constituted the desired output, and was edited for display purposes. The following color changes were made; “soils” layer (red), “possible partners” layer (blue), “interested parties” layer (green) and “currently zoned agriculture” (gray). Also, changing the transparency of the layers allowed for the overlapping characteristics to be identified. When overlapped, the primary red, green, and blue (RGB) colors of the spectrum commonly used in visual display, produced secondary colors representing the best locations for farms. Conservation land was labeled with a black hatch pattern to delineate it as “undevelopable,” and roads were made red for easy identification.

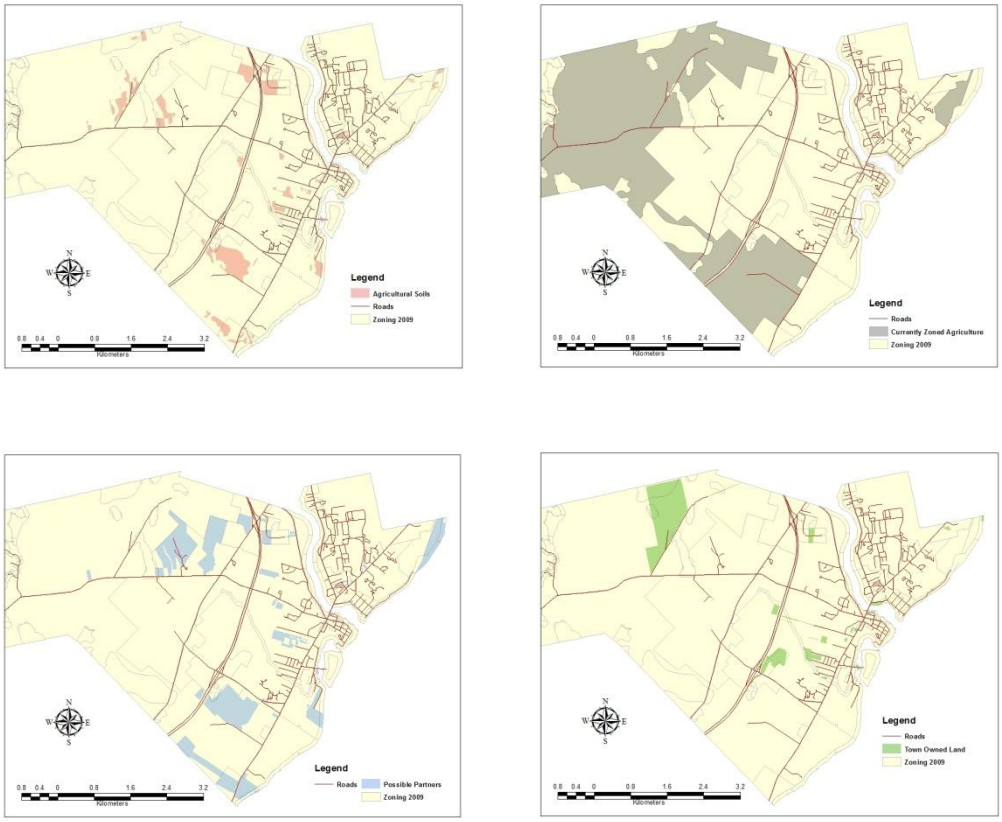

Figure 4: Layers that were included in the suitability determination. Clockwise from the top right, good agricultural soil, currently zoned agricultural, town owned land, possible partners.

C. Raster Development

Through research it was decided that some ranking system would be useful once possible parcels were identified (Spee &Wim, 2003; Zhang, 2012; Herrmann, 1999). This required converting features to pseudo-binary rasters and adding them together in the map algebra tool. Typical binary rasters contain important features given the value of one and the area outside of the feature is given a value of zero. In this pseudo-raster, the outside area was given a value of zero but the features were given a weighted value above one. The first step was to join each of the six layers (soil, possible partners, interested

parties, conservation land, distance buffer, and agricultural land) to the Orono polygon so that all six extents would have an identical boundary. The Union tool was used to combine each pair and each combination was converted to a raster using its FID (Feature ID). Each raster was given a cell size of "5" in an attempt to retain the neatness of the smaller parcels.

All aspects of the research on local food systems were used to determine the importance of the different layers. In this suitability analysis good soil with a low grade was given the highest value because it essential to have good soil for agriculture (Cather, 2008). Property owned by the town was also given the highest value because costs would be minimized (Hayden & Buck, 2011; Smith & Miller 2011). The infrastructure's proximity to the downtown was also give a high value within 500m, with a decreasing value beyond that point (Blake et al 2010; Feenstra, 2001; Vernez Moudon et al, 2006)

Based on the necessary infrastructure requirements of a local food system and the identified community factors, the following values were given to each reclassification: "interested party parcels" were given a value of 3, "possible partner parcels" were given a value of 2, "agricultural soils" were given a value of 3, and "currently zoned ag." were given a value of 2. The seven rings of the distance buffer were given values of 3, 3, 2, 2, 1, 1, 1, originating at the center. The transition from 2 to 1 corresponds to a distance of 1km. All the negative space of these layers were given a value of 0. The "conserved_lands" were given a value of 0 and the negative space was given a value of 1. Conservation land that cannot be developed was given a value of zero so that when it was multiplied with the sum of the other layers it would eliminate any value in the conservation area (Duram & Oberholtzer, 2010; Feenstra, 2002; Hayden & Buck, 2012;

Hinrichs, 2003; Kremer & DeLiberty, 2011; Li & Li, 2011; Lyson, 2004; Martinez et al, 2010; Nordahl, 2009). Specific reasoning behind the given values will be explored in the discussion section.

Once all of the separate rasters had been reclassified to pseudo-binary values all but the conservation layer were added together in the "map algebra" tool. The combination was labeled "total_values," and contains raster values from 0 to 10, with 0 being the lowest and 10 being the highest. This total values raster was then multiplied by the conservation area raster and the final output was labeled "total_rank." This output contains values from 0 to 10 and when displayed as a classified or stratified display the different parcels are clearly visible.

III. RESULTS

The results of the GIS analysis provided some possible locations that may be utilized for the infrastructure of an intensified local food system. The overall distribution of useable land is provided first with subsequent individual locations shown. These locations are each assigned an identification number and their qualities are indicated. All parcels described below as possible infrastructure sites are currently zoned as "medium density residential," and all are located within 2 km of the possible distribution location at the center of Orono.

