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Values-based supply chains: local and regional food systems in the Upper Midwest United States

Kevin Richard Duerfeldt
Iowa State University

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**Values-based supply chains: Local and regional food systems in the Upper
Midwest United States**

by

Kevin Richard Duerfeldt

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY

Co-majors: Sustainable Agriculture; Horticulture

Program of Study Committee:
Cynthia L. Haynes, Major Professor
J. Gordon Arbuckle
Jennifer M. Boussetot
Ajay Nair
Lisa A. Schulte Moore

Iowa State University

Ames, Iowa

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ABSTRACT

In recent years there has been growing public interest in sustainable food systems. One effect of growing interest is the proliferation of values-based supply chains or local food systems. The main limiting factor of local food systems is infrastructure for aggregation and access to supply chains. Food hubs have been identified as one solution. My purpose is to capture valuable data about the state of local foods industries in 2012 and inform organizations developing food hubs. To do this I surveyed characteristics of established food hubs and analyzed local Iowa vineyards and wineries, as a case study of an established local food system. I developed the following objectives: 1) determine the number and kind of food hubs operating in the Upper Midwest United States, 2) examine age, business structure, and products of food hubs regionally, 3) examine the location of food hubs in relation to their grower suppliers and customers, and 4) document financial, physical, human, and information resources, used while operating food hubs. To complete these objectives I developed and administered a 57-question survey to 91 food hubs in the Upper Midwest United States. Thirty-four food hubs responded (37%). Ninety percent of food hubs were for profit organizations mainly operating as corporations (47%) or cooperatives (38%). Food hubs used varying amounts and types of facilities and equipment originally financed using cooperative members (43%), private investors (29%), and private loans (24%). By facilitating communication between growers and consumers (73%) and between growers (65%) food hubs also build human and social capital within their local food system. Overall food hubs were

highly variable, likely due to contextual differences such as consumer market, inventory supply, values, and financial resources. When analyzing Iowa's grape and wine industry I developed three spatial questions: 1) How are vineyards and wineries distributed in Iowa? 2) Are there statistically significant clusters of vineyards or wineries? 3) What are the site characteristics of vineyards? Mapping and statistical analyses were completed using ArcGIS, GeoDa, and Microsoft Excel. Through spatial analysis I saw the influence of market access on vineyard and winery density. Though there was no correlation between county population and vineyard or winery density, box plot maps of vineyards and wineries per county clearly show counties in the upper quartile near population centers and counties in the lower quartile in less populated areas. Based on proximity between vineyards and wineries alone, currently wineries should be able to meet aggregation needs of vineyards with winery service area ranging from 2046 km to 513375 km and the greatest distance between a vineyard and its closest winery being 54 km.

CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Dissertation Organization

Five manuscripts are presented in this dissertation. Chapter 1 includes a review of food hub values-based supply chain literature as well as my research objectives for each chapter. Chapter 2 is a manuscript discussing the general demographics and distribution of food hubs in the Upper Midwest United States prepared for submission in *The Journal of Agriculture, Food Systems and Community Development*. Chapter 3 is a manuscript describing financial and physical resources utilized by food hubs prepared for submission in *The Journal of Food Distribution Research*. Chapter 4 is a manuscript describing food hubs use of human and information resources, and how food hubs develop additional human and social capital. It is intended for submission in *The Journal of Agriculture Food and Human Values*. Chapter 5 is a manuscript describing and comparing the distributions of vineyards and wineries in Iowa. It has been prepared for submission in *The American Journal of Enology and Viticulture*. Chapter 6 presents general conclusions and a discussion of the dissertation as a whole. Appendix A is the survey tool sent to food hubs in the Upper Midwest United States.

Introduction

The purpose of this dissertation is to present characteristics of food hubs established in the Midwest United States. This will make organizations looking to

create new food hubs more aware of the types of financial, human, information, and physical resources needed to operate food hubs. Demographics of current food hubs will assist new food hubs with setting benchmarks for success by informing them of the size, profitability, and impact of current food hubs. In order to accomplish this we first need to understand scope, organization, benefits, and challenges of local food systems for context.

Local/Regional Food Systems

“Local” is one label used to describe characteristics associated with food. Other common labels include natural, organic, sustainable, fair trade, family farm, grass fed, and pasture or free range. These labels convey values associated with the production and marketing of food. Local may have a variety of definitions depending on source and context, ranging from vague to concrete. Authors and research participants including growers, retailers, and consumers, have different ways of conceptualizing and defining “local” (Ostrom, 2006): community (Berry, 1996), political boundaries i.e. county or state (Harris et al., 2000; Norton, 2008; Pirog, 2003; Pirog and Rasmussen, 2008; Wilkins et al., 1996; Zepeda and Leviten-Reid, 2004), provenance or eco-region (Barham et al., 2005; Tregear et al., 1998), distance in miles with upper limits ranging from 30 to 400 miles (Chambers et al., 2007; Durham et al., 2009; Flint, 2004; Johnson et al., 2012; Nabhan, 2002; Pirog and Rasmussen, 2008; and Pretty et al., 2005), distance measured in time with upper limits ranging from 5 hours to 1 day (Porjes, 2007; Zepeda and Leviten-Reid, 2004), or some combination of these; i.e. within 100 miles or produced in your state.

Some research shows that consumers assume local includes not only geographic proximity but also characteristics of quality, freshness, and other value labels (Thompson et al., 2008 on Feenstra, 2002).

“Flexible localism” refers to how distances considered to be local vary between regions (Durham et al., 2009 and Ilbery and Maye, 2006). The percentage of producers defining local as their own or surrounding counties was much greater in densely populated areas than in more rural areas where local was considered to be a larger geographical area (Selfa and Qazi, 2005). Their studies show the importance of context in studying and developing local food systems.

The 2008 Farm Bill defined “locally or regionally produced agricultural food product” as “any agricultural food product that is raised, produced, and distributed in ... the locality or region in which the final product is marketed, so that the total distance that the product is transported is less than 400 miles from the origin of the product”; or “any agricultural food product that is raised, produced, and distributed in ... the State in which the product is produced.” (Johnson and Becker, 2008).

Alternatively, the Food and Drug Administration Food Safety Modernization Act defined a “qualified end-user”—for the purposes of exempting smaller, local producers from regulation—as “the consumer of the food; or ... a restaurant or retail food establishment ... that is located ... in the same State as the farm that produced the food; or ... not more than 275 miles from such farm” (Johnson et al., 2012). This example shows inconsistencies in the definition of local even within the federal government.

Alternatively, Tregear et al., in 1998 found that consumers associate “local” with foods from certain geographic regions. This shows the change in consumer views between 1998 when “local” was associated as a product with an identified geographic region of origin, and, 2007, when “locavore” was named the New Oxford American Dictionary word of the year and defined as “a person whose diet consists only or principally of locally grown or produced food”. Foods Tregear found consumers associated with local in 1998 are now referred to as locality foods (Chambers et al., 2007) or place-based foods (Futrell and Chase, 2004 and Giovannucci et al., 2010). Locality foods are food products, or recipes typical of a community, eco-region, provenance, or terroir. Product examples of locality food include bourbon, Columbian coffee, 100% Florida oranges, Vidalia onions, Camembert, Roquefort, Welsh Beef, etc. Locality foods have a particular region of origin but are often marketed nationally and internationally (Jones et al., 2004). Examples of locality foods policy areas include protected designation of origin, protected geographical indication, and traditional specialties guaranteed in the European Union (European Commission, 2014) and the Country of Origin Labeling and Distinctive Products Annexes (311 and 313) of the North American Free Trade Agreement, 1994.

Values-Based Supply Chains

Across the country food systems alternative to industrialized, commodity markets are developing. These systems are based on values such as equitable incomes for farmers and farm workers and costs for consumers, high quality fresh produce, environmentally sound production practices, reduced transportation

distances and energy consumption, and use labels such as “local”, “regional”, “sustainable”, “family farm”, and “organic” (Feenstra et al., 2011). Producers, consumers, and even some intermediaries (processors, restaurant owners, and grocers) feel these values are underrepresented in our conventional food system, which focuses on low prices and convenience. These food system dissenters have been creating alternative food systems that embody and preserve their values throughout the supply chain (Flaccavento, 2009). In addition to embedded values these systems also maintain transparency throughout the system by sharing information such as production practices and cost of production (Stevenson and Pirog, 2008). Alternative values-based supply chains can be divided into two groups: 1) direct-to-consumer and 2) aggregated supply chains.

Direct-To-Consumer Supply Chains

Direct-to-consumer supply chains include those where producers and consumers exchange goods and services directly without involvement from intermediary agents. Direct-to-consumer local food supply chains may include farm stands, farmers markets, Community Supported Agriculture (CSA) farms, pick your own or agritourism farms, and direct-to-consumer websites (Hughes et al., 2007 and Martinez et al., 2010). The number of farmers markets and CSA methods has increased in recent years. The number of farmers markets has grown from 3,137 and 5,274 in 2002 and 2009 respectively to over 8,100 in 2014, a 158% increase over 10 years (Martinez et al., 2010 and USDA, Agricultural Marketing Service, 2014). The concept of CSAs originated in the 1960's in Europe and Japan and by 1986 there were two farms operating CSAs in the United States (Adam, 2006;

Farnsworth et al., 1996; Groh and McFadden, 1990; and Van En, 1992). The 2012 census of agriculture found 12,617 farms marketed products through a CSA structure. This continued increase even through economic downturns suggests that increased demand for local foods is more than a temporary fad.

Aggregated Supply Chains

Aggregated supply chains include intermediaries such as collaborative multiform CSAs, grower or consumer cooperatives, wholesalers, and retailers. These intermediaries, also known as food hubs, are potential components of aggregated, local or regional, values-based supply chains. In essence food hubs “facilitate the aggregation, storage, processing, distribution, and/or marketing of locally or regionally produced food products” (Barham, 2011 and Barham et al., 2012). This definition is purposefully and necessarily flexible to include the vast array of businesses and organizations using a number of business strategies to facilitate local and regional food systems (Fischer et al., 2012). They distribute local foods to institutions or businesses such as hospitals, schools, nursing homes, prisons, grocery stores, retailers, and restaurants as well as individual household consumers.

Hotel, restaurant, and institutional markets are complex and managers must include menu offerings, geographic location, ownership status, purchasing and payment policies, package forms, convenience, and compliance with state and federal government regulations when selecting food suppliers (Reid and Reigel, 1988 and Strohbehn and Gregoire, 2003). They typically face obstacles including inconsistent availability and quality, difficulty identifying reliable local suppliers,

making purchases, and dealing with multiple suppliers (Hardesty, 2008; Martinez et al., 2010; and Painter, 2008). Food hubs have been identified as an intermediary capable of ameliorating these challenges connecting small and medium scale local producers and institutions, specifically schools and hospitals (Abate, 2008; Lawless et al., 1999; Martinez et al., 2010; Vogt and Kaiser 2008

Food hubs use one of four distribution models: retail driven, nonprofit driven, producer driven, or consumer driven (Diamond and Barham, 2011). Food hubs often support and catalyze regional food system development (Melone et al., 2010) and take many different forms, vary in size, organizational structure, geographic area served, products carried, customers and farmers served, and whether or not they carry imported items (Cheng & Seely 2011; Day-Farnsworth et al., 2009; and Melone et al., 2010). Commonly observed forms include: producer or consumer cooperatives, produce auctions, private or non-profit wholesalers, or as multi-farm CSAs (Day-Farnsworth et al., 2009; Bregendahl and Flora, 2006).

In 2011 the National Food Hub Survey surveyed 72 food hubs and 35 public markets (Barham, 2011) from the USDA working list of food hubs (USDA, 2011). In 2013 another national survey of food hubs was completed; this time 222 food hubs were surveyed from members of the National Good Food Network Food Hub Collaboration. As local and regional food systems develop, food hubs are establishing, becoming more well known, and beginning to network better leading to the 107% increase in the number of surveyed food hubs in just two years. Fischer, 2013 found that, while the majority of food hubs are now supporting themselves with

little or no grant assistance due to their values and missions, traditional measures of financial success may be less relevant.

Benefits of Local Foods

Commonly claimed benefits of local food systems over conventional national or international food systems include greater economic returns for farmers, better quality and more nutritious food for consumers, better access to food for consumers, environmental benefits from smaller diversified farms using less chemicals, and less energy for transportation due to fewer food miles (Born and Purcell, 2006; Hinrichs, 2003; and Tregear, 2011). The assumption that each of these benefits are inherent in all local food systems has been debated (Hinrichs, 2003), and has been referred to as the “local trap”. These benefits are not inherent to local food systems due to their scale, but due to the social actors participating in them and their agendas (Born and Purcell, 2006).

Economic Impact

Direct marketing of local foods is a small but fast growing segment of U.S. agriculture. Sales increased from \$812,000,000 in 2002 to \$1,211,270,000 in 2007, but stayed relatively the same between 2007 and 2012 rising to \$1,309,827,000, a 61% increase over 10 years (USDA National Agriculture Statistics Service, Census of Agriculture 2002, 2007, and 2012).

In Iowa, the 229 farmers markets had total estimated sales of \$20 million during the 2004 market season (Otto and Varner, 2005). In 2009 it was estimated that 203 farmers markets were operating in Iowa serving 4,000 customers, 1,200 vendors and generating \$38.4 million in sales (Otto, 2010). While the number of Iowa farmers markets decreased the remaining farmers markets grew. From 2004 to 2009, the Cedar Rapids farmers' market sales increased \$4,308,000, and Des Moines grew \$9,678,000 (Otto, 2010). The national average per farm value of direct sales to consumers, intermediaries, and institutions was reported to be \$56,240 in 2008 (Low and Vogel, 2011). The average per farm value of direct sales to consumers, intermediaries, and institutions in Iowa was reported to be \$102,420 in 2012 (Bregendahl and Enderton, 2012).

Each full-time job created in local foods adds an additional half-time job in other sectors of the Iowa economy (Martinez et al., 2010 and Otto and Varner, 2005). Moreover, every \$1 million in local food sales adds an additional 7.7 to 13 full time jobs to the state economy (Bregendahl and Enderton, 2012).

To Producers

Local and regional food systems create alternatives for farmers looking to differentiate their product in a more financially viable market (Bendfeldt, et al., 2011 and Diamond and Barham, 2011). Access to land and rising costs of land, equipment, chemical inputs, and facilities have made purchasing and operating a farm expensive and difficult for small and beginning farmers (Ahearn, 2009). Fruits, vegetables, specialty meats and dairy, cut flowers, honey, etc. provide high value

alternatives that require less land and equipment to produce while still providing a living wage for farm families and workers. Diversified specialty crop farms' average net income per acre ranged from \$3,757 to \$5,664 depending on size (Hendrickson, 2005). Net income per acre is estimated to be \$304-\$364 for corn and \$311-\$334 for soybeans in 2014 (Schnitkey, 2013). Food hubs, specifically, benefit producers by helping them obtain greater prices, giving them additional marketing options, and giving them greater access to markets (Barham, 2011; Clancy and Ruhf, 2010; and Flaccavento, 2009). Value-based supply chains build personal and professional communities, allowing growers to expand their knowledge of farming practices and marketing (Bregendahl, 2006) and reduce uncertainty about future economic viability due to interdependence of participants (Hand, 2010).

Small-scale and beginning farmers may gain particular benefit from food hubs. Common barriers for beginning farmers include 1) opportunity to access land and 2) capital required for purchasing land and equipment at a profitable scale (Ahearn, 2011). Food hubs assist small-scale and beginning farmers by supplying packing, sizing, grading, and storage facilities as well as umbrella liability coverage (CAFF, 2011). The cooperative nature of food hubs also encourages communication between farmers and assists beginning farmers with developing practical knowledge, marketing skills, professional relationships (Bregendahl and Flora, 2006) and allows them to focus on fewer select crops reducing labor and management requirements (Perry and Franzblau, 2010).

To Consumers

Development of local and regional food systems can increase access to produce that embodies consumer-supported values. Values-based supply chains make local fresh fruits, vegetables, baked goods, dairy products, and meat more available and prevalent in the community (Matson et al., 2011) and assist the functionality of farm to institution programs (Erlbaum et al., 2011). Direct-to-consumer chains may even make products more affordable by reducing intermediaries and overhead expenses (Barham, 2011 and Matson and Cook, 2011). The Iowa Department of Land Stewardship (IDALS) has programs to provide farmers market vouchers to low income and elderly residents allowing them to use WIC and SNAP benefits at local farmers markets (IDALS, 2014; USDA FNS, 2014). These programs increase access for all residents, not just those with sufficient income. Aggregated supply chains can be used to increase the amount of local produce in conventional retail and service locations making local food purchases more convenient.

To Community

Economic benefits of local and regional food systems include reduction in unemployment, increased local tax revenue, greater regional branding, attraction and retention of local businesses, improved rural economies, improved economic security, increased environmental stewardship, improved public health, and a better quality of life (Masi et al., 2010). Each job created in direct local food sales through farmers markets creates an additional 0.45 to 0.78 jobs in other sectors of the economy (Henneberry et al., 2009 and Otto and Varner, 2005). Local agriculture not only supports farmers but also provides opportunities for other businesses such as

specialty food stores, boutiques, quilt shops, restaurants and inns through tourism. These businesses employ residents and can create an atmosphere desired by city dwellers for weekend trips, improving the local economy through integrated rural tourism or all-round sustainable tourism. (Clark and Chabrel, 2007; Ilbery et al., 2007; Sims, 2009; and Torres, 2002). The Amana Colonies, for example, have built a thriving tourist industry with local foods as a major component of its foundation. More than 800,000 tourists come to visit this 150-year-old group of villages each year, spending \$42 million dollars annually (Wood, 2011). Local food and agri-tourism business in the Amana Colonies include a microbrewery, six wineries, and 10 specialty local food shops (Amana Colonies, 2014).

Considerations and Challenges

Lack of distribution systems and infrastructure and lack of capital to develop infrastructure is often identified as the largest hurdle for local food systems to overcome (Day-Farnsworth et al., 2009; Erlbaum et al., 2011; Hardy and Holz-Clause, 2008; Kirby et al., 2007; Martinez et al., 2010; Perrett, 2007; and Vogt and Kaiser, 2008).

For farmers, growing produce for wholesale markets, including food hubs, requires modification of production and business practices. Growing for wholesale markets requires increased volume to compensate for reduced price per unit, often meaning farmers must mechanize (Abate, 2008; Gregorie et al., 2005; and Guptill and Wilkens, 2002). Larger quantities may also mean additional labor and

development of managerial and accounting skills to handle employees, extra insurance, and tax obligations, which farmers may or may not have (Day-Farnsworth et al., 2009). Farmers who are most satisfied by customer interactions may lose job satisfaction when transitioning from direct to consumer to wholesale markets (Slama, 2010).

Food safety and traceability are major concerns throughout values-based supply chains. Due to small farm size, products often are combined at food hubs to make processing, shipping, and marketing economical, which reduce traceability (Krissoff et al., 2004), and means all growers must be held to equally high standards for food safety. Food hubs and their growers, supplying government institutions such as schools, are required to have GAP certification and follow food safety guidelines. Farmers and food hub managers require assistance and managerial expertise related to food safety practices, recordkeeping, insurance, and regulatory certifications (Clancy and Ruhf, 2010; Lawless, 1999; Matson and Cook, 2011; and Tropp and Barham, 2008). Food hubs may even assist growers with coming into compliance with these regulations and provide umbrella liability insurance coverage (CAFF, 2011 as seen in Lerman et al., 2012).

General business management and marketing issues have been sited as being common among food hubs. Developing products, finding new markets, and matching quantities being supplied by farmers and purchased by customers are all common marketing challenges food hubs must overcome in order to continue growth and minimize loss while ensuring a steady supply to customers. Food hubs must not only manage quality assurance, food safety records, logistics, and organizational

growth but also communicate this information to growers, customers, government agencies, and other conventional supply chain participants. These tasks may be difficult for food hub operators and farmers who come from a production background and have varying degrees of supply chain experience (Clancy and Ruhf, 2010; Dreier and Taheri, 2008 and 2009; Matson and Cook, 2011; and Melone et al., 2010).

I will address the lack of local foods distribution infrastructure (Day-Farnsworth et al., 2009; Erlbaum et al., 2011; Hardy and Holz-Clause, 2008; Kirby et al., 2007; Martinez et al., 2010; Perrett, 2007; and Vogt and Kaiser, 2008) by determining characteristics of current food hubs as well as what resources and practices they use while operating. This will inform organizations interested in establishing new food hubs of what community conditions may have promoted success and what financial, physical, human, and information resources current food hubs use to conduct business. Perspective food hubs may then consider these conditions and resources during planning. By learning from the experiences of pioneers in local food enterprises new food hubs will be able to avoid potential problems and increase growth and success. To accomplish this goal I developed the following chapters and objectives.

Objectives: Chapter 2 Demographics and Distribution of Food Hubs

This study will inform groups seeking to develop local and regional food hubs by providing demographics of current food hubs. The objectives of this study are to, 1) determine the number and kind of food hubs operating in the Upper Midwest

United States as well as what market segment they fill, 2) examine the organizations age, business structure, and products carried to better describe existing food hubs, 3) examine the location of food hubs in relation to their grower suppliers and customers, and to 4) survey what criteria are used for selecting the location of food hubs.

These findings will contribute to the literature by 1) adding detailed regional data to current national food hub survey findings, 2) providing data from another year that can be combined with national studies to get a longitudinal picture of local food system development, and 3) including a geographic information systems approach not included in previous surveys. Additional practical implications may include making information available for organizations and government agencies to create and evaluate food system development plans and policies and giving organizations interested in creating food hubs information on potential returns, common legal structures, and locational considerations. If this information assists with creating new food hubs or expanding current food hubs the benefits to society could include increased markets for local farmers, increased consumer access to fresh, local produce, and economic development.

Objectives: Chapter 3 Physical and Financial Resources Required by Food Hubs

This study will inform groups seeking to develop local and regional food hubs of the physical and financial resources used by current food hubs. The objectives of this study are to, 1) determine the number and kind of food hubs operating in the

Upper Midwest United States, 2) examine the facilities and equipment used to establish and maintain current food hubs, 3) examine the financial capital used to establish and expand current food hubs, and to 4) examine cash flows of current food hubs to assess their financial viability.

This Chapter makes three contributions to the literature: 1) regional food hub data that compliments national studies, 2) an additional temporal sample of food hub characteristics for future longitudinal studies, and 3) suggest case studies as a method for overcoming the large variation among food hubs and still obtaining meaningful data. I also hope that this chapter will inform groups exploring the possibility of starting new food hubs of 1) the amount of financial capital needed to establish a food hub, 2) sources of financial capital used by existing food hubs, 3) facilities and equipment used by current food hubs, and 4) how current food hubs have minimized their physical and financial capital requirements through careful planning and community partnerships.

Objectives: Chapter 4 Information and Human Resources Required by Food Hubs

To assist with the development of local and regional food hubs, I completed the following objectives: 1) identify quantities and characteristics of human resources required by food hubs in the form of employees, suppliers, and customers, 2) determine if food hubs are developing social, cultural, or human capital in their community (and how), 3) characterize information management and procedures

needed to properly operate food hubs including inventory management, certifications, and guidelines for produce.

I intend to contribute to the literature: 1) complimentary regional food hub data, 2) an additional point-in-time sample of food hub characteristics for future longitudinal studies, 3) suggest case studies as a method for overcoming the large variation among food hubs and assisting food system developers with recreating current successes, and 4) give examples of how food hubs build human and social capital by offering continuing education and facilitating communication. Practical implications of this chapter include presenting to perspective food hubs, 1) three commonly used inventory management systems, 2) numbers of employees, customers, and growers used by current food hubs, and 3) how food hubs build these human resources by facilitating communication and offering educational experiences.

Objectives: Chapter 5 Geographic Distribution and Topographic Conditions of Iowa Vineyards and Wineries

A preliminary step to more in-depth spatial analysis of the Iowa grape and wine industry and Iowa's suitability for grape production is better understanding the spatial distribution of Iowa vineyards and wineries. This study intends to answer three spatial questions for the state of Iowa. 1) How are vineyards and wineries distributed in Iowa? 2) Are there statistically significant clusters of vineyards or wineries? 3) What are the site characteristics of vineyards? By describing how

vineyards and wineries are distributed we can identify areas that can easily be expanded and marketed as “wine regions” and areas that lagging behind, assist extension personnel with advising these vineyards and wineries, and gain insights from an established local foods industry that can be applied to food hubs.

By completing the objectives of these five chapters I hope to add to the literature a regional view of food hubs in the Upper Midwest United States for comparison with national statistics, and add data from another point in time for longitudinal studies. Chapters two and five also give examples of how geographic information systems may be useful in industry planning and monitoring. Chapter four shows that food hubs not only move physical product but also build human and social capital. Modeling vineyards and wineries provided an example of a more mature local food system and how growers, aggregators, and consumers are distributed. All five chapters provide examples of current food hubs with ideas and suggestions for organizations looking to establish new food hubs.

References

- Abate, G. (2008). Local food economies: Driving forces, challenges, and future prospects. *Journal of Hunger and Environmental Nutrition*, 3(4), 384-399.
- Adam, K. L. (2006). *Community supported agriculture*. ATTRA-National Sustainable Agriculture Information Service. Butte, MT. Retrieved from <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=262>. Last retrieved July 10, 2014
- Ahearn, M. C. (2011). Potential Challenges for Beginning Farmers and Ranchers. *Choices*, 26(2), 6.

- Ahearn, M., & Newton, D. J. (2009). *Beginning farmers and ranchers*. US Department of Agriculture, Economic Research Service.
- Amana Colonies Visitor Center. (2014). Amana Colonies: The handcrafted escape. Retrieved from www.amanacolonies.com. Last retrieved July 9, 2014.
- Barham, E., Lind, D., and Jett, L. (2005). The Missouri regional cuisines project: connecting to place in the restaurant. *Urban Place: Reconnections with the Natural World*.
- Barham, J. (2011). Regional food hubs: Understanding the scope and scale of food hub operations. Washington, DC: USDA AMS. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5090409>. Last Retrieved July 19, 2014.
- Barham, J., Tropp, D., Enterline, K., Farbman, J., Fisk, J., and Kiraly, S. (2012). Regional food hub resource guide. U.S. Department of Agriculture, Agricultural Marketing Service. Washington D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097957>. Last retrieved July 12, 2014.
- Bendfeldt, E. S., Walker, M., Bunn, T., Martin, L., and Barrow, M. (2011). A Community- Based Food System: Building Health, Wealth, Connection, and Capacity as the Foundation of Our Economic Future. Virginia Cooperative Extension. Retrieved from <http://pubs.ext.vt.edu/3306/3306-9029/3306-9029-PDF.pdf>. Last retrieved June 18, 2014
- Berry, W. (1996). *The unsettling of America*. 3rd edition, revised. Sierra Club Books, San Francisco, CA.
- Born, B., and Purcell, M. (2006). Avoiding the local trap scale and food systems in planning research. *Journal of Planning Education and Research*, 26(2), 195-207.
- Bregendahl, C. (2006). Local food consumption and rural public health. *Rural Roads, National Rural Health Association*, 4(3), 16-19.
- Bregendahl, C., and Enderton, A. 2012 Economic Impacts of Iowa's Regional Food Systems Working Group. Leopold Center for Sustainable Agriculture. Ames, IA.
- Bregendahl, C., and Flora, C. B. (2006). The role of collaborative community supported agriculture: lessons from Iowa. North Central Regional Center for Rural Development. East Lansing, MI.
- Chambers, S., Lobb, A., Butler, L., Harvey, K., and Bruce Traill, W. (2007). Local, national and imported foods: a qualitative study. *Appetite*, 49(1), 208-213.

- Cheng, M., & Seely, K. (2011). Building Regional Produce Supply Chains: Helping Farms Access and Sell to Multiple Channels, Helping Large-Volume Buyers Access Regional Foods (pp. 1-32). San Francisco: FarmsReach.
- Clancy, K., and Ruhf, K. (2010). Is local enough? Some arguments for regional food systems. *Choices*, 25(1), 123-135.
- Clark, G., and Chabrel, M. (2007). Measuring integrated rural tourism. *Tourism geographies*, 9(4), 371-386.
- Community Alliance with Family Farmers. (2011). Establishing an aggregation and marketing center for California's north coast (pp.1-51): Community alliance with Family Farmers.
- Day-Farnsworth, L., McCown, B., Miller, M., & Pfeiffer, A. (2009). *Scaling Up: Meeting the Demand for Local Food*. University of Wisconsin-Extension Agricultural Innovation Center, University of Wisconsin Center for Integrated Agricultural Systems. Madison, WI. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091489>. Last retrieved July 10, 2014.
- Diamond, A., and Barham, J. (2011). Money and mission: moving food with value and values. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 101-117.
- Dreier, S., and Taheri, M. (2008). *Innovative Models: Small Grower and Retailer Collaborations: Good Natured Family Farms and Balls Food Stores*. Wallace Center, Winrock International.
- Dreier, S., and Taheri, M. (2009). Innovative Models: Small Grower and Retailer Collaborations, Part B-Balls Food Stores Perspective (pp. 1-10). Arlington: Wallace Center at Winrock International.
- Durham, C. A., King, R. P., and Roheim, C. A. (2009). Consumer Definitions of "Locally Grown" for Fresh Fruits and Vegetables. *Journal of Food Distribution Research*, 40(1).
- Erlbaum, J., McManus, K., and Nowak, A. (2011). Colorado Local Food Hubs for Farm to School Products: An Initial Feasibility Analysis of Local Food Hubs for Colorado Producers and Schools (pp. 1-53). *Colorado: Real Food Colorado*.
- European Commission. (2014). Geographical indications of traditional specialties. Retrieved from ec.europa.eu/agriculture/quality/schemes/index_en.htm. Last Retrieved June 11, 2014.

- Farnsworth, R. L., Thompson, S. R., Drury, K. A., and Warner, R. E. (1996). Community supported agriculture: filling a niche market. *Journal of food distribution research*, 27, 90-98.
- Feenstra, G. (2002). Creating space for sustainable food systems: Lessons from the field. *Agriculture and Human Values*, 19(2), 99-106.
- Feenstra, G., Allen, P., Hardesty, S. D., Ohmart, J., and Perez, J. (2011). Using a supply chain analysis to assess the sustainability of farm-to-institution programs. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 69-84.
- Fischer, M., Hamm, M., Pirog, R., Fisk, J., Farbman, J., and Kiraly, S. (2013). Findings of the 2013 national food hub survey. Michigan State University Center for Regional Food Systems & The Wallace Center at Winrock International. Retrieved from <http://foodsystems.msu.edu/activities/food-hub-survey>. Last retrieved July 5, 2014
- Flaccavento, A. (2009). Healthy food systems: A toolkit for building value chains. Central Appalachian Network. Central Appalachian Network. Retrieved from <http://www.cannetwork.org/documents/Value%20Chain%20Toolkit%2007.22.09.pdf>. Last retrieved June 18, 2014.
- Flint, A. (2004). Think globally, eat locally: move over, organic. A new socially conscious food movement wants to reset the American table. *The Boston Globe*, August, 15. Retrieved from http://www.boston.com/news/globe/ideas/articles/2004/08/15/think_globally_eat_locally?pg=full. Last retrieved June 18, 2014.
- Futrell, S. and Chase, C. (2004) Muscatine Melon. A Case Study of a Place-Based Food in Iowa. Leopold Center for Sustainable Agriculture, Ames IA.
- Giovannucci, D., Barham, E., and Pirog, R. (2010). Defining and marketing "local" foods: geographical indications for US products. *The Journal of World Intellectual Property*, 13(2), 94-120.
- Gregoire, M. B., Arendt, S. W., and Strohbehn, C. (2005). Iowa producers' perceived benefits and obstacles in marketing to local restaurants and institutional foodservice operations. *Journal of Extension*, 43(1), 1RBI1.
- Groh, T., and McFadden, S. (1990). *Farms of tomorrow: community supported farms farm supported communities*. Bio-dynamic Farming and Gardening Association. Milwaukee, WI.
- Guptill, A., and Wilkins, J. L. (2002). Buying into the food system: Trends in food retailing in the US and implications for local foods. *Agriculture and Human Values*, 19(1), 39-51.
- Hand, M. S. (2010). Local Food Supply Chains Use Diverse Business Models to Satisfy Demand. *Amber Waves*, 8(4), 18-23.

- Hardy, C., & Holz-Clause, M. (2008). Bridging the Gap: What does it take to bring small and medium sized producers and retail and foodservice distributors together? (pp. 1-24). Ames: Leopold Center for Sustainable Agriculture, Iowa State University. Competitive grant report: M2006-05. Retrieved from <http://www.leopold.iastate.edu/sites/default/files/grants/M2006-05.pdf>. Last retrieved July 10, 2014
- Harris, B., Burress, D. A., Mercer, S. O., Oslund, P., and Rose, C. C. (2000). *Kaw Valley focus groups on local and organic produce*. University of Kansas, Institute for Public Policy and Business Research.
- Hendrickson, J. (2005). Grower to Grower: Creating a livelihood on a fresh market vegetable farm. Center for Integrated Agricultural Systems. University of Wisconsin. Madison, WI. Retrieved from <http://www.cias.wisc.edu/wp-content/uploads/2008/07/grwr2grwr.pdf>. Last retrieved July 9, 2014.
- Henneberry, S.R., B. Whitacre, and H.N. Agustini. November 2009. "An Evaluation of the Economic Impacts of Oklahoma Farmers' Markets," *Journal of Food Distribution Research*, Vol. 40, pp 64-78.
- Hinrichs, C. C. (2003). The practice and politics of food system localization. *Journal of rural studies*, 19(1), 33-45.
- Hughes, D. W., Eades, D., Robinson, K., Carpio, C., Isengildina, O., and Brown, C. (2007). What is the Deal with Local Food Systems: Or, Local Food Systems from a Regional Science Perspective. In *54th Annual North American Meetings of the Regional Science Association International*. 2007: Savannah GA. WP 11-2007-01.
- Ilbery, B., and Maye, D. (2006). Retailing local food in the Scottish–English borders: A supply chain perspective. *Geoforum*, 37(3), 352-367.
- Ilbery, B., Saxena, G., and Kneafsey, M. (2007). Exploring tourists and gatekeepers' attitudes towards integrated rural tourism in the England–Wales border region. *Tourism Geographies*, 9(4), 441-468.
- Iowa Department of Agriculture and Land Stewardship. (2014). Farmers Market Nutrition Program. Retrieved from http://www.iowaagriculture.gov/Horticulture_and_FarmersMarkets/farmersMarketNutritionProgram.asp. Last retrieved June 11, 2014
- Johnson, R., and Becker, G. S. (2008). The 2008 Farm Bill: Major Provisions and Legislative Action. Congressional Research Service, Library of Congress.
- Johnson, R., Aussenberg, R. A., and Cowan, T. (2012, January). The Role of Local Food Systems in US Farm Policy. In *Congressional Research Service Report for Congress* (R42155).