A. General Findings

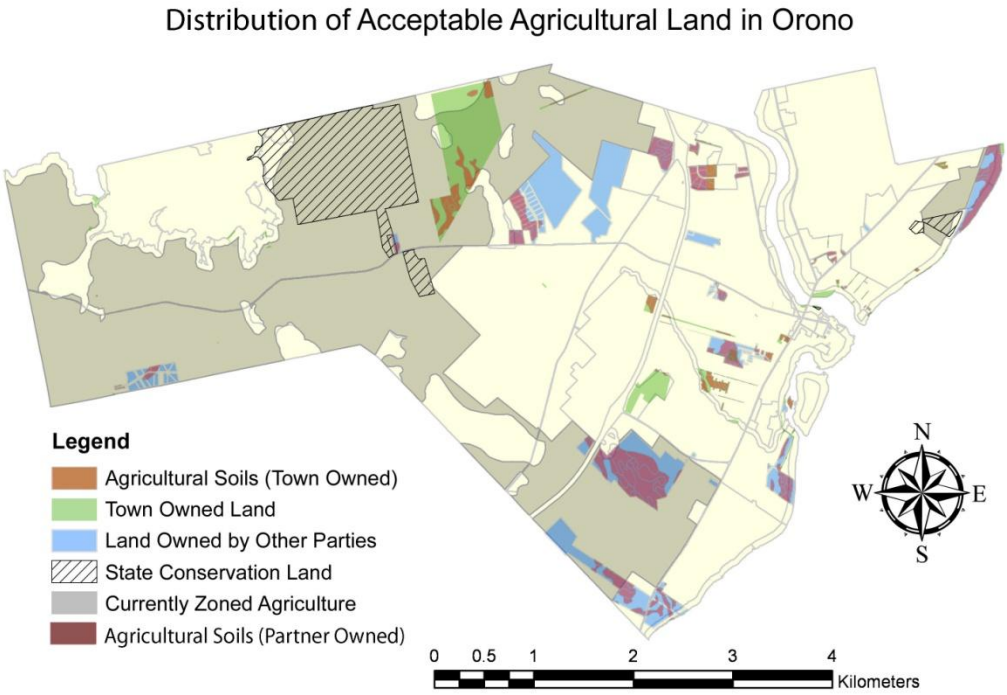

Figure 5

The results of overlapping the layers produced Figure 5. This figure shows that there is no land zoned for agricultural use near the downtown, but that there is soil good for agriculture under some of the open parcels there. The largest piece of land owned by the Town of Orono is located off of Taylor Road in the northern portion of the town; there are two relatively large parcels located closer to the center of town, and one contains good agricultural soil. That particular parcel was identified as a possible infrastructure site and will be discussed in more detail. From the parcel data used, seven undeveloped subdivision clusters were identified in Orono, with most located away from the town center. One undeveloped subdivision cluster is close to the center and is over good agricultural soil; this will be discussed later. Only four potential sites for infrastructure were located in an area that is currently zoned for agricultural use.

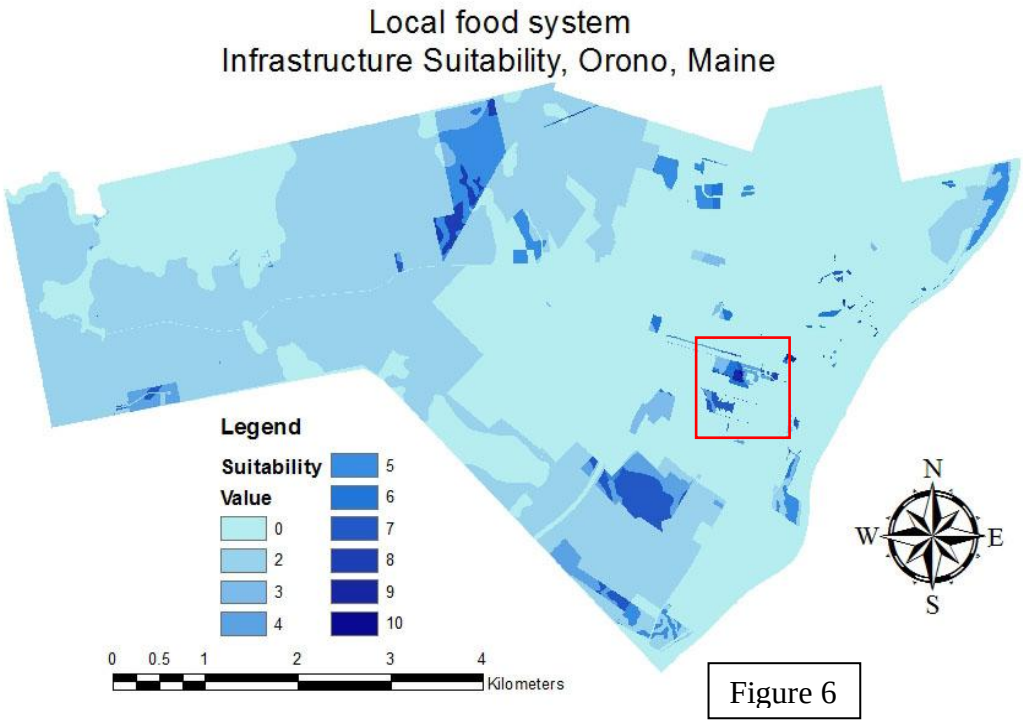

Figure 6

The results of the ranked suitability are displayed in Figure 6. Agricultural land contains a value of 2, with some slivers of highly suitable land in the northern part of the town that are zoned for agriculture, owned by the town, and contains good agricultural soil. One large parcel of land that is suitable for agricultural infrastructure is located in the southern part of Orono. This land contains good soil for agriculture and is currently zoned for agriculture, but it is not owned by the town. This land is currently held by Sewall Company. Two smaller locations were identified as suitable and are located closer to the center of Orono. Both sites are in residential neighborhoods. The first site is owned by the Town of Orono, and the other collection of parcels is owned by Sunset Development, with a large center parcel being owned by the town. Either site contains a large proportion of agricultural soil and will be discussed further.

B. Specific Locations for Infrastructure

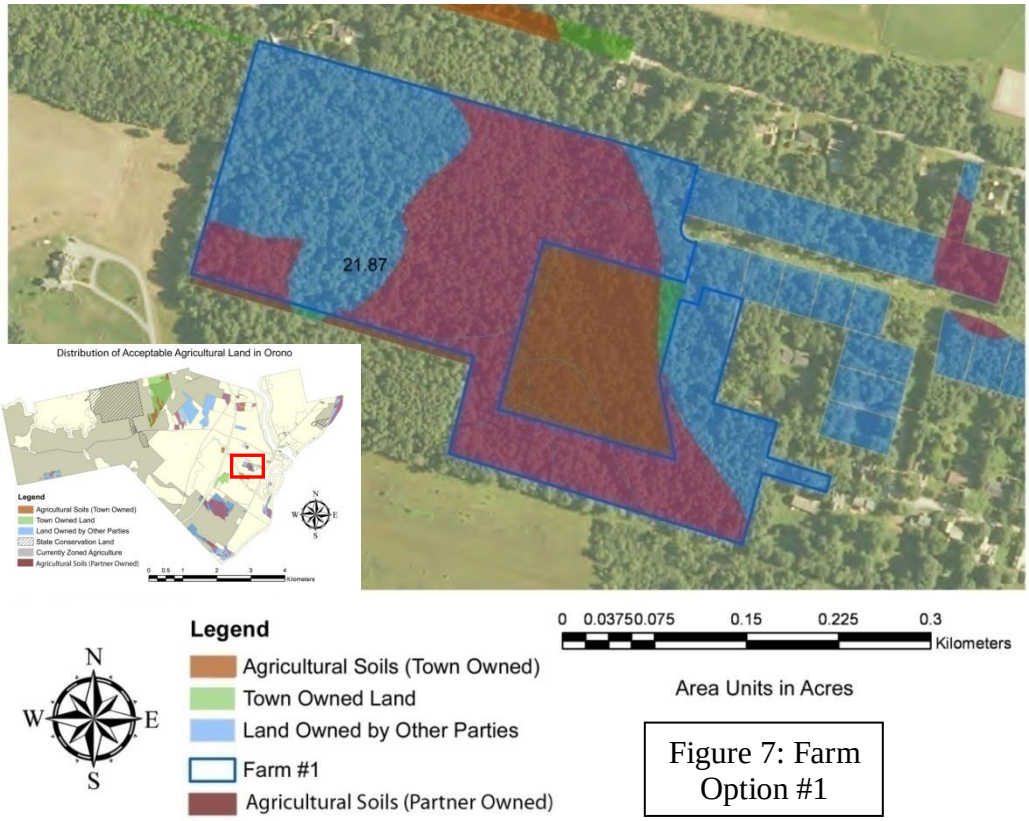

Figure 7: Farm Option #1

The first option that was investigated in more detail is displayed in Figure 7. This parcel of 21.9 acres is located off of an undeveloped paper street known as Rose Lane. A paper stree is a street that was drawn up on paper but was never actually paved. The parcel data used identified the owner as Sunset Development. This large piece of land is wooded and surrounds a parcel of land owned by the Town of Orono. As of March 2012, there is no direct road access to this land. Within this property 15.9 acres are suitable agricultural soil.

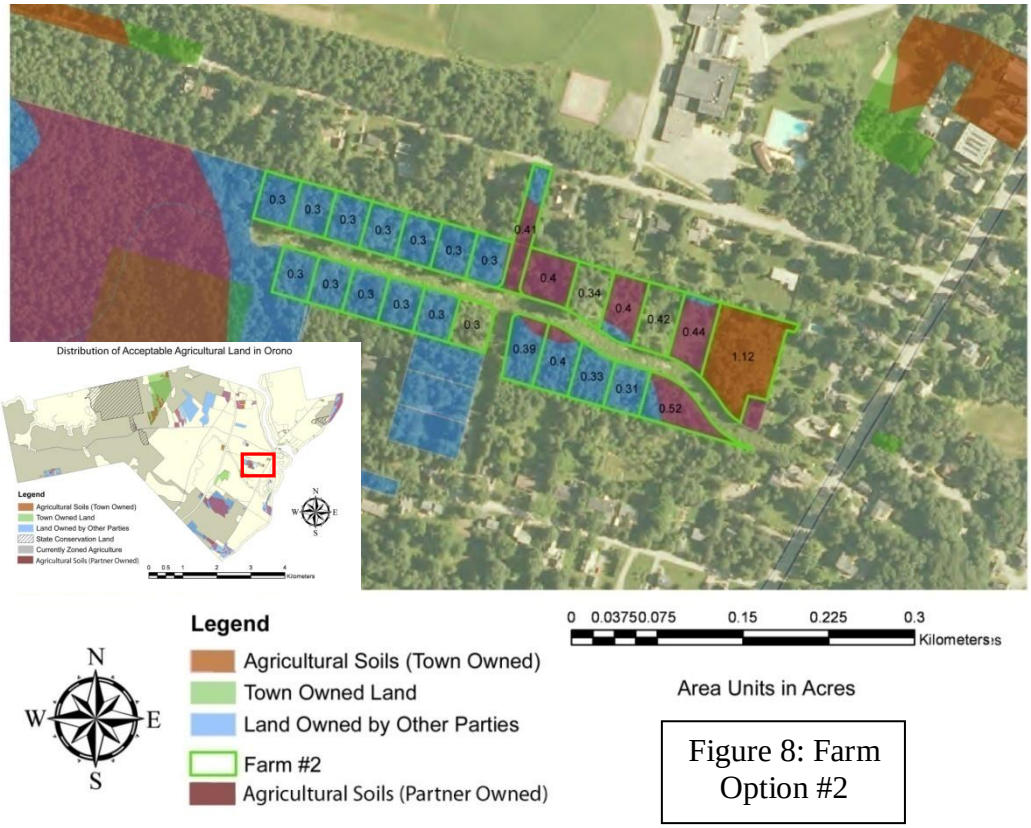

Figure 8: Farm Option #2

The second possible location for agricultural infrastructure near the downtown is displayed in Figure 8. This collection of 25 parcels is also located on the undeveloped paper street Rose Lane and is also owned by Sunset Development. There are three parcels that were included in this figure because the parcel data did not identify a current owner. The Town of Orono owns 1.12 acres that abut land owned by Sunset Development. The area of the parcels is divided up with 5.7 acres of land on the north side of Rose Lane and 3.5 acres on the south side of Rose Lane. The physical boundary of Rose Lane itself contains 1.9 acres. In total there are 9.2 acres of land (11.1 acres if Rose Lane is included). Of this amount 3.71 acres are identified as agricultural soil. The only means of access to this location is through the slender parcel that connects Rose Lane and Westwood Drive.

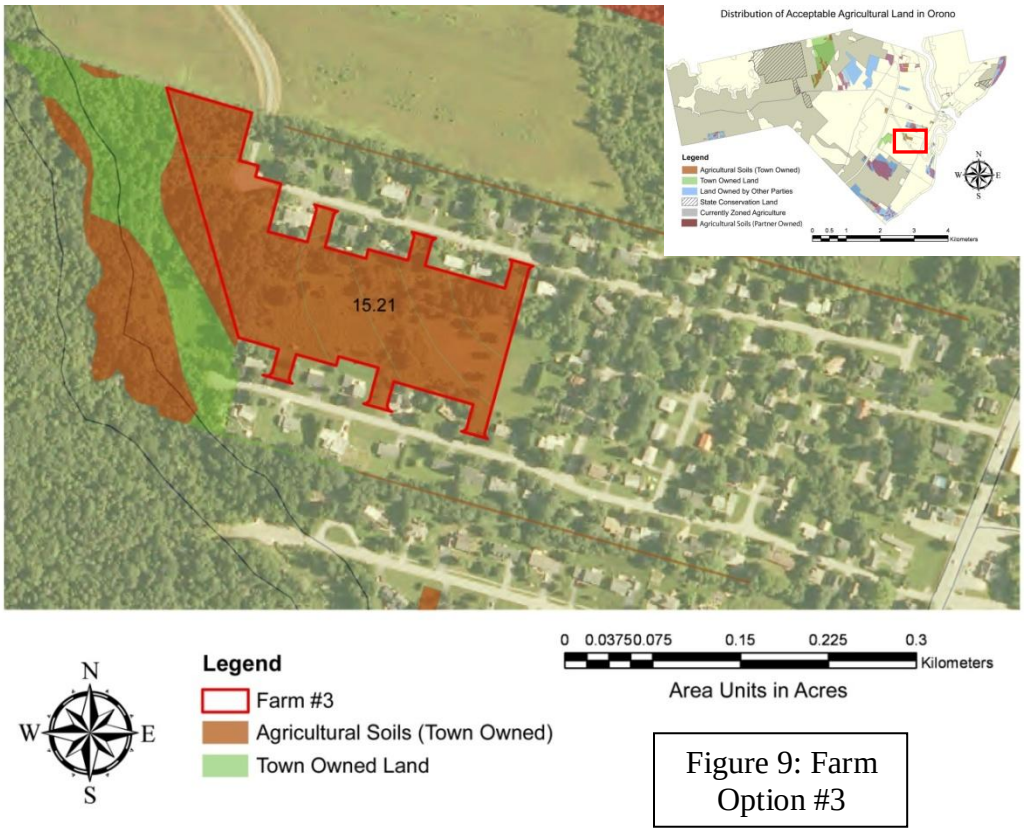

Figure 9: Farm Option #3

Location three is identified in Figure 9. This location is located between Mainewood and Gilbert Streets in a residential neighborhood and abuts Sklar Park, and is currently owned by the town. The parcel itself is owned by the Town of Orono, and the area bordered in red is 15.21 acres in total. Almost all of this is identified as good agricultural land, and there is road access to this site at multiple locations.