- Jones, P., Comfort, D., and Hillier, D. (2004). A case study of local food and its routes to market in the UK. *British Food Journal*, 106(4), 328-335.
- Kirby, L. D., Jackson, C., and Perrett, A. (2007). Growing Local: Expanding the Western North Carolina Food and Farm Economy. *Appalachian Sustainable Agriculture Project, Asheville, NC*.
- Krissoff, B., Kuchler, F., Calvin, L., Nelson, K., and Price, G. (2004). *Traceability in the US food supply: economic theory and industry studies* (pp. 3-10). US Department of Agriculture, Economic Research Service.
- Lawless, G., Stevenson, G., Hendrickson, J., Cropp, R. (1999). The farmer-food buyer dialogue project. University of Wisconsin Center for Cooperatives Occasional Paper No. 13. University of Wisconsin Center for Cooperatives. Madison, WI. Retrieved from <http://www.uwcc.wisc.edu/info/ffbuyer/toc.html>. Last retrieved July 12, 2014.
- Lerman, T., Feenstra, G., and Visher, D. (2012). A Practitioner's Guide to Resources and Publications on Food Hubs and Values-Based Supply Chains: A Literature Review. Sustainable Agriculture Research and Education Program, Agricultural Sustainability Institute, University of California, Davis. Retrieved from http://www.sarep.ucdavis.edu/sfs/KYF%20grey%20literature%20review%207.9.12_compressed.pdf. Last retrieved July 19, 2014
- Low, S. A., and Vogel, S. (2011). Direct and intermediated marketing of local foods in the United States. US Department of Agriculture, Economic Research Service.
- Martinez, S., Hand, M., Da Para, M., Pollack, S., Ralston, K., Smith, T., Vogel, S., Clark, S., Lohr, L., Low, S., and Newman, C. (2010). Local food systems; concepts, impacts, and issues (No. 97). U.S. Department of Agriculture Economic Research Service. Washington, D.C. DIANE Publishing. Darby, PA.
- Masi, B., Schaller, L., and Shuman, M. (2010). The 25% Shift: The Benefits of Food Localization for Northeast Ohio and How to Realize Them. Retrieved from <http://www.neofoodweb.org/sites/default/files/resources/the25shift-foodlocalizationintheNEOregion.pdf>. Last retrieved June 18, 2014.
- Matson, J., and Cook, C. (2011). Virtual Food Hubs Help Producers Tap Into Local Food Markets. *Rural Cooperatives*, 78, 4-8.
- Matson, J., Sullins, M., and Cook, C. (2011). Keys to success for food hubs. *Rural Cooperatives*, 78(3), 9.
- Melone, B., Cardenas, E., Cochran, J., Gross, J., Reinbold, J., Brenneis, L., Sierra, L., Cech, S., and Zajfen, V. (2010). California Network of Regional Food

- Hubs: A Vision Statement and Strategic Implementation Plan (pp. 1-60). *California: Regional Food Hub Advisory Council.*
- Nabhan, G. P. (2002). *Coming home to eat: The pleasures and politics of local foods.* WW Norton and Company.
- NAFTA Secretariate. (2014). North American Free Trade Agreement. Annex 311 and 313. Retrieved from <https://www.nafta-sec-alena.org/Default.aspx?tabid=97andlanguage=en-US>. Last retrieved June 11, 2014.
- Norton, F. (2008). Wal-Mart Expo 'A lot like dating': World's top retailer dangles a chance for local food vendors to sell to its stores. *The News and Observer*, April 17, 2008.
- Ostrom, M. (2006). Everyday meanings of "local food": Views from home and field. *Community Development*, 37(1), 65-78.
- Otto, D. (2010). Consumers, vendors, and the economic importance of Iowa farmers markets: An economic impact survey analysis. Ames, IA: Leopold Center for Sustainable Agriculture, Iowa State University.
- Otto, D., and Varner, T. (2005). Consumers, Vendors, and the Economic Importance of Iowa Farmers' Markets: An Economic Impact Survey Analysis. Ames, IA: Leopold Center for Sustainable Agriculture, Iowa State University. Retrieved from <https://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2005-05-consumers-vendors-and-economic-importance-iowa-farmers-markets-economic-impact-survey-analysis.pdf>. Last retrieved July 17, 2014
- Perrett, A. (2007). The infrastructure of food procurement and distribution: Implications for farmers in western North Carolina. *Appalachian Sustainable Agriculture Project*. Asheville, NC.
- Perry, J., and Franzblau, S. (2010). *Local Harvest: A Multifarm CSA*. USDA Northeast Sustainable Agriculture Research and Education. College Park, MD.
- Pirog, R. (2003). Ecolabel Value Assessment: Consumer and retailer perceptions of local foods. Leopold Center for Sustainable Agriculture, Ames IA.
- Pirog, R., and Rasmussen, R. (2008). Food, fuel and the future: Consumer perceptions of local food, food safety and climate change in the context of rising prices. Ames, IA: Leopold Center for Sustainable Agriculture.
- Porjes, S. (2007). Fresh and Local Food in the US Packaged Facts. *Rockville, MD.*

- Pretty, J. N., Ball, A. S., Lang, T., and Morison, J. I. (2005). Farm costs and food miles: An assessment of the full cost of the UK weekly food basket. *Food Policy*, 30(1), 1-19.
- Reid, R.D. and Reigel, C.D. 1998. Purchasing Practices of Large Foodservice Firms. Center for Advanced Purchasing Studies, National Association of Purchasing Management, Tempe, AZ.
- Schnitkey G. (2013). Corn and soybean returns suggest stable Illinois acreages. *FarmDocDaily*. University of Illinois. Urbana-Champaign, IL. Retrieved from <http://farmdocdaily.illinois.edu/2013/10/corn-soybean-returns-stable-illinois-acreages.html>. Last retrieved July 9, 2014
- Selfa, T., and Qazi, J. (2005). Place, taste, or face-to-face? Understanding producer–consumer networks in “local” food systems in Washington State. *Agriculture and Human Values*, 22(4), 451-464.
- Sims, R. (2009). Food, place and authenticity: local food and the sustainable tourism experience. *Journal of Sustainable Tourism*, 17(3), 321-336.
- Slama, J. (2010). Wholesale success: A farmer’s practical guide to selling, postharvest handling, and packing produce. Familyfarmed.org. Last retrieved June 11, 2014.
- Stevenson, G. W., and Pirog, R. (2008). Values-based supply chains: Strategies for agrifood enterprises of the middle. *Food and the mid-level farm: Renewing an agriculture of the middle*, 119-143. MIT Press, Cambridge, MA.
- Strohbehn, C. H., and Gregoire, M. B. (2003). Case studies of local food purchasing by central Iowa restaurants and institutions. *Foodservice research international*, 14(1), 53-64.
- Thompson Jr, E., Harper, A. M., and Kraus, S. (2008). *Think Globally—Eat Locally: San Francisco Foodshed Assessment*. American Farmland Trust. Retrieved from <http://www.farmland.org/programs/states/ca/Feature%20Stories/documents/ThinkGloballyEatLocally-FinalReport8-23-08.pdf>. Last retrieved June, 18, 2014.
- Torres, R. (2002). Toward a better understanding of tourism and agriculture linkages in the Yucatan: tourist food consumption and preferences. *Tourism Geographies*, 4(3), 282-306.
- Tregear, A. (2011). Progressing knowledge in alternative and local food networks: critical reflections and a research agenda. *Journal of Rural Studies*, 27(4), 419-430.
- Tregear, A., Kuznesof, S., and Moxey, A. (1998). Policy initiatives for regional foods: some insights from consumer research. *Food Policy*, 23(5), 383-394.

- Tropp, D., and Barham, J. (2008). *National farmers market summit proceedings report* (No. 148269). Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5066926>. Last retrieved July 19, 2014.
- US Department of Agriculture (2011 and 2013). Working list of food hubs. US Department of Agriculture, Agriculture Marketing Service. Washington DC. Retrieved from <http://www.ams.usda.gov/AMSV1.0/foodhubs>. Last retrieved July 8, 2014.
- US Department of Agriculture. (2002, 2007, and 2012). Census of agriculture. *US Department of Agriculture, National Agricultural Statistics Service, Washington, DC*. Retrieved from <http://www.agcensus.usda.gov>. Last retrieved June 18, 2014.
- US Department of Agriculture. (2014). Farmers' Market Directory. US Department of Agriculture, Agriculture Marketing Service, Washington, DC. Retrieved from <http://search.ams.usda.gov/farmersmarkets/>. Last retrieved June 18, 2014.
- US Department of Agriculture. (2014). Food and Nutrition Service. Retrieved from <http://www.fns.usda.gov>. Last retrieved June 18, 2014
- Van En, R. (1992). *Basic formula to create community supported agriculture*. Cornell University. Ithaca, NY.
- Vogt, R. A., and Kaiser, L. L. (2008). Still a time to act: A review of institutional marketing of regionally-grown food. *Agriculture and Human Values*, 25(2), 241-255.
- Wilkins, J. L. (2002). Consumer perceptions of seasonal and local foods: A study in a US community. *Ecology of food and nutrition*, 41(5), 415-439.
- Wilkins, J. L., Bokaer-Smith, J., and Hilchey, D. (1996). Local foods and local agriculture: a survey of attitudes among northeastern consumers. *Project Report. Division of Nutritional Sciences, Cornell Cooperative Extension*.
- Wood. (2011, April 29). Amana Colonies are a major economic engine. *Corridor Business Journal*. Retrieved from <http://www.corridorbusiness.com/news/a-major-economic-engine/>. Last retrieved July 9, 2014
- Zepeda, L., and Leviten-Reid, C. (2004). Consumers' views on local food. *Journal of Food Distribution Research*, 35(3), 1-6.

CHAPTER II

DEMOGRAPHICS AND DISTRIBUTION OF FOOD HUBS

Abstract

In recent years there has been growing public interest in sustainable food systems. The effects of this growing interest are the proliferation of values-based supply chains or local food systems and food hubs that facilitate product movement. The objectives of this study are to: 1) estimate the number and kind of food hubs operating in the Upper Midwest United States, 2) examine age, business structure, and products of food hubs, 3) examine the location of food hubs in relation to their grower suppliers and customers, and 4) survey the criteria used for selecting the location of food hubs. I developed and administered a survey and analyzed food hub locations using geographic information systems (GIS). I found 97 food hubs, 90% of which were for profit organizations mainly operating as corporations (47.6) or cooperatives (38.1). These food hubs had an average age of 16.5 years and mean gross sales were different between age categories ($p=0.001$) with older food hubs having larger sales. These food hubs carried mainly local fresh produce (95%), meat (72.7%), dairy (54.5%), and eggs (72.7%). Food hubs acknowledged proximity to customers as the most important criteria when choosing facilities (4.09 on a 5 point Likert scale), but no differences were found comparing the population density of the surrounding area to food hub profitability or structure. My findings show that

building contextual organizations that develop appropriate structure and community capital for their unique situation is the key to success of values-based supply chains.

Introduction

Public interest in sustainable food systems is, in part, the result of the environmental movement, the community and food security movement, and the slow food movement (Gaytan, 2003; Guptill and Wilkins, 2002; Ilbery and Maye, 2006; and Martinez et al., 2010). The effects of these growing movements are the proliferation of values-based supply chains or local food systems. Values-based supply chains differ from traditional supply chains in that they attempt to capture price premiums in the market by embedding environmental and social values in their products (Feenstra et al., 2011). Price premiums enhance small and medium farm financial viability (Feenstra et al., 2011 and Stevenson and Pirog, 2008), encourage local economic activity (Enshayan, 2009; Henneberry et al., 2009; Holt-Gimenez and Wang, 2011; Otto and Varner, 2005; and Sonntag, 2008), and correlate to improved health and community engagement (Ahern et al., 2011; Saldivar-Tanaka and Krasny, 2004; and Salois, 2012).

The lack of built capital in the form of distribution systems and infrastructure and the lack of financial capital to construct built capital is often identified as the largest hurdle for local food systems (Kirby et al., 2007; Martinez et al., 2010; and Vogt and Kaiser, 2008). Insufficient distribution chains restrict the movement of local produce from growers to consumers, decreasing opportunities for farmers and

access to local produce for consumers. Food hubs have been proposed as the solution for developing and coordinating local food system infrastructure (Day-Farnsworth et al., 2009; Erlbaum et al., 2011; Hardy and Holz-Clause, 2008; Kirby et al., 2007; Martinez et al., 2010; Perrett, 2007; and Vogt and Kaiser, 2008). Food hubs facilitate the aggregation, storage, processing, distribution, and/or marketing of locally or regionally produced food products (Barham, 2011).

Two other food hub surveys have been conducted at the national level (Barham, 2011 and Fischer et al., 2013). Barham (2011) surveyed 72 food hubs nationwide and Fischer surveyed 222 food hubs in 2013. These results show the recent, rapid growth of local foods and food hubs and are supported by Barham (2012). Both Barham (2011) and Fischer (2013) found most food hubs had been in operation less than 5 years 60% 62% respectively. Barham (2011) found 36% of food hubs operated as non-profits, 27% of food hubs operated as cooperatives, and 26% as Limited Liability Corporations or S Corporations. Fischer (2013) found 47% food hubs were for profit, 34% were non-profits, and 13% of food hubs operated under a cooperative structure. Corporate legal structure shows that food hubs have gone through planning with accountants and attorneys, considering liability and taxation issues as well as the long-term sustainability of the food hub past its founders or current owners.

Nearly all food hubs carry fresh produce 91% (Barham 2011) and 93% (Fischer et al., 2013) with meat, eggs, and dairy rounding out the top four most carried products. In 2013 16% food hubs sold directly to consumers through online

stores, 20% through retail storefronts, and 29% through CSAs (Fischer et al., 2013). These food hubs selling directly to consumers reported that direct to consumer sales accounted for 49% to 58% of their gross sales (Fischer et al., 2013). Diamond (2011) and Morley (2008) categorized food hubs based on the values-based supply chain participant managing the operation and divide food hubs into retail driven, non-profit driven, and producer driven.

Location impacts the daily operations and financial viability of food hubs with physical facilities because it partially determines access to public infrastructure, property costs, transportation expenses, visibility, size of customer base, and proximity to growers and customers. Close proximity of food hubs to their growers and customers reduces food miles, influence consumer perceptions of local, and means community benefits of local food systems such as improved rural economies, and increased environmental stewardship impact both consumers and growers, rather than being transferred to a neighboring community. Fischer (2013) found that the majority of food hub customers live within 50 miles of the food hub and that regions of the country with nine food hubs not within or adjacent to metropolitan counties reported a higher dependence on grant funding, suggesting proximity to a metropolitan area increased financial independence and sustainability.

In order to gain better understanding of the number, type, and size of food Hubs in the Upper Midwest United States I developed the following objectives: 1) determine the number and kind of food hubs operating in the Upper Midwest United States as well as what market segment they fill, 2) examine the age, business structure, and products carried by food hubs to better describe existing food hubs, 3)

examine the location of food hubs in relation to their grower suppliers and customers, and to 4) survey the criteria used for selecting the location of food hubs. This study will inform groups seeking to develop local and regional food hubs by providing demographics of current food hubs. Completing these objectives will compliment national studies by adding detailed information about the state of food hubs regionally and providing data from another historical point for later longitudinal studies.

Based on these objectives I developed the following research questions and hypotheses: 1) How many and what type of food hubs are operating in the Upper Midwest United States? 2) How are food hubs legally structured? 3) What is the mean and median age of food hubs in the Upper Midwest United States? 4) What types of products do food hubs typically carry? 5) Does the population density surrounding food hubs impact business type or profitability? My hypotheses are that 1) Mean gross revenue will vary by business structure. 2) Mean net profit will vary by business structure. 3) Mean gross revenue will vary by business age. 4) Mean gross revenue will vary by surrounding population density. 5) Business type will vary based on surrounding population density. The answers to these questions could aid food system developers and policy makers in creating and evaluating food systems by recording 2012 data for later comparisons. These answers may also assist food hub developers by informing them of how current food hubs are structured and giving them benchmarks for comparing sales or profits.

Methods and Materials

A list was compiled of 97 food hubs based in the 12-state North Central Sustainable Agriculture Research and Education region (NCR SARE) (Appendix A). Criteria for selection was independent organizations based in the study area that facilitate the aggregation, storage, processing, distribution, and/or marketing of locally or regionally produced food (Barham, 2011). Food hub contact information came from the working list of food hubs maintained by the United States Department of Agriculture, Agriculture Marketing Service (USDA, 2014), Buy Fresh Buy Local campaigns (Food Routes Network, 2014), market finder websites such as Market Maker (Food Industry Market Maker, 2014), and an online search. To the best of my knowledge these include all food hubs operating in the Upper Midwest United States in 2012.

A mixed mode survey was developed using the tailored design method (Dillman, 2000). The survey received exempt approval from the Iowa State University Institutional Review Board. The survey consisted of 57 questions (Appendix B). This chapter focuses on the portion of the survey related to general operations and demographics. There were one open ended, one Likert Scale, and 13 multiple choice questions in this section of the survey. The survey tool was reviewed for readability using Microsoft Word (Microsoft Corporation, Redmond, WA) and was found to have a Flesch-Kincaid readability index score of 7.3 (Flesch and Gould, 1949). A survey professional at Iowa State University and a group of local food system experts reviewed the survey tool for validity and content. The survey was revised per their suggestions before being administered.

The survey was originally emailed to 79 participants using Survey Monkey (Palo Alto, CA) on May 22, 2012 with follow up emails sent on June 8th and June 19th. Surveys were also mailed to 12 Amish produce auctions May 31st and reminder phone calls were made between June 18th and 22nd. Six of the food hubs were not surveyed due to insufficient contact information or because they were large food distribution companies with a local food division and were outside the scope of this survey.

Mailed hard copies were entered into Survey Monkey upon arrival. Results were downloaded into SPSS (IBM, Armonk, NY) to calculate descriptive statistics and conduct one way ANOVA analyzes and find differences in between business type and gross profit, business type and net revenue, and years in business and gross sales.

Maps were created using ArcGIS (ESRI, Redlands, CA). Addresses were collected when creating the survey frame and geocoded using the U.S. Census Bureau Geocoder (U.S. Census Bureau, 2014). Shapefiles containing administrative boundaries and total population per census tract were also obtained from the U.S. Census Bureau. Twenty-five mile buffers were added around food hub locations, based on survey results for average distance to customers. Buffers were spatially joined to census tracts to obtain population within a 25-mile radius of each food hub. Using results from spatial analysis I also conducted one way ANOVA analysis between 25 mile population and gross profit and 25 mile population and business type.

Results

**Food Hub
Demographics**

I found a

total of 97

businesses,

nonprofits, and

networks in the

Upper Midwest

United States

NCR SARE

Region (Illinois,

Indiana, Iowa,

Kansas,

Michigan,

Minnesota,

Missouri,

Nebraska, North

Dakota, Ohio,

South Dakota,

and Wisconsin)

Table 1. Food hubs found in the Upper Midwest United States coded by type of operation based on information from food hub website. Population includes all food hubs found while responses only include those that participated in the survey.

	Population N		Responses n	
	Count	Percent	Count	Percent
Consumer coop	15	15%	9	26%
Distributor	15	15%	6	18%
Producer auction	15	15%	2	6%
Multi farm CSA	14	14%	4	12%
Grocery store	13	13%	5	15%
Network	5	5%	1	3%
Online farmers market	4	4%	3	9%
Producer coop	3	3%	0	0%
Restaurant	3	3%	2	6%
Caterer	2	2%	0	0%
Farm	2	2%	1	3%
Farm to school	2	2%	0	0%
Farmers market	2	2%	0	0%
Mobile market	2	2%	1	3%
Total	97	100%	34	100%

Table 2. Market segments served by food hubs in the Upper Midwest United States and number of food hubs in each segment, using information found on food hubs' websites. The first object is what type of an organization the food hub is. The second object is who the food hub primarily sells to.

	Population (N)		Responses (n)	
	Count	Percent	Count	Percent
Distributor to consumers	34	35%	18	53%
Farmer to consumers	21	22%	5	15%
Distributor to businesses and institutions	17	18%	6	18%
Farmer to distributors	15	15%	2	6%
Other	10	10%	3	9%
Total	97	100%	34	100%

that perform or facilitate tasks associated with food hubs; i.e. aggregation, storage, processing, distribution and/or marketing of local foods

(Barham, 2011).

These organizations represented 14 different types of food hubs (Table 1)

and filled different segments of the values-based

supply chain (Table 2). Of the 97 food hubs, 91 were surveyed by this study and 34 food hubs responded to this survey (37% response rate) (Tables 1 and 2).

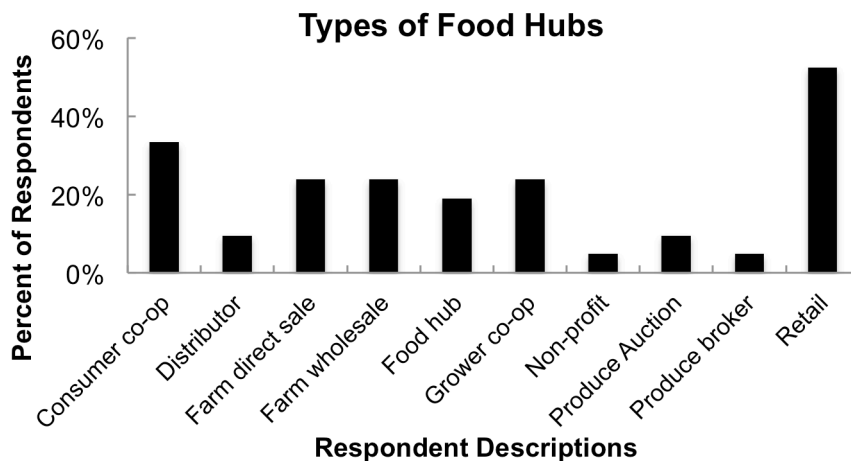


Figure 1. The percent of participants describing their food hub as belonging in each category. Participants were allowed to answer each option that applied. For example, a food hub could be both a consumer cooperative and retail. 46 responses from n=21 participants.

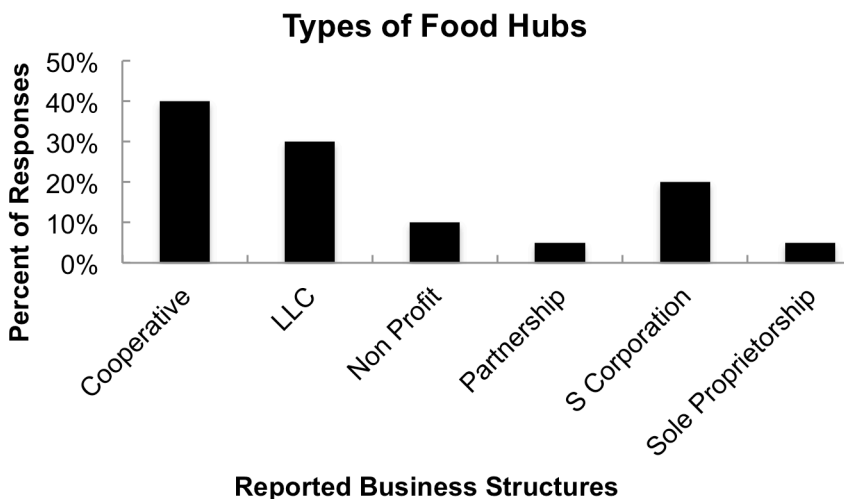


Figure 2. Percent of respondents operating as each business structure (n=21).

Respondents were biased toward food hubs serving consumers. Between the population and respondents there is an 18% increase in food hubs coded as distributor to consumer (Table 2). Respondents were also biased toward technology use with 9% fewer Amish produce auctions in the response sample than the population. Food hubs most often described their organizations as retail (52%), consumer cooperative

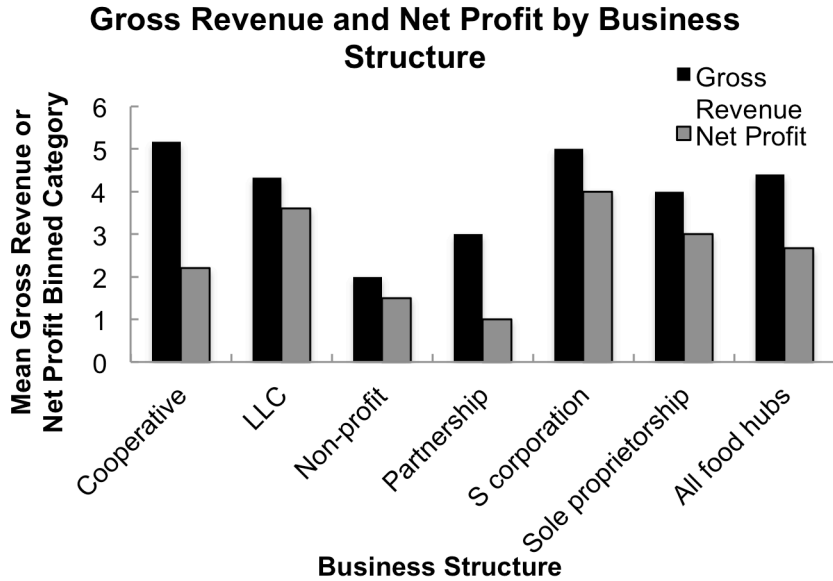


Figure 3. Mean binned category for gross sales and net profits by business structure. Binned categories were 1=less than \$25,000, 2=\$25,000 to \$49,999, 3=\$50,000 to \$99,999, 4= \$100,000 to \$499,999, 5=\$500,000 to \$1,000,000 and 6=over \$1,000,000 for both gross revenue and net profit. Number of respondents (n) for gross sales and net profits respectively, sole proprietorship n=1 and n=1, partnership n=1 and n=1, S corporation n=4 and n=1, limited liability corporation n=6 and n=5, non-profit n=2 and n=2, total gross sales n=20 and net profit n=15.

Table 3. ANOVA table for reported gross sales by reported number of years in business. Mean gross sales are significantly different between years in business categories.

	Sum of Squares	df	Mean Square	F	P
Between Groups	33.800	5	6.760	7.280	.001
Within Groups	13.000	14	.929		
Total	46.800	19			

(33%), and growers/farmers selling direct to consumer or wholesale (24% each) (Fig. 1). These responses are similar to how I coded food hubs. I coded 68% of the food hubs that responded as

primarily serving individual households (Table 1).

Food hubs in this study mainly operate as

cooperatives, limited liability corporations (LLC), or S

corporations (Fig. 2). LLC and S corporations are two corporate structures that may treat owner income differently depending on how they are established. Food hub owners make the choices with the council of accountants and attorneys.

Corporations and cooperatives appear to be more profitable than partnerships, cooperatives, or non-profits (Fig. 3) but no statistical differences in gross sales or net revenue between business operation types were found using one way ANOVA (Fig. 3).

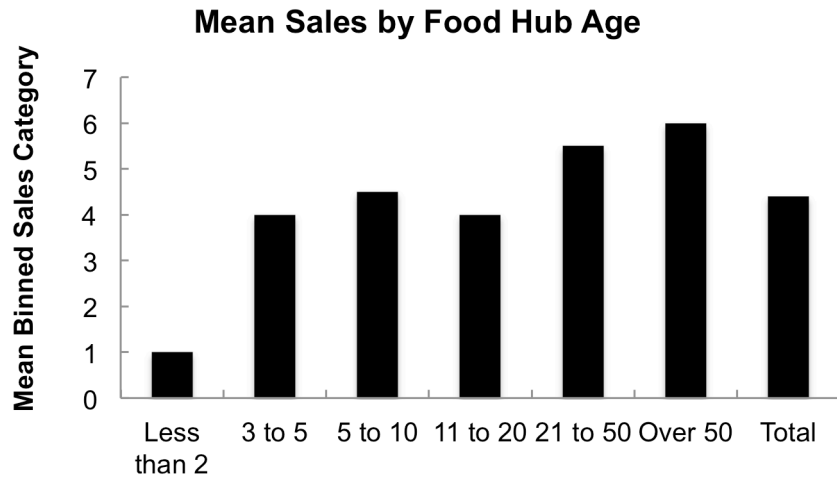


Figure 4. Mean reported gross sales by number of years in business. Sales categories: 1 = less than \$25,000, 2 = \$25,000 to \$49,999, 3 = \$50,000 to \$99,999, 4 = \$100,000 to \$499,999, 5 = \$500,000 to \$1,000,000, and 6 = over \$1,000,000.

The greatest number of responses for number of years in business was split with seven food hubs answering 5 to 10 years (32%) and seven food hubs answering 21 to 50 years (32%). Fifty-four percent of food hubs are less than 10 years old with an average of 16.5 years after removing one outlier that has been in business for over 90 years. Most food hubs responded that their organizations are growing, with 59% reporting positive growth. This claim was supported by my findings that reported gross sales increased with number of years in business with average gross sales being significantly different between age categories at $p=0.001$ (Fig. 4 and Table 3).

Food hubs surveyed carry a wide range of products including fruits and vegetables, meat, dairy, eggs, value added products, cut flowers, and bedding plants

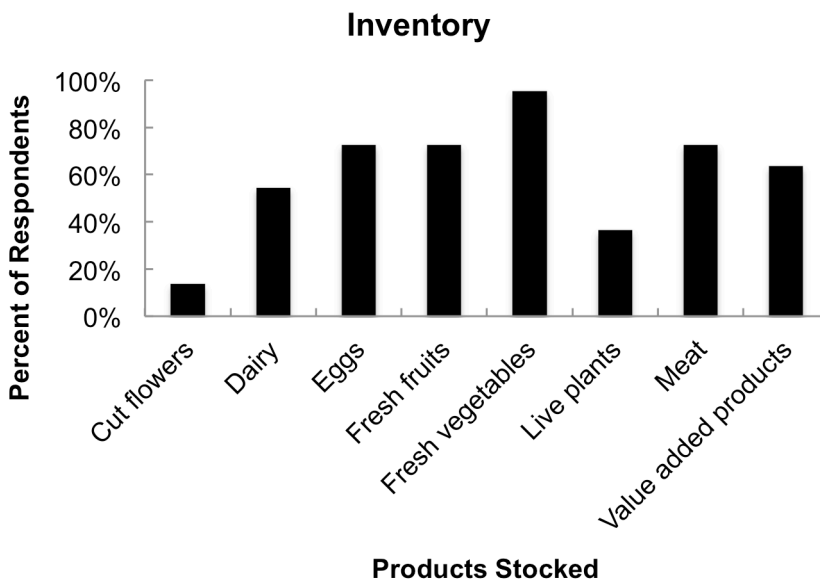


Figure 5. Percent of food hubs that carry each type of product. Food hubs were allowed to answer multiple times, 113 responses from $n=22$ participants.

(Fig. 5). There were 113 responses from 22 participant food hubs, meaning most food hubs answered multiple times. On average food hubs carry six of the nine

products listed. Less than half the respondents sold “fresh cut flowers and woody florals” and “bedding plants”.

Food Hub Location and Proximity to Growers and Customers

Fifty-nine percent of food hubs responded that the farthest farm from which they regularly obtain

produce was more than 50 miles away. The most often reported average distance from farms to food hub was less than 25 miles (54%)

(Fig. 6). Most food hubs said that their

customers live within 25 miles of the food hub (68%) (Fig. 6).

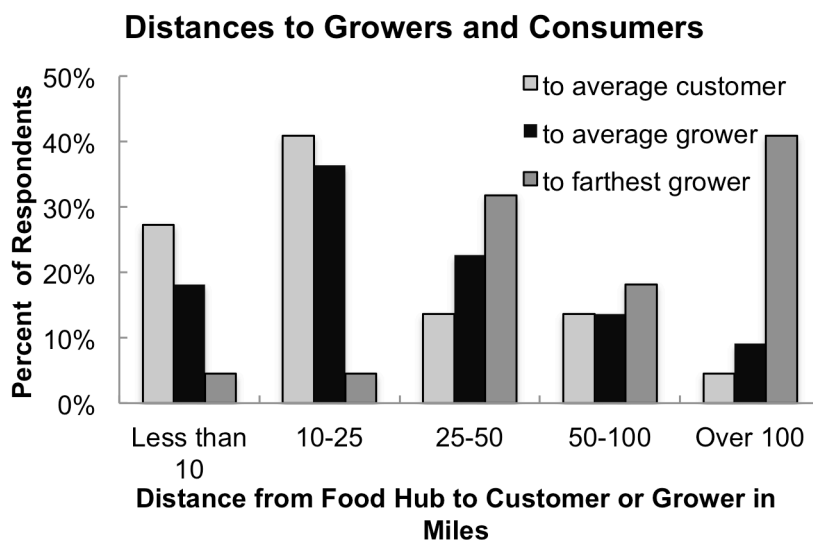


Figure 6. The distance in miles between food hubs and 1) grower – greatest distance, 2) grower – average distance, and 3) customer – average distance, n=22.

I mapped 84 of the 97 food hubs from the survey frame (Table 1) with U.S. census tracts to measure the potential customers within 25 miles of food hubs. Twenty-five miles was chosen based on the reported average distance from food hubs to customers. Populations within 25 miles of food hubs ranged from 16,001 to 6,009,297 with a mean population of 974,166 and median population of 394,705. There were no differences found between means for gross sales or net revenue

using one-way ANOVA when stratified by the 25-mile market population (Fig. 7). Counties with food hubs populations ranged from 4,357 to 5,194,675 with a median of 170,952. Twenty-two food hubs (26%) were located in or adjacent to metropolitan areas of 1,000,000 or more people. Food hubs reported that distance to customers was the most important factor impacting their decision of where to locate (mean score of 4.09 (Table 4)). Other major considerations listed by participants were availability and cost.

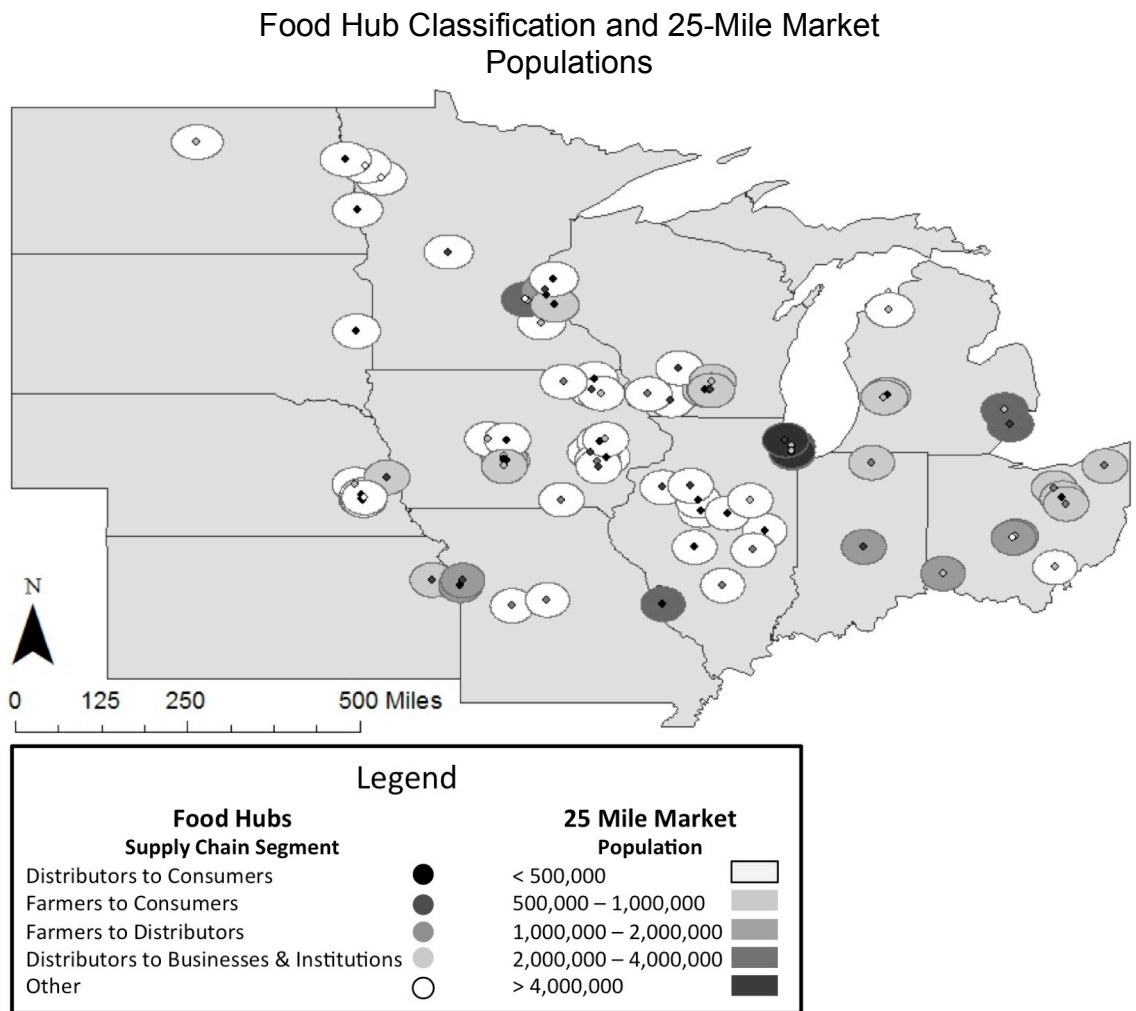


Figure 7. Map of study area showing food hubs' location and coded business classification over the population within a 25-mile radius of the food hubs location.

Table 4. *Food Hub Criteria for selecting food hub location and ranked importance.*

	1	2	3	4	5	Mean score	Response Count
Distance to customers	1	1	5	3	12	4.09	22
Access to infrastructure	1	2	4	5	7	3.79	19
Distance from suppliers	3	1	4	5	7	3.60	20
Availability of land	3	0	4	7	5	3.58	19
Availability of labor	4	0	6	9	1	3.15	20
Other location considerations							4

Discussion

Food Hub Demographics

I found food hubs operating within values-based supply chains to have a wide variety of organizational types and financial scales. This huge variety has also been discussed by other authors (Cheng and Seely, 2011; Clancy and Ruhf, 2010; and Melone et al., 2010), and is partially due to disagreements on the definition of food hubs and characteristics that include or exclude individual operations (Feenstra et al., 2011). While 90% of food hubs that responded were for-profit organizations structured as cooperatives (40%) or limited liability corporations (30%), I also had two non-profit organizations participate (Table 1 and Fig. 1). Compared to national food hub surveys (Barham, 2011 and Fischer et al., 2013) I found a much greater percent of for-profit enterprises, likely due to the study area and the definitional problem of food hubs.

I classified food hubs by market segment (farms to consumers, farms to distributor, distributor to institution, distributor to consumers, and other) and found

that a majority of food hubs specialized in sales to consumers rather than institutions (Table 2). Two reasons may be to obtain an increased percentage of consumer food dollars and that consumer purchases may be more values-based while institutional purchasing may be more budget or efficiency conscious. Food hubs have different strengths and weaknesses depending on which segment of the values-based supply chain is managing the food hub (Diamond and Barham, 2011 and Morley et al., 2008). I found food hubs in the Upper Midwest U.S. were mostly retail and farmer driven (Tables 1 and 2). These types of food hubs are likely to have a broad base of retail and production expertise, common goals, individual commitment, and entrepreneurial attitudes. However, these food hubs may be troubled by overreliance on one market, a relative lack of financial resources, and the ambitions of individuals overshadowing the ambitions of the organization (Diamond and Barham, 2011 and Morley et al., 2008).

Most food hubs are fairly young organizations. My study showed a much larger number of years in business than Barham (2011) or Fischer et al. (2013). The differences are likely due to the number of private and cooperative grocery stores and family farms included in this study. After four years 50% of small businesses survive, 17% close but owners considered them successful, and 33% closed and were unsuccessful (Headd, 2003). The high-risk, first four-year period included roughly 22% of respondents. Seven food hubs in this study responded that they had been in business five to 10 years and seven food hubs responded 21 to 50 years.

Ninety-six percent of food hubs carried fresh vegetables while 73% carried fresh fruits. Meat (73%), eggs (73%), edible value-added products (64%), and Dairy

(55%) are other products carried by the majority of respondents. The only two categories not carried by most respondents were live ornamental plants (36%) and fresh cut flowers (14%). These numbers were similar to results from Barham (2011) and Fischer (2013). Fischer also asked whether products were sourced exclusively locally, locally when available, locally and non-locally, or exclusively non-locally and found that all products: nonfood items, fresh produce, milk and dairy products, and eggs were sourced exclusively locally at least 61% of the time. These results show most food hubs are committed to carrying locally sourced products and focus on edible items. Additional farm products such as cut flowers, bedding plants, even wool may create opportunities for local farmers and allow food hubs to expand their product lines.

Food hubs' mean sales were different between age groups, and older food hubs reported greater sales. This is likely due to two factors 1) elimination of unsuccessful food hubs and 2) growth of food hubs that remained. Alternatively, Fischer (2013) found that business efficiency ratio (proportion of total expenses to total revenue) declined as the age of food hubs increased. Food hubs in operation for more than 10 years and cooperatives had average business efficiency ratios less than one and were therefore not profitable after 10 years (Fischer et al., 2013).

Food Hub Location and Proximity to Growers and Customers

Location impacts the daily operations and financial viability of food hubs with physical facilities because it partially determines access to public infrastructure,

property costs, transportation expenses, visibility, size of customer base, and proximity to growers and customers. Close proximity of food hubs to their growers and customers reduces food miles, influence consumer perceptions of local, and means community benefits of local food systems such as improved rural economies, and increased environmental stewardship impact both consumers and growers, rather than being transferred to a neighboring community.

Several different factors are considered when choosing a location for facilities, the most important of which is distance to customers (Table 4). Fischer (2013) found that the majority of food hub customers live within 50 miles of the food hub. My study's scale started with a lower distance value and found that 68% of survey respondents said the average distance from their food hub to regular customers was less than 25 miles, well within most distance-based definitions of local (Chambers et al., 2007; Durham et al., 2009; Flint, 2004; Nabhan, 2002; Pirog and Rasmussen, 2008; and Pretty et al., 2005). I found no impact from population on the profitability or structure of food hubs. The median population was 394,705 with 25 miles of food hubs and the median county population was 170,952. Alternatively, Fischer (2013) suggested proximity to a metropolitan area does increase financial independence and sustainability when looking at food hubs collectively between regions.

I found food hubs to be greatly variable organizations that fill gaps in values-based supply chains. These variations are primarily based on who runs the food hub, why the food hub was established, who the food hub's primary customers are, and what resources were available for establishment and expansion. Food hubs in

the Upper Midwest United States mainly act as distributors selling to individual consumers. I found no difference in sales or profit based on the business structure but I did find a difference in mean sales between food hub age group with older food hubs having greater gross sales. Over half of food hubs average growers and customers were within 25 miles of the food hub, well within most distance-based definitions of local. Though 40% said that their most distant regular grower was over 100 miles away, meaning many food hubs carry additional non-local products. Though some authors found urban food hubs to be more profitable due to their large consumer base I found no correlation between sales or profit and population density within 25 miles of the food hub.

This study provides a more detailed view of one region on the country and allows for comparisons with national studies. It also provides important data that could later be combined with data from national statistics to observe local foods industry growth. My results reiterate both the variability and definitional problems related to food hubs that other authors have found. I built on previous food hub studies by including a GIS mapping approach when looking at food hub distribution in the region and population density around food hubs. Practical implications of these results include making industry data available to food system developers and policy workers so they may create and evaluate food system development plans and policy, evaluating progress toward goals stated in documents such as the Iowa Local Food and Farm Plan. These results also give organizations considering establishing a food hub ideas of market segments to fill, potential financial returns, and shows both urban and rural food hubs are feasible.

References

- Ahern, M., Brown, C., & Dukas, S. (2011). A National Study of the Association Between Food Environments and County-Level Health Outcomes. *The Journal of Rural Health*, 27(4), 367-379.
- Balls Food Stores Perspective (pp. 1-10). Arlington: Wallace Center at Winrock International. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091495>. Last retrieved July 17, 2014
- Barham, J. (2011). Regional food hubs: Understanding the scope and scale of food hub operations. Washington, DC: USDA AMS. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5090409>. Last Retrieved July 19, 2014
- Barham, J., Tropp, K., Farbman, J., Fisk, J., and Kiraly, S. (2012). Regional food hub resource guide. US Department of Agriculture, Agriculture Marketing Service. Washington D.C.
- Boule, D., Hubert, G., Jensen, A., Kull, A., Kim, J., Marshall, C., Meagher, K., and Rittenhouse, T. (2011). Context matters: Visioning a food hub in Yolo and Solano counties. Prepared for the Ag and Food Alliance. Sebastopol, CA. Retrieved from http://sarep.ucdavis.edu/sfs/files/ContextMatters_VisioningAFoodHubInYoloAndSolanoCounties_6-17-11_FINAL.pdf. Last retrieved July 12, 2014.
- Cantrell, P and Heuer, B. (March 2014). Food Hubs: Solving Local. The Wallace Center at Winrock International. Retrieved from <http://ngfn.org/solvinglocal>. Last retrieved July 6, 2014.
- Chambers, S., Lobb, A., Butler, L., Harvey, K., and Bruce Traill, W. (2007). Local, national and imported foods: a qualitative study. *Appetite*, 49(1), 208-213.
- Cheng, M., & Seely, K. (2011). Building Regional Produce Supply Chains: Helping Farms Access and Sell to Multiple Channels, Helping Large-Volume Buyers Access Regional Foods (pp. 1-32). San Francisco: FarmsReach.
- Clancy, K., and Ruhf, K. (2010). Is local enough? Some arguments for regional food systems. *Choices*, 25(1), 123-135.
- Day-Farnsworth, L., McCown, B., Miller, M., and Pfeiffer, A. (2009). *Scaling Up: Meeting the Demand for Local Food*. University of Wisconsin-Extension Agricultural Innovation Center, University of Wisconsin Center for Integrated Agricultural Systems. Madison, WI. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091489>. Last retrieved July 10, 2014.

- Diamond, A., and Barham, J. (2011). Money and mission: moving food with value and values. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 101-117.
- Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (Vol. 2). New York: Wiley.
- Dreier, S., & Taheri, M. (2009). Innovative Models: Small Grower and Retailer Collaborations, Part B. Wallace Center at Winrock International, Arlington, VA. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091495>. Last retrieved July 19, 2014
- Durham, C. A., King, R. P., and Roheim, C. A. (2009). Consumer Definitions of "Locally Grown" for Fresh Fruits and Vegetables. *Journal of Food Distribution Research*, 40(1).
- Enshayan, K. (2009). Community economic impact assessment for a multi-county local food system in northeast Iowa. Leopold Center for Sustainable Agriculture. Ames, IA. Retrieved from http://www.leopold.iastate.edu/sites/default/files/grants/M2008-05_0.pdf. Last retrieved July 17, 2014.
- Erlbaum, J., McManus, K., and Nowak, A. (2011). Colorado Local Food Hubs for Farm to School Products: An Initial Feasibility Analysis of Local Food Hubs for Colorado Producers and Schools (pp. 1-53). *Colorado: Real Food Colorado*.
- Feenstra, G., Allen, P., Hardesty, S. D., Ohmart, J., and Perez, J. (2011). Using a supply chain analysis to assess the sustainability of farm-to-institution programs. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 69-84.
- Fischer, M., Hamm, M., Pirog, R., Fisk, J., Farbman, J., and Kiraly, S. (2013). Findings of the 2013 national food hub survey. Michigan State University Center for Regional Food Systems and The Wallace Center at Winrock International. Retrieved from <http://foodsystems.msu.edu/activities/food-hub-survey>. Last retrieved July 5, 2014.
- Flaccavento, A. (2009). Healthy food systems: A toolkit for building value chains. Central Appalachian Network. Central Appalachian Network. Retrieved from <http://www.cannetwork.org/documents/Value%20Chain%20Toolkit%2007.22.09.pdf>. Last retrieved June 18, 2014.
- Flesch, R., and Gould, A. J. (1949). *The art of readable writing* (p. 196). New York: Harper.

- Flint, A. (2004). Think globally, eat locally: move over, organic. A new socially conscious food movement wants to reset the American table. *The Boston Globe*, August, 15. Retrieved from http://www.boston.com/news/globe/ideas/articles/2004/08/15/think_globally_eat_locally?pg=full. Last retrieved June 18, 2014.
- Food Routes Network, LLC. (2014). National Buy Fresh Buy Local. FoodRoutes Network, LLC. Millheim, PA. Retrieved from <http://foodroutes.org/buy-fresh-buy-local/>. Last retrieved July 10, 2014.
- Gaytan, M. (2003). Globalizing the Local: Slow Food and the Collective Imaginary, paper presented at the annual meeting of the American Sociological Association, Atlanta, GA, August 16, 2003.
- Guptill, A., and J.L. Wilkins. (2002). "Buying into the Food System: Trends in Food Retailing in the U.S. and Implications for Local Foods," *Agriculture and Human Values*, Vol. 19, pp. 39-51.
- Hardy, C., & Holz-Clause, M. (2008). Bridging the Gap: What does it take to bring small and medium-sized producers and retail and foodservice distributors together? (pp. 1-24). Ames: Leopold Center for Sustainable Agriculture, Iowa State University. Retrieved from <http://www.leopold.iastate.edu/grants/m2006-05>. Last retrieved July 19, 2014
- Headd, B. (2003). Redefining business success: Distinguishing between closure and failure. *Small Business Economics*, 21(1), 51-61.
- Henneberry, S. R., Whitacre, B., & Agustini, H. N. (2009). An Evaluation of the Economic Impacts of Oklahoma Farmers Markets. *Journal of Food Distribution Research*, 40(3), 64-78.
- Holt-Giménez, E., & Wang, Y. (2011). Reform or transformation?: the pivotal role of food justice in the US food movement. *Race/Ethnicity: Multidisciplinary Global Contexts*, 5(1), 83-102.
- Ilbery, B., and D. Maye. (2006). "Retailing Local Food in the Scottish-English Borders: A Supply Chain Perspective," *Geoforum*, Vol. 37, pp. 352-367.
- Kirby, L. D., Jackson, C., and Perrett, A. (2007). Growing Local: Expanding the Western North Carolina Food and Farm Economy. Appalachian Sustainable Agriculture Project, Asheville, NC.
- Lamie, D., Dunning, R., Bendfeldt, E., Lelekacs, J., Velandia, M., and Meyer, L. (2013). Local food systems in the south: A call for a collaborative approach to assessment. *Choices*, 4th quarter 2013, 28(4). Retrieved from <http://www.choicesmagazine.org/choices-magazine/theme-articles/developing-local-food-systems-in-the-south/local-food-systems-in-the->

- south-a-call-for-a-collaborative-approach-to-assessment. Last retrieved July 17, 2014
- Lerman, T., Feenstra, G., and Visher, D. (2012). A Practitioner's Guide to Resources and Publications on Food Hubs and Values-Based Supply Chains: A Literature Review. Sustainable Agriculture Research and Education Program, Agricultural Sustainability Institute, University of California, Davis.
- Market Maker. (2014). Food Industry Market Maker: Linking Agricultural Markets. University of Illinois Extension. Urbana-Champaign, IL. Retrieved from <http://foodmarketmaker.com/main/about>. Last retrieved July 10, 2014.
- Martinez, S., Hand, M., Da Para, M., Pollack, S., Ralston, K., Smith, T., Vogel, S., Clark, S., Lohr, L., Low, S., and Newman, C. (2010). Local food systems; concepts, impacts, and issues (No. 97). U.S. Department of Agriculture Economic Research Service. Washington, D.C. DIANE Publishing. Darby, PA.
- Melone, B., Cardenas, E., Cochran, J., Gross, J., Reinbold, J., Brenneis, L., Sierra, L., Cech, S., and Zajfen, V. (2010). California Network of Regional Food Hubs: A Vision Statement and Strategic Implementation Plan (pp. 1-60). *California: Regional Food Hub Advisory Council*.
- Morley, A., Morgan, S., and Morgan, K. (2008). *Food hubs: The 'missing middle' of the local food infrastructure*. Business Relationships, Accountability, Sustainability, and Society Centre. Cardiff University. Cardiff, United Kingdom. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091491>. Last retrieved July 12, 2014.
- Nabhan, G. P. (2002). *Coming home to eat: The pleasures and politics of local foods*. WW Norton and Company.
- Otto, D., and Varner, T. (2005). Consumers, Vendors, and the Economic Importance of Iowa Farmers' Markets: An Economic Impact Survey Analysis. Ames, IA: Leopold Center for Sustainable Agriculture, Iowa State University. Retrieved from <https://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2005-05-consumers-vendors-and-economic-importance-iowa-farmers-markets-economic-impact-survey-analysis.pdf>. Last retrieved July 17, 2014.
- Perrett, A. (2007). The infrastructure of food procurement and distribution: Implications for farmers in western North Carolina. *Appalachian Sustainable Agriculture Project*. Asheville, NC.
- Pirog, R., and Rasmussen, R. (2008). Food, fuel and the future: Consumer perceptions of local food, food safety and climate change in the context of rising prices. Ames, IA: Leopold Center for Sustainable Agriculture.

- Pretty, J. N., Ball, A. S., Lang, T., and Morison, J. I. (2005). Farm costs and food miles: An assessment of the full cost of the UK weekly food basket. *Food Policy*, 30(1), 1-19.
- Saldivar-Tanaka, L., & Krasny, M. E. (2004). Culturing community development, neighborhood open space, and civic agriculture: The case of Latino community gardens in New York City. *Agriculture and human values*, 21(4), 399-412.
- Salois, M. J. (2012). Obesity and diabetes, the built environment, and the 'local' food economy in the United States, 2007. *Economics & Human Biology*, 10(1), 35-42.
- Sommers, F. G., & Dineen, T. (1984). Curing nuclear madness. *Methuen, Toronto*.
- Sonntag, V. 2008. Why Local Linkages Matter: Findings from the Local Food Economy Study. Seattle, Wash.: Sustainable Seattle. Report. Retrieved from <http://www.sustainableseattle.org/images/Programs/LocalFoodEconomyStudy/LFE%20REPORT%20FINAL-2.pdf>. Last retrieved July 17, 2014.
- Stevenson, G. W., and Pirog, R. (2008). Values-based supply chains: Strategies for agrifood enterprises of the middle. *Food and the mid-level farm: Renewing an agriculture of the middle*, 119-143. MIT Press, Cambridge, MA.
- U.S. Census Bureau. (2014). Census Geocoder. U.S. Census Bureau. Washington, D.C. Retrieved from <https://www.census.gov/geo/maps-data/data/geocoder.html>. Last retrieved July 17, 2014
- USDA. (2014). Working list of food hubs. U.S. Department of Agriculture, Agricultural Marketing Service, Washington, D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/foodhubs>. Last retrieved July 5, 2014
- Vogt, R. A., and Kaiser, L. L. (2008). Still a time to act: A review of institutional marketing of regionally-grown food. *Agriculture and Human Values*, 25(2), 241-255.

CHAPTER III

PHYSICAL AND FINANCIAL RESOURCES REQUIRED BY FOOD HUBS

Abstract

Aggregation and access to supply chains have been identified as a limiting factor to increase scale and availability of local foods. Food hubs have been identified as one possible solution. In order to assist groups interested in developing food hubs I developed the following objective, document financial and tangible resources and operational procedures used while operating food hubs. To complete these objectives I developed a 57-question survey and administered it to food hub managers in the Upper Midwest of the United States. Thirty-four food hubs responded for a response rate of 37%. Due to food hubs wide range of size and scope amounts and types of facilities and equipment used varied greatly, for example refrigerated storage space ranged from 0 to 4,500 square feet with a mean of 541 square feet. Facilities were leased (35%), owned (35%), or both leased and owned (18%). Some food hubs also mentioned community partnerships that provide them access to facilities at a free or reduced cost. To finance their operations food hubs originally obtained capital from cooperative members (43%), private investors (29%), and private loans (24%). Fifty-nine percent of food hubs were able to finance later expansions using company profits that ranged from less than \$25,000 to over \$1,000,000 with 52% of food hubs reporting 2011 profits of less than \$50,000. The

variability in food hub facilities and profits are a result of the variability in the food hubs themselves, as they have formed in different situations with different goals in mind.

Introduction

With the continued steady growth of direct-to-consumer supply chains (Adam, 2006; Farnsworth et al., 1996; Groh and McFadden, 1990; Hughes et al., 2007; Martinez et al., 2010; USDA, Agricultural Marketing Service, 2014; and Van En, 1992) attention of community developers and researchers has moved to aggregated, values-based supply chains. Values-based supply chains that include aggregation and distribution through intermediaries to supply institutions, restaurants, and grocery retailers increase consumer access to local or regional foods (Matson and Cook, 2011) and market opportunities for farmers (Barham, 2011; Clancy and Ruhf, 2010; and Flaccavento, 2009). The Leopold Center for Sustainable Agriculture, The Ohio State University, and the USDA have all recently published reports recognizing the need for increased production of local foods and developing infrastructure for aggregation and distribution (Clark et al., 2011; Martinez et al., 2010; Pirog et al., 2011). It has been proposed that developing local food systems will 1) improve the financial viability of farmers (Bendfeldt, et al., 2011 and Diamond and Barham, 2011), 2) increase consumer access to values-based products, 3) reduce chemical and fuel usage, and 4) support the local economy (Born and Purcell, 2006; Hinrichs, 2003; and Tregear, 2011).

A shortage of distribution systems and infrastructure is often cited as the greatest challenge for local food systems to overcome (Day-Farnsworth et al., 2009; Erlbaum et al., 2011; Hardy and Holz-Clause, 2008; Kirby et al., 2007; Martinez et al., 2010; Perrett, 2007; and Vogt and Kaiser, 2008). The shortage of distribution systems and facilities restricts the amount of product that is able to move through the system. It also means purchasers often must source products from multiple small scale vendors rather than one wholesaler. Shared processing and distribution infrastructure also benefits farmers by allowing them to outsource processing and marketing responsibilities and focus on production. “Food hubs facilitate the aggregation, storage, processing, distribution, and/or marketing of locally or regionally produced food products” (Barham, 2011). Because of their function, food hubs have been purposed as the solution for developing and coordinating local food system infrastructure (Day-Farnsworth et al., 2009; Erlbaum et al., 2011; Hardy and Holz-Clause, 2008; Kirby et al., 2007; Martinez et al., 2010; Perrett, 2007; and Vogt and Kaiser, 2008).

Two national food hub surveys have asked questions pertaining to physical and financial resources used by food hubs (Barham, 2011 and Fischer et al., 2013). Fischer (2013) found that 70% had warehouse and that 22% had retail space. Food hub case studies show how organizational structure impacts facilities and equipment needed. Examples include, Regional Access, LLC, which utilizes nine vehicles and a 25,000 square foot warehouse space to aggregate local food products across New York state (Schmit et al., 2013). Virtual food hubs such as Red Tomato (Cantrell and Heuer, 2014) and consignment auctions such as Fenimore Produce Auction (Day-

Farnsworth et al., 2009) facilitate delivery from farm to customer without storing the product in order to limit requirements for facilities and reduce overhead costs.

Reliance on outside funding and the ability to self-fund using food hub profits is as variable as all other characteristics of food hubs. Barham (2011) found that 35% of food hubs took advantage of state and 20% took advantage of federal funding programs. Fisher (2013) found that 23% of food hubs took advantage of state and 23% took advantage of federal funding programs. These numbers show that while important for some food hubs government subsidies are not required by all food hubs. More food hubs accepted donations than received government assistance 23% received donations from organizations, 40% received foundation grants, 40% received in-kind support, and 41% received donations from individuals. That more food hubs received in-kind support and donations from individuals than federal or state assistance suggests that community engagement at the local level these food hubs operate may be as important or more important than state or federal policy. Barham (2011) found a range for gross sales from \$46,000 to \$40 million, with average sales of \$3.7 million, and median sales of \$700,000. After removing food hubs with gross sales over \$3 million, average sales equaled \$871,000 and median sales of \$580,000 (Barham, 2011). Ten food hubs had gross sales over \$1,000,000 and identified as financially viable (Barham, 2012). Seven food hubs predicted they would break even in 1-3 years (Barham, 2012). Fischer (2013) found slightly lower average and median sales, \$3,284,632 and \$450,000, respectively.

This study will inform groups seeking to develop local and regional food hubs of the physical and financial resources used by current food hubs. The objectives of

this study are: 1) examine the facilities and equipment used to establish and maintain current food hubs, 2) examine the financial capital used to establish and expand current food hubs, and 3) examine cash flows of current food hubs to assess their financial viability. Specifically, my research questions are: 1) What size of facilities and pieces of equipment do food hubs in the Upper Midwest United States use during operations? 2) Where do food hubs in the Upper Midwest United States obtain financial capital for establishment and growth and how much do they require? 3) What are average gross profits and net revenues for food hubs in the Upper Midwest United States? By answering these questions I will to present regional data that can be compared to national data, record the state of food hubs at another point in time for future comparisons, and suggest facilities perspective food hubs should consider as well as ways to finance them.

Methods and Materials

A list was compiled of 97 food hubs based in the 12-state North Central Sustainable Agriculture Research and Education region (NCR SARE) (Appendix A). Criteria for selection was independent organizations based in the study area that facilitate the aggregation, storage, processing, distribution, and/or marketing of locally or regionally produced food (Barham, 2011). Food hub contact information came from the working list of food hubs maintained by the United States Department of Agriculture, Agriculture Marketing Service (USDA, 2014), Buy Fresh Buy Local campaigns (Food Routes Network, 2014), market finder websites such as Market

Maker (Food Industry Market Maker, 2014), and an online search. To the best of my knowledge these include all food hubs operating in the Upper Midwest United States in 2012.

A mixed mode survey was developed using the tailored design method (Dillman, 2000). The survey received exempt approval from the Iowa State University Institutional Review Board. The survey consisted of 57 questions (Appendix B). This chapter focuses on the portion of the survey related to physical and financial resources. There were three open ended, two Likert Scale, and ten multiple choice questions in this section of the survey. The survey tool was reviewed for readability using Microsoft Word (Microsoft Corporation, Redmond, WA) and was found to have a Flesch-Kincaid readability index score of 7.3 (Flesch and Gould, 1949). A survey professional at Iowa State University and a group of local food system experts reviewed the survey tool for validity and content. The survey was revised per their suggestions before being administered.

The survey was originally emailed to 79 participants using Survey Monkey (Palo Alto, CA) on May 22, 2012 with follow up emails sent on June 8th and June 19th. Surveys were also mailed to 12 Amish produce auctions May 31st and reminder phone calls were made between June 18th and 22nd. Six of the food hubs were not surveyed due to insufficient contact information or because they were large food distribution companies with a local food division and were outside the scope of this survey.

Mailed hard copies were entered into Survey Monkey upon arrival. Results were downloaded into SPSS (IBM, Armonk, NY) to calculate descriptive statistics.

Results

Thirty-four food hubs responded (37%) and reported a wide variety in capacity of facilities (Table 1). Food hubs reported having zero to 4,500 square feet of refrigerated storage space, zero to 65,000 square feet of non-refrigerated storage space, and zero to 20,800 square feet of retail space. Food hubs primarily owned (35%) or leased (35%) these facilities; 17% both owned and leased space (n=28). One food hub uses donated refrigerator space in local churches, showing an example of a partnership between a food hub and other community organizations.

Regardless of scale/size of operation there are several pieces of equipment used to move or manage inventory and facilitate food hubs' role as intermediaries. Specifically I asked about delivery vehicles, fork lifts and pallet forks, inventory management systems, and wash stations and repackaging lines for light processing.

Table 1. Amounts of space in square feet needed to operate food hubs in the upper Midwest United States.

	n	Min	Max	Mean	Median	Std. Deviation
Refrigerated storage space	27	0	4,500	541	85	1,176
Non-refrigerated storage space	27	0	65,000	3,693	350	12,520
Retail space	28	0	20,800	1,330	0	4,117

For most items the highest-ranking responses were “have” or “don’t need” (Fig. 1). The one exception was the quality of inventory management systems. Nine participants indicated that they are

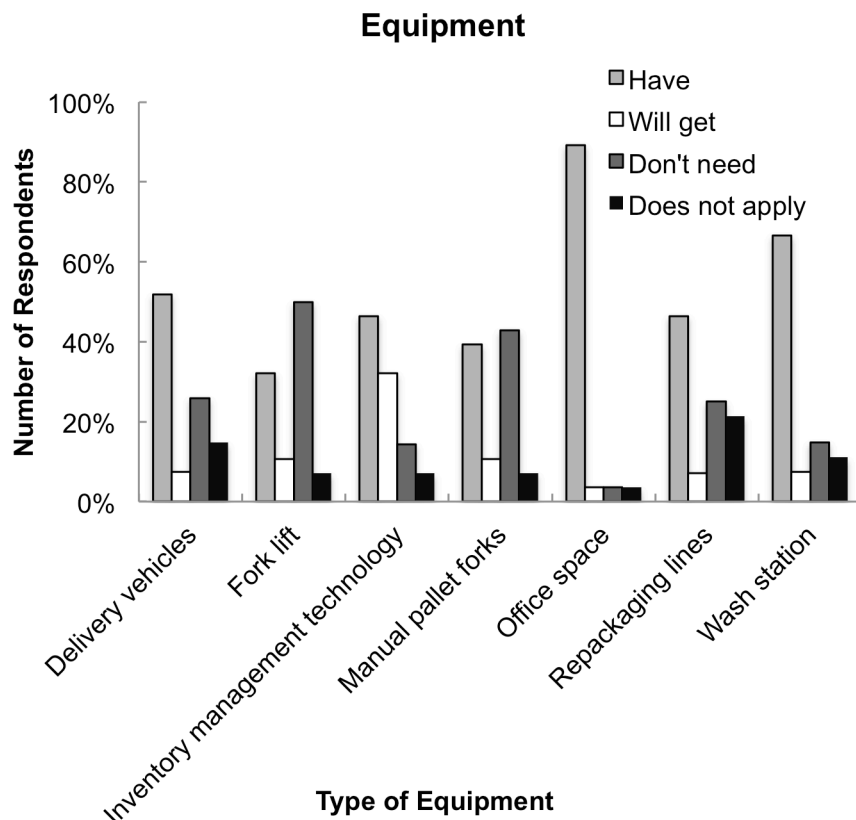


Figure 1. Percent of food hubs responding have, will get, don’t need, and does not apply when asked what types of equipment are necessary to operate their food hub (n=28).

planning on upgrading their inventory management systems. Food hubs were also asked what other pieces of equipment are important for current operations. Responses exemplify the variety of ways food hubs fill needs in values-based supply chains. Two participants mentioned point of sale software, credit card readers, cash registers and other equipment for the retail side of their business. One produce auction mentioned horses and horse drawn wagons for moving produce around the auction floor. Two respondents, including the produce auction, responded that producers complete the produce washing, grading, and packaging on farm before

delivery. But, the respondents provide supplies for packing and need boxes, shipping bins, coolers, and storage space for these items.

In order to finance the purchase of facilities and equipment, food hubs have obtained investments and financing from multiple sources (Fig. 2). Food hubs received original financing from cooperative members, private

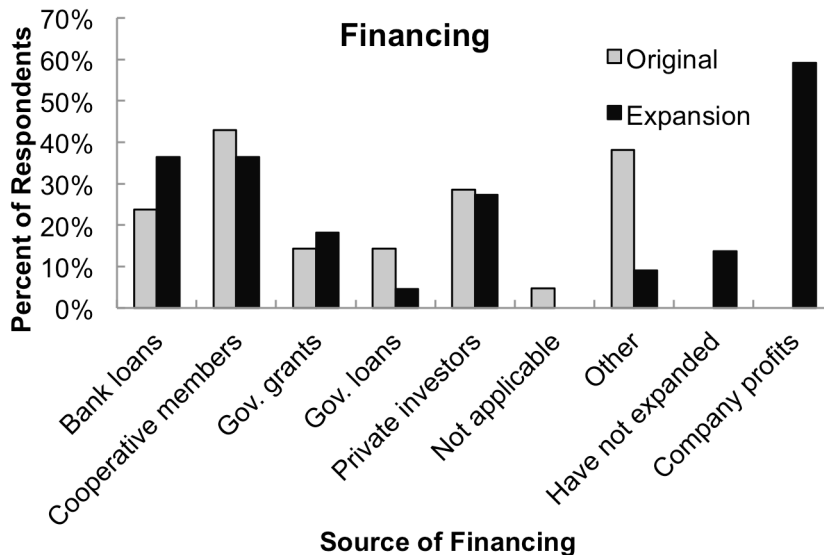


Figure 2. Histogram showing sources of financing and how many food hubs have utilized each, both to initially start up and to finance expansions. The sum of original financing equals 35, n=21 and the sum of expansion financing equals 45, n=22. This means food hubs are accessing multiple forms of financing.