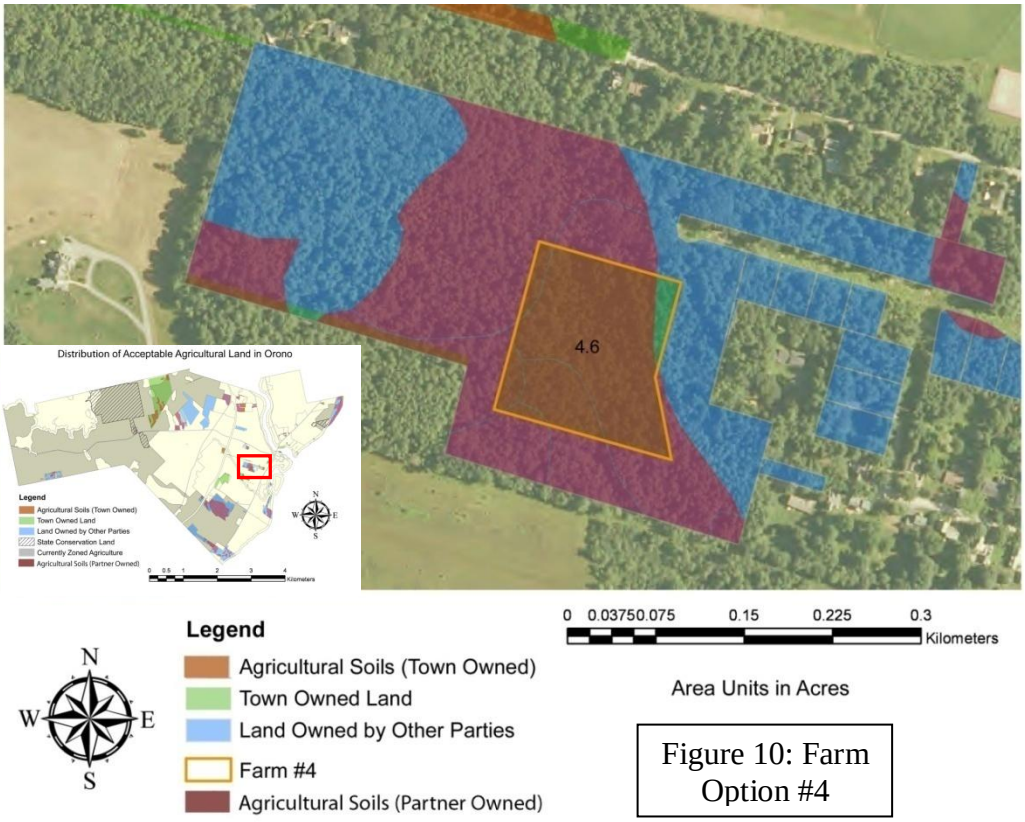

Figure 10: Farm Option #4

Location four is displayed in Figure 10. This location is owned by the Town of Orono, but is surrounded by land that is owned by Sunset Development. This land would be accessible through the undeveloped paper street of Rose Lane, but currently there is no road access. This option is 4.6 acres in size with 4.3 acres of agricultural soil.

C. Distribution Locations

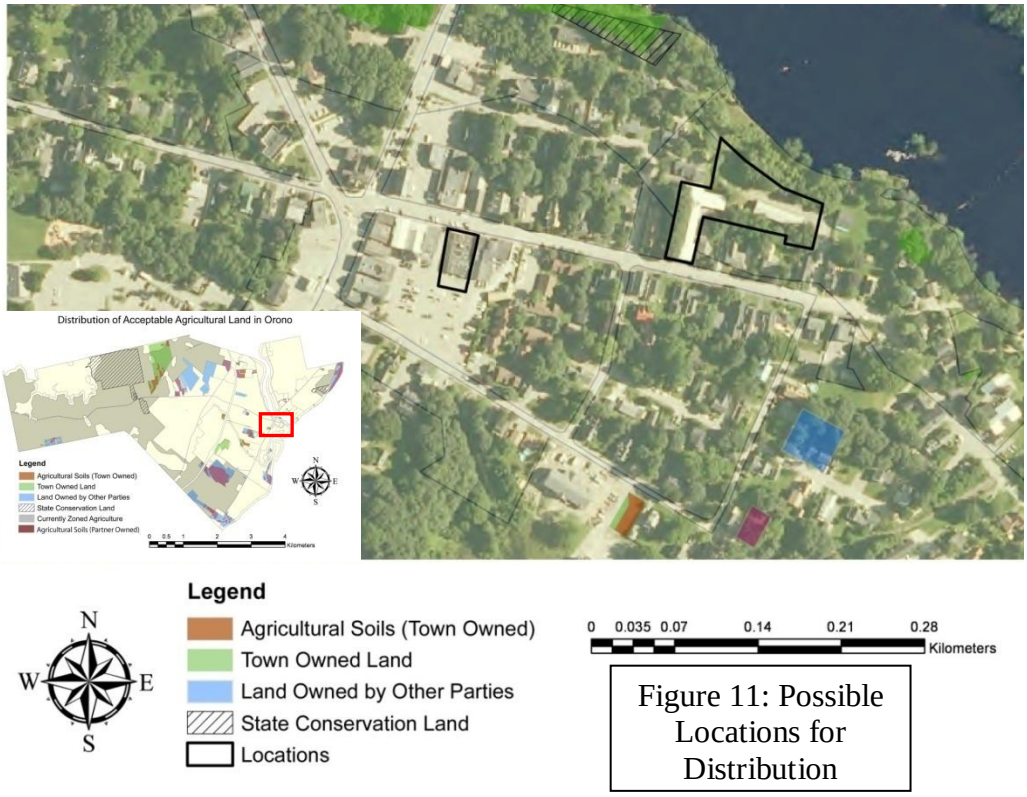

Figure 11: Possible Locations for Distribution

The parcels outlined in black in Figure 11 are two locations that were identified as possible distribution points from discussion with knowledgeable members of the community. The location at 19 Mill Street is the parcel to the west, and the second location at 74 Mill Street is the parcel to the East. Nineteen Mill Street is owned by L. Zanchi as indicated by the parcel data, and is zoned “village commercial.” The parcel data for 74 Mill Street indicates that it is owned by KMS Company and that it is zoned “conditional.”

IV. DISCUSSION

The results of this analysis provide potential options and more importantly, points for discussion and debate. When reflecting on the specific suitability analysis conducted, the data used was chosen because it would present characteristics that were considered important to the development of a local food system or any agricultural system (Cather, 2008; Follett, 2008; Freedman & Bess, 2011; Labao, 1990; Lyson, 1995; Lyson, 2004; Morgan et al, 2006; Varner & Otto, 2008). Any development that occurs must be done in a location deemed acceptable by the town, or be presented in front of a review board for approval. Zoning designation was chosen as a layer because knowing what land is currently zoned for agriculture will help to determine possible restrictions on development (Voigt, 2011). The land ownership layer was also used because knowing what land is already owned by the town or university will point to the best economic options (Martinez, et al, 2010; Nordahl, 2009). The land ownership layer was used again because considering who may be interested in assisting in the development of a farm will allow for new partnerships to be built in the community and could possibly add resources to the cause (Kremer & DeLiberty, 2011). A soils data layer was included because understanding the soil types will guide the decision of what to grow and where to grow it (Cather, 2008; NRCS, 2011). Successful agriculture with minimal inputs requires soil that contains a large amount of nutrients, is well drained and is mostly level. These criteria were most easily identified in the soils data layer. The vernal pool layer and the conservation layer were included in the analysis because both of these sites are protected by state and/or federal law against development. Because of rare habitat and species, any development on this land could have disastrous effects on the local ecosystem (Wiebe,

2003). A layer based on possible distribution locations was included because one of the goals of this thesis was to establish how a local food system would look in Orono. In order to best supply the Orono community, and to be most accessible, the distribution location would have to be located in Orono, most likely near the center. The two locations identified were used because they were the most logical based on their current occupancy, past and present use, and their location.

Research was conducted to identify local farmers in Orono, but only one member of the Orono Farmers market was listed from Orono, with only four other past members being from Orono (Roberts, 1998). The search for land owned by the town yields a few larger parcels that are distributed around the town, but more results are returned when the SQL is run to identify possible partner parcels. This is to be expected, as there are a number of undeveloped subdivisions and clustered parcels owned by real estate companies in the Orono area. Orono or university-owned land, and land that is currently zoned for agriculture, is given the highest values for the following reasons. If Orono or the University already owns the property, funds would not have to be spent to acquire suitable land. This savings means that it is less likely that the public will place roadblocks in front of the development (Lyson, 1995). While no parcels owned by the University were identified, those parcels would also save money. However, any land that is owned by the University cannot just be signed over to be developed into a farm. For any development of land a review must be conducted as to the educational and institutional benefit of the use, unless land is donated specifically for agriculture (Klosterman, 1995). Also, regardless of who the owner is, if the land is already zoned as agricultural there will be no conflicts with zoning regulations (Voigt, 2011). This is important because it will

prevent the town or another party from having to rezone land or go through the tedious process of reworking zoning laws (Voigt, 2011).

The results of the ranked suitability raster display the best locations for integration into a local food system (Li & Li, 2011). A few locations that are most suitable and meet most of the local food system infrastructure criteria, are located near the downtown. While some of the best identified locations for agriculture are located outside of the 1km radius from the town center, and would contribute less to establishing an integrated food system (Unger & Wooten, 2006; Vernez Moudon et al, 2006). There are other parcels scattered around the town that meet some of the criteria and may be useable, but these would require more involvement by other parties or more inputs to develop. Some of these parcels were ranked lower because they were not zoned for agriculture, while other were ranked lower because they were not owned by the town (Kremer & DeLiberty, 2011).

When including property that is not owned by the party interested in development, the sales motivation of the owner must be considered, along with alternative buyers who could possibly place a higher value on the property. Although the purchase of land for community agriculture may seem like a noble cause, people and corporations may be willing to hold onto the land in support of their own interest (Martinez et al, 2010). To investigate possible sites in more detail, those chosen had the highest value and were close to the downtown (Spee & Wim, 2003; Vernez Moudon et al, 2006). Sites close to the downtown were specifically chosen because they would be most easily integrated into the community and would stand out as a unique piece of the community.

A. Specific Site Reflection

When discussing the findings of this suitability analysis with the Town Planner of Orono, it was determined that some of the sites selected for further investigation were not suitable for development as local food system infrastructure. The process of identifying sites owned by the town was appropriate for selecting parcels, but because of exclusions from the data used some site specific characteristics were not picked up. Farm option number four (Figure 10), was determined to be a significant vernal pool that was not included in the state vernal pool registry. The conservation importance of vernal pools makes Farm option number four as well as farm option number one (Figure 7) undevelopable. Some land that was identified by the analysis in the northern part of the town and thought to be suitable for agricultural use was determined to be unsuitable. Although the entire parcel is not compromised, at the center of the parcel there is Orono's landfill. While land south of the landfill contains good agricultural soil, the conditions may be deemed unacceptable with further testing. Also, the public would most likely not approve of that development.

B. Weighting Raster Values

When developing the raster suitability analysis, the different data layers I used were each given a value based on their perceived importance to the development of a local food system. Specifically, they were given a value based on developing a local food system from scratch that could possibly be considered economically feasible, support a large number of people, and be significantly integrated into the community.

The scale of 0 to 10 was chosen because it was a manageable scale for the number of factors that were included. Because of discussion with knowledgeable members of the community, it was decided that a larger local food system should be integrated with the town. This integration was further specified as close to the downtown so that it would be accessible to a large number of people and contribute to the downtown. For this reason, the distance of an acceptable downtown was determined and the weights for the distance from the distribution locations were weighted accordingly. By placing the farm locations near the downtown, costs for transportation would be minimized, pick-your-own systems would be possible, volunteerism would be facilitated, and visibility would be maximized in this community. These possibilities resulted in the distinction from 3 to 2 being placed at 1/2km and from 2 to 1 at 1km. These values and possible benefits are unique to the local food system development in Orono.

Because of the limited resources of the University and the Town, any land that was already owned by the town was given the highest individual ranking of 3. By providing the higher value, the importance of saving money is recognized and emphasized. Possible partners were given a value of 2 because they are locations of open land but are privately owned and would incur higher costs to acquire. Real estate companies were the primary source of possible partners because the current market may motivate the sale of land for other uses.

Good agricultural land was also given the highest value of 3 because one of the identifying factors of a local food system is the economic and environmental sustainability of it. By developing the agricultural infrastructure on high quality land, money is saved by not applying as many fertilizer and pesticides. Also, the environment

and the surrounding community do not suffer the consequences of over application or under absorption.

Because conservation land is protected against development it was given a value of zero. At the present time, state conservation land does not allow agricultural practices, and the easements placed on Orono Land Trust land also do not allow for agriculture (Orono Land Trust, 2011). If it was determined that the land trust was interested in developing a local sustainable agricultural food system, then maybe the value of the land would increase.

The values that were placed on the different layers and conditions of the land, were specifically ranked based on the resources of the Orono community, the research that was done on the requirements of local food systems, and the specific goals that were discussed. In reality all local food systems do not require the same infrastructure and therefore a different set of data layers and weights may be required when performing an analysis for a different system in a different location.

C. Unique Conditions

When comparing the three models, farmers' market, co-op and CSA, in my determination of the essential characteristics of a local food system, some infrastructure characteristics overlap while others do not. There are certain infrastructure pieces that need to be more heavily weighted or even included or excluded based on what system is chosen. Certainly a site search would not be an effective method if possible locations for production were already established, such as private farms. In the development of a farmers market or co-op, searching out farms by product variety, carrying capacity, and

distance would be important. Alternatively, when developing a CSA or community garden, the population center, locations of open land, and pollution levels may be important factors. Determining suitable sites for the infrastructure of a local food system is not a uniform process for all systems.

The analysis process performed for this thesis attempted to identify locations for infrastructure within a very limited area. The restrictive set of developmental circumstances that were used to develop this suitability analysis, may be acceptable for the scope of this thesis in Orono, but may not be acceptable for determining the suitability of other larger local food systems. Upon further review of the methods used for developing the suitability analysis, it was determined that if a suitability analysis is to be used for identifying the best locations for local food system infrastructure, the desired characteristic of the specific system must be carefully reviewed and ranked so that the weightings can be determined before analysis begins. This method of ranking and the suitability analysis performed may not be effective in other locations and alternative techniques may be needed.