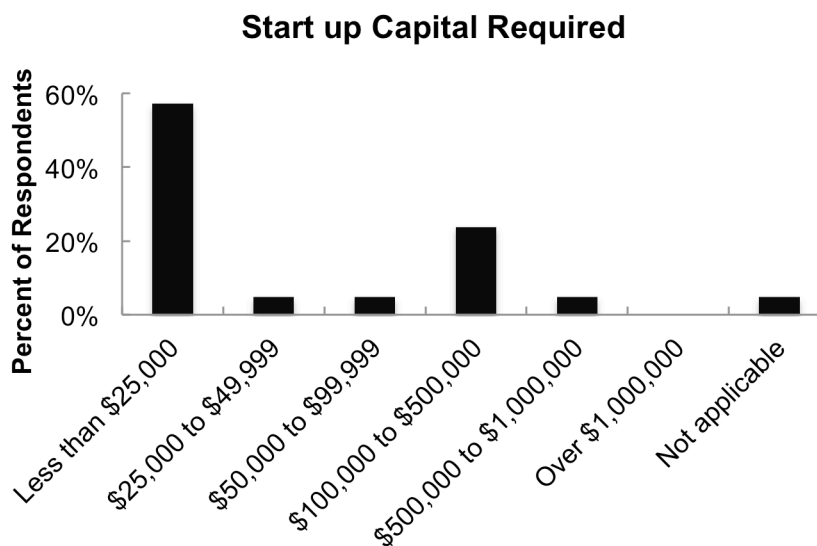


Figure 3. The amount of start up capital required to establish each food hub n=21.

investors, and bank loans. Thirty-five responses from 21 participants indicate that some food hubs are

receiving start up capital from two or more sources. Fifty-seven percent of participants said their food hub required less than \$25,000 in initial start up capital (Fig.

3). Expansion was primarily funded through a combination of company profits, bank loans, investors, and cooperative members. Forty-five responses from 22 participants indicate that individual food hubs are financing

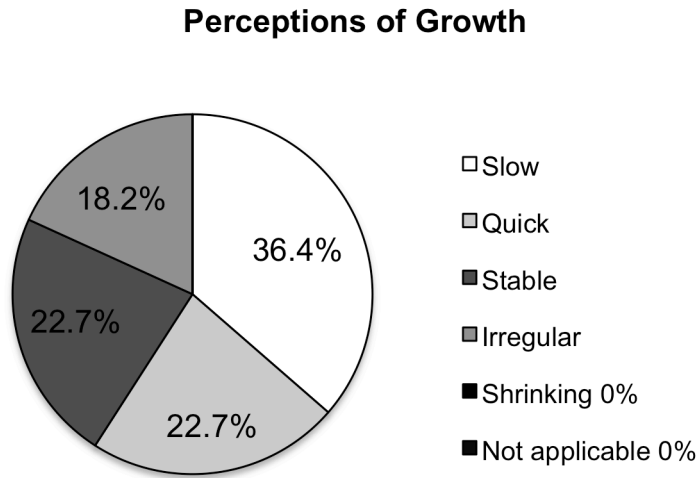


Figure 4. Food hub representatives' perceptions of growth their business's growth. Slow, quick, and irregular are all positive growth. Stable is no growth and shrinking is negative growth. n=22.

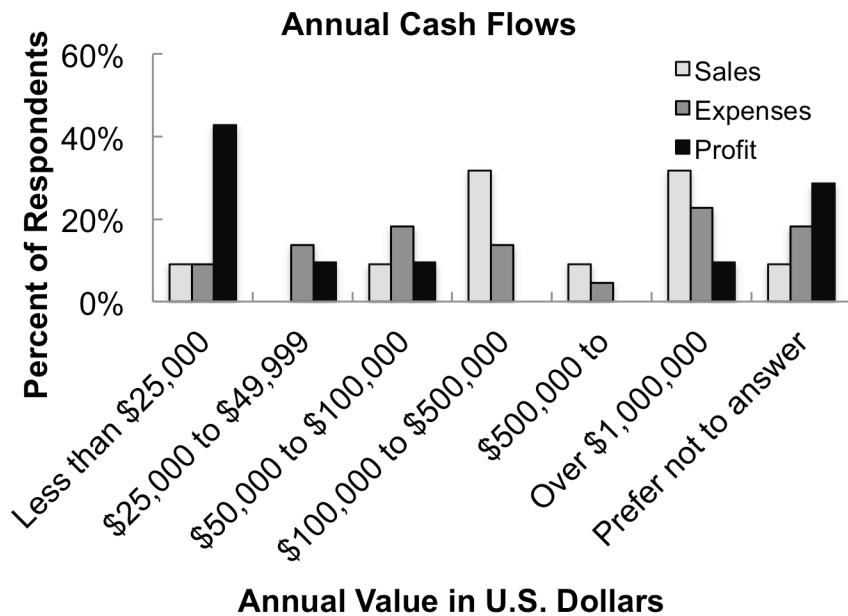


Figure 5. Reported gross sales, expenses, and net revenue for 2011. Respondent totals as follows gross sales, n=22, 20 providing dollar amounts; business expenses, n=22, 18 providing dollar amounts; and net revenue, n= 21, 15 providing dollar amounts.

expansions using multiple sources (Fig. 2). Other reported sources of initial financing were personal savings, private grants and foundations, and city economic development loans. Private grants were also listed as a source of capital for expansion. Three food hubs (14%) said they have not expanded, and not needed financing (Fig. 2). Later five food hubs (23%) responded that their business was stable and had not grown (Fig. 4); meaning 9% of respondents' answers were inconsistent between these two questions.

Sixteen of the 22 food hubs (72%) reported gross sales in the hundreds of thousands or millions of dollars (Fig. 5) and the average gross sales were between \$100,000 and \$500,000 (Table 2). Nine food hubs reported net revenue of less than \$25,000

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Table 2. Descriptive statistics of reported 2011 gross sales, expenses, and net revenue categories. 1 = < \$25,000; 2 = \$25,000 to \$50,000; 3 = \$50,000 to \$100,000; 4 = \$100,000 to \$500,000; 5 = \$500,000 to \$1,000,000; and 6 = > \$1,000,000

	n	Min	Max	Mean	Median	Std. Deviation
Gross sales	14	1	6	4.36	4	1.44
Expenses	14	1	6	3.64	3.5	1.65
Net revenue	14	1	6	2.78	2.5	1.8

net revenue using reported gross sales minus reported expenses to test if reported gross sales, reported expenses, and reported net revenue are compatible. Eighty-five percent of respondents who answered all three questions gave compatible answers for gross sales, expenses, and net revenue, where the range for gross sales minus the range for expenses fell within the range for net revenue. When asked to rank expenses from least to greatest, food hubs consistently ranked labor as one of the top expenses, (mean score 5.45 on a six point Likert Scale) (Table 3.).

Other notable expenses were health and liability insurance, inventory, and the purchase, repair, and maintenance of equipment and facilities.

Table 3. Counts and mean of responses to forced ranked scale of expenses, 1 being least-cost expense, 6 being greatest cost expense.

	1 least	2	3	4	5	6 greatest	mean	NA	n
Labor	0	1	0	2	3	14	5.45	0	20
Equipment	0	1	8	6	3	0	3.61	0	18
Energy (electricity and fuel)	2	3	6	3	3	3	3.55	0	20
Land (facilities payments or rent)	2	3	1	5	5	0	2.67	5	21
Taxes, certification fees, inspections	6	6	3	2	4	0	2.62	0	21
Materials (packaging, office supplies, labels, etc.)	8	7	2	4	1	0	2.23	0	22
Other notable expenses									6

Discussion

Food hubs used a variety of facilities and equipment depending on their business structure and having appropriate amounts and types of infrastructure, that allow work to be completed efficiently while not becoming a financial burden, is imperative for the financial success of food hubs (Diamond and Barham, 2011). I found that 81% had storage space and 46% of food hubs had retail space. This is double Fischer (2013) for retail space but is reasonable since a larger percent of food hubs in this study were retail groceries and consumer cooperatives. Since my study in 2012, and the national survey in 2013, new food hubs have been added to the USDA working list of food hubs (USDA, 2014). It is likely that my survey frame

included a greater number of both privately held and consumer cooperative grocery stores. The large variance in square footage of facilities and types of equipment utilized is not surprising when considering the variety of ways food hubs operate (Boule et al., 2011; Diamond and Barham, 2011; and Morley et al., 2008).

Though I found most food hubs reporting that they have facilities and equipment to operate at their current scales, others have found capitalization to procure facilities and equipment a common barrier for groups interested in starting food hubs (Day-Farnsworth, et al., 2009 and Matson et al., 2013). One potential solution to providing infrastructure and minimizing capital investment is transitional food systems that use current conventional infrastructure to move values-based product (Bloom and Hinrichs, 2011; Clancy, 2009; and Clark et al., 2011).

Access to capital for investment has consistently been identified as a constraint for developing food hubs, even as markets become more favorable (Day-Farnsworth, et al., 2009 and Matson et al., 2013). I asked whether food hubs had received government grants or low interest loans. Fourteen percent of food hubs received government grants and 14% received low interest government loans. Both national food hub surveys found a greater reliance on government funding for start up capital (Barham, 2011 and Fischer et al., 2013). Fisher (2013) also found more dependence on financial donations, grants, and in-kind support. When I asked about other sources of start up capital, only two food hubs, or 10% of respondents mentioned private grants and contributions from foundations. The majority of food hubs in all three studies did not receive government assistance in the form of loans or grants. If future policy will be used to develop food hubs, questions may include

asking food hubs that did receive subsidies if those subsidies were critical for their success and asking food hubs that did not receive subsidies why they did not. If financial subsidies are not important to food hubs then focus can shift from constraints to more effective places to intervene in our food system such as regulating feedback loops or the rules of the system (Meadows, 2008).

Food hubs in the Upper Midwest U.S. had similar median sales to food hubs nationally, between \$100,000 and \$500,000. I intentionally removed organizations that I felt were too large to be replicated by small to medium sized groups of growers and/or consumers before conducting my survey, which is why the original results in Barham (2011) were so much larger than ours. Much of the results depend on the investigators definition of food hub and the survey frames. At that level of median sales some food hubs report being able to fund expansion projects. Other food hubs grossing \$700,000 still reported a reliance on some external funding to cover services and activities (Barham, 2011).

Seven of my surveyed food hubs also reported gross sales over \$1,000,000, but only four of these food hubs reported their profits', two over \$1,000,000 and two less than \$25,000. Profits of less than \$25,000 with sales of over \$1,000,000 seem unreasonable. However, depending on the food hub model (Diamond and Barham 2011) and values of the organization (Feenstra et al., 2011; Flaccavento, 2009; and Stevenson and Pirog, 2008) profits may have been intentionally low (Fischer et al., 2013) in order to pass the most value to other participants in the values-based supply chain such as farmers, customers, and cooperative members. The Intervale Food Hub, Burlington, VT returns between 65% and 85% of gross sales to growers

(Schmidt et al., 2011). Traditional measures of success, using growth of financial capital, may not be a reasonable measure of food hub success (Fischer et al., 2013), without evaluating other forms of community capital (Flora and Flora, 2013).

The key common finding of our research as well as Barham (2011) and Fischer (2013) were that food hubs exhibit a great deal of diversity in their business models and how they operate. This diversity, and food hubs' success, is due to food hubs forming organizational structures to fit within the context of their location, values, and perceptions and needs of growers and customers (Boule et al., 2011; Diamond and Barham, 2011; and Morley et al., 2008). These organizational structures then influence operations, investments in infrastructure, and ability to self-fund (Diamond and Barham, 2011).

Based on my findings I recommend that new food hubs look for ways to minimize the financial burden of facilities through community partnerships. By engaging other community organizations food hubs may also build community support and gain customers. Financing food hubs was most often done through owners, cooperative members, and private business loans. While state and federal sources of financial capital may be well used establishing food hubs, being able to self fund annual operations and expansion through annual profits is imperative for the long-term stability of the food hub. Due to low percentage of food hubs utilizing state and federal financing options, policy makers should determine the cause and work to increase participation in these programs or prioritize funding differently to build other sectors of values-based supply chains such as feedback loops, information flowers, or rules of the system.

Again we see the great variability that is inherent in food hubs as a whole. While this variability, due to the vagueness of the definition of food hubs, makes statistical analysis of food hubs difficult it also allows food hubs to be contextual organizations tailored to their situation. One way to circumvent the variability issue and still assist organizations looking to establish food hubs may be through case studies. Case studies would allow perspective food hubs to use a smaller sample that more closely resemble the conditions where they are looking to establish a food hub and the type of food hub they are interested in.

References

- Adam, K. L. (2006). *Community supported agriculture*. ATTRA-National Sustainable Agriculture Information Service. Butte, MT. Retrieved from <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=262>. Last retrieved July 10, 2014.
- Barham, J. (2012). Regional food hubs: One solution for overcoming barriers for local producers. USDA Agricultural Marketing Service. Washington, D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097265>. Last retrieved July 12, 2014.
- Barham, J. (2011). Regional food hubs: Understanding the scope and scale of food hub operations: Preliminary findings from a national survey of regional food hubs. Washington, DC: USDA AMS. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5090409>. Last Retrieved July 19, 2014.
- Bendfeldt, E. S., Walker, M., Bunn, T., Martin, L., and Barrow, M. (2011). A Community- Based Food System: Building Health, Wealth, Connection, and Capacity as the Foundation of Our Economic Future. Virginia Cooperative Extension. Retrieved from <http://pubs.ext.vt.edu/3306/3306-9029/3306-9029-PDF.pdf>. Last retrieved June 18, 2014.
- Bloom, J. D., and Hinrichs, C. C. (2011). Moving local food through conventional food system infrastructure: Value chain framework comparisons and insights. *Renewable Agriculture and Food Systems*, 26(01), 13-23.

- Born, B., and Purcell, M. (2006). Avoiding the local trap scale and food systems in planning research. *Journal of Planning Education and Research*, 26(2), 195-207.
- Boule, D., Hubert, G., Jensen, A., Kull, A., Kim, J., Marshall, C., Meagher, K., and Rittenhouse, T. (2011). Context matters: Visioning a food hub in Yolo and Solano counties. Prepared for the Ag and Food Alliance. Sebastopol, CA. Retrieved from http://sarep.ucdavis.edu/sfs/files/ContextMatters_VisioningAFoodHubInYoloAndSolanoCounties_6-17-11_FINAL.pdf. Last retrieved July 12, 2014.
- Cantrell, P and Heuer, B. (March 2014). Food Hubs: Solving Local. The Wallace Center at Winrock International. Retrieved from <http://ngfn.org/solvinglocal>. Last retrieved July 6, 2014.
- Clancy, K. (2009). What are we talking about when we talk about local and regional food systems. Proceedings of the Northeast Regional Center for Rural Development; Enhancing Local and Regional Food Systems: Exploring the Research, What Works, and What We Need to Learn. Kerhonkson, NY. May 19-20, 2009.
- Clancy, K., and Ruhf, K. (2010). Is local enough? Some arguments for regional food systems. *Choices*, 25(1), 123-135.
- Clark, J., J. Sharp, and S. Inwood. (2011). Scaling-up connections between regional Ohio specialty crop producers and local markets: Distribution as the missing link. The Ohio State University. Columbus, OH. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097255>. Last retrieved July 10, 2014.
- Day-Farnsworth, L., McCown, B., Miller, M., and Pfeiffer, A. (2009). *Scaling Up: Meeting the Demand for Local Food*. University of Wisconsin-Extension Agricultural Innovation Center, University of Wisconsin Center for Integrated Agricultural Systems. Madison, WI. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091489>. Last retrieved July 10, 2014.
- Diamond, A., and Barham, J. (2011). Money and mission: moving food with value and values. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 101-117.
- Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (Vol. 2). New York: Wiley.
- Erlbaum, J., McManus, K., and Nowak, A. (2011). Colorado Local Food Hubs for Farm to School Products: An Initial Feasibility Analysis of Local Food Hubs for Colorado Producers and Schools (pp. 1-53). *Colorado: Real Food Colorado*.

- Farnsworth, R. L., Thompson, S. R., Drury, K. A., and Warner, R. E. (1996). Community supported agriculture: filling a niche market. *Journal of food distribution research*, 27, 90-98.
- Feenstra, G., Allen, P., Hardesty, S. D., Ohmart, J., and Perez, J. (2011). Using a supply chain analysis to assess the sustainability of farm-to-institution programs. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 69-84.
- Feenstra, G., Lerman, T., and Visher, D. (2012). Food hubs and vales-based supply chains: A toolkit for California farmers and ranchers. Sustainable Agriculture Research and Education Program, Agricultural Sustainability Institute, University of California. Davis, CA. Retrieved from <http://www.sarep.ucdavis.edu/sfs/7Dec2012VBSC%20farmer%20toolkit.pdf>. Last retrieved July 12, 2014.
- Fischer, M., Hamm, M., Pirog, R., Fisk, J., Farbman, J., and Kiraly, S. (2013). Findings of the 2013 national food hub survey. Michigan State University Center for Regional Food Systems and The Wallace Center at Winrock International. Retrieved from <http://foodsystems.msu.edu/activities/food-hub-survey>. Last retrieved July 5, 2014.
- Flaccavento, A. (2009). Healthy food systems: A toolkit for building value chains. Central Appalachian Network. Central Appalachian Network. Retrieved from <http://www.cannetwork.org/documents/Value%20Chain%20Toolkit%2007.22.09.pdf>. Last retrieved June 18, 2014.
- Flesch, R., and Gould, A. J. (1949). *The art of readable writing* (p. 196). New York: Harper.
- Flora, C.B. and Flora, J.L. (2013) *Rural Communities: Legacy and Change*, 4th edn. Boulder: Westview Press. Boulder, CO.
- Food Routes Network, LLC. (2014). National Buy Fresh Buy Local. FoodRoutes Network, LLC. Millheim, PA. Retrieved from <http://foodroutes.org/buy-fresh-buy-local/>. Last retrieved July 10, 2014.
- Groh, T., and McFadden, S. (1990). *Farms of tomorrow: community supported farms farm supported communities*. Bio-dynamic Farming and Gardening Association. Milwaukee, WI.
- Hardy, C., and Holz-Clause, M. (2008). Bridging the Gap: What does it take to bring small and medium sized producers and retail and foodservice distributors together? (pp. 1-24). Ames: Leopold Center for Sustainable Agriculture, Iowa State University. Competitive grant report: M2006-05. Retrieved from <http://www.leopold.iastate.edu/sites/default/files/grants/M2006-05.pdf>. Last retrieved July 10, 2014

- Hinrichs, C. C. (2003). The practice and politics of food system localization. *Journal of rural studies*, 19(1), 33-45.
- Hughes, D. W., Eades, D., Robinson, K., Carpio, C., Isengildina, O., and Brown, C. (2007). What is the Deal with Local Food Systems: Or, Local Food Systems from a Regional Science Perspective. In *54th Annual North American Meetings of the Regional Science Association International*. 2007: Savannah GA. WP 11-2007-01.
- Kirby, L. D., Jackson, C., and Perrett, A. (2007). Growing Local: Expanding the Western North Carolina Food and Farm Economy. *Appalachian Sustainable Agriculture Project, Asheville, NC*.
- Market Maker. (2014). Food Industry Market Maker: Linking Agricultural Markets. University of Illinois Extension. Urbana-Champaign, IL. Retrieved from <http://foodmarketmaker.com/main/about>. Last retrieved July 10, 2014
- Martinez, S., Hand, M., Da Para, M., Pollack, S., Ralston, K., Smith, T., Vogel, S., Clark, S., Lohr, L., Low, S., and Newman, C. (2010). Local food systems; concepts, impacts, and issues (No. 97). U.S. Department of Agriculture Economic Research Service. Washington, D.C. DIANE Publishing. Darby, PA.
- Matson, J., and Cook, C. (2011). Virtual Food Hubs Help Producers Tap Into Local Food Markets. *Rural Cooperatives*, 78, 4-8.
- Matson, J., Sullins, M., and Cook, C. (2013). The role of food hubs in local food marketing. USDA Rural Development Service. Washington, D.C. Service Report 73. Retrieved from <http://www.rurdev.usda.gov/supportdocuments/sr73.pdf>. Last retrieved July 12, 2014
- Meadows, D. (2008). Thinking in systems a primer. White River Junction, VT: Chelsea Green Publishing Company.
- Morley, A., Morgan, S., and Morgan, K. (2008). *Food hubs: The 'missing middle' of the local food infrastructure*. Business Relationships, Accountability, Sustainability, and Society Centre. Cardiff University. Cardiff, United Kingdom. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091491>. Last retrieved July 12, 2014.
- Perrett, A. (2007). The infrastructure of food procurement and distribution: Implications for farmers in western North Carolina. *Appalachian Sustainable Agriculture Project*. Asheville, NC.
- Pirog, R., C. Bregendahl, B. Larabee, J. Jensen, J. Obudzinski, J. Joel, and J. Hermsen. 2011. Iowa local food and farm plan. Leopold Center for

- Sustainable Agriculture. Ames, IA. Retrieved from <http://www.leopold.iastate.edu/pubs-and-papers/iowa-local-food-and-farm-plan>. Last retrieved July 10, 2014.
- Schmidt, M. C., Kolodinsky, J. M., DeSisto, T. P., and Conte, F. C. (2011). Increasing farm income and local food access: A case study of a collaborative aggregation, marketing, and distribution strategy that links farmers to markets. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 157–175. Retrieved from <http://dx.doi.org/10.5304/jafscd.2011.014.017>. Last retrieved July 12, 2014.
- Schmit, T.M., B.B.R. Jablonski, and D. Kay. 2013. "Assessing the Economic Impacts of Regional Food Hubs: the Case of Regional Access." Cornell University. September. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5105918>. Last retrieved July 12, 2014.
- Stevenson, G. W., and Pirog, R. (2008). Values-based supply chains: Strategies for agrifood enterprises of the middle. *Food and the mid-level farm: Renewing an agriculture of the middle*, 119-143. MIT Press, Cambridge, MA.
- Tregear, A. (2011). Progressing knowledge in alternative and local food networks: critical reflections and a research agenda. *Journal of Rural Studies*, 27(4), 419-430.
- US Department of Agriculture. (2014). Food and Nutrition Service. Retrieved from <http://www.fns.usda.gov>. Last retrieved June 18, 2014
- USDA. (2014). Working list of food hubs. U.S. Department of Agriculture, Agricultural Marketing Service, Washington, D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/foodhubs>. Last retrieved July 5, 2014
- Van En, R. (1992). *Basic formula to create community supported agriculture*. Cornell University. Ithaca, NY.
- Vogt, R. A., and Kaiser, L. L. (2008). Still a time to act: A review of institutional marketing of regionally-grown food. *Agriculture and Human Values*, 25(2), 241-255.

CHAPTER IV

HUMAN AND INFORMATION RESOURCES REQUIRED BY FOOD HUBS

Abstract

Aggregation and access to supply chains have been identified as limiting factors to increase scale and availability of local foods. Food hubs have been identified as one solution. The objective of this study was to document human resources, information resources, and operational procedures needed to operate such entities. To complete these objectives I developed a 57-question survey and administered it to food hubs in the Upper Midwest United States. Thirty-four food hubs responded (37%). While the total number of employees varied greatly (1 to 500, mean=45, and median=9), food hubs hired more full time year round staff than any other category (mean=39.16 and median=3 employees). Two food hubs (7%) specifically mentioned offsetting the need for employees using volunteers. More commonalities can be found in that food hubs develop human and social capital by facilitating communication and offering educational opportunities. Sixty-four percent of food hubs indicated that they facilitate communication between growers, 73% between growers and customers, and 41% between growers and government or nongovernmental organizations. Facilitating communication develops human and social capital and maintains transparency through the system. Food hubs also offered educational experiences including guest speakers (50% and 33%), Good

Agricultural Practices training (45% and 40%), and training on organic practices (35% and 13%) for employees and growers respectively. One food hub went as far as to offer a new farmer incubator program.

Introduction

Growers, intermediaries, and consumers seek to maintain transparency and core values such as equitable incomes for farmers and workers, ecological sustainability, community capacity, and healthy food access using values-based supply chains (Flaccavento, 2009 and Lerman et al., 2012). Food hubs are one part of the values-based supply chain as they, “facilitate the aggregation, storage, processing, distribution, and/or marketing of locally or regionally produced food products” (Barham, 2011). While food hubs perform these tasks they invest and develop community capitals (Flora et al., 2012 and Flora and Flora, 2013). Food hubs individually build the skills and abilities of growers and customers and connections within and between organizations. Collectively food hubs and their network of participants have the political capital to influence rules and regulations of the entire food system. Evidence of alternative food systems political capital can be seen in both Colorado and Oregon placing genetically modified organism labeling initiatives on the ballot (Stone, 2014). While neither passed, that they were brought to a vote shows significant political capital. Values-based supply chains and food hubs enhance small and medium farm financial viability (Feenstra et al., 2011 and Stevenson and Pirog, 2008), encourage local economic activity (Enshayan, 2009;

Henneberry et al., 2009; Holt-Gimenez and Wang, 2011; Otto and Varner, 2005; and Sonntag, 2008), and correlate to improved health and community engagement (Ahern et al., 2011; Saldivar-Tanaka and Krasny, 2004; and Salois, 2012). Food hubs require human capital in the form of employees, suppliers, and customers; and information including guidelines and requirements for food safety and quality, certifications and regulations, and inventory management in order to operate. They actively develop these resources through communication and continuing education to ensure their continued growth.

Two other food hub surveys have been conducted; these were done nationwide (Barham, 2011 and Fischer et al., 2013). Nationally, food hubs show huge variation in the number of employees needed to run the operation. Barham (2011) found numbers ranging from 0-112 full time employees and 0-40 part time employees, both with medians of three. To simplify results Fischer (2013) asked for employment numbers in full time equivalents (FTEs) and found while FTEs ranged from 0 to 155, 54% of food hubs had two FTEs or fewer. Not surprisingly the number of full time employees was positively correlated with gross sales and number of years the food hub had been in business (Fischer et al., 2013). Larger food hubs will need more employees to manage operations and as businesses age successful ones tend to grow while unsuccessful ones tend to drop out, raising statistics for gross sales and number of employees.

The mean number of suppliers food hubs sourced produced from averaged 40 (Barham, 2011) and 80 (Fischer et al., 2013). Few food hubs required any production practices of those suppliers (antibiotic free 43% and pasture raised 35%

were the greatest). Only 9% of food hubs reported requiring their growers to be GAP certified. Though many food hubs did have “preferred”, values-based, producer practices (Fischer et al., 2013).

Fischer (2013) delved more deeply into the type of suppliers because of food hubs’ potentially important role in marketing food from small to midsized producers. They found slightly greater percentages of women and people of color supplying food hubs than the national average for primary operators of farms. On average 26% of producers had been in operation for less than 10 years, equal to the national proportion of beginning farmers, and 76% of food hubs reported that all or most of their producers were small to midsized, farms with less than \$500,000 in annual sales. Of 107 food hubs and found 52% mention supporting farmers in their mission statements (Fischer et al., 2013). In order to support beginning, disadvantaged, and/or small to medium sized farms, food hubs offer a variety of services including offering continuing education and facilitating communication to build human and social capital in local food systems (Flora and Flora 2013).

To assist with the development of local and regional food hubs, I completed the following objectives: 1) identify quantities and characteristics of human resources required by food hubs in the form of employees, suppliers, and customers, 2) determine if food hubs are developing social, cultural, or human capital in their community (and how), 3) characterize information management and procedures needed to properly operate food hubs including inventory management, certifications, and guidelines for produce. My research questions developed from these objectives include: 1) How do food hubs in the Upper Midwest United States

manage inventory turnover? 2) What guidelines do food hubs Upper Midwest United States use when purchasing produce? 3) How many suppliers do food hubs in the Upper Midwest United States source products from? 4) How many and what types of employees do food hubs Upper Midwest United States hire? 5) How many and what types of customers do food hubs in the Upper Midwest United States serve? Do food hubs in the Upper Midwest United States facilitate communication within values-based supply chains and if so between which groups? 6) Do food hubs in the Upper Midwest United States provide educational opportunities for employees or growers and if so what types?

By answering these questions I hope to present a more focused few of food hubs within the region and record data for future comparisons of food hubs over time. This will allow regional food hubs to better compare themselves to national statistics and track industry changes temporally. This information may also assist groups looking to establish food hubs by showing them the numbers of employees, suppliers, and customers establish food hubs interact with and suggesting commonly used procedures such as ways to manage inventory on hand. I also hope to show how food hubs in the Upper Midwest United States have the ability to not only move physical product from growers to consumers but also build a community of people who share ideas and experience building human and social capital.

Methods and Materials

A list was compiled of 97 food hubs based in the 12-state North Central Sustainable Agriculture Research and Education region (NCR SARE) (Appendix A). Criteria for selection was independent organizations based in the study area that facilitate the aggregation, storage, processing, distribution, and/or marketing of locally or regionally produced food (Barham, 2011). Food hub contact information came from the working list of food hubs maintained by the United States Department of Agriculture, Agriculture Marketing Service (USDA, 2014), Buy Fresh Buy Local campaigns (Food Routes Network, 2014), market finder websites such as Market Maker (Food Industry Market Maker, 2014), and an online search. To the best of my knowledge these include all food hubs operating in the Upper Midwest United States in 2012.

A mixed mode survey was developed using the tailored design method (Dillman, 2000). The survey received exempt approval from the Iowa State University Institutional Review Board. The survey consisted of 57 questions (Appendix B). This chapter focuses on the portion of the survey related to human and information resources. There were eight open ended, two Likert Scale, and 16 multiple-choice questions in this section of the survey. The survey tool was reviewed for readability using Microsoft Word (Microsoft Corporation, Redmond, WA) and was found to have a Flesch-Kincaid readability index score of 7.3 (Flesch and Gould, 1949). A survey professional at Iowa State University and a group of local food system experts reviewed the survey tool for validity and content. The survey was revised per their suggestions before being administered.

The survey was originally emailed to 79 participants using Survey Monkey (Palo Alto, CA) on May 22, 2012 with follow up emails sent on June 8th and June 19th. Surveys were also mailed to 12 Amish produce auctions May 31st and reminder phone calls were made between June 18th and 22nd. Six of the food hubs were not surveyed due to insufficient contact information or because they were large food distribution companies with a local food division and were outside the scope of this survey.

Mailed hard copies were entered into Survey Monkey upon arrival. Results were downloaded into SPSS (IBM, Armonk, NY) to calculate descriptive statistics.

Results

Inventory Management

Thirty-four food hubs responded to this survey (37%). Food hubs described different procedures for managing quality and quantity of inventory. I asked food hubs how they balance demand with supply as an open-ended question. Sixteen food hubs responded to this question. Seven food hubs (43.8%) rely on pre-orders and only purchase from growers what has already been ordered from them. Three grocers (18.8%) used point of sale software to view the current inventory and the quantity sold last week when purchasing local produce. One grocer also stated that local producers are a convenient source of in-season product when inventory falls short and the next shipment is not expected for several days. Two produce auctions

(12.5%) responded that the market determined quantity supplied, demand, and price. Most food hubs reported using computer records to manage inventory or flow of product. Only one food hub used mobile devices, and three used bar codes

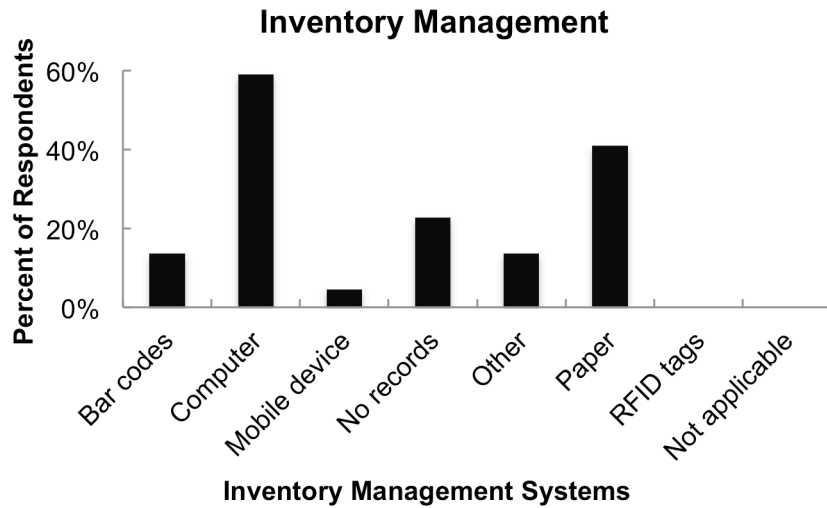


Figure 1. The number of food hubs who use each type of inventory management system to direct products moving in and out of facilities, balance quantity supplied and quantity demanded, and track turnover of products (n= 22).

(Fig. 1). Most food hubs responded that inventory management included the food hub taking ownership and possession of

produce, 85.7% and 72.7% respectively (Fig. 2).

Most food hubs indicated that they make requests of producers to standardize product,

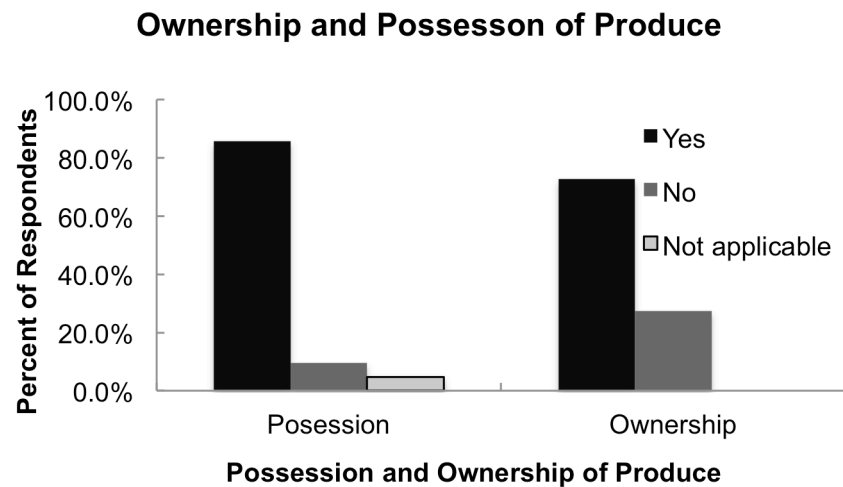


Figure 2. Percent of food hubs that take physical possession or ownership of produce, describes how produce moves in and out of food hub management (n= 22).

only one (4.8%) said they had no requirements or guidelines (Fig. 3). In addition to these guidelines, four food hubs (19%) have guidelines for organic or natural production practices. Some food

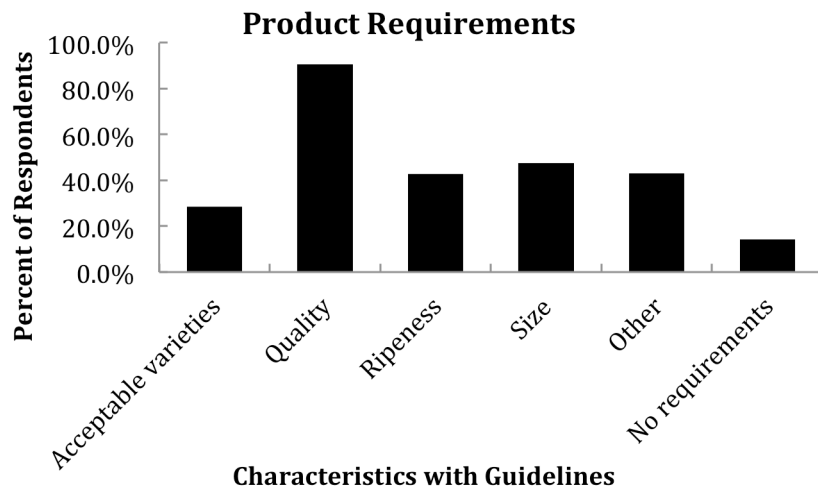


Figure 3. Percent of food hubs responding that they have guidelines or requirements for each characteristic; quality, ripeness, size, varieties, and other (n= 21).

hubs follow these guidelines and requirements through their own facilities. Five food hubs reported having employees certified in Good Handling Practices (GHP) and four reported having GHP certified facilities. GHP is an USDA audit verification program used to verify operators' efforts to minimize risk of contamination of fruits, vegetables, and nuts by microbial pathogens (USDA, 2013). Six food hubs have certified organic facilities.

Employees

When asked what type of employment food hubs offered, 89% of food hubs responded that they employed full-time, year-round employees and 50% responded that they employed full-time, seasonal employees. Seventy-five percent of food hubs employed part-time, year-round employees and 46% employed part-time seasonal employees. Food hubs were allowed to answer more than one category if they employed more than one type of employee. The average number of employees

reported by food hubs was 39.16 full-time, year-round employees; 5.36 full-time, seasonal; 6.57 part-time, year-round; and 3.09 part-time, seasonal (Table 1). In addition to paid employees, two food hubs acknowledged the importance of volunteers. One food hub had only one part time paid staff person but “upwards of 20 volunteers who serve in a part time capacity”.

Food hubs were then asked to divide employees into administrative, broker,

Table 1. Descriptive statistics for number of employees and type of employment reported by food hubs.

	n	min	max	mean	median	standard deviation
Full time, year round	25	0	500	39.16	3	107.25
Full time, seasonal	14	0	60	5.36	0	15.88
Part time, year round	21	0	65	6.57	2	13.84
Part time, seasonal	11	0	15	3.09	1	4.64

laborer, and other roles based on full time equivalent (FTE) (Table 2). Ninety-three percent of food hubs reported employing administrative staff, 75% brokers, 82% laborers, and

46% other important staff.

Table 2. Descriptive statistics for the number of each type of employee reported by food hubs.

	n	min	max	mean	median	standard deviation
Administrative ¹	26	0.25	50	5.37	2	10.04
Brokers ²	21	0	25	2.08	1	5.38
Laborers ³	23	0	220	25.54	2	59.54
Other ⁴	13	0	20	4.54	3	5.33

listed in the other category included

1. Administrative and office staff - administrative assistant, chief executive officer, chief financial officer, managers, etc.
2. Brokers - employees managing sourcing and distributing produce.
3. Laborers - receiving, shipping, processing, custodial, etc.
4. Other - explained in open-ended responses.

auctioneers, bookkeepers, and marketing. Administrative staff was the only category reported by all food hubs, with a minimum of 0.25 FTE to a maximum of 50 FTE.

Table 3. Reported length of employment for the least recently hired (longest employed) and most recently hired employee (newest employed) employees.

	n	min	max	average	median	standard deviation
longest employed	28	3	300	94.04	60	103.50
newest employed	27	0.1	84	9.56	2	19.37

Participants were also asked to rank their perceptions of employee turnover as too low, acceptable, or too high. Eighty-five percent said employee turnover was acceptable. One respondent said that they thought turnover was too high. Average tenure for the longest employed person was 94.04 months, with a median 60 months. The tenure

for the newest employee averaged 9.56 months, with a median 2 months (Table 3).

Customers and Suppliers

The number of customers that food

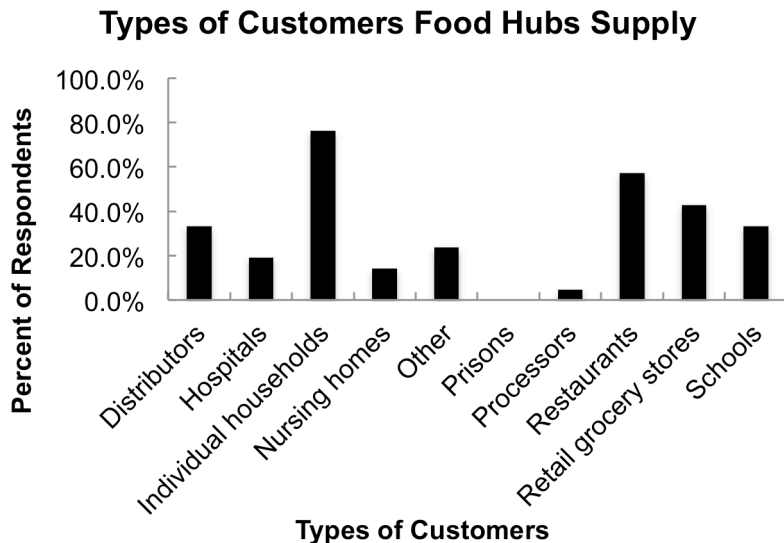


Figure 4. The number of food hubs reporting that they supply products to each type of consumer (n= 21).

Table 4. Descriptive statistics for reported number of growers supplying food hubs and customers purchasing through food hubs.

	n	min	max	average	median	standard deviation
number of growers	20	0	220	50.45	16	72.10
number of customers	21	8	54000	5033.67	120	12866.17

hubs worked with ranged from 8 to 54,000, with an average of 5,033.67, and a median of 120 (Table 4). Food hubs specializing in retail reported number of customers in thousands of customers per day or week. Food hubs focusing on institutions and multi-farmer community supported agriculture (CSA) programs reported far fewer customers than retail cooperatives and reported their total number of customer accounts. The most common type of customer was an individual household, with 16

food hubs reporting that they sell to individual consumers (Fig. 4). Two food hubs also mentioned selling to people who intended to resell produce at farmers markets and roadside stands. The number of growers and

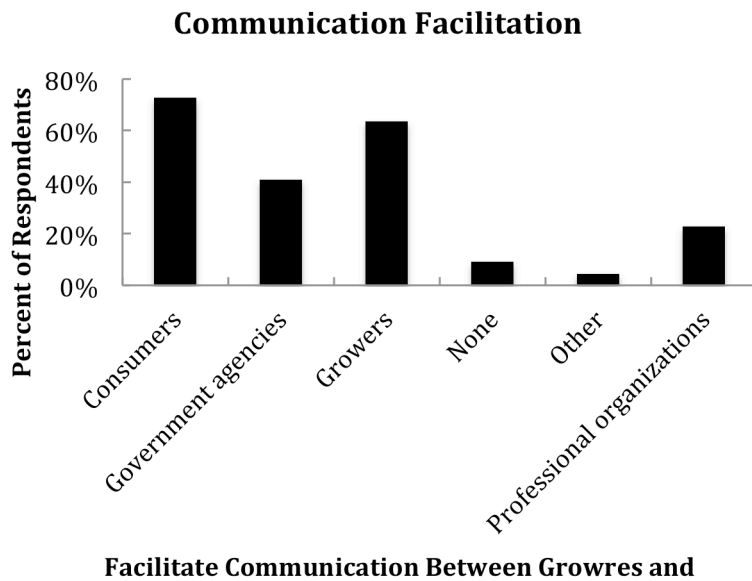


Figure 5. Number of food hubs that facilitate communication between growers and different participants in the values-based supply chain or external organizations (n= 22).

consumers food hubs work with varied greatly with a standard deviation of 72.10 and 12866.17 respectively.

Food hubs purchased from between zero and 220 growers, with an average 50.45 and a median of 16 (Table 4). The one food hub that reported purchasing from zero producers does not take ownership of produce and therefore makes no purchases.

Human and Social Capital

Food hubs are also developing human and social capital by facilitating communication between participants and providing continuing education opportunities. Food hubs facilitate communication between multiple groups with the most common groups being between individual growers and between growers and consumers (Fig. 5).

One food hub specifically works with “disease control issues with the help of university pathologists”. Food hubs are also offering continuing education and training opportunities to their

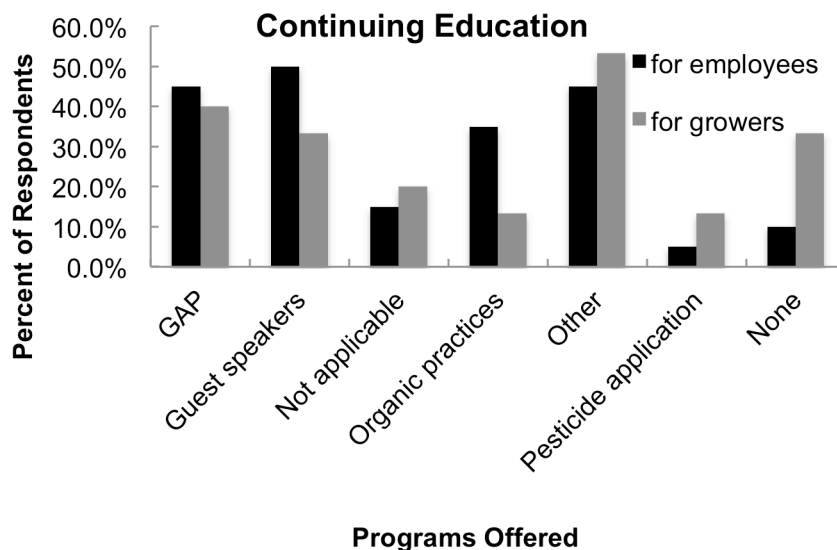


Figure 6. Food hubs reporting offering each type of continuing education program to employees or growers (n=20 for employees and n= 15 for growers).

employees and growers (Fig. 6). Other opportunities for employees included food-handling certification, web based learning and workshops, regular team meetings, and “classes on organics, GMO foods, and store merchandizing policy”. Additional opportunities for growers included informal consulting on production practices, software use, packaging, and licensing and compliance with government regulations. One food hub even offers a “comprehensive new farmer incubator program over a 3-4 year course program”.

Discussion

Food hubs used a wide variety of ways to fill their labor requirements. The number of employees ranged from 0-500 employees, much larger than Barham (2011) and Fischer (2013) 112 and 155 employees respectively. I found a tendency toward full-time and year-round staff over part-time and seasonal. All three surveys found the median number of paid full time employees to be three and that food hubs recognized the benefit volunteers add to their organization. Even with only having 3 full time employees and utilizing volunteers food hubs still reported labor as their greatest expense. The reason why number of employees is important is because it shows while some food hubs are large businesses employing over 100 people most are extremely small businesses. Much of the results depend on the investigators definition of food hub and the survey frames. I included several privately held and consumer cooperative grocers that purchase and distribute local produce. Some of these grocers had multiple locations and increased our findings for maximum

number of employees. There is still discussion on the definition of food hub and what characteristics incorporate or eliminate an individual operation (Feenstra et al., 2012). The vagueness of the definition is a benefit in that it is much more inclusive of the many organizations that act as intermediaries in local and regional systems but it also makes comparisons within and between studies difficult. From the perspective of someone interested in establishing a local food hub the range of these results make them unhelpful. Alternatively finding case studies that closely match the situation and goals of those interested in starting a new food hub may be more beneficial.

I found that nearly all food hubs had requirements for product grade (USDA, 2012) and 19% had requested organic or natural production practices of their producers. While 40% of food hubs in my study offered Good Agriculture Practices (GAP) education programs to employees and growers, Fischer (2013) found that only 9% of food hubs reported all or most of their growers had adopted GAP certification since beginning supplying their food hub. This could mean that while growers are learning GAP procedures they are not becoming certified due to the cost prohibitive nature of certifications. One food hub, GROWN Locally, Decorah, IA, is planning to adopt third-party certification to accommodate growers who cannot afford to formally comply with requirements of GAP (Borst, 2010). These studies were conducted before the implementation of the Food Safety Modernization Act (FDA, 2014), which is likely to increase the number of food hubs and farms with food safety certifications such as GAP (Fischer et al., 2013). Managing the on hand availability of produce both on-hand and available through the year has been sited

as one of the major challenges for food hubs as they continue to grow (Fischer et al., 2013). Food hubs in my study managed inventory by circumventing the issue, requiring customers to pre-order so that food hubs did not keep excess produce in stock or using an auction system to set quantity supplied and price. Other food hubs put massive amounts of time and energy not only managing their inventory but helping their growers with production planning to manage inventory within the system (Lyons and Oldham, 2014).

I found the median number of suppliers to be 16 and that 76% of food hubs sold to individual households due to my inclusion of private and consumer cooperative grocery stores and multi-farm CSAs. I also found similar numbers as Fischer (2013) for percent of food hubs selling to schools or school food service providers (33% and 35% respectively), restaurants (57 and 58% respectively), and hospitals (19% and 22% respectively). This means some of the grocers and multi-farm CSAs are also providing wholesale quantities to businesses and institutions.

I found 72.7% of food hubs reported facilitating communication between growers, and 63.6% between growers and consumers. Food hubs consistently communicate product origin and the story of the produce, farm, and farmer in order to differentiate these premium local products (Day-Farnsworth et al., 2009; Lawless et al., 1999; and Martinez et al., 2010). While some virtual food hubs specialized in only facilitating communication, without taking possession or ownership of any product (Matson et al., 2013). By facilitating communication between growers and providing education opportunities, food hubs assist growers with developing

leadership skills and knowledge, a necessary element for local food system growth (Morley et al., 2008 and Tropp and Barham, 2008).

This study found that in addition to facilitating communication, food hubs assist growers by providing training, continuing education, and informal consulting services, results supported by Fischer (2013). Continuing education also assists farmers with meeting market requirements for record keeping, GAP certification, liability insurance, (Shipman, 2009; Tropp and Barham, 2008; Lawless et al., 1999) and providing information resources for food hubs that reduce risk (Matson et al., 2013). Learning from personal experience and the experience of peers is an effective method of developing human capital and technical change in agriculture (Foster and Rosenzweig, 1995). The Local Food Hub, Charlottesville, VA, has assisted growers with networking, liability, website development, and tractability at the same time it holds consumer education workshops and events. The Local Food Hub has reinvested \$850,000 in the local farming community, and growers report average sales increases of 25% because of it (Barham et al., 2012).

The key common findings of our research were that food hubs exhibit a great deal of diversity in their business models and how they operate. This diversity, and food hubs' success, is due to food hubs forming organizational structures to fit within the context of their location, values, and perceptions and needs of growers and customers (Boule et al., 2011; Diamond and Barham, 2011; and Morley et al., 2008). These organizational structures then influence operations and the amount of human or information capital required to operate (Diamond and Barham, 2011). Food hubs also invest in human capital, developing and educating growers and consumers, to

expand the local food system (Barham et al., 2012; Lawless et al., 1999; Shipman, 2009; and Tropp and Barham, 2008)

This information shows the importance of food hubs not only as aggregators and distributors of physical product but also as educators and facilitators of communication, who are actively developing local food systems. This study will help groups interested in starting food hubs by giving them aggregated information on what kinds of human and information resources other established food hubs use. By combining these aggregated figures with case studies from the literature, interested groups will have a much better idea of what to expect when starting a food hub and be able to plan how to proceed.

REFERENCES

- Ahern, M., Brown, C., & Dukas, S. (2011). A National Study of the Association Between Food Environments and County-Level Health Outcomes. *The Journal of Rural Health*, 27(4), 367-379.
- Barham, J., Tropp, D., Enterline, K., Farbman, J., Fisk, J., and Kiraly, S. (2012). Regional food hub resource guide. U.S. Department of Agriculture, Agricultural Marketing Service. Washington D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097957>. Last retrieved July 12, 2014.
- Barham, J. (2011). Regional food hubs: Understanding the scope and scale of food hub operations: Preliminary findings from a national survey of regional food hubs. Washington, DC: USDA AMS. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5090409>. Last Retrieved July 19, 2014.
- Borst, A. (2010). Cooperative food hubs: Food hubs fill the 'missing middle' helping small producers tap local markets. Rural Cooperatives. Bi-monthly USDA publication. November/December issue. Retrieved from

- <http://www.rurdev.usda.gov/SupportDocuments/CoopMag-nov10.pdf>. Last retrieved July 12, 2014
- Boule, D., Hubert, G., Jensen, A., Kull, A., Kim, J., Marshall, C., Meagher, K., and Rittenhouse, T. (2011). Context matters: Visioning a food hub in Yolo and Solano counties. Prepared for the Ag and Food Alliance. Sebastopol, CA. Retrieved from http://sarep.ucdavis.edu/sfs/files/ContextMatters_VisioningAFoodHubInYoloAndSolanoCounties_6-17-11_FINAL.pdf. Last retrieved July 12, 2014.
- Day-Farnsworth, L., McCown, B., Miller, M., and Pfeiffer, A. (2009). *Scaling Up: Meeting the Demand for Local Food*. University of Wisconsin-Extension Agricultural Innovation Center, University of Wisconsin Center for Integrated Agricultural Systems. Madison, WI. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091489>. Last retrieved July 10, 2014.
- Diamond, A., and Barham, J. (2011). Money and mission: moving food with value and values. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 101-117.
- Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (Vol. 2). New York: Wiley.
- Enshayan, K. (2009). Community economic impact assessment for a multi-county local food system in northeast Iowa. Leopold Center for Sustainable Agriculture. Ames, IA. Retrieved from http://www.leopold.iastate.edu/sites/default/files/grants/M2008-05_0.pdf. Last retrieved July 17, 2014.
- Feenstra, G., Allen, P., Hardesty, S. D., Ohmart, J., and Perez, J. (2011). Using a supply chain analysis to assess the sustainability of farm-to-institution programs. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 69-84.
- Feenstra, G., Lerman, T., Visher, D. (2012). Food hubs and values based aggregation and distribution: A toolkit for California farmers and ranchers. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097934>. Last retrieved July 19, 2014.
- Fischer, M., Hamm, M., Pirog, R., Fisk, J., Farbman, J., and Kiraly, S. (2013). Findings of the 2013 national food hub survey. Michigan State University Center for Regional Food Systems and The Wallace Center at Winrock International. Retrieved from <http://foodsystems.msu.edu/activities/food-hub-survey>. Last retrieved July 5, 2014

- Flaccavento, A. (2009). Healthy food systems: A toolkit for building value chains. Central Appalachian Network. Central Appalachian Network. Retrieved from <http://www.cannetwork.org/documents/Value%20Chain%20Toolkit%2007.22.09.pdf>. Last retrieved June 18, 2014.
- Flesch, R., and Gould, A. J. (1949). *The art of readable writing* (p. 196). New York: Harper.
- Flora, C. B., Bregendahl, C., and Renting, H. (2012). Collaborative Community-supported Agriculture: Balancing Community Capitals for Producers and Consumers. *Int. J. of Soc. of Agr. and Food*, 19(3), 329-346.
- Flora, C.B. and Flora, J.L. (2013) *Rural Communities: Legacy and Change*, 4th edn. Boulder: Westview Press. Boulder, CO.
- Food and Drug Administration, FDA. 2014. Food safety modernization act. H.R. 2751--111th Congress: 2009. Food and Drug Administration. Washington, D.C. Retrieved from <http://www.fda.gov/Food/GuidanceRegulation/FSMA/default.htm>. Last retrieved July 12, 2014.
- Food Routes Network, LLC. (2014). National Buy Fresh Buy Local. FoodRoutes Network, LLC. Millheim, PA. Retrieved from <http://foodroutes.org/buy-fresh-buy-local/>. Last retrieved July 10, 2014.
- Foster, A. D., and Rosenzweig, M. R. (1995). Learning by doing and learning from others: Human capital and technical change in agriculture. *Journal of political Economy*, 1176-1209.
- Henneberry, S. R., Whitacre, B., & Agustini, H. N. (2009). An Evaluation of the Economic Impacts of Oklahoma Farmers Markets. *Journal of Food Distribution Research*, 40(3), 64-78.
- Holt-Giménez, E., & Wang, Y. (2011). Reform or transformation?: the pivotal role of food justice in the US food movement. *Race/Ethnicity: Multidisciplinary Global Contexts*, 5(1), 83-102.
- Lawless, G., Stevenson, G., Hendrickson, J., Cropp, R. (1999). The farmer-food buyer dialogue project. University of Wisconsin Center for Cooperatives Occasional Paper No. 13. University of Wisconsin Center for Cooperatives. Madison, WI. Retrieved from <http://www.uwcc.wisc.edu/info/ffbuyer/toc.html>. Last retrieved July 12, 2014.
- Lerman, T., Feenstra, G., and Visher, D. (2012). A Practitioner's Guide to Resources and Publications on Food Hubs and Values-Based Supply Chains: A Literature Review. Sustainable Agriculture Research and Education Program, Agricultural Sustainability Institute, University of California, Davis. Retrieved from

- http://www.sarep.ucdavis.edu/sfs/KYF%20grey%20literature%20review%207.9.12_compressed.pdf. Last retrieved July 19, 2014
- Lyons, S. and Oldham, M. (2014). Production Planning for Aggregators. Ames, IA: Leopold Center for Sustainable Agriculture, Iowa State University. Retrieved from <http://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2014-06-production-planning-aggregators.pdf>. Last retrieved November 19, 2014.
- Market Maker. (2014). Food Industry Market Maker: Linking Agricultural Markets. University of Illinois Extension. Urbana-Champaign, IL. Retrieved from <http://foodmarketmaker.com/main/about>. Last retrieved July 10, 2014.
- Martinez, S., Hand, M., Da Para, M., Pollack, S., Ralston, K., Smith, T., Vogel, S., Clark, S., Lohr, L., Low, S., and Newman, C. (2010). Local food systems; concepts, impacts, and issues (No. 97). U.S. Department of Agriculture Economic Research Service. Washington, D.C. DIANE Publishing. Darby, PA.
- Matson, J., Sullins, M., and Cook, C. (2013). The role of food hubs in local food marketing Report 73. USDA Rural Development Service. Washington, D.C. Retrieved from <http://www.rurdev.usda.gov/supportdocuments/sr73.pdf>. Last retrieved July 12, 2014
- Morley, A., Morgan, S., and Morgan, K. (2008). *Food hubs: The 'missing middle' of the local food infrastructure*. Business Relationships, Accountability, Sustainability, and Society Centre. Cardiff University. Cardiff, United Kingdom. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091491>. Last retrieved July 12, 2014.
- Otto, D., and Varner, T. (2005). Consumers, Vendors, and the Economic Importance of Iowa Farmers' Markets: An Economic Impact Survey Analysis. Ames, IA: Leopold Center for Sustainable Agriculture, Iowa State University. Retrieved from <https://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2005-05-consumers-vendors-and-economic-importance-iowa-farmers-markets-economic-impact-survey-analysis.pdf>. Last retrieved July 17, 2014.
- Saldivar-Tanaka, L., & Krasny, M. E. (2004). Culturing community development, neighborhood open space, and civic agriculture: The case of Latino community gardens in New York City. *Agriculture and human values*, 21(4), 399-412.
- Salois, M. J. (2012). Obesity and diabetes, the built environment, and the 'local' food economy in the United States, 2007. *Economics & Human Biology*, 10(1), 35-42.

- Shipman, D. (2009). Setting the stage: Local food issues and policies, presentation at Local Food Systems: Emerging Research and Policy Issues Conference. USDA, Economic Research Service, Washington D.C. June 26, 2009
- Sonntag, V. 2008. Why Local Linkages Matter: Findings from the Local Food Economy Study. Seattle, Wash.: Sustainable Seattle. Report. Retrieved from <http://www.sustainableseattle.org/images/Programs/LocalFoodEconomyStudyLFE%20REPORT%20FINAL-2.pdf>. Last retrieved July 17, 2014.
- Stevenson, G. W., and Pirog, R. (2008). Values-based supply chains: Strategies for agrifood enterprises of the middle. *Food and the mid-level farm: Renewing an agriculture of the middle*, 119-143. MIT Press, Cambridge, MA.
- Stone, A. (2014). GMO food critics see losses at ballot box – and a more hostile congress. National Geographic News. Retrieved from <http://news.nationalgeographic.com/news/2014/11/141106-gmo-food-labels-laws-election-colorado-oregon-ngfood/>. Last retrieved November 19, 2014.
- Tropp, D., and Barham, J. (2008). *National farmers market summit proceedings*. United States Department of Agriculture, Agriculture Marketing Service. Washington, D.C. report (No. 148269). Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5066926>. Last retrieved July 12, 2014.
- US Department of Agriculture, Agricultural Marketing Service (USDA AMS). (2013). USDA GAP and GHP audit. Retrieved from <http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP>. Last retrieved July 12, 2014
- US Department of Agriculture, Agricultural Marketing Service (USDA AMS). (2012). Grading, certification and verification. Retrieved from <http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateN&navID=USGradeStandards&rightNav1=USGradeStandards&topNav=&leftNav=&page=FreshGradeStandardsIndex&resultType=&acct=freshgrdcert>. Last retrieved July 12, 2014.
- USDA. (2014). Working list of food hubs. U.S. Department of Agriculture, Agricultural Marketing Service, Washington, D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/foodhubs>. Last retrieved July 5, 2014
- US Department of Agriculture, National Agricultural Statistical Service (USDA NASS). (2007). 2007 Census of agriculture. United State national level data. Washington, DC.

CHAPTER V

GEOGRAPHIC DISTRIBUTION AND TOPOGRAPHIC CONDITIONS OF IOWA
VINEYARDS AND WINERIES

Abstract

Between 2004 and 2013 the number of Iowa vineyards grew from 165 to 306 and the number of wineries grew from 30 to 95. A spatial evaluation of 2012 vineyards and wineries may assist with vineyard management and industry development. To evaluate Iowa's grape and wine industry I addressed four spatial questions: 1) How are vineyards and wineries distributed in Iowa? 2) Are there statistically significant clusters of vineyards or wineries? 3) What are the site characteristics of vineyards? 4) Based on distance can current wineries serve as aggregators for vineyards? To answer these questions I obtained lists of 2012 vineyards and wineries from extension personnel and the Iowa Alcoholic Beverages Division. Political boundaries and topographic data were obtained from the Iowa Geospatial Data Clearinghouse. Spatial and statistical analyses were performed using ArcGIS, GeoDa, and Microsoft Excel. I found greater concentrations of vineyards and wineries near metropolitan areas. Moran's $i=0.32$ for vineyards and 0.13 for wineries meaning there is positive global spatial autocorrelation and counties with greater numbers of wineries and vineyards are located together. Regression analysis showed a slight positive correlation between county population and the number of vineyards or wineries $r^2=0.20$ for vineyards and $r^2=0.17$ for

wineries. The farthest distance between a vineyard and winery was 54 kilometers and winery service areas ranged from 2,046 to 5,135.95 square kilometers. Through this analysis we see the influence of growing conditions, market access, and competing or complementary land use on vineyard and winery site selection.

Introduction

Recorded grape and wine production in Iowa dates back to 1857, when A.S. Bonham planted a vineyard near Council Bluffs (Maney, 1921). By 1919 Iowa ranked sixth in the nation in grape production, producing 5,443 metric tonnes (U.S. Agricultural Census, 1920). Iowa's grape and wine industry declined through the mid to late 1900's due to a combination of prohibition, the Armistice Day freeze of 1940, 2,4-D damage, and increased focus on agronomic crops (Pirog, 2000 and White, 2004). By 1966 Iowa's grape production had decreased to 217 metric tonnes (Pirog, 2000).

Increased interest in local food systems has accompanied a resurgence in Iowa grape and wine production. The establishment of a statewide growers association in 2000 to advocate for grape and wine growers politically and assist with marketing Iowa wines has facilitated this resurgence (Iowa Wine Growers Association, 2014). Between 2004 and 2013 the number of Iowa vineyards grew from 165 to 306 and the number of grew wineries from 30 to 95 (White, 2013). The Iowa wine industry produced a \$420 million economic impact in 2012, from 1,250 acres in grape production (Frank, Rimerman and Co., 2012). Even with the rapid

growth of the Iowa wine industry, Iowans annually consume 1.44 gallons of wine per person, nearly half the US average. Only 5.84 percent of total wine sales in Iowa are native Iowa wines (Tordsen, 2012). These statistics suggest that there is room for growth of wine sales as a whole and sales of local Iowa wines. The Iowa wine industry has the potential to impact other local food systems in the state by adding local table grapes and wine to product offerings, increasing tourism, and providing aggregation, distribution, and wholesale experience to other local crops producers and food hubs (Pirog, 2000).

Wineries are often located near each other to take advantage of favorable environments for grape growing and collective marketing strategies. There are five wine trails through wine producing regions promoted by Travel Iowa (Travel Iowa, 2014). Terroir (geography, geology, and climate of a place) explains some of this clustering but not clustering within a region (Yang et al., 2010).

Mapping wine regions and vineyards using geographic information systems (GIS) is becoming commonly used for two purposes. First, state agencies are using regional terroir maps to identify potential wine growing areas and to assist growers in such areas with varietal selections and cultural management (Boyer, 1998; Foss and Morris, 2010; and Jones et al., 2004). Second, growers are combining terroir maps with maps of past harvest yields and quality to implement precision viticulture (Arano et al., 2009; Bramley, 2001; Bramley et al., 2005; Reynolds et al., 2007; and Smith and Whigham 1999). Other agriculture industries are also using GIS similarly to identify productive areas, source materials, and locate planned processing facilities

analogous to vineyards and wineries (Haddad and Anderson, 2008 and Haddad, et al., 2009).

A preliminary step to more in-depth spatial analysis of the Iowa grape and wine industry and Iowa's suitability for grape production is better understanding the spatial distribution of Iowa vineyards and wineries. This study intends to answer three spatial questions for the state of Iowa. 1) How are vineyards and wineries distributed in Iowa? My hypothesis is that vineyards and wineries will have positive spatial autocorrelation meaning that they will be grouped together in areas with favorable environmental and economic conditions. 2) Are there statistically significant clusters of vineyards or wineries? 3) What are the topographic characteristics of vineyards? My hypothesis is that vineyards and wineries will be located on suitable or moderately suitable slopes and aspects and that the distribution of vineyard and winery slopes and aspects will be different than the distribution of Iowa, showing considerable, intentional placement of vineyards. By describing how vineyards and wineries are distributed we can identify areas that can easily be expanded and marketed as "wine regions" and areas that lagging behind.

During initial stages of mapping vineyards and wineries I noticed areas where vineyards and wineries appeared clustered in lines. Comparisons with other maps showed these vineyards and wineries were located along rivers, this observation lead to an additional research question and hypothesis. 1) What is the distribution of distance from Iowa vineyards and wineries to rivers? 2) Is this distribution different from the distribution for all of Iowa? Our additional hypotheses are: 1) The distribution for distance from Iowa vineyards to rivers is different than the distribution

for all of Iowa to rivers. 2) The distribution for distance from Iowa wineries to rivers is different than the distribution for all of Iowa to rivers. The answers to these additional questions may guide future research on factors influencing vineyard and winery placement, landowners' criteria for determining land use, and vineyard or winery owners' criteria for purchasing property.

Methods and Materials

Data for this study was supplied by multiple sources. Michael White, Iowa State University Extension Field Specialist in Viticulture supplied his list of winery and vineyard clients. This information was combined with a list of wineries provided by the Iowa Alcoholic Beverages Division and a list of vineyards supplied by the Iowa Department of Natural Resources to create the complete list used in analysis. This list was geocoded in ArcGIS (ESRI, Redlands, CA) to place them on the map and locations were verified using aerial images. State and county boundaries, incorporated places, Iowa roads, interstates, rivers, and elevation were all supplied by the Iowa Department of Natural Resources. The US Census Bureau, via the Iowa Geospatial Data Server, provided county population.

Assumptions made at the beginning of analysis include that all vineyards are selling commercially and producing wine grapes and not table grapes for fresh consumption. I also am assuming that topography at the mapped address point location is an acceptable representation of the conditions in the vineyard for this preliminary study.

I viewed statewide distribution of vineyards and wineries by determining the number of each in each of Iowa's 99 counties in ArcGIS and exporting the shape file to GeoDa (Tempe, AZ). In GeoDa I conducted exploratory spatial analysis, regression analysis, and tests for global and local spatial autocorrelation (Anselin, 1995). Exploratory Data analysis included creating box plot maps depicting the number of vineyards and wineries in each county to see statewide distribution and detect outliers. Counties are classified as outliers if they are 1.5 times higher or lower than the interquartile range (75 percentile minus 25 percentile, describing the middle of the distribution) (GeoDa Center, 2014). Spatial autocorrelation is tests against Tobler's first law of geography, "everything is related to everything else but near things are more related than distant things." (Tobler, 1970). Measures of spatial autocorrelation are calculated in GEODA for a given significance level or pseudo-p value ($p=0.01$) using Moran's I and Local Indicators of Spatial Association (LISA). Moran's I is a number between -1 and 1 that tests against the null hypothesis that features are randomly located (Moran's $I=0$). Negative values mean like features are separated while positive values mean like features are found together.

In order to evaluate the appropriateness of current vineyard and winery locations I extracted site topography from raster layers for percent slope and aspect, and compared them to recommended conditions from Kurtural (2002). Values from these raster layers were extracted to vineyard and winery points and then exported into Excel (Microsoft Corporation, Redmond, WA) for statistical analysis. Values were placed in suitability categories based on Kurtural (2002). The percents of vineyards, wineries, and total Iowa land in each category were used to create

histograms. I then compared vineyard and winery distributions to the distribution for all of Iowa, using Pearson's chi-square analysis in GraphPad (GraphPad Software, Inc., La Jolla, CA). Pearson's chi-square measures the likelihood that differences between the distributions for vineyards or wineries and the distribution for Iowa arose by chance.