CHAPTER 4: MODELS FOR ORONO

I. INVESTIGATING ORONO

In order to establish models for the Town of Orono, the essential factors of local food systems need to be identified. When identifying a dedicated manager for a food system in Orono, there are currently a few options. The managing committee of the Orono Farmers' Market has been effective at sustaining that local food system for almost two decades and would be capable of managing an expanded system (Stephenson et al, 2008; Varner & Otto, 2008). Another possible unique option for Orono is the committed and knowledgeable Cooperative Extension Office based at the university. These individuals have a wide variety of knowledge and skills and are dedicated to promoting education in the region (Cooperative Extension, 2012). A local food systems managed by cooperative extension would be well prepared for any challenges that it would face, although their involvement may be limited by budget constraints and the time that staff can dedicate. Besides these two managerial options, the university in general is a resource that could be tapped to involve dedicated business people who are committed to developing local food systems.

In order to establish whether or not the community contains enough support for an expanded local food system, the survey done by the office of institutional advancement was referenced (University of Maine OIS, 2008).The fact that there are local food systems in Orono suggests that there are a number of people interested in developing a larger local food system (Jemison, 2011; Roberts, 1998). While this is not enough information to establish sufficient support for actual development, it is a starting point to base these models.

The political and financial backing for developing a local food system in Orono also needs to be determined. The town of Orono supports the farmers market by providing it with a public location through the winter months, while the university supports the farmers market during the growing season (Roberts, 1998). Agriculture is permitted in Orono on university owned land, and is subject to approval in medium density residential zones (Gonyar et al, 1995). The zoning in Orono is not restrictive and would be conducive to the development of a local food system with infrastructure near the downtown (Ordinances: Town of Orono, 1995; Richert, 2011). The financial support for a local food system in Orono could possibly come from the university. Although the university has been restructuring their budget over the last few years, the development of a sustainable agriculture major and its commitment to purchasing local goods for use in dining halls, shows the university's interest in local food systems (Fernandez, 2011). However, the limited budget of the university and the high costs that such involvement would call for, could cause the university to not be interested. Private managers in Orono would possibly be able to get state or federal assistance to develop an intensified local food system, but the university has the best chance of getting financial backing by combining the systems development with education (Feenstra, 2002).

The suitability analysis in this thesis identifies some of the possible locations that could be included in the infrastructure of a local food system. If the managers and the community were brought together it is possible that they would identify other locations or have other ideas as to how to develop the system. Utilizing the research that was conducted the following thoughts and models were expanded upon. These three models

are based on the three most popular systems and contain some similarities, while other pieces of them vary greatly.

II. UNIVERSAL REQUIREMENTS

Upon investigating possible local food systems in Orono, it is clear that there are many different options. For the sake of exploring their feasibility and implementation, this report identifies a few examples of the most common local food systems and how they would be structured in Orono. Specific to the town of Orono there are a few components that would need to be included in whatever system was adopted. First, the university would have to play a major role. The finances, leadership, and research capacity of the university exceed the means of the town. Placing a good piece of the burden of establishing a local food system on the university, would allow the Orono community the freedom to focus their individual means where necessary, but allows them to participate when they were willing and able (Selfa & Qazi, 2005). However, the availability of university funds to support a larger system comes into question again.

Second, any local food system constructed in cooperation between the town of Orono and the university should exist to serve all the in the community no matter what their means (Sibley, 1999; Thomas, 2009). It is suggested that no matter the system implemented, it should be not-for-profit. This would increase the acceptance of a new local food system, and present a more dedicated and educational system that is of greater service to the community than a profit-driven system would (Hinrichs, 2000). Using a non-profit system would support the greatest ideals of what a local food system should be and minimize competition with the current Orono farmers' market (Lyson, 1995).

Third, in order to serve the community for a substantial part of the year, if not the whole year, some type of greenhouse should be built to facilitate winter growing (Cather, 2008; Hinrichs, 2000; Smith & Miller, 2011). By providing year-round products, people could realize that there are some regional products that can be obtained throughout the year. These requirements as well as the different aspects of the three models explained below, all require funding and backing to ensure their acceptance and success. A lot of time and a large amount of funding would be required to begin development of any system, and to sustain the system into the future. The duration of the system should be discussed and will dictate the amount of resources that will be required upfront as well as for the duration of the system (Stephenson et al, 2008).

The three models outlined below are not meant to be finished representations that could be enacted immediately, but are meant to identify some possible options for the aspects and resources that are required in a local food system. The models are based on the research conducted into the essential pieces of a successful local food system, as well as discussion with some member of the professional community.

III. UNIQUE MODELS

A. First Model

The first type of system that could be implemented in Orono would be a larger CSA. This type of food system would expand the Black Bear Food Guild and could strengthen its connection with the community. Such a system could be run by dedicated Cooperative Extension staff and members of the Sustainable Agriculture program, if members of the staff were able to dedicate themselves and money could be allocated to

support their commitment. This system could utilize what land was already being used at Rogers Farm, but in order to meet the staple demands of a larger consumer base, this new CSA could also utilize a new farm location closer to the downtown, allowing for "pick-your-own" distribution if desired. A number of shares would be set aside for those who are food insecure, who would be able to sign up for them. Graduate students, and summer interns receiving a stipend could grow the produce as well as maintain the site. CSA membership and distribution procedures could be managed by a member of the Cooperative Extension program and a faculty member of the Sustainable Agriculture program.

This extended CSA program could allow a wide variety of community involvement and could be accessible to a large number of people (Hinrichs, 2003). The costs associated with this model are apparent. If the town contributed the use of a parcel of its land, costs would be limited to equipment and the price of constructing a greenhouse. If not, the university may have to increase the amount of land dedicated to a CSA at Rogers Farm or purchase land from the town or a private owner (Hinrichs, 2000). Stipends for managers and student interns could be covered by the sales of CSA shares and would not come from the university or the Town of Orono. This option may compete rather directly with some suppliers that frequent the Orono Farmers' Market, but produce could be tailored to minimize competition with vegetable and fruit producers (Martinez et al, 2010). A larger CSA could allow the residents of Orono access to a weekly yield while providing students the opportunity to learn and develop as farmers and community members. This model could also provide those in the community who are in need with a weekly supply of fresh, healthy produce (Thomas, 2009).

B. Second Model

The second model that could be a possibility for Orono would be the development of a local food co-op. The structure of management could be similar to that of the CSA, with a partnership of Cooperative Extension and Sustainable Agriculture running the farming operation and a third manager strictly for distribution. For this model, the distribution center could be in a shop in downtown Orono. Two locations for consideration are 19 Mill Street, which previously held a small grocery store, or 74 Mill Street, the location of the Byer building, a large manufacturing structure (Follett, 2008). Produce could be provided by a new farm near the downtown, and could be supplemented by local farmers who wanted to sell their products during the week. If products did not sell and were going to lose their freshness they would be converted into value added dishes that could be served from a small café or provided to those in need. Educational programs could be held for people who want to learn better ways to cook and techniques for maximizing nutritional gains (Martinez et al, 2010).