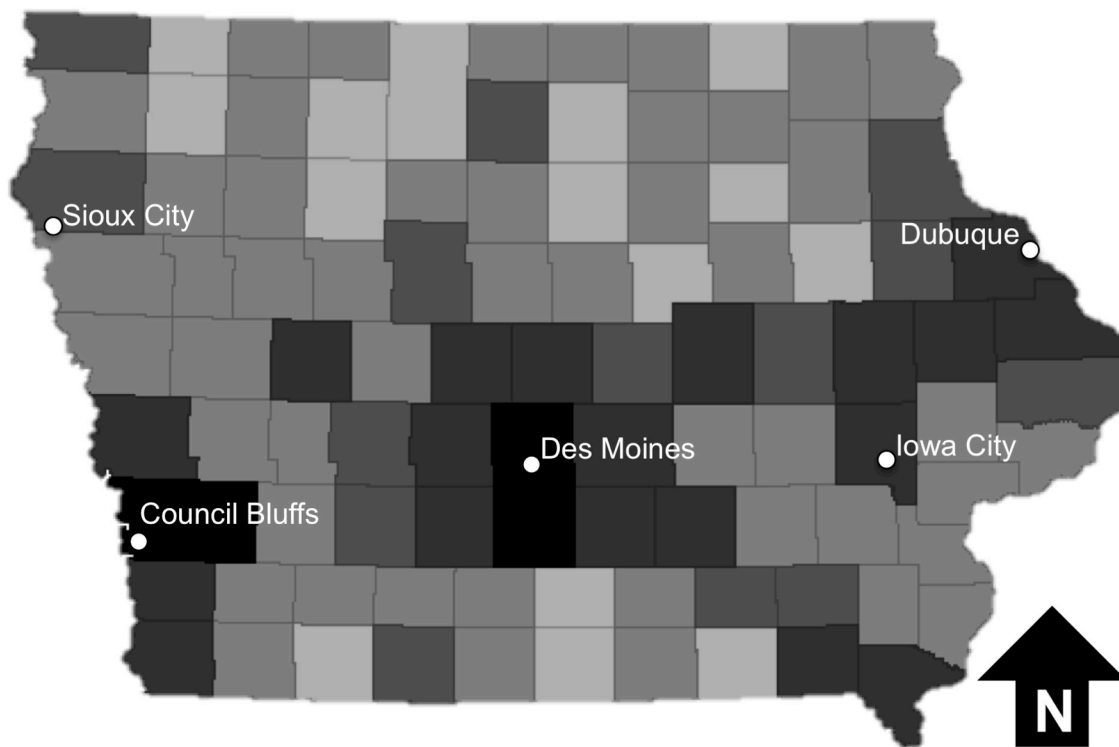
The ability of Iowa wineries to serve as aggregation points for vineyards was measured using Thiessen polygons and Euclidean distances created using vineyard and winery locations. Thiessen polygons create a polygon around a point such as a winery that shows all the area that is closer to that point than any other points i.e. wineries. Euclidean distance creates a series of graduated outlines around an object, each outline shows areas that are equidistant to the object. Thiessen polygons and Euclidean distances were used to measure winery service area and distance to vineyards respectively. Thiessen polygons and Euclidean distances were finally compared to vineyard locations to evaluate the possible effectiveness of current wineries to serve as aggregation facilities for current vineyards.

Results

I found greater concentrations of vineyards in the central part of Iowa along interstate 80 and focused around population centers, specifically Council Bluffs and Des Moines (fig. 1). Three of Iowa's 99 counties, Polk, Pottawattamie, and Warren were identified as upper outliers. Greater concentrations of wineries were also found around population centers (fig. 2). Iowa counties of Dubuque, Iowa, and

Pottawattamie were identified as upper outliers for the number of wineries. I found weak correlations of $r^2 = 0.20$ between county population and the number of vineyards and $r^2 = 0.17$ between county population and the number of wineries. Tests for global spatial autocorrelation showed Moran's $i = 0.32$ for vineyards and $i = 0.13$ for wineries (pseudo $p = -0.1$). Four Iowa counties, Madison, Marion, Polk, and Warren

Distribution of Vineyards by County

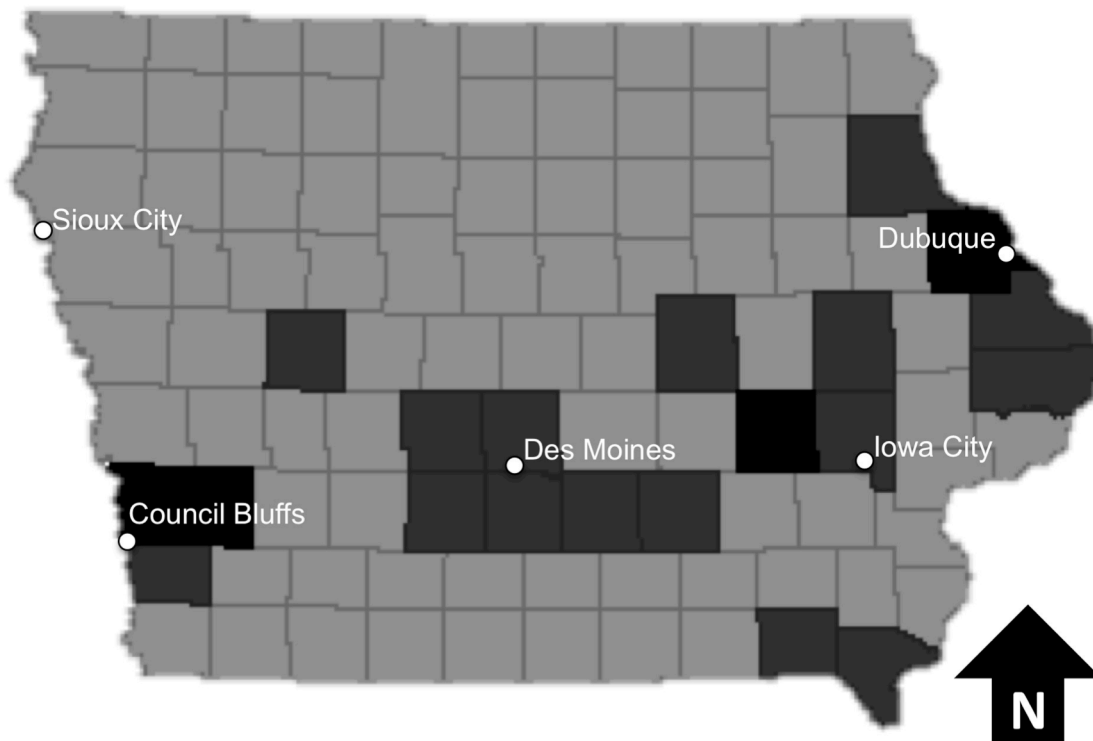


(number of counties in parentheses)
 Lower Outlier (0)
 <25% (15)
 25%-50% (48)
 50%-75% (14)
 >75% (19)
 Upper Outlier (3)

Figure 1. Box plot map of vineyards per county. Three counties, Polk, Pottawattamie, and Warren, were identified as outliers, having unusually high numbers of vineyards ($N=368$).

were identified as high clusters of vineyards (counties having a high number of vineyards, who's nearest six counties also have high numbers of vineyards). Two Iowa counties, Clay and Emmet, were identified as low clusters of vineyards (counties having a low number of vineyards, who's nearest six counties also have low numbers of vineyards). One county, Buena Vista, was identified as a low cluster

Distribution of Wineries by County



(number of counties in parentheses)
 Lower Outlier (0)
 <25% (0)
 25%-50% (80)
 50%-75% (0)
 >75% (16)
 Upper Outlier (3)

Figure 2. Box plot map of wineries per county. Three counties, Dubuque, Iowa, and Pottawattamie, were identified as outliers, having unusually high number of wineries (N=103).

of wineries (a county having a low number of wineries, who's nearest six counties also have low numbers of wineries). One county, Jones, was identified as a low-high cluster (a county having a low number of wineries, who's nearest six counties have high numbers of wineries). All clusters were significant at pseudo $p=0.01$.

Distance From River

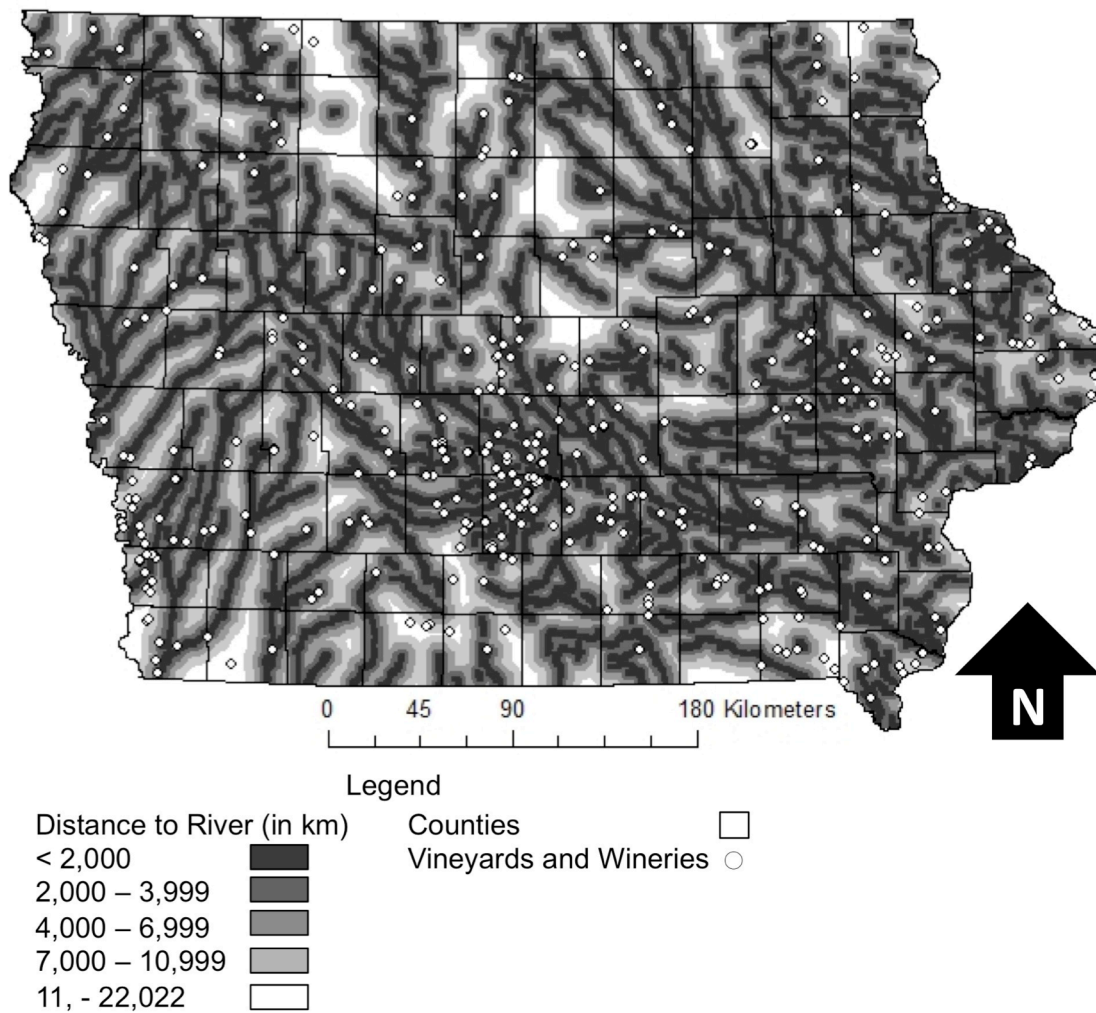


Figure 3. Map displaying Euclidean distance from rivers, 368 vineyards, and 103 wineries. Shading represents graduated distances around rivers.

Fifty-two percent of vineyards were located within 2 kilometers of a river compared to only 39 percent of Iowa land being located within two

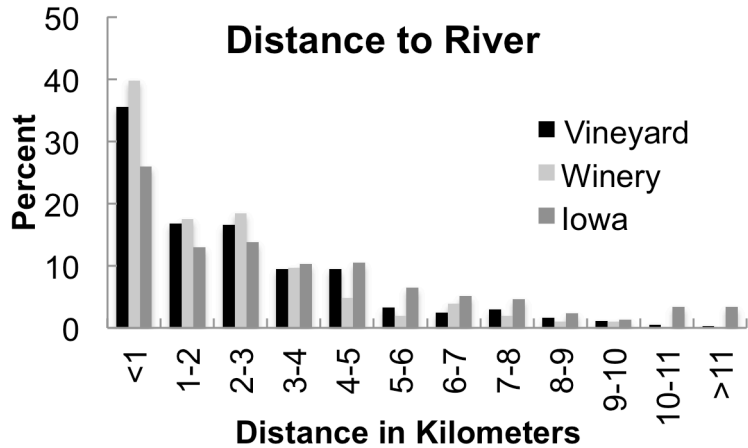


Figure 4. Percentage of vineyards (N=368), wineries (N=103) and all of Iowa in each category of distance to nearest river.

kilometers of a river (fig. 3) (Chi-square equals 49.498 with eight degrees of freedom and a P value of less than 0.0001). This means there is statistically significant evidence that vineyards are not located near rivers by random

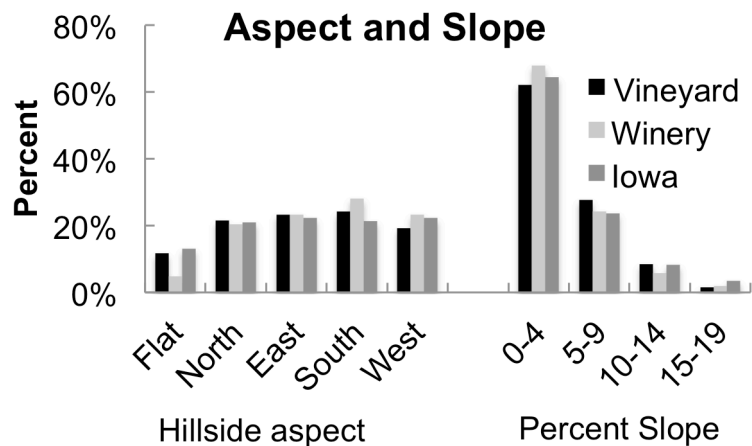


Figure 5. Hillside aspect, (the direction the slope faces) and slope in percent of vineyards (N=368), wineries (N=103), and all of Iowa.

chance (fig. 4). When distance from a winery to

a river was measured, 57.3 percent of wineries are located within two kilometers of a river. Chi-square equals 26.123 with eight degrees of freedom and a P value of less than 0.001. There is significant evidence that wineries are not located near rivers by random chance (fig. 4).

Eighty-nine percent of Iowa vineyards and 92% of Iowa wineries are located on slopes of less than 10%. This is not significantly different than all lowan land fig. 5). Aspect of wineries and vineyards were evenly distributed between flat, north, south, east, and west and were not different then expected values for Iowa (fig. 5).

Winery Service Area

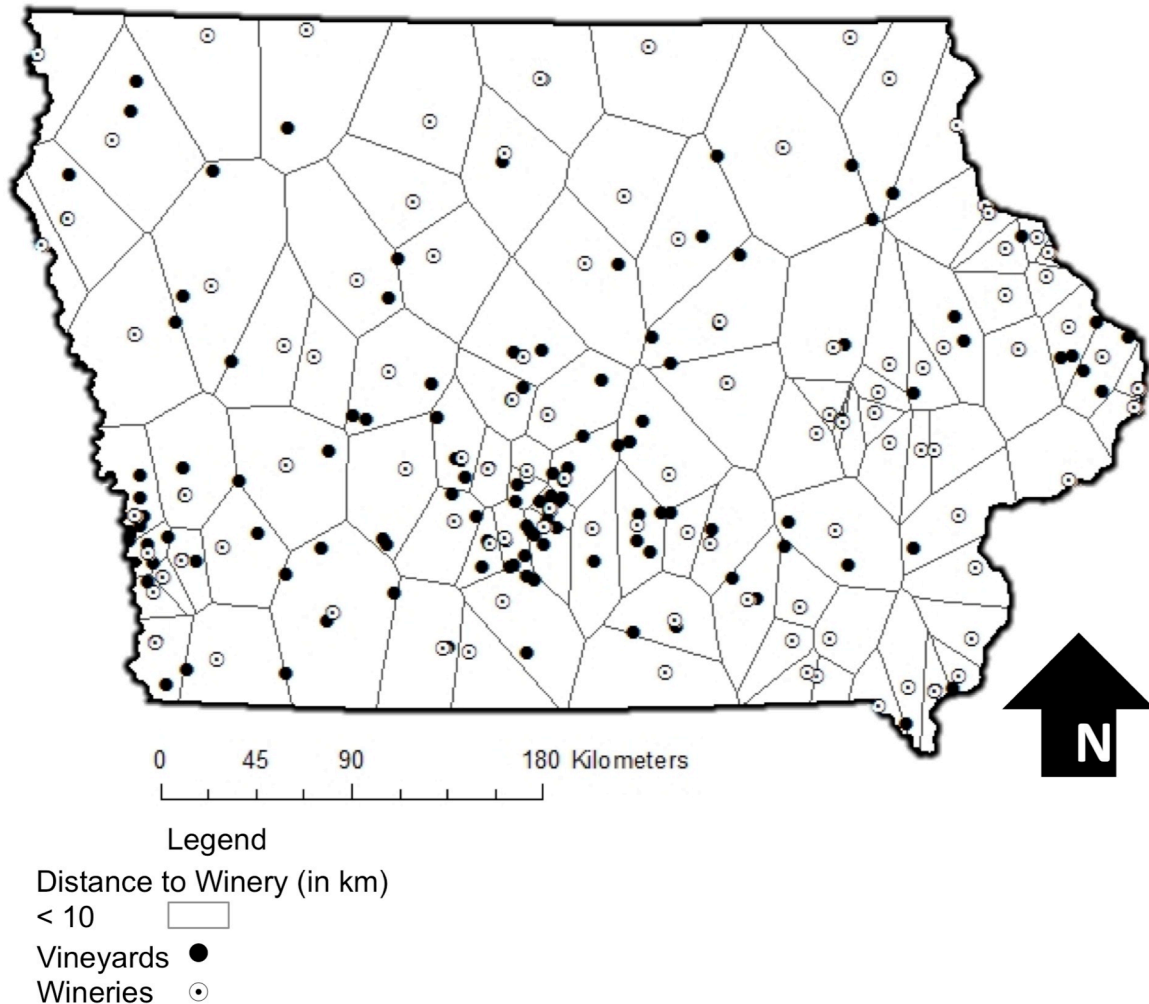


Figure 6. Thiessen polygons divide Iowa by nearest winery. Each polygon represents service area if a winery would serve as an aggregation facility for vineyards located closer to that winery than any other. min = 2,046 ha; max = 513,375 ha; mean = 141,454 ha; standard deviation = 105711 ha.

Polygons generated around each winery show service areas if existing wineries were used as aggregation facilities for vineyards. Service areas would

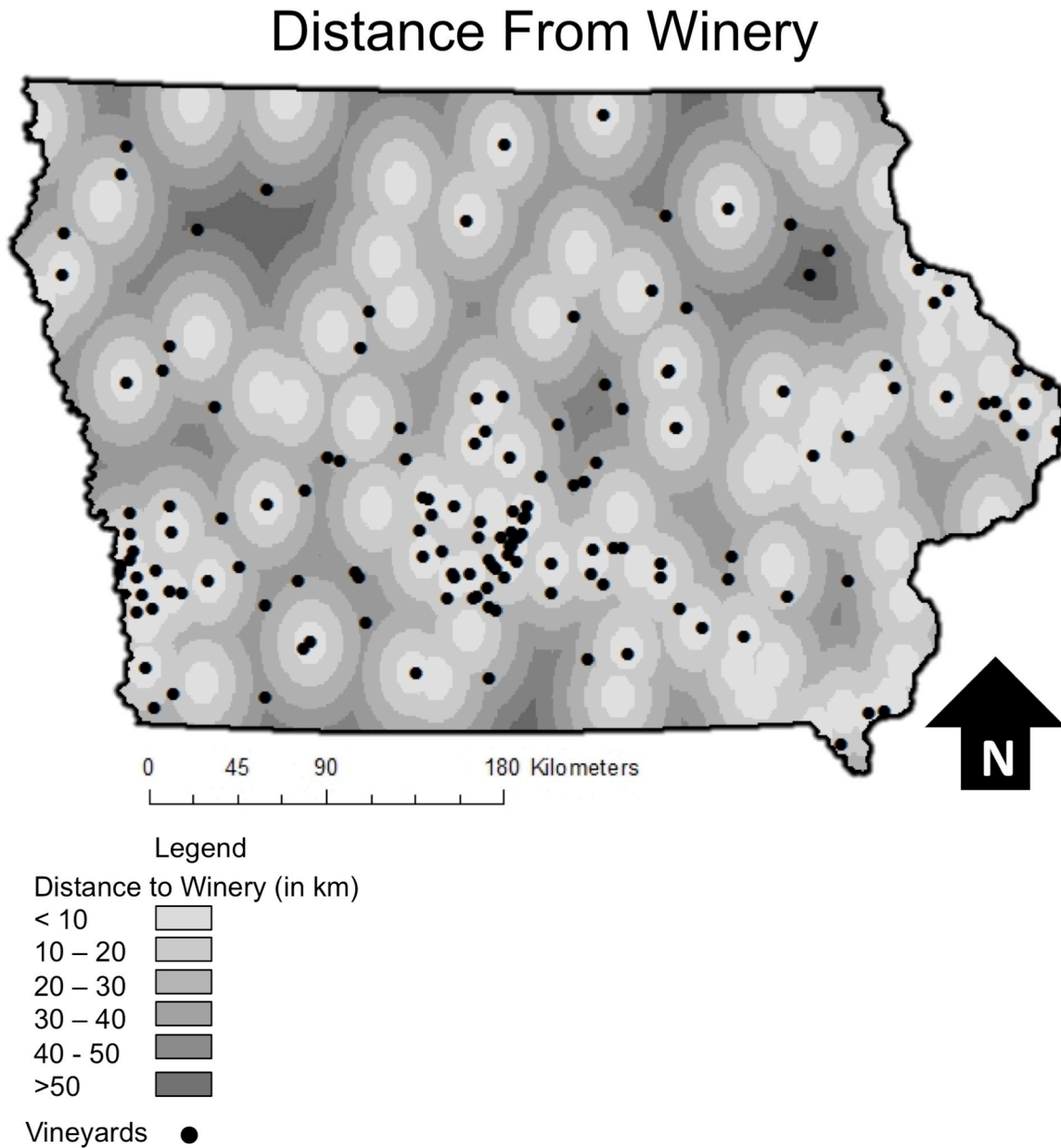


Figure 7. Euclidean distance from wineries displays graduated distances from wineries and which vineyards may be served by multiple wineries and which vineyards may be under served by current wineries.

range from 2,046 ha to 513,375 ha with a mean of 141,454 ha and median of 123,591 ha (fig. 6). Euclidean distance shows that the greatest distance between a vineyard and its closest winery is 54 kilometers (fig. 7).

Discussion

I found counties with larger numbers of vineyards and wineries clustered near large population centers. This could be due to a combination of factors including not only population but also, age, level of education, economic status, and lifestyle behaviors of customers, all of which impact wine and wine tourism target demographics (Bruwer et al., 2012; Getz et al., 1999; and Thach and Olsen, 2006). Most visitors to wineries will be local and regional in origin and visitor volumes are greatest when wineries are located near heavily populated areas (Dodd, 1995 and Getz et al., 1999), as they provide options for weekend day-trips (South Australian Tourist Commission, 1997). Yang (2010) examined vineyard and winery clusters and found that terroir explains some but not all of similar clustering in Washington and California. Yang (2010) also found a strong positive correlation between wine tasting scores, wine price, and location, and positive affects on price per bottle of wine due to spillover of knowledge and reputation between vineyards and wineries within clusters.

I found that while lowan vineyards and wineries are more likely to be located next to rivers there is no difference between actual and expected values for slope and aspect. I found that most vineyards and wineries are placed on suitable or

moderately suitable slopes of 0-10% next to rivers with suitable or moderately suitable aspects facing east or north (Kurtural, 2002) (figs. 4, 5, and 6). Slope and aspect are important considerations when placing vineyards. Slopes between 5-15% are suitable and moderately suitable because cold air will flow downhill while operators are still able to operate equipment safely. Aspect impacts the amount of light the vineyard receives daily as well as temperatures during early spring freeze thaw cycles. The proximity to rivers could be due to river valleys providing appropriate slopes. To understand vineyard and winery locations we must look at all criteria that impact selecting a site on which to establish a vineyard.

The inevitable question is whether land was purchased for the establishment of a vineyard or winery or if the land was already owned and its use as a vineyard was one of many possible uses. Other criteria then become more important such as proper growing conditions, access to markets and transportation, land value, and competing and complementary land uses. While I don't know why vineyards and wineries tend to be located near rivers without further investigation, I can speculate that factors including competition and herbicide drift from row crops, suitable growing conditions, scenic views for event rental, and maybe even early settlement patterns have had an influence. Three potential areas where an established wine industry could be expended include around Council Bluffs, near Des Moines, and between Iowa City and Dubuque. Future modeling work on these smaller scale study areas would include more detailed and complex data such as soil morphology and fertility that were too data intensive and prohibitive at the state wide level.

Initial spatial analysis reveals that current wineries are capable of serving as aggregation facilities for vineyards. Thiessen polygons divide Iowa into polygons based on which winery is closest, with lines between polygons being equidistant from two wineries. We can see that the largest winery service area is 513,375 ha. Euclidean distances show that the majority of vineyards would be adequately served by at least one winery. There are two exceptions, where groups of wineries fall in areas of greater than average distance to a winery (fig. 7). These groups may consider cooperating to construct shared processing facilities to better meet their needs. The majority of wineries import additional grape juice from surrounding states and California to blend with Iowa grape juice (Pirog, 2000). Apparently there are excess processing capabilities in the state for the amount of grapes produced. Increasing wine grape production could generate local economic gains.

Future studies include re-digitizing vineyards and wineries using aerial images to create poly lines over the trellises and polygons for the buildings. This would allow us to better estimate conditions in the vineyard and better understand individual vineyard and industry size. Grower surveys to collect information such as acres in production, average yields, cultivars used, and types of products produced would also be useful to verify and expand this data. With better understanding of vineyard and industry scale we could identify areas of the state to develop, make prescriptive recommendations on future vineyard or winery locations (Foss and Morris, 2010 and Jones et al., 2004), and begin precision management of vineyards (Arano et al., 2009; Bramley 2001; Bramley et al., 2005; Reynolds et al., 2007; and Smith and Whigham 1999).

This information will help extension personnel and the Iowa Grape and Wine Growers association to better understand and manage the grape production and wine tourism in Iowa by adding more detail to materials they already produce (White, 2013). By further developing local wine production and tourism I will also facilitate development in other areas of agritourism (Wargenau and Che, 2006) and local food systems (Pirog, 2000) learning lessons from this industry that already aggregates, processes, stores, and distributes local product across the state.

References

- Anselin, L. (1995). Local indicators of spatial association—LISA. *Geographical analysis*, 27(2), 93-115.
- Arano, J., J. Martines-Casasnovas, M. Ribes-Dasi, and J. Rosell. (2009). Review. precision viticulture. research topics, challenges, and opportunities in site-specific vineyard management. *Spanish Journal of Agriculture Research*. 7(4): 779-790.
- Boyer, J. (1998). Geographic analysis of viticulture potential in Virginia. Master's thesis. Virginia Polytechnic Institute and State University.
- Bramley, R. G. V. (2001). Progress in the development of precision viticulture-Variation in yield, quality and soil properties in contrasting Australian vineyards. *Precision tools for improving land management. Occasional report*, (14), 25-43.
- Bramley, R., A. Proffitt, C. Hinze, B. Pearse, and R. Hamilton. (2005). Generating benefits from precision viticulture through selective harvesting. *Proceedings of the 5th European Conference on Precision Agriculture*.
- Bruwer, J., Lesschaeve, I., and Campbell, B. L. (2012). Consumption dynamics and demographics of Canadian wine consumers: Retailing insights from the tasting room channel. *Journal of Retailing and Consumer Services*, 19(1), 45-58.
- Can, A. 1996. GIS and spatial analysis of housing and mortgage markets. *Journal of Housing Research* 9: 61-86

- Dodd, T. (1995). Opportunities and Pitfalls of Tourism in a Developing Wine Industry. *International Journal of Wine Marketing*, 7(1): 5-16.
- Foss, C. and D. Morris. 2010. Champagne comes to England: Assessing the potential of GIS in the identification of prime vineyard sites in south and east England. *Findings in Built and Rural Environments*.
- Frank, Rimmerman and Co. LLP. (2012). The economic impact of Iowa wine and wine grapes – 2012. Commissioned by Iowa State University. Retrieved from http://www.traveliowa.com/UserDocs/Iowa_2012_EI_Report_FINAL.pdf. Last retrieved June 23, 2014.
- GeoDa Center for Geospatial Analysis and Computation. (2014). Glossary of key terms. Arizona State University School of Geographic Sciences and Urban Planning. Retrieved from <https://geodacenter.asu.edu/node/390#sa>. Last retrieved November 14, 2014.
- Getz, D., Dowling, R., Carlsen, J., and Anderson, D. (1999) "Critical Success Factors for Wine Tourism", *International Journal of Wine Marketing*, Vol. 11 Iss: 3, pp.20 – 43.
- Haddad, M. and P. Anderson. 2008. A gis methodology to identify potential corn stover collection locations. *Biomass and Bioenergy*. 32: 1097-1108.
- Haddad, M., G. Taylor, and F. Owusu. 2009. Locational choices of the ethanol industry in the Midwest corn belt. *Economic Development Quarterly*. 24: 74.
- Iowa Wine Growers Association. (2014). Report on the Iowa wine and grape industry. Iowa Wine Growers Association. Des Moines, IA. Retrieved from <http://iowawinegrowers.org/wp-content/uploads/2014/02/Legislative-Report-sm.pdf>. Last retrieved July 10, 2014.
- Jones, G., A. Duff, and J. Myers. 2004. Modeling Viticultural Landscapes: A GIS Analysis of the Terroir Potential in the Umpqua Valley of Oregon. *Geoscience Canada*.
- Kurtural, S. (2002). Vineyard site selection. Report of Cooperative extension services, Department of Horticulture, University of Kentucky
- Maney, T. J. (1921). *Grape production and distribution in western Iowa*. Agricultural Experiment Station, Iowa State College of Agriculture and Mechanic Arts.
- Pirog, R. (2000). *Grape expectations: a food system perspective on redeveloping the Iowa Grape Industry*. Leopold Center for Sustainable Agriculture, Iowa State University.

- Reynolds, A., I. Senchuk, C. van der Reest, and C. de Savigny. 2007. Use of gps and gis for elucidation of the basis for terroir: Spatial variation in an Ontario Riesling vineyard. *American Journal of Enology and Viticulture*. 58:2 145-162.
- Smith, L., and P. Whigham. 1999. Spatial aspects of vineyard management and wine grape production. SIRC 99 – the 11th annual colloquium of the spatial information research centre.
- South Australian Tourist Commission, 1997. Wine and Tourism: A Background Research Report. Adelaide.
- Thach, E. C. and Olsen, J. E. (2006), Market segment analysis to target young adult wine drinkers. *Agribusiness*, 22: 307–322.
- Tobler WR: A computer movie simulating urban growth in the Detroit Region. *Economic Geography* 1970, 46:234-240.
- Tordsen, C. (2012). Iowa native wine production and sales report for the period ending 12/31/2012. Iowa State University Value Added Ag Programs. Ames, IA. Retrieved from <http://www.extension.iastate.edu/wine/sites/www.extension.iastate.edu/files/wine/Jan2013Iowa%20Native%20Wine%20Production%20and%20Sales%20Report.pdf>. Last retrieved June 23, 2014.
- Travel Iowa. (2014). Get inspired: Wine and Beer. Iowa Tourism. Des Moines, IA. Retrieved from <http://www.traveliowa.com/GetInspired/WineAndBeer>. Last retrieved July 9, 2014.
- US Department of Agriculture. (1920). Census of agriculture. US Department of Agriculture, Washington D.C. Vol. VI, Part I, Table IV.
- Wargenau, A., and Che, D. (2006). Wine tourism development and marketing strategies in Southwest Michigan. *International Journal of Wine Marketing*, 18(1), 45-60.
- White, M. (2004). Iowa: Viticulture (Grapes) 101. Proceedings, Integrated Crop Management Conference. 12-2-2004. Retrieved from <http://viticulture.hort.iastate.edu/info/pdf/icmgrapes101.pdf>. Last retrieved June 23, 2014.
- White, M. (2013). Iowa's "new" vineyard and winery map. Wine-Grower-News #247. Iowa State University Extension and Outreach. Ames, IA. Retrieved from http://www.extension.iastate.edu/wine/sites/www.extension.iastate.edu/files/WineGrowerNews247_05July2013.pdf. Last retrieved June 23, 2014.
- Yang, N., McCluskey, J. J., & Brady, M. P. (2012). The Value of Good Neighbors: A Spatial Analysis of the California and Washington State Wine Industries. *Land Economics*, 88(4), 674-684.

CHAPTER VI

GENERAL CONCLUSIONS

Summary

I found food hubs include a wide variety of cooperatives, farms, multiform CSAs, distributors, wholesalers, grocers, online farmers markets, produce auctions, and networks. All of these organizations facilitate the aggregation, storage, processing, distribution, and/or marketing of locally/regionally produced food products (Barham, 2011). Building contextual organizations that develop appropriate structure and physical, financial, human and information resources for their unique situation is the key to success of values-based supply chains (Boule et al., 2011; Cantrell, 2014; Dreier and Taheri, 2009; Flaccavento, 2009; and Lerman et al., 2012). In this dissertation I presented results from a survey of food hubs in the Upper Midwest United States. I summarized differences in demographics and described the amounts of information resources and built, human, and social capital (Flora and Flora, 2013) developed and utilized by food hubs.

Chapter 2 Demographics and Distribution of Food Hubs

Value-based supply chains, and food hubs operating within them, have a wide variety of values, organizational types, infrastructure, and practices (Cheng and Seely, 2011; Clancy and Ruhf, 2010; and Melone et al., 2010). Most food hubs on my list were cooperatives (40%) or limited liability corporations (30%), and 90% were

for-profit organizations. Food hubs have different strengths and weaknesses depending on which segment of the values-based supply chain is managing the food hub. Food hubs in the Upper Midwest U.S. were mostly retail and farmer driven. They are likely to have a broad base of retail and production expertise, common goals, individual commitment, and entrepreneurial attitudes (Diamond and Barham, 2011 and Morley et al., 2008).

Most food hubs are fairly young organizations and carry similar products. Sixty percent have been in operation five years or less (Barham, 2011 and Fischer et al., 2013). I found the average number of years in business to be 20 years. All three studies found that nearly all food hubs carry fresh produce (Barham, 2011 and Fischer et al., 2013). Meat, eggs, and dairy make up the other products carried by the majority of food hubs in all three studies (Barham, 2011 and Fischer et al., 2013).

Food hubs consider several different factors when choosing a location for facilities, proximity to customers and growers, accessibility, and cost of facilities, on food hub went as far as to say facilities had to be free through a community partnership. The most important criteria was distance to customers due to the retail nature of our survey respondents. I found that 68% of food hubs said the average distance from their food hub to regular customers was less than 25 miles. I found little impact from population on the profitability or structure of food hubs. The median population was 394,705 within 25 miles of food hubs and the median county population was 170,952.

Chapter 3 Physical and Resources Required by Food Hubs

Food hubs used a variety of facilities and equipment depending on their business structure and having the correct amount and type of infrastructure is imperative for the financial success of food hubs (Cantrell and Heuer, 2014; Day-Farnsworth et al., 2009; Diamond and Barham, 2011; and Schmit et al., 2013). I found most food hubs reported having the facilities and equipment required to operate at their current scales. Others have found capitalization to procure facilities and equipment a common barrier for food hubs (Day-Farnsworth, et al., 2009 and Matson et al., 2013). One potential solution is transitional food systems that use current conventional infrastructure to move values-based product (Bloom and Hinrichs, 2011; Clancy, 2009; and Clark et al., 2011).

Access to capital for investment has consistently been identified as a constraint for developing food hubs (Day-Farnsworth, et al., 2009 and Matson et al., 2013). This study found most food hubs received funding through conventional investors, loans, and cooperative members. Only 14% percent of food hubs received government grants or loans and 10% received private grants or contributions from foundations.

Food hubs in the Upper Midwest U.S. had median sales between \$100,000 and \$500,000. Profits appeared low, but depending on the food hub model (Diamond and Barham 2011) and its values (Feenstra et al., 2011; Flaccavento, 2009; and Stevenson and Pirog, 2008) profits may have been intentionally low

(Fischer et al., 2013). Traditional measures of success, using growth of financial capital, may not be a reasonable measure of food hub success (Fischer et al., 2013), without evaluating other forms of community capital (Flora and Flora, 2013).

Chapter 4 Information and Human Resources Required by Food Hubs

Food hubs used a wide variety of ways to fill their labor requirements. I found a tendency toward full-time and year-round staff over part-time and seasonal. Some food hubs also recognized the benefit volunteers add to their organization.

Fischer (2013) analyzed the mission statements of 107 food hubs and found 52% mention supporting farmers. In order to support these beginning, disadvantaged, and/or small to medium sized farms, food hubs offer a variety of services including continuing education and facilitating communication. I found 72.7% of food hubs reported facilitating communication between growers, and 63.6% between growers and consumers. By facilitating communication between growers and providing education opportunities, food hubs assist growers with developing leadership skills and knowledge, a necessary element for local food system growth (Morley et al., 2008 and Tropp and Barham, 2008). I found that 40% of food hubs offered GAP education programs to employees and growers. Alternatively, Fischer (2013) found that only 9% of food hubs reported all or most of their growers adopted GAP certification since beginning supplying their food hub, but did not ask what percent of farms were GAP certified. This could mean that while

growers are learning GAP procedures they are not becoming certified due to cost restrictions.

These findings show the importance of food hubs not only as aggregators and distributors of physical product but also as educators and facilitators of communication, who are actively developing local food systems.

Chapter 5 Geographic Distribution and Topographic Conditions of Iowa Vineyards and Wineries

I found counties in Iowa with larger numbers of vineyards and wineries clustered near large population centers. This could be due to a combination of factors including not only population but also, age, level of education, economic status, and lifestyle behaviors, all of which impact wine and wine tourism target demographics (Bruwer et al., 2012; Getz et al., 1999; and Thach and Olsen, 2006).

While Iowa vineyards and wineries are more likely to be located next to rivers, there is no difference between actual and expected values for slope and aspect. The question is whether land was purchased for the establishment of a vineyard or winery or if the land was already owned and its use as a vineyard was one of many possible uses. Other criteria then become more important such as proper growing conditions, access to markets and transportation, land value, and competing and complementary land uses.

Initial spatial analysis reveals that current wineries are capable of serving as aggregation facilities for vineyards. I can see that the largest winery service area (Thiessen Polygon) is 513,375 ha. Euclidean distances show that the majority of vineyards would be adequately served by at least one winery. There are two exceptions, where groups of wineries fall in areas of greater than average distance to a winery (chapter 5, fig. 7).

Additional Comments

Much of the results depend on the investigators definition of food hub and the survey frames. I included several privately held and consumer cooperative grocers that purchase and distribute local produce. Some of these grocers had multiple locations and increased my findings for maximum number of employees. There is still disagreement on the definition of food hubs and characteristics, chiefly scale, that include or exclude an individual operation (Feenstra et al., 2011).

Since my study in 2012, and the national survey in 2013, new food hubs have been added to the USDA working list of food hubs (USDA, 2014). Barham (2011) surveyed 72 food hubs nationwide and Fischer (2013) surveyed 222 food hubs in 2013. I identified 97 organizations that I believe fit the definition of food hub in the Upper Midwest U.S. in 2012. These results show the recent, rapid growth of local foods and food hubs and are supported by Barham (2011). More than half of food hubs surveyed reported beginning operations since 2008 (Fischer et al., 2013). It is likely that my survey frame included a larger number of both privately held and

consumer cooperative grocery stores. The large variance in square footage of facilities and types of equipment utilized is not surprising when considering the variety of ways food hubs operate (Boule et al., 2011; Diamond and Barham, 2011; and Morley et al., 2008).

Future Work

Through this dissertation I have shown that food hubs form to fit a particular situation. Case studies for food hubs in the Upper Midwest United States need to be continuously added and updated to the current existing case study literature. These will then be available as examples for groups looking for specifics rather than general aggregated information. Other sectors of the values-based supply chain form the context in which food hubs develop. More research into size and motivations of consumers and producers in the region would provide additional information on the context in the Upper Midwest United States. The development of tools that interested organizations could use to assess their communities and determine which type of food hub would be best would also be helpful.

Future studies on the Iowa grape and wine industries could include digitizing trellises and buildings on vineyards and wineries to get better detail. This would allow us to better estimate conditions in the vineyard and better understand individual vineyard and industry size. Grower surveys to collect information such as acres in production, average yields, cultivars, and types of products produced would also be useful to verify and expand this data. With better understanding of vineyard

and industry scale we could identify areas of the state to develop, make prescriptive recommendations on future vineyard or winery locations (Foss and Morris, 2010 and Jones et al., 2004), and begin precision management of vineyards (Arano et al., 2009; Bramley 2001; Bramley et al., 2005; Reynolds et al., 2007; and Smith and Whigham 1999).

References

- Arano, J., J. Martines-Casasnovas, M. Ribes-Dasi, and J. Rosell. (2009). Review. precision viticulture. research topics, challenges, and opportunities in site-specific vineyard management. *Spanish Journal of Agriculture Research*. 7(4): 779-790.
- Barham, J. (2011). Regional food hubs: Understanding the scope and scale of food hub operations. Washington, DC: USDA AMS. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5090409>. Last Retrieved July 19, 2014
- Bloom, J. D., and Hinrichs, C. C. (2011). Moving local food through conventional food system infrastructure: Value chain framework comparisons and insights. *Renewable Agriculture and Food Systems*, 26(01), 13-23.
- Boule, D., Hubert, G., Jensen, A., Kull, A., Kim, J., Marshall, C., Meagher, K., and Rittenhouse, T. (2011). Context matters: Visioning a food hub in Yolo and Solano counties. Prepared for the Ag and Food Alliance. Sebastopol, CA. Retrieved from http://sarep.ucdavis.edu/sfs/files/ContextMatters_VisioningAFoodHubInYoloAndSolanoCounties_6-17-11_FINAL.pdf. Last retrieved July 12, 2014.
- Bramley, R. G. V. (2001). Progress in the development of precision viticulture-Variation in yield, quality and soil properties in contrasting Australian vineyards. *Precision tools for improving land management. Occasional report*, (14), 25-43.
- Bramley, R., A. Proffitt, C. Hinze, B. Pearse, and R. Hamilton. (2005). Generating benefits from precision viticulture through selective harvesting. Proceedings of the 5th European Conference on Precision Agriculture.

- Bruwer, J., Lesschaeve, I., and Campbell, B. L. (2012). Consumption dynamics and demographics of Canadian wine consumers: Retailing insights from the tasting room channel. *Journal of Retailing and Consumer Services*, 19(1), 45-58.
- Cantrell, P and Heuer, B. (March 2014). Food Hubs: Solving Local. The Wallace Center at Winrock International. Retrieved from <http://ngfn.org/solvinglocal>. Last retrieved July 6, 2014.
- Cheng, M., & Seely, K. (2011). Building Regional Produce Supply Chains: Helping Farms Access and Sell to Multiple Channels, Helping Large-Volume Buyers Access Regional Foods (pp. 1-32). San Francisco: FarmsReach.
- Clancy, K. (2009). What are we talking about when we talk about local and regional food systems. Proceedings of the Northeast Regional Center for Rural Development; Enhancing Local and Regional Food Systems: Exploring the Research, What Works, and What We Need to Learn. Kerhonkson, NY. May 19-20, 2009.
- Clancy, K., and Ruhf, K. (2010). Is local enough? Some arguments for regional food systems. *Choices*, 25(1), 123-135.
- Clark, J., J. Sharp, and S. Inwood. 2011. Scaling-up connections between regional Ohio specialty crop producers and local markets: Distribution as the missing link. The Ohio State University. Columbus, OH. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097255>. Last retrieved July 10, 2014.
- Day-Farnsworth, L., McCown, B., Miller, M., and Pfeiffer, A. (2009). *Scaling Up: Meeting the Demand for Local Food*. University of Wisconsin-Extension Agricultural Innovation Center, University of Wisconsin Center for Integrated Agricultural Systems. Madison, WI. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091489>. Last retrieved July 10, 2014.
- Diamond, A., and Barham, J. (2011). Money and mission: moving food with value and values. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 101-117.
- Dreier, S., & Taheri, M. (2009). Innovative Models: Small Grower and Retailer Collaborations, Part B. Wallace Center at Winrock International, Arlington, VA. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091495>. Last retrieved July 19, 2014
- Feenstra, G., Allen, P., Hardesty, S. D., Ohmart, J., and Perez, J. (2011). Using a supply chain analysis to assess the sustainability of farm-to-institution

- programs. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 69-84.
- Fischer, M., Hamm, M., Pirog, R., Fisk, J., Farbman, J., and Kiraly, S. (2013). Findings of the 2013 national food hub survey. Michigan State University Center for Regional Food Systems and The Wallace Center at Winrock International. Retrieved from <http://foodsystems.msu.edu/activities/food-hub-survey>. Last retrieved July 5, 2014.
- Flaccavento, A. (2009). Healthy food systems: A toolkit for building value chains. Central Appalachian Network. Central Appalachian Network. Retrieved from <http://www.cannetwork.org/documents/Value%20Chain%20Toolkit%2007.22.09.pdf>. Last retrieved June 18, 2014.
- Flaccavento, A. (2009). Healthy food systems: A toolkit for building value chains. Central Appalachian Network. Central Appalachian Network. Retrieved from <http://www.cannetwork.org/documents/Value%20Chain%20Toolkit%2007.22.09.pdf>. Last retrieved June 18, 2014.
- Flora, C.B. and Flora, J.L. (2013) *Rural Communities: Legacy and Change*, 4th edn. Boulder: Westview Press. Boulder, CO.
- Foss, C. and D. Morris. 2010. Champagne comes to England: Assessing the potential of GIS in the identification of prime vineyard sites in south and east England. *Findings in Built and Rural Environments*.
- Getz, D., Dowling, R., Carlsen, J., and Anderson, D. (1999) "Critical Success Factors for Wine Tourism", *International Journal of Wine Marketing*, Vol. 11 Iss: 3, pp.20 – 43.
- Jones, G., A. Duff, and J. Myers. 2004. *Modeling Viticultural Landscapes: A GIS Analysis of the Terroir Potential in the Umpqua Valley of Oregon*. Geoscience Canada.
- Lerman, T., Feenstra, G., and Visher, D. (2012). *A Practitioner's Guide to Resources and Publications on Food Hubs and Values-Based Supply Chains: A Literature Review*. Sustainable Agriculture Research and Education Program, Agricultural Sustainability Institute, University of California, Davis.
- Matson, J., Sullins, M., and Cook, C. (2013). The role of food hubs in local food marketing. USDA Rural Development Service. Washington, D.C. Service Report 73. Retrieved from <http://www.rurdev.usda.gov/supportdocuments/sr73.pdf>. Last retrieved July 12, 2014
- Melone, B., Cardenas, E., Cochran, J., Gross, J., Reinbold, J., Brenneis, L., Sierra, L., Cech, S., and Zajfen, V. (2010). *California Network of Regional Food*

Hubs: A Vision Statement and Strategic Implementation Plan (pp. 1-60).
California: Regional Food Hub Advisory Council.

- Morley, A., Morgan, S., and Morgan, K. (2008). *Food hubs: The 'missing middle' of the local food infrastructure*. Business Relationships, Accountability, Sustainability, and Society Centre. Cardiff University. Cardiff, United Kingdom. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091491>. Last retrieved July 12, 2014.
- Reynolds, A., I. Senchuk, C. van der Reest, and C. de Savigny. 2007. Use of gps and gis for elucidation of the basis for terroir: Spatial variation in an Ontario Riesling vineyard. *American Journal of Enology and Viticulture*. 58:2 145-162.
- Schmit, T.M., B.B.R. Jablonski, and D. Kay. 2013. "Assessing the Economic Impacts of Regional Food Hubs: the Case of Regional Access." Cornell University. September. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5105918>. Last retrieved July 12, 2014.
- Smith, L., and P. Whigham. 1999. Spatial aspects of vineyard management and wine grape production. SIRC 99 – the 11th annual colloquium of the spatial information research centre.
- Stevenson, G. W., and Pirog, R. (2008). Values-based supply chains: Strategies for agrifood enterprises of the middle. *Food and the mid-level farm: Renewing an agriculture of the middle*, 119-143. MIT Press, Cambridge, MA.
- Thach, E. C. and Olsen, J. E. (2006), Market segment analysis to target young adult wine drinkers. *Agribusiness*, 22: 307–322.
- Tropp, D., and Barham, J. (2008). *National farmers market summit proceedings report* (No. 148269). Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5066926>. Last retrieved July 19, 2014.
- USDA. (2014). Working list of food hubs. U.S. Department of Agriculture, Agricultural Marketing Service, Washington, D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/foodhubs>. Last retrieved July 5, 2014

REFERENCES

- Abate, G. (2008). Local food economies: Driving forces, challenges, and future prospects. *Journal of Hunger and Environmental Nutrition*, 3(4), 384-399.
- Adam, K. L. (2006). *Community supported agriculture*. ATTRA-National Sustainable Agriculture Information Service. Butte, MT. Retrieved from <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=262>. Last retrieved July 10, 2014
- Adam, K. L. (2006). *Community supported agriculture*. ATTRA-National Sustainable Agriculture Information Service. Butte, MT. Retrieved from <https://attra.ncat.org/attra-pub/summaries/summary.php?pub=262>. Last retrieved July 10, 2014.
- Ahearn, M. C. (2011). Potential Challenges for Beginning Farmers and Ranchers. *Choices*, 26(2), 6.
- Ahearn, M., & Newton, D. J. (2009). *Beginning farmers and ranchers*. US Department of Agriculture, Economic Research Service.
- Ahern, M., Brown, C., & Dukas, S. (2011). A National Study of the Association Between Food Environments and County-Level Health Outcomes. *The Journal of Rural Health*, 27(4), 367-379.
- Amana Colonies Visitor Center. (2014). Amana Colonies: The handcrafted escape. Retrieved from www.amanacolony.com. Last retrieved July 9, 2014.
- Anselin, L. (1995). Local indicators of spatial association—LISA. *Geographical analysis*, 27(2), 93-115.
- Arano, J., J. Martines-Casasnovas, M. Ribes-Dasi, and J. Rosell. (2009). Review. precision viticulture. research topics, challenges, and opportunities in site-specific vineyard management. *Spanish Journal of Agriculture Research*. 7(4): 779-790.
- Balls Food Stores Perspective (pp. 1-10). Arlington: Wallace Center at Winrock International. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091495>. Last retrieved July 17, 2014
- Barham, E., Lind, D., and Jett, L. (2005). The Missouri regional cuisines project: connecting to place in the restaurant. *Urban Place: Reconnections with the Natural World*.
- Barham, J. (2011). Regional food hubs: Understanding the scope and scale of food hub operations: Preliminary findings from a national survey of regional food

- hubs. Washington, DC: USDA AMS. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5090409>. Last Retrieved July 19, 2014.
- Barham, J. (2012). Regional food hubs: One solution for overcoming barriers for local producers. USDA Agricultural Marketing Service. Washington, D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097265>. Last retrieved July 12, 2014.
- Barham, J., Tropp, D., Enterline, K., Farbman, J., Fisk, J., and Kiraly, S. (2012). Regional food hub resource guide. U.S. Department of Agriculture, Agricultural Marketing Service. Washington D.C. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097957>. Last retrieved July 12, 2014.
- Bendfeldt, E. S., Walker, M., Bunn, T., Martin, L., and Barrow, M. (2011). A Community- Based Food System: Building Health, Wealth, Connection, and Capacity as the Foundation of Our Economic Future. Virginia Cooperative Extension. Retrieved from <http://pubs.ext.vt.edu/3306/3306-9029/3306-9029-PDF.pdf>. Last retrieved June 18, 2014
- Berry, W. (1996). *The unsettling of America*. 3rd edition, revised. Sierra Club Books, San Francisco, CA.
- Bloom, J. D., and Hinrichs, C. C. (2011). Moving local food through conventional food system infrastructure: Value chain framework comparisons and insights. *Renewable Agriculture and Food Systems*, 26(01), 13-23.
- Born, B., and Purcell, M. (2006). Avoiding the local trap scale and food systems in planning research. *Journal of Planning Education and Research*, 26(2), 195-207.
- Borst, A. (2010). Cooperative food hubs: Food hubs fill the 'missing middle' helping small producers tap local markets. Rural Cooperatives. Bi-monthly USDA publication. November/December issue. Retrieved from <http://www.rurdev.usda.gov/SupportDocuments/CoopMag-nov10.pdf>. Last retrieved July 12, 2014
- Boule, D., Hubert, G., Jensen, A., Kull, A., Kim, J., Marshall, C., Meagher, K., and Rittenhouse, T. (2011). Context matters: Visioning a food hub in Yolo and Solano counties. Prepared for the Ag and Food Alliance. Sebastopol, CA. Retrieved from http://sarep.ucdavis.edu/sfs/files/ContextMatters_VisioningAFoodHubInYoloAndSolanoCounties_6-17-11_FINAL.pdf. Last retrieved July 12, 2014.
- Boyer, J. (1998). Geographic analysis of viticulture potential in Virginia. Master's thesis. Virginia Polytechnic Institute and State University.

- Bramley, R. G. V. (2001). Progress in the development of precision viticulture- Variation in yield, quality and soil properties in contrasting Australian vineyards. *Precision tools for improving land management. Occasional report*, (14), 25-43.
- Bramley, R., A. Proffitt, C. Hinze, B. Pearse, and R. Hamilton. (2005). Generating benefits from precision viticulture through selective harvesting. Proceedings of the 5th European Conference on Precision Agriculture.
- Bregendahl, C. (2006). Local food consumption and rural public health. *Rural Roads, National Rural Health Association*, 4(3), 16-19.
- Bregendahl, C., and Enderton, A. 2012 Economic Impacts of Iowa's Regional Food Systems Working Group. Leopold Center for Sustainable Agriculture. Ames, IA.
- Bregendahl, C., and Flora, C. B. (2006). The role of collaborative community supported agriculture: lessons from Iowa. North Central Regional Center for Rural Development. East Lansing, MI.
- Bruwer, J., Lesschaeve, I., and Campbell, B. L. (2012). Consumption dynamics and demographics of Canadian wine consumers: Retailing insights from the tasting room channel. *Journal of Retailing and Consumer Services*, 19(1), 45-58.
- Can, A. 1996. GIS and spatial analysis of housing and mortgage markets. *Journal of Housing Research* 9: 61-86
- Cantrell, P and Heuer, B. (March 2014). Food Hubs: Solving Local. The Wallace Center at Winrock International. Retrieved from <http://ngfn.org/solvinglocal>. Last retrieved July 6, 2014.
- Chambers, S., Lobb, A., Butler, L., Harvey, K., and Bruce Traill, W. (2007). Local, national and imported foods: a qualitative study. *Appetite*, 49(1), 208-213.
- Cheng, M., & Seely, K. (2011). Building Regional Produce Supply Chains: Helping Farms Access and Sell to Multiple Channels, Helping Large-Volume Buyers Access Regional Foods (pp. 1-32). San Francisco: FarmsReach.
- Clancy, K. (2009). What are we talking about when we talk about local and regional food systems. Proceedings of the Northeast Regional Center for Rural Development; Enhancing Local and Regional Food Systems: Exploring the Research, What Works, and What We Need to Learn. Kerhonkson, NY. May 19-20, 2009.
- Clancy, K., and Ruhf, K. (2010). Is local enough? Some arguments for regional food systems. *Choices*, 25(1), 123-135.

- Clark, G., and Chabrel, M. (2007). Measuring integrated rural tourism. *Tourism geographies*, 9(4), 371-386.
- Clark, J., J. Sharp, and S. Inwood. (2011). Scaling-up connections between regional Ohio specialty crop producers and local markets: Distribution as the missing link. The Ohio State University. Columbus, OH. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5097255>. Last retrieved July 10, 2014.
- Community Alliance with Family Farmers. (2011). Establishing an aggregation and marketing center for California's north coast (pp.1-51): Community alliance with Family Farmers.
- Day-Farnsworth, L., McCown, B., Miller, M., & Pfeiffer, A. (2009). *Scaling Up: Meeting the Demand for Local Food*. University of Wisconsin-Extension Agricultural Innovation Center, University of Wisconsin Center for Integrated Agricultural Systems. Madison, WI. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091489>. Last retrieved July 10, 2014.
- Diamond, A., and Barham, J. (2011). Money and mission: moving food with value and values. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 101-117.
- Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (Vol. 2). New York: Wiley.
- Dodd, T. (1995). Opportunities and Pitfalls of Tourism in a Developing Wine Industry. *International Journal of Wine Marketing*, 7(1): 5-16.
- Dreier, S., & Taheri, M. (2009). Innovative Models: Small Grower and Retailer Collaborations, Part B. Wallace Center at Winrock International, Arlington, VA. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091495>. Last retrieved July 19, 2014
- Dreier, S., and Taheri, M. (2008). *Innovative Models: Small Grower and Retailer Collaborations: Good Natured Family Farms and Balls Food Stores*. Wallace Center, Winrock International.
- Durham, C. A., King, R. P., and Roheim, C. A. (2009). Consumer Definitions of "Locally Grown" for Fresh Fruits and Vegetables. *Journal of Food Distribution Research*, 40(1).

- Enshayan, K. (2009). Community economic impact assessment for a multi-county local food system in northeast Iowa. Leopold Center for Sustainable Agriculture. Ames, IA. Retrieved from http://www.leopold.iastate.edu/sites/default/files/grants/M2008-05_0.pdf. Last retrieved July 17, 2014.
- Erlbaum, J., McManus, K., and Nowak, A. (2011). Colorado Local Food Hubs for Farm to School Products: An Initial Feasibility Analysis of Local Food Hubs for Colorado Producers and Schools (pp. 1-53). *Colorado: Real Food Colorado*.
- European Commission. (2014). Geographical indications of traditional specialties. Retrieved from ec.europa.eu/agriculture/quality/schemes/index_en.htm. Last Retrieved June 11, 2014.
- Farnsworth, R. L., Thompson, S. R., Drury, K. A., and Warner, R. E. (1996). Community supported agriculture: filling a niche market. *Journal of food distribution research*, 27, 90-98.
- Feenstra, G. (2002). Creating space for sustainable food systems: Lessons from the field. *Agriculture and Human Values*, 19(2), 99-106.
- Feenstra, G., Allen, P., Hardesty, S. D., Ohmart, J., and Perez, J. (2011). Using a supply chain analysis to assess the sustainability of farm-to-institution programs. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 69-84.
- Feenstra, G., Lerman, T., and Visser, D. (2012). Food hubs and value-based supply chains: A toolkit for California farmers and ranchers. Sustainable Agriculture Research and Education Program, Agricultural Sustainability Institute, University of California. Davis, CA. Retrieved from <http://www.sarep.ucdavis.edu/sfs/7Dec2012VBSC%20farmer%20toolkit.pdf>. Last retrieved July 12, 2014.
- Fischer, M., Hamm, M., Pirog, R., Fisk, J., Farbman, J., and Kiraly, S. (2013). Findings of the 2013 national food hub survey. Michigan State University Center for Regional Food Systems & The Wallace Center at Winrock International. Retrieved from <http://foodsystems.msu.edu/activities/food-hub-survey>. Last retrieved July 5, 2014
- Flaccavento, A. (2009). Healthy food systems: A toolkit for building value chains. Central Appalachian Network. Central Appalachian Network. Retrieved from <http://www.cannetwork.org/documents/Value%20Chain%20Toolkit%2007.22.09.pdf>. Last retrieved June 18, 2014.
- Flesch, R., and Gould, A. J. (1949). *The art of readable writing* (p. 196). New York: Harper.

- Flint, A. (2004). Think globally, eat locally: move over, organic. A new socially conscious food movement wants to reset the American table. *The Boston Globe*, August, 15. Retrieved from http://www.boston.com/news/globe/ideas/articles/2004/08/15/think_globally_eat_locally?pg=full. Last retrieved June 18, 2014.
- Flora, C. B., Bregendahl, C., and Renting, H. (2012). Collaborative Community-supported Agriculture: Balancing Community Capitals for Producers and Consumers. *Int. J. of Soc. of Agr. and Food*, 19(3), 329-346.
- Flora, C.B. and Flora, J.L. (2013) *Rural Communities: Legacy and Change*, 4th edn. Boulder: Westview Press. Boulder, CO.
- Food and Drug Administration, FDA. 2014. Food safety modernization act. H.R. 2751--111th Congress: 2009. Food and Drug Administration. Washington, D.C. Retrieved from <http://www.fda.gov/Food/GuidanceRegulation/FSMA/default.htm>. Last retrieved July 12, 2014.
- Food Routes Network, LLC. (2014). National Buy Fresh Buy Local. FoodRoutes Network, LLC. Millheim, PA. Retrieved from <http://foodroutes.org/buy-fresh-buy-local/>. Last retrieved July 10, 2014.
- Foss, C. and D. Morris. 2010. Champagne comes to England: Assessing the potential of GIS in the identification of prime vineyard sites in south and east England. *Findings in Built and Rural Environments*.
- Foster, A. D., and Rosenzweig, M. R. (1995). Learning by doing and learning from others: Human capital and technical change in agriculture. *Journal of political Economy*, 1176-1209.
- Frank, Rimerman and Co. LLP. (2012). The economic impact of Iowa wine and wine grapes – 2012. Commissioned by Iowa State University. Retrieved from http://www.traveliowa.com/UserDocs/Iowa_2012_EI_Report_FINAL.pdf. Last retrieved June 23, 2014.
- Futrell, S. and Chase, C. (2004) *Muscatine Melon. A Case Study of a Place-Based Food in Iowa*. Leopold Center for Sustainable Agriculture, Ames IA.
- Gaytan, M. (2003). *Globalizing the Local: Slow Food and the Collective Imaginary*, paper presented at the annual meeting of the American Sociological Association, Atlanta, GA, August 16, 2003.
- Getz, D., Dowling, R., Carlsen, J., and Anderson, D. (1999) "Critical Success Factors for Wine Tourism", *International Journal of Wine Marketing*, Vol. 11 Iss: 3, pp.20 – 43.

- Giovanucci, D., Barham, E., and Pirog, R. (2010). Defining and marketing "local" foods: geographical indications for US products. *The Journal of World Intellectual Property*, 13(2), 94-120.
- Gregoire, M. B., Arendt, S. W., and Strohbehn, C. (2005). Iowa producers' perceived benefits and obstacles in marketing to local restaurants and institutional foodservice operations. *Journal of Extension*, 43(1), 1RBI1.
- Groh, T., and McFadden, S. (1990). *Farms of tomorrow: community supported farms farm supported communities*. Bio-dynamic Farming and Gardening Association. Milwaukee, WI.
- Guptill, A., and J.L. Wilkins. (2002). "Buying into the Food System: Trends in Food Retailing in the U.S. and Implications for Local Foods," *Agriculture and Human Values*, Vol. 19, pp. 39-51.
- Haddad, M. and P. Anderson. 2008. A gis methodology to identify potential corn stover collection locations. *Biomass and Bioenergy*. 32: 1097-1108.
- Hand, M. S. (2010). Local Food Supply Chains Use Diverse Business Models to Satisfy Demand. *Amber Waves*, 8(4), 18-23.
- Hardy, C., & Holz-Clause, M. (2008). Bridging the Gap: What does it take to bring small and medium sized producers and retail and foodservice distributors together? (pp. 1-24). Ames: Leopold Center for Sustainable Agriculture, Iowa State University. Competitive grant report: M2006-05. Retrieved from <http://www.leopold.iastate.edu/sites/default/files/grants/M2006-05.pdf>. Last retrieved July 10, 2014
- Harris, B., Burress, D. A., Mercer, S. O., Oslund, P., and Rose, C. C. (2000). *Kaw Valley focus groups on local and organic produce*. University of Kansas, Institute for Public Policy and Business Research.
- Headd, B. (2003). Redefining business success: Distinguishing between closure and failure. *Small Business Economics*, 21(1), 51-61.
- Hendrickson, J. (2005). Grower to Grower: Creating a livelihood on a fresh market vegetable farm. Center for Integrated Agricultural Systems. University of Wisconsin. Madison, WI. Retrieved from <http://www.cias.wisc.edu/wp-content/uploads/2008/07/grwr2grwr.pdf>. Last retrieved July 9, 2014.
- Henneberry, S. R., Whitacre, B., & Agustini, H. N. (2009). An Evaluation of the Economic Impacts of Oklahoma Farmers Markets. *Journal of Food Distribution Research*, 40(3), 64-78.
- Hinrichs, C. C. (2003). The practice and politics of food system localization. *Journal of rural studies*, 19(1), 33-45.

- Holt-Giménez, E., & Wang, Y. (2011). Reform or transformation?: the pivotal role of food justice in the US food movement. *Race/Ethnicity: Multidisciplinary Global Contexts*, 5(1), 83-102.
- Hughes, D. W., Eades, D., Robinson, K., Carpio, C., Isengildina, O., and Brown, C. (2007). What is the Deal with Local Food Systems: Or, Local Food Systems from a Regional Science Perspective. In *54th Annual North American Meetings of the Regional Science Association International*. 2007: Savannah GA. WP 11-2007-01.
- Ilbery, B., and D. Maye. (2006). "Retailing Local Food in the Scottish-English Borders: A Supply Chain Perspective," *Geoforum*, Vol. 37, pp. 352-367.
- Ilbery, B., Saxena, G., and Kneafsey, M. (2007). Exploring tourists and gatekeepers' attitudes towards integrated rural tourism in the England–Wales border region. *Tourism Geographies*, 9(4), 441-468.
- Iowa Department of Agriculture and Land Stewardship. (2014). Farmers Market Nutrition Program. Retrieved from http://www.iowaagriculture.gov/Horticulture_and_FarmersMarkets/farmersMarketNutritionProgram.asp. Last retrieved June 11, 2014
- Iowa Wine Growers Association. (2014). Report on the Iowa wine and grape industry. Iowa Wine Growers Association. Des Moines, IA. Retrieved from <http://iowawinegrowers.org/wp-content/uploads/2014/02/Legislative-Report-sm.pdf>. Last retrieved July 10, 2014.
- Johnson, R., and Becker, G. S. (2008). The 2008 Farm Bill: Major Provisions and Legislative Action. Congressional Research Service, Library of Congress.
- Johnson, R., Aussenberg, R. A., and Cowan, T. (2012, January). The Role of Local Food Systems in US Farm Policy. In *Congressional Research Service Report for Congress* (R42155).
- Jones, G., A. Duff, and J. Myers. 2004. Modeling Viticultural Landscapes: A GIS Analysis of the Terroir Potential in the Umpqua Valley of Oregon. Geoscience Canada.
- Jones, P., Comfort, D., and Hillier, D. (2004). A case study of local food and its routes to market in the UK. *British Food Journal*, 106(4), 328-335.
- Kirby, L. D., Jackson, C., and Perrett, A. (2007). Growing Local: Expanding the Western North Carolina Food and Farm Economy. *Appalachian Sustainable Agriculture Project, Asheville, NC*.
- Krissoff, B., Kuchler, F., Calvin, L., Nelson, K., and Price, G. (2004). *Traceability in the US food supply: economic theory and industry studies* (pp. 3-10). US Department of Agriculture, Economic Research Service.