This model provides the maximum community involvement and educational opportunity (Fulton & Giannakas, 2001). Two or three dedicated managers could oversee the farming and grocery operation, while graduate students, and student interns receiving a stipend could grow the produce and operate the grocery distribution. The opportunity could be available for those who were in need to volunteer time at the distribution center in exchange for food, and forms of federal or state assistance would be accepted (Hibbert et al, 2006). The greatest costs of this model come from the need to rent or purchase the grocery space and, if necessary, purchase farmland near the downtown. Sales from the store would hopefully be enough to cover all prolonged costs. With a growing number of

federal assistance and startup grants being provided by the federal government there is the possibility that this model would qualify for assistance to get off the ground, then be supported by itself (Martinez et al, 2010).

This co-op could minimally interfere with the Orono Farmers' Market, as it would only be open during the week (Follett, 2008; Hinrichs, 2000). Donations of produce and other goods, both food and non–food items, could be accepted into the grocery distribution for sale. This could allow the community to have access to healthy local food during the week while continuing the producer-consumer interaction on the weekends. During the winter, the greenhouses of the downtown farm could supply the community with a limited amount of fresh produce. This model could serve those in need while providing the town with a supply of fresh products every day. It could also serve as an educational setting for community members as well as students interested in marketing and sales.

C. Third Model

The third possible model is an expansion of the Orono Farmers Market. The goal of this model would be to establish a permanent, year-round setting where the market could take place. In this model, the Orono Farmers Market could be moved to the Byer Building at 74 Mill Street, and farmers would be able to set up stands inside. The management system could be quite different for this model. Management of the market could be run by the Orono Farmers' Market, while the building could either be owned by the town or the university. In this model, a smaller downtown farm could be managed by Cooperative Extension and the Sustainable Agriculture Program. This farm could consist

of a larger greenhouse for winter production, as well as supplementing the farmers' market with unique products during the growing season. The Byer Building, if owned by the Town of Orono, could become a community center as well as the center of an established and year-round farmers' market.

The costs for this model are vast. The purchase and renovation of the Byer Building would be expensive for whatever party owned the building. The development of a small farm with greenhouses near the downtown would also be an expense for the university. These costs, along with the stipends for student interns could be covered by sales of the products grown, as well as grants. Excess farm produce could go to serve the food insecure in the community, and whatever the farmers from the market would be willing to donate could serve the food insecure as well. This new local food system, could enhance the existing farmers'market and provide a new community center that could be the new revitalizing focus of the downtown.

	Model 1: Larger CSA	Model 2: Expanded Farmers Market	Model 3: Food Co-op
Producer	-U. of Maine Student Interns -Volunteers	-U. of Maine Student Interns *-Farmer Donations*	-U. of Maine Student Interns -Volunteers *-Farmer Donations*
Consumer	-Shareholders -Those in need in the University and Orono Communities	-Anyone who visits the market -Those in need in the University and Orono Communities	-Anyone who visits the store -Those in Need in the University and Orono Communities
Management	-Cooperative Extension -SAG -University Graduate Students	-Cooperative Extension -SAG -University Graduate Students	-Cooperative Extension -SAG -School of Business -University Graduate Students
Infrastructure	-Expansion at Rogers Farm *-New Downtown Farm with*	-Expansion at Rogers Farm -New Downtown Farm -New Market setting	-New Downtown Farm -New Grocery/ Market Setting
Funding	-Shareholder payments -Grants	-Sales -Grants -University of Maine	-Sales -Grants -University of Maine
Costs	-Intern Stipends -Possible Purchase of Land & Equipment	-Intern Stipends -Purchase of Land -Purchase of Equipment *-Possible Purchase of Market Setting*	-Intern Stipends -Purchase of Land -Purchase of Equipment -Purchase of Grocery/Market Location
*If necessary**			

Figure 12: Displays the three possible models that were developed for Orono

These models require different levels of participation by members of the Orono and university communities. The purpose of each of these models is similar but the realistic goals of the models vary. Local food systems are developed to fulfill the needs of the community, and each of these models would be the most effective at fulfilling different needs. The model of a larger farmers market is most effective at fulfill the goal

of providing more local food to the community and increasing the visibility of the market. The model of a larger CSA, again fulfills the goal of supplying more local food in the community, but also can be very effective for getting more people involved and increasing their awareness about where there food comes from. A larger CSA can also fulfill the goal of providing for the needy in the community. By growing more shares than are needed, or by accepting alternative forms of payment, the CSA can provide healthy food to those who may not be able to normally afford it. The model of a co-op grocery best fulfills the goal of providing local food to the community but also fulfills the goal of providing educational opportunities, and involving more people in the community.

Whatever model is adopted by the community, one must remember that it is just that: a community effort between the Town of Orono, The University of Maine, the Orono Farmers' Market, and the people who make up these institutions. The establishment of any local food system would certainly be an accomplishment; it could be considered an example of dedication and teamwork that could serve as a model for changing how we eat and how we interact as a community.

D. Competition Concerns

While the Orono Community Garden and other community programs provide for some members of the community who are food insecure, a larger local food system in Orono could supply food to a larger number of people who face food insecurity or who need assistance (Lyson, 2004; Thomas, 2009). The participants in the Orono Farmers' Market desire to be able to continue to supply those who visit the market, as well as

themselves, while continuing to gain a profit. A more intensified local food system could meet this demand and supply food to those who cannot afford it, but more research is needed to determine the extent of food insecurity in the Orono community.

A second possible demand that is not being fulfilled is the availability of local products during the week. The Orono Farmers' Market provides foodstuffs and other goods on the weekends, and also provides goods on Tuesdays throughout the summer. However, for the rest of the week there is a local food void in the community. A second local food system or an expansion of the current one could provide a location where local vendors could bring their goods and have them available on a daily basis. This weekly market setting would not produce the same producer/consumer connection present at the farmers' market; but it could provide prolonged community interaction, as well as unique educational and marketing opportunities (Follett, 2008; Hinrichs, 2000; Schmit & Gomez, 2011; Tropp, 2008).

The proposal for a new local food system is not meant to drive this established and flourishing farmers' market, or the other local food initiative in Orono out of business. The hopeful goal of any new local food system would be to work alongside the Orono Farmers' Market and the other systems to serve the community. The current farmers' market supplies a wide variety of produce and products to the community, and there is a strong connection between these growers, the university, and townspeople (Roberts, 2011). However, there are opportunities that are not being fulfilled. There will inevitably be competition, and unfortunately competition between local food systems has been shown to hurt both systems' chances for success (Varner& Otto, 2008).

An obvious area of overlap is present in the fact that the current Orono systems and another local food system would be supplying the same type of goods in a relatively small market. By supplying the same type of products, a new local food system poses a threat to the current farmers' market. If the system provides these products during the week, farmer's market participants could see their sales decline on the weekend (Varner& Otto, 2008). Also, if consumers do not feel the need to purchase goods in the new local food system, it will not be successful. A second less obvious area of overlap occurs in the type of environmental service they provide. The farmers' market fills a niche where people of similar environmental opinions can come together. While getting more people involved in local food and other environmental discussions is not a bad thing, if the operations are not managed effectively, a rift could form between multiple groups leading to poor coordination and a decrease in the quality of services provided (Haden & Buck, 2012; Martinez et al,2010).

Before any system is chosen to expand the presence of local food in the Orono and university communities, an economic analysis would have to be performed to see the effect of a new local food system. Both the possible profits, and the possible profit loss for a new system or the existing systems would be beneficial to developing these models and for investigating any other options.