- Kurtural, S. (2002). Vineyard site selection. Report of Cooperative extension services, Department of Horticulture, University of Kentucky
- Lamie, D., Dunning, R., Bendfeldt, E., Lelekacs, J., Velandia, M., and Meyer, L. (2013). Local food systems in the south: A call for a collaborative approach to assessment. *Choices*, 4th quarter 2013, 28(4). Retrieved from <http://www.choicesmagazine.org/choices-magazine/theme-articles/developing-local-food-systems-in-the-south/local-food-systems-in-the-south-a-call-for-a-collaborative-approach-to-assessment>. Last retrieved July 17, 2014
- Lawless, G., Stevenson, G., Hendrickson, J., Cropp, R. (1999). The farmer-food buyer dialogue project. University of Wisconsin Center for Cooperatives Occasional Paper No. 13. University of Wisconsin Center for Cooperatives. Madison, WI. Retrieved from <http://www.uwcc.wisc.edu/info/ffbuyer/toc.html>. Last retrieved July 12, 2014.
- Lerman, T., Feenstra, G., and Visser, D. (2012). A Practitioner's Guide to Resources and Publications on Food Hubs and Values-Based Supply Chains: A Literature Review. Sustainable Agriculture Research and Education Program, Agricultural Sustainability Institute, University of California, Davis. Retrieved from http://www.sarep.ucdavis.edu/sfs/KYF%20grey%20literature%20review%207.9.12_compressed.pdf. Last retrieved July 19, 2014
- Low, S. A., and Vogel, S. (2011). Direct and intermediated marketing of local foods in the United States. US Department of Agriculture, Economic Research Service.
- Lutkehaus, N. (2008). *Margaret Mead: The making of and American icon*. Princeton University Press. Princeton, NJ.
- Maney, T. J. (1921). *Grape production and distribution in western Iowa*. Agricultural Experiment Station, Iowa State College of Agriculture and Mechanic Arts.
- Market Maker. (2014). Food Industry Market Maker: Linking Agricultural Markets. University of Illinois Extension. Urbana-Champaign, IL. Retrieved from <http://foodmarketmaker.com/main/about>. Last retrieved July 10, 2014.
- Martinez, S., Hand, M., Da Para, M., Pollack, S., Ralston, K., Smith, T., Vogel, S., Clark, S., Lohr, L., Low, S., and Newman, C. (2010). Local food systems; concepts, impacts, and issues (No. 97). U.S. Department of Agriculture Economic Research Service. Washington, D.C. DIANE Publishing. Darby, PA.
- Masi, B., Schaller, L., and Shuman, M. (2010). The 25% Shift: The Benefits of Food Localization for Northeast Ohio and How to Realize Them. Retrieved from

- <http://www.neofoodweb.org/sites/default/files/resources/the25shift-foodlocalizationintheNEOregion.pdf>. Last retrieved June 18, 2014.
- Matson, J., and Cook, C. (2011). Virtual Food Hubs Help Producers Tap Into Local Food Markets. *Rural Cooperatives*, 78, 4-8.
- Matson, J., Sullins, M., and Cook, C. (2013). The role of food hubs in local food marketing. USDA Rural Development Service. Washington, D.C. Service Report 73. Retrieved from <http://www.rurdev.usda.gov/supportdocuments/sr73.pdf>. Last retrieved July 12, 2014
- Matson, J., Sullins, M., and Cook, C. (2011). Keys to success for food hubs. *Rural Cooperatives*, 78(3), 9.
- Melone, B., Cardenas, E., Cochran, J., Gross, J., Reinbold, J., Brenneis, L., Sierra, L., Cech, S., and Zajfen, V. (2010). California Network of Regional Food Hubs: A Vision Statement and Strategic Implementation Plan (pp. 1-60). *California: Regional Food Hub Advisory Council*.
- Morley, A., Morgan, S., and Morgan, K. (2008). *Food hubs: The 'missing middle' of the local food infrastructure*. Business Relationships, Accountability, Sustainability, and Society Centre. Cardiff University. Cardiff, United Kingdom. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5091491>. Last retrieved July 12, 2014.
- Nabhan, G. P. (2002). *Coming home to eat: The pleasures and politics of local foods*. WW Norton and Company.
- NAFTA Secretariate. (2014). North American Free Trade Agreement. Annex 311 and 313. Retrieved from <https://www.nafta-sec-alena.org/Default.aspx?tabid=97andlanguage=en-US>. Last retrieved June 11, 2014.
- Norton, F. (2008). Wal-Mart Expo 'A lot like dating': World's top retailer dangles a chance for local food vendors to sell to its stores. *The News and Observer*, April 17, 2008.
- Ostrom, M. (2006). Everyday meanings of "local food": Views from home and field. *Community Development*, 37(1), 65-78.
- Otto, D. (2010). Consumers, vendors, and the economic importance of Iowa farmers markets: An economic impact survey analysis. Ames, IA: Leopold Center for Sustainable Agriculture, Iowa State University.
- Otto, D., and Varner, T. (2005). Consumers, Vendors, and the Economic Importance of Iowa Farmers' Markets: An Economic Impact Survey Analysis. Ames, IA:

- Leopold Center for Sustainable Agriculture, Iowa State University. Retrieved from <https://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2005-05-consumers-vendors-and-economic-importance-iowa-farmers-markets-economic-impact-survey-analysis.pdf>. Last retrieved July 17, 2014
- Perrett, A. (2007). The infrastructure of food procurement and distribution: Implications for farmers in western North Carolina. *Appalachian Sustainable Agriculture Project*. Asheville, NC.
- Perry, J., and Franzblau, S. (2010). *Local Harvest: A Multifarm CSA*. USDA Northeast Sustainable Agriculture Research and Education. College Park, MD.
- Pirog, R. (2000). *Grape expectations: a food system perspective on redeveloping the Iowa Grape Industry*. Leopold Center for Sustainable Agriculture, Iowa State University.
- Pirog, R. (2003). Ecolabel Value Assessment: Consumer and retailer perceptions of local foods. Leopold Center for Sustainable Agriculture, Ames IA.
- Pirog, R., and Rasmussen, R. (2008). Food, fuel and the future: Consumer perceptions of local food, food safety and climate change in the context of rising prices. Ames, IA: Leopold Center for Sustainable Agriculture.
- Pirog, R., C. Bregendahl, B. Larabee, J. Jensen, J. Obudzinski, J. Joel, and J. Hermsen. 2011. Iowa local food and farm plan. Leopold Center for Sustainable Agriculture. Ames, IA. Retrieved from <http://www.leopold.iastate.edu/pubs-and-papers/iowa-local-food-and-farm-plan>. Last retrieved July 10, 2014.
- Porjes, S. (2007). Fresh and Local Food in the US Packaged Facts. *Rockville, MD*.
- Pretty, J. N., Ball, A. S., Lang, T., and Morison, J. I. (2005). Farm costs and food miles: An assessment of the full cost of the UK weekly food basket. *Food Policy*, 30(1), 1-19.
- Reid, R.D. and Reigel, C.D. 1998. Purchasing Practices of Large Foodservice Firms. Center for Advanced Purchasing Studies, National Association of Purchasing Management, Tempe, AZ.
- Reynolds, A., I. Senchuk, C. van der Reest, and C. de Savigny. 2007. Use of gps and gis for elucidation of the basis for terroir: Spatial variation in an Ontario Riesling vineyard. *American Journal of Enology and Viticulture*. 58:2 145-162.
- Saldivar-Tanaka, L., & Krasny, M. E. (2004). Culturing community development, neighborhood open space, and civic agriculture: The case of Latino community gardens in New York City. *Agriculture and human values*, 21(4), 399-412.

- Salois, M. J. (2012). Obesity and diabetes, the built environment, and the 'local' food economy in the United States, 2007. *Economics & Human Biology*, 10(1), 35-42.
- Schmidt, M. C., Kolodinsky, J. M., DeSisto, T. P., and Conte, F. C. (2011). Increasing farm income and local food access: A case study of a collaborative aggregation, marketing, and distribution strategy that links farmers to markets. *Journal of Agriculture, Food Systems, and Community Development*, 1(4), 157–175. Retrieved from <http://dx.doi.org/10.5304/jafscd.2011.014.017>. Last retrieved July 12, 2014.
- Schmit, T.M., B.B.R. Jablonski, and D. Kay. 2013. "Assessing the Economic Impacts of Regional Food Hubs: the Case of Regional Access." Cornell University. September. Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5105918>. Last retrieved July 12, 2014.
- Schnitkey G. (2013). Corn and soybean returns suggest stable Illinois acreages. *FarmdocDaily*. University of Illinois. Urbana-Champaign, IL. Retrieved from <http://farmdocdaily.illinois.edu/2013/10/corn-soybean-returns-stable-Illinois-acreages.html>. Last retrieved July 9, 2014
- Selfa, T., and Qazi, J. (2005). Place, taste, or face-to-face? Understanding producer–consumer networks in "local" food systems in Washington State. *Agriculture and Human Values*, 22(4), 451-464.
- Shipman, D. (2009). Setting the stage: Local food issues and policies, presentation at Local Food Systems: Emerging Research and Policy Issues Conference. USDA, Economic Research Service, Washington D.C. June 26, 2009
- Sims, R. (2009). Food, place and authenticity: local food and the sustainable tourism experience. *Journal of Sustainable Tourism*, 17(3), 321-336.
- Slama, J. (2010). Wholesale success: A farmer's practical guide to selling, postharvest handling, and packing produce. Familyfarmed.org. Last retrieved June 11, 2014.
- Smith, L., and P. Whigham. 1999. Spatial aspects of vineyard management and wine grape production. SIRC 99 – the 11th annual colloquium of the spatial information research centre.
- Sommers, F. G., & Dineen, T. (1984). Curing nuclear madness. *Methuen, Toronto*.
- Sonntag, V. 2008. Why Local Linkages Matter: Findings from the Local Food Economy Study. Seattle, Wash.: Sustainable Seattle. Report. Retrieved from <http://www.sustainableseattle.org/images/Programs/LocalFoodEconomyStudy/LFE%20REPORT%20FINAL-2.pdf>. Last retrieved July 17, 2014.

- South Australian Tourist Commission, 1997. *Wine and Tourism: A Background Research Report*. Adelaide.
- Stevenson, G. W., and Pirog, R. (2008). Values-based supply chains: Strategies for agrifood enterprises of the middle. *Food and the mid-level farm: Renewing an agriculture of the middle*, 119-143. MIT Press, Cambridge, MA.
- Strohbehn, C. H., and Gregoire, M. B. (2003). Case studies of local food purchasing by central Iowa restaurants and institutions. *Foodservice research international*, 14(1), 53-64.
- Thach, E. C. and Olsen, J. E. (2006), Market segment analysis to target young adult wine drinkers. *Agribusiness*, 22: 307–322.
- Thompson Jr, E., Harper, A. M., and Kraus, S. (2008). *Think Globally—Eat Locally: San Francisco Foodshed Assessment*. American Farmland Trust. Retrieved from <http://www.farmland.org/programs/states/ca/Feature%20Stories/documents/ThinkGloballyEatLocally-FinalReport8-23-08.pdf>. Last retrieved June, 18, 2014.
- Tordsen, C. (2012). Iowa native wine production and sales report for the period ending 12/31/2012. Iowa State University Value Added Ag Programs. Ames, IA. Retrieved from <http://www.extension.iastate.edu/wine/sites/www.extension.iastate.edu/files/wine/Jan2013Iowa%20Native%20Wine%20Production%20and%20Sales%20Report.pdf>. Last retrieved June 23, 2014.
- Torres, R. (2002). Toward a better understanding of tourism and agriculture linkages in the Yucatan: tourist food consumption and preferences. *Tourism Geographies*, 4(3), 282-306.
- Travel Iowa. (2014). Get inspired: Wine and Beer. Iowa Tourism. Des Moines, IA. Retrieved from <http://www.traveliowa.com/GetInspired/WineAndBeer>. Last retrieved July 9, 2014.
- Tregear, A. (2011). Progressing knowledge in alternative and local food networks: critical reflections and a research agenda. *Journal of Rural Studies*, 27(4), 419-430.
- Tregear, A., Kuznesof, S., and Moxey, A. (1998). Policy initiatives for regional foods: some insights from consumer research. *Food Policy*, 23(5), 383-394.
- Tropp, D., and Barham, J. (2008). *National farmers market summit proceedings report* (No. 148269). Retrieved from <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5066926>. Last retrieved July 19, 2014.

- U.S. Census Bureau. (2014). Census Geocoder. U.S. Census Bureau. Washington, D.C. Retrieved from <https://www.census.gov/geo/maps-data/data/geocoder.html>. Last retrieved July 17, 2014
- US Department of Agriculture (2011 and 2013). Working list of food hubs. US Department of Agriculture, Agriculture Marketing Service. Washington DC. Retrieved from <http://www.ams.usda.gov/AMSV1.0/foodhubs>. Last retrieved July 8, 2014.
- US Department of Agriculture, Agricultural Marketing Service (USDA AMS). (2013). USDA GAP and GHP audit. Retrieved from <http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP>. Last retrieved July 12, 2014
- US Department of Agriculture, Agricultural Marketing Service (USDA AMS). (2012). Grading, certification and verification. Retrieved from <http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateN&navID=USGradeStandards&rightNav1=USGradeStandards&topNav=&leftNav=&page=FreshGradeStandardsIndex&resultType=&acct=freshgrdce>. Last retrieved July 12, 2014.
- US Department of Agriculture, National Agricultural Statistical Service (USDA NASS). (2007). 2007 Census of agriculture. United State national level data. Washington, DC.
- US Department of Agriculture. (1920). Census of agriculture. US Department of Agriculture, Washington D.C. Vol. VI, Part I, Table IV.
- US Department of Agriculture. (2002, 2007, and 2012). Census of agriculture. *US Department of Agriculture, National Agricultural Statistics Service, Washington, DC*. Retrieved from <http://www.agcensus.usda.gov>. Last retrieved June 18, 2014.
- US Department of Agriculture. (2014). Farmers' Market Directory. US Department of Agriculture, Agriculture Marketing Service, Washington, DC. Retrieved from <http://search.ams.usda.gov/farmersmarkets/>. Last retrieved June 18, 2014.
- US Department of Agriculture. (2014). Food and Nutrition Service. Retrieved from <http://www.fns.usda.gov>. Last retrieved June 18, 2014
- Van En, R. (1992). *Basic formula to create community supported agriculture*. Cornell University. Ithaca, NY.
- Vogt, R. A., and Kaiser, L. L. (2008). Still a time to act: A review of institutional marketing of regionally-grown food. *Agriculture and Human Values*, 25(2), 241-255.

- Wargenau, A., and Che, D. (2006). Wine tourism development and marketing strategies in Southwest Michigan. *International Journal of Wine Marketing*, 18(1), 45-60.
- White, M. (2004). Iowa: Viticulture (Grapes) 101. Proceedings, Integrated Crop Management Conference. 12-2-2004. Retrieved from <http://viticulture.hort.iastate.edu/info/pdf/icmgrapes101.pdf>. Last retrieved June 23, 2014.
- White, M. (2013). Iowa's "new" vineyard and winery map. Wine-Grower-News #247. Iowa State University Extension and Outreach. Ames, IA. Retrieved from http://www.extension.iastate.edu/wine/sites/www.extension.iastate.edu/files/WineGrowerNews247_05July2013.pdf. Last retrieved June 23, 2014.
- Wilkins, J. L. (2002). Consumer perceptions of seasonal and local foods: A study in a US community. *Ecology of food and nutrition*, 41(5), 415-439.
- Wilkins, J. L., Bokaer-Smith, J., and Hilchey, D. (1996). Local foods and local agriculture: a survey of attitudes among northeastern consumers. *Project Report. Division of Nutritional Sciences, Cornell Cooperative Extension*.
- Wood. (2011, April 29). Amana Colonies are a major economic engine. *Corridor Business Journal*. Retrieved from <http://www.corridorbusiness.com/news/a-major-economic-engine/>. Last retrieved July 9, 2014
- Yang, N., McCluskey, J. J., & Brady, M. P. (2012). The Value of Good Neighbors: A Spatial Analysis of the California and Washington State Wine Industries. *Land Economics*, 88(4), 674-684.
- Zepeda, L., and Leviten-Reid, C. (2004). Consumers' views on local food. *Journal of Food Distribution Research*, 35(3), 1-6.

APPENDIX A

FOOD HUBS FOUND IN UPPER MIDWEST UNITED STATES

Name	Website	City	State
Annie's Garden and Greens	anniesgardensandgreens.com	Ft. Atkinson	IA
Campbell's Nutrition	campbellsnutrition.com	Des Moines	IA
Cedar Valley Produce Auction	cedarvalleyproduceauction.com	Elma	IA
Cyd's Catering	cateringbycyd.com	Johnston	IA
Frytown Produce Auction	yoderauctionservice.com	Frytown	IA
Gateway Market	gatewaymarket.com	Des Moines	IA
GROWN Locally	grownlocally.com	Decorah	IA
harvest from the hart of Iowa	harvestfromtheheartofiowa.net	Marshalltown	IA
henry's viLLAge Market	henrysvillagemarket.com	Homestead Amana	IA
Iowa Food Cooperative	iowafood.org	Ames	IA
Iowa Valley Food Cooperative	iowavalleyfood.com	Amana	IA
La Quercia	laquercia.us	Norwalk	IA
new pioneer Co-op	newpi.coop	Iowa City	IA
Oneota	oneotacoop.com	Decorah	IA
orgAniC greens LLC		Kalona	IA
Pronto & FarmTable		Des Moines	IA
Scenic Valley Produce		Ogden	IA
Southern Iowa Produce Auction	southerniowaproduce.com	Bloomfield	IA
sproUts UnLiMited, inC.	sproutsunlimitedinc.com	Marion	IA
Taste! To Go, Catering & Events	tastetogo.net	Des Moines	IA
Wheatsfield Co-op	wheatsfield.coop	Ames	IA
Arthur Produce Auction		Aurther	IL
Central IL Produce Auction		Shobonier	IL
Common Ground Food Co-op	commonground.coop	Urbana	IL
Common Ground Grocery	commongroundgrocery.com	Bloomington	IL
Food Fantasies	foodfantasies.com	Springfield	IL
Fresh Moves Mobile Produce Market	freshmoves.org	Chicago	IL
Good Earth Food Alliance CSA	goodearthfoodalliance.com	Farmington	IL
Goodness Greenness	goodnessgreenness.com	Chicago	IL
Gourmet Gorilla, Inc	gourmetgorilla.com	Chicago	IL

Healthy Food Hub CSA	healthyfoodhub.org	Chicago	IL
Heritage Farmers Market		Pekin	IL
Irv & Shelly's Fresh Picks	freshpicks.com	Niles	IL
Local Growers Network	localgrowersnetwork.info	Galesburg	IL
MARKET on the Square		Carlinville	IL
Naturally Yours Grocery		Normal	IL
Robert's Seafood Market	robertsseafoodmarket.com	Springfield	IL
Stewards of the Land	thestewardsoftheland.com	Fairbury	IL
Strawberry Fields	strawberry-fields.com	Urbana	IL
Basic Roots	basicrootscommunityfoods.kaysue.org	Indianapolis	IN
Wakarusa Produce Auction	wakarusaproduceauction.com	Goshen	IN
Good Natured Family Farms	goodnatured.net	Bronson	KS
Rolling Praire Farmers Alliance	rollingprairie.net	Lawrence	KS
Cherry Capital Foods	cherrycapitalfoods.com	Traverse City	MI
Eastern Market	detroiteasternmarket.com	Detroit	MI
Harvest Michigan	harvestmichigan.com	Clarkston	MI
Walsma and Lyons	walsmalyons.com	Byron Center	MI
West Michigan Cooperative	westmichigancoop.com	Grand Rapids	MI
Big River Farms (Minnesota Food Association)	mnfoodassociation.org	St. Croix	MN
City Center Market	citycentermarket.coop	Cambridge	MN
Coop Partners Warehouse (Wedge Food Coop)	cooppartners.coop	St. Paul	MN
Food Aliance Midwest	foodalliance.org	St. Paul	MN
Hugh's Gardens	hughsgardens.com	Moorhead	MN
Kadejan Market	kadejan.com	Glenwood	MN
La	lalaicecream.com	Fertile	MN
Local D'lish	localdlish.com	Minneapolis	MN
Minnesota Dehydrated Vegetables Inc.	mdvcorp.com	Fosston	MN
RBJ's	spreadablefruit.com	Crookston	MN
River Market Community Co-op		Stillwater	MN
Southeast Minnesota Food Network	southeastmnfood.com	Elgin	MN
Thousand Hills Cattle Company	thousandhillscattleco.com	Cannon Falls	MN
VeloVeggies	veloveggies.com	Hennepin County	MN
Whole Farm Cooperative	wholefarmcoop.com	Long Prairie	MN
Beans and Greens Moblie Market	beansandgreens.org	Kansas City	MO

Central Missouri Produce Auction		Fortuna	MO
Clark Produce Auction		Clark	MO
Farm to Family Naturally LLC	sappingtonfarmersmkt.com	St. Louis	MO
Four County Produce Auction	dougevansauctions.com	Windsor	MO
North Missouri Produce Auction		Jamesport	MO
Amazing Grains Natural Foods Market	amazinggrains.org	Grand Forks	ND
Blaine's Best Seeds		Rugby	ND
Breadsmith	breadsmith.com	Fargo	ND
Grow Nebraska	buygrownebraska.org	Kearney & Grand Island	NE
Heartland Nuts 'N More Cooperative	heartlandnutsnmore.com	Valparaiso	NE
Leon's Gourmet Grocer	leonsgourmetgrocer.com	Lincoln	NE
Nebraska Food Cooperative	nebraskafood.org	Lincoln	NE
Open Harvest Cooperative Grocery	openharvest.coop	Lincoln	NE
Red Clover Market, Inc	redclovermarket.com	Lincoln	NE
tomato	tomatotomato.org	Omaha	NE
Farmer's Produce Auction	mthopeauction.com	Mt. Hope	OH
Geauga Growers	geaugagrowers.webs.com	Middlefield	OH
Green B.E.A.N. Delivery	greenbeandelivery.com	Columbus/Cincinnati	OH
Homerville Wholesale Produce Auction	brightdsl.net	Homerville	OH
Local Matters	local-matters.org	Columbus	OH
Local Roots Market & Café (Wooster Local Foods Cooperative)	localrootswoster.com	Wooster	OH
Shagbark Seed and Mill Company (Appalachian Staple Foods)	asfc.weebly.com	Athens	OH
South Dakota Local Foods Co-op	sdlocalfood.org	Brookings	SD
Fennimore Produce Auction	ifmwi.org	Fennimore	WI
Fine Acres Market		St. Croix	WI
Green and Green	greenandgreenfarms.com	Mineral Point	WI
Growers Produce Auction	growersproduceauction.com	Cashton	WI
Metcalfe's Market	shopmetcalfes.com	Madison	WI
Neesvig's Inc.	neesvigs.com	Windsor	WI
Simply Wisconsin	simplywi.com	Monona	WI
whole earth grocery	wholeearthgrocery.coop	River Falls	WI
Willy Street Co-op	wilystreet.coop	Madison	WI
Wisconsin Home Harvest	localharvest.org	Reedsburg (Saulk County)	WI

APPENDIX B

SURVEY OF FOOD HUBS

Food Hub Resources

1. Letter of Introduction

We are a team of researchers with Iowa State University and would like to invite you to participate in a short 20-minute survey. Participation is voluntary and you may skip any question at any time.

The purpose of this study is to determine which physical, financial, human, and information resources are important in running the business you are representing. A summary of results from this survey will be included in a resource guide for establishing and managing local food aggregation businesses. Specific information pertaining to your business or organization will be kept confidential. We value your expertise and would like to make your knowledge available to others planning similar businesses.

We have selected your company to participate in this survey based on your role as an aggregator of local foods, your participation in local and regional food systems, and your location within our study area in the North Central region of the United States. We obtained your name from one of the following sources: the USDA AMS working list of food hubs, Local Harvest, Market Maker, and/or Buy Fresh Buy Local.

This research is funded by the Leopold Center for Sustainable Agriculture, the Iowa Local Food and Farm Plan, and North Central Region Sustainable Agriculture Research and Education.

Please complete and submit this survey by June 1st. Please contact me at kduerff@iastate or 402-245-8114 with any questions you may have.

Thank you for your time and participation in this important survey. Together we can assist emerging groups food aggregation businesses and grow the local and regional food systems, benefiting all of its participants.

Sincerely,

Kevin Duerfeldt
Graduate Assistant
Iowa State University

***1. Do you agree to participate in this survey?**

Yes

No

Food Hub Resources**2. Physical Resources**

1. Do your facilities include cooler space for produce storage, and if so how much? Please fill in the blank with an estimate in square feet, place a zero if you have no refrigerated storage space.

2. Does your business have non-climate controlled storage space, and if so how much? Please fill in the blank with an estimate in square feet, place a zero in the blank if you have no storage facilities.

3. Does your business have retail space, and if so how much? Please fill in the blank with an estimate in square feet, place a zero in the blank if you have no retail space.

4. Does your business own or lease the storage space from questions 1, 2, or 3? Please select all that apply.

- Own
 Lease
 Both
 Neither
 Not applicable

5. Does your facility have a shipping/receiving loading dock capable of handling straight truck or semi trucks? Please select one.

- Yes
 No

Food Hub Resources

6. What other kinds of equipment or facilities do you feel are necessary for operating at your scale? Check in the appropriate column for each asset.

	Have	Will get	Don't need	Does not apply
Delivery vehicles	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fork lift	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Manual pallet forks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inventory management technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Office space	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Repackaging lines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wash station	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other important equipment

Food Hub Resources

3. Human Resources

1. How many people does this firm employ? Please fill in the number of employees including yourself for each category.

Full time, year round	<input type="text"/>
Full time, seasonal	<input type="text"/>
Part time, year round	<input type="text"/>
Part time, seasonal	<input type="text"/>
Other, please explain	<input type="text"/>

2. What types of employees does your business employ? Please fill in an estimate of the number of employees for each type of position. You may use decimals for employees that are divided between multiple areas.

Administrative and office staff (administrative assistant, chief executive officer, chief financial officer, managers, etc)	<input type="text"/>
Brokers (manage sourcing and distributing produce)	<input type="text"/>
Laborers (receiving, shipping, processing, custodial, etc)	<input type="text"/>
Other, please provide the number of employees and description of position	<input type="text"/>

3. How long has the longest employed employee worked for this firm? Please fill in the length of time this employee has worked in number of months?

4. How long has the newest employee been working for this firm? Please fill in the length of time this employee has worked in number of months.

5. How would you describe your business employee turnover? Please select one.

- Too high
 Acceptable
 Too low
 Not applicable

Food Hub Resources

4. Information Resources

1. How many growers do you purchase from? Please fill in the number of growers you have, place a zero in the blank if you do not purchase an items from local or regional growers.

Number of growers

2. Does your company grow any of the produce that moves through your facility? Please select one.

Yes

No

3. What percentage of your produce comes from the largest 10% of growers? Please select one.

Less than 20%

20 - 39%

40 - 59%

60 - 79%

80 - 100%

Other (please specify)

4. How many customers do you supply? Please fill in the number of customers you have. For institutions such as hospitals, schools, and grocery stores with multiple locations please count each location separately.

Number of customers

Food Hub Resources

5. What types of customers do you supply? Please select all that apply.

- Schools
- Hospitals
- Nursing homes
- Prisons
- Restaurants
- Individual household consumers
- Wholesale food distribution company
- Retail grocery stores
- Processing companies

Other (please specify)

6. What percentage of your annual sales comes from your top 10% of customers? Please select one.

- Less than 20%
- 20 - 39%
- 40 - 59%
- 60 - 79%
- 80 - 100%

Other (please specify)

7. What is your turnover rate for fresh produce (how long does produce spend in your facilities on average)? Please fill in the number of days. Please type not applicable if you do not keep fresh produce on hand.

Number of days

8. How do you manage balancing produce coming in and produce going out? Please describe your process for balancing the type and amount of produce supplied by growers with the amount and type ordered by customers.

Food Hub Resources

9. Do you have an inventory tracking system and if so which kind? Please select all that apply.

- No we do not have a system for tracking inventory
- Paper records
- Computer based records
- Records on mobile device (ipad, smart phone, tablet, etc)
- Radio frequency identification tags
- Bar codes
- Not applicable

Other (please specify)

10. When tracking inventory how important are the following? Please rank the importance of each with 5 being very important and 1 being not important.

	1 unimportant	2 somewhat unimportant	3 neutral	4 somewhat important	5 important
Produce origin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Variety or cultivar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amount of inventory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Quality grade	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Date received	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
End consumer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food Safety	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other concerns with tracking inventory

Food Hub Resources

11. Do you make requests of growers to standardize produce? Please check all that apply.

- No we do not have any requirements of growers
- We have guidelines for quality
- We have guidelines for ripeness
- We have guidelines for size
- We have guidelines for acceptable varieties
- Not applicable

Other (please specify)

12. Do you facilitate communication between growers, consumers, professional organizations, or state officials? Please check all that apply.

- No we do not facilitate communication between groups
- We facilitate communication between growers
- We facilitate communication between growers and consumers
- We facilitate communication between growers and government or non government organizations such as University Extension, Grower Associations, and state Departments of Agriculture
- We facilitate communication between growers and professional organizations such as state grower associations
- Not applicable

Other (please specify)

Food Hub Resources

13. Do you provide any continuing education or networking opportunities for employees?

Please check all that apply.

- No we do not provide any continuing education opportunities
- Good Agricultural Practices training
- Pesticide application training
- Organic agriculture training
- Guest speakers
- Not applicable

Other (please specify)

14. Do you provide any continuing education or networking opportunities for growers?

Please check all that apply.

- No we do not provide any continuing education opportunities
- Good Agricultural Practices training
- Pesticide application training
- Organic agriculture training
- Guest speakers
- Not applicable

Other (please specify)

15. How does your firm receive produce? Please select that apply

- Growers deliver
- We pick up
- Meet at central location
- Not applicable

Other (please specify)

Food Hub Resources**16. How does your firm deliver produce? Please select all that apply.**

- Deliver with company owned vehicles
- Contract delivery with 3rd party company
- Customers pick up
- Wholesale customer or broker manages deliveries
- Organize grower delivery
- Not applicable

Other (please specify)

17. Do you at any time take physical possession of the produce?

- Yes
- No
- Not applicable

18. Do you take ownership of the produce at any time?

- Yes
- No
- Not applicable

19. Are any of your facilities certified organic? Please select one.

- Yes
- No
- Not Applicable

**20. Are any of your facilities or employees GAP (good agricultural practices) certified?
Please select one.**

- Employees
- Facilities
- Both employees and facilities
- Neither employees or facilities
- Not applicable

Food Hub Resources

21. Are any of your facilities or employees GHP (good handling practices) certified? Please select one.

- Employees
- Facilities
- Both employees and facilities
- Neither employees or facilities
- Not applicable

Food Hub Resources

5. Financial Resources

1. How was your business originally financed? Select all that apply.

- Bank loans
- Government grants
- Low interest government loans
- Private investors
- Cooperative members
- Not applicable

Other (please specify)

2. How much initial capital was required to start? Please select one.

- Less than \$25,000
- \$25,000 to \$49,999
- \$50,000 to \$99,999
- \$100,000 to \$500,000
- \$500,000 to \$1,000,000
- Over \$1,000,000
- Not applicable

3. What original assets were held by owners/members/ investors before forming the business and were used to establish the business? Please select all that apply.

- Land
- Employees
- Buildings
- Cold storage
- Machinery such as fork lifts or delivery vehicles
- Not applicable

Other (please specify)

Food Hub Resources

4. Were the facilities currently being used by the business owned by an owner/member/investor before the business was established?

- Yes
 No
 Not applicable

5. Has the business expanded since first establishing? If so how were expansions financed? Please select all that apply.

- Have not expanded
 Company profits
 Bank loans
 Government grants
 Low interest government loans
 Private investors
 Cooperative members
 Not applicable

Other (please specify)

6. How much were your gross sales for 2011? Please select one.

- Less than \$25,000
 \$25,000 to \$49,999
 \$50,000 to \$100,000
 \$100,000 to \$500,000
 \$500,000 to \$1,000,000
 Over \$1,000,000
 Not applicable
 Prefer not to answer

Food Hub Resources**7. How much was your business's net revenue for 2011? Please select one.**

- Less than \$999
- \$1,000 to \$4,999
- \$5,000 to \$9,999
- \$10,000 to \$24,999
- \$25,000 to \$49,999
- \$50,000 to \$100,000
- \$100,000 to \$500,000
- \$500,000 to \$1,000,000
- Over \$1,000,000
- Not applicable
- Prefer not to answer

8. How much were your business's expenses for 2011? Please select one.

- Less than \$25,000
- \$25,000 to \$49,999
- \$50,000 to \$100,000
- \$100,000 to \$500,000
- \$500,000 to \$1,000,000
- Over \$1,000,000
- Not applicable
- Prefer not to answer

Food Hub Resources

9. Please rank these annual expenses in order from greatest priced to least priced.

	1 least expense	2	3	4	5	6 greatest expense	Not Applicable
Labor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Equipment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land (facilities payments or rent)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy (electricity and fuel)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Materials (packaging, office supplies, labels, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Taxes, certification fees, inspections	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other notable expenses

Food Hub Resources

6. General Information and Process for Establishing

1. Which of the following best describes your business? Please select all that apply

- Farmer/grower direct to consumer sales
- Farmer/grower wholesale
- Produce aggregator/food hub
- Produce broker
- Distributor/wholesale supplier
- Retail
- Produce Auction
- Grower Cooperative
- Consumer Cooperative
- Community Based Non Profit

Other (please specify)

Food Hub Resources

2. Which crops do you typically handle? Check all that apply.

- Fresh fruits
- Fresh vegetables
- Fresh cut flowers/Woody florals
- Bedding plants/hanging baskets
- Value added products (jams, baked goods etc)
- Meat
- Dairy
- Eggs

Other regular products

3. How long has your company been in business? Please select one category.

- Less than 2 years
- 3 to 5 years
- 5 to 10 years
- 11 to 20 years
- 21 to 50 years
- Over 50 years

4. Where did the idea to begin this business originate? Please select all that apply.

- 1 person's idea
- Interest from multiple growers
- Consumer demands

Other (please specify)

Food Hub Resources

5. How did you choose a location for your business? Please rank in order of importance.

	1 unimportant	2 somewhat unimportant	3 neutral	4 somewhat important	5 important
Distance from suppliers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Distance to customers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Availability of land	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Availability of labor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Access to infrastructure (highway, electricity, water, etc)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other location considerations

6. What is the greatest distance from your business to a regular grower who supplies produce to your business?

- Less than 10 miles
- 10-25 miles
- 25-50 miles
- 50-100 miles
- Over 100 miles
- Not applicable

7. What would you consider to be the average distance from your business to your growers?

- Less than 10 miles
- 10-25 miles
- 25-50 miles
- 50-100 miles
- Over 100 miles

8. What would you consider the average distance from your business to a customer?

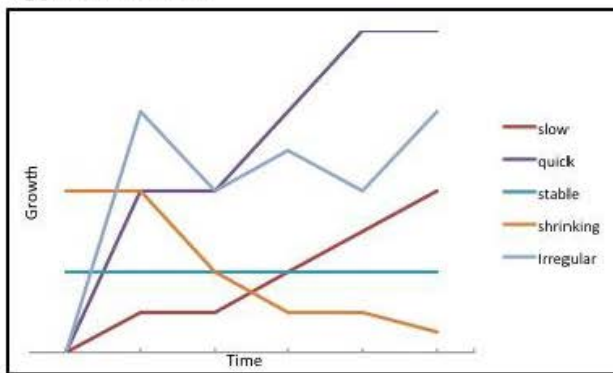
- Less than 10 miles
- 10-25 miles
- 25-50 miles
- 50-100 miles
- Over 100 miles

Food Hub Resources

9. Which best describes the growth of your business? Please select one and refer to the graph below for examples showing types of growth over time.

- Slow
- Quick
- Stable
- Shrinking
- Irregular
- Not applicable

Types of Growth



10. Which of the following business types best describes how your business was originally established? Please select one.

- Sole proprietorship
- Partnership