Another concern that does not relate to the economic factors of competing local food systems, is the possible competition between farm development near the downtown, conservation efforts, and further residential development (Feenstra, 2002; Kremer & DeLiberty, 2011; Stephenson et al, 2008). Orono is already focused on the environment. With the establishment of The Orono Land Trust in 1986, the people of Orono set goals

of maintaining open space in the town and continuing to provide a public trail system (Orono Land Trust, 2011). When considering the desire for smart growth of the Orono community, is the development of a local farm system the best choice for the use of land in town that has other intrinsic, economic, or social values? This is a question that is not easily determined, and the wide variety of analyses necessary to answer this question was beyond the scope of this project.

E. Further Research in Orono

In the Orono and University of Maine communities there are avenues of support, supply, and teamwork that have yet to be explored. Further research needs to be conducted into the demand of a local food system in both communities. The university already uses many local products in its dining halls, but students who live off campus do not have easy access to these products. In the Town of Orono, the townspeople must travel to Hannaford's, IGA, or Wal-Mart to purchase groceries during the week. Research needs to be conducted that investigates more fully the desires of permanent Orono residents to see a local grocery store downtown or an expanded year round farmers market. Without this research, any local food system that was developed would risk failure by being located in an unsupportive and undedicated community that did not involve itself in the process (Selfa & Qazi, 2005; Stephenson et al, 2008; Varner & Otto, 2008).

Another very important aspect that must be researched further are the needs of the Orono and university communities. While some needs have been identified, their depth and breadth must be investigated. If this aspect were to be studied it must be done with

caution and in confidence, as the subject of food security can be a sensitive topic (Lyson, 2004). If a local food system were developed and the community did not need its service, the purpose of the system and the motivation for it could be lost. By tying a local food system into other aspects of education, distribution, and community the chances for its success increase (Cather, 2008; Follett, 2008; Lyson, 2004; Schmit & Gomez, 2011; Setela et al, 2011).

If an expanded local food system were to be implemented in Orono, the contributing ownership parties must make sure that there are sufficient funds to complete the initiation process (Labao, 1990; Martinez, 2010; Stephenson et al, 2008). Without the proper funding, any local food system would not be able to establish itself sufficiently in order to be successful. This funding could be derived from federal, state, or private grants, and would most easily be obtained if there were an educational component to the local food system effort. Funding could also come from donations or taxation. Taxation is never a popular option and might only be accepted if the community were convinced that the local food system was a commons service in which all people of the community had a stake in (Donahue, 1999).

For the development of these models as well as any other model that is brought forward, a feasibility study would be useful (Delind, 2010; Duram & Oberholtzer, 2010). One was not conducted for this thesis because an actual plan for development was not developed and investigated. However, if at any point in the future a more involved and expanded local food system is discussed, a feasibility study would be helpful, discussing the involvement of different managers, consumers, infrastructure, methods, and funds. In order to obtain the best idea of whether or not a system will be successful, accurate

information on all aspects must be gathered, and all possibilities must be discussed. The inclusion of a variety of parts and models will provide the best range of viewpoints and lead to the best chance for success (Feenstra, 2002; Stephenson et al, 2008).

F. Unique Opportunities

As a Land Grant University, the University of Maine has been on the cutting edge of agricultural research and solutions, as well as other sciences. The university should continue to do so. With building interest in local food systems to replace our current industrial agriculture, it may be time for the university to involve itself more intensely in sustainable local agricultural fields. Every college and university across the country is part of some community. The University of Maine has an opportunity to develop a deeper connection with its community and test out new local food ideas. For Orono, the chance to establish itself as a model of partnership and community connection, brings both social and financial questions.

While this research focused on establishing and incorporating a larger local food system in Orono, the university is close enough to Bangor that it could work to develop a regional food system. A system of that magnitude would have to be planned out and coordinated very carefully (Durham et al, 2009; Eckert & Shetty, 2011; Lyson et al, 1995; Nordahl, 2009). More infrastructure would have to be designated for a community farm, while the distribution system would have to be expanded so that it was accessible to an even larger number of people (Hinrichs, 2000; Lee, 2011; Lyson, 2004). All parties involved must find an answer to the question, "Is a local food system worth the time, money, and risk?"

IV. CONCLUSION

The conclusion of this thesis does not mean that all aspects of local food systems in Orono have been investigated. On the contrary, only a small but essential piece of the research has been completed (Duram & Oberholtzer, 2010; Feenstra, 2002; Stephenson et al, 2008). This thesis provides the basis for understanding what is needed for a local food system, and it validates that there is land available in Orono that could be utilized in a local food system. By completing the land suitability assessment and establishing possible avenues of development, a flag has been raised marking a use of land that should be considered if or when development in that part of the community occurs.

Every community is unique, and each of the local food systems discussed in this thesis have some unique interactions. The success of the food system can be boiled down to a few factors. Dedicated and involved communities, motivated and knowledgeable managers, and political and financial support are the most essential determinants of successful systems. When developing a local food system, these three aspects should be the first to be identified and deemed suitable. With these essential aspects well researched and securely in place, the other factors of infrastructure and producers can be identified and can fall into place in the systems. Whatever system is chosen, it will need constant attention as it shifts to meet the needs of the community and the requirements for those involved.

Once the keystone factors are in place infrastructure can be identified by different methods. One of the most effective methods for identifying land or regions to support a system is a suitability analysis (Eckert & Shetty, 2011; Kalogirou, 2002; Li & Li, 2011; Malczwski, 2004). This suitability analysis should be based off the requirements of the

system chosen, and in a system that is going to be based around the public community it should include their goals and desires (Cox et al, 2008; Thilmany, 2008; Varner & Otto, 2008; Wiebe, 2003). In a system that is going to be based around a private group of contributing members, all members should have a say in what the system does (Goldman & Clancy, 1991; Ehlers & Fox, 1982; Hibbert et al, 2006; Hinrichs, 2003).

This investigation into the requirements of a local food system, and the comparison of some of these requirements to the current situation of the Town of Orono concludes that the town is not presently ready for an intensified local food system. Even with the presence of the University of Maine, not enough of the community is in support of a larger local food system than that which is presently established. Further research into the desires of the university and Orono communities may discover otherwise. It was determined that the necessary infrastructure is available for development, but a proposed cost was not established, and needs to be investigated. Whether it would be the University of Maine or the Town of Orono that contributed the funds for development, both communities should benefit.

The establishment of a local food system is not a choice to be made quickly. There are many factors that must be analyzed and integrated for a system to be successful. In the end, the needs of the community should be central to any decision. The goal of the field of Land Use Planning is to map communities for the future. The goal of any agricultural system should be to provide food now as well as for the future. Planning food into our communities may give us the best chance for sustainability. In the Growing Town of Orono, no one can predict how the values and demands of its citizens will

evolve, or what will happen in the next 150 years of this unique partnership with the University of Maine.

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Authors Biography

Gregory P. Viens was born in Attleboro, Massachusetts on August 13, 1990. He was raised in Mansfield, Massachusetts and later moved to Attleboro, graduating from Bishop Feehan High School in 2008. Gregory majored in Ecology and Environmental Science and chose the concentration of Land Use Planning. Upon Graduation Gregory plans to return home and pursue a career in Environmental Consulting, monitoring or remediation. If his interest persists, and the opportunity presents itself, Gregory would possibly return to school to pursue an advanced degree in Land Planning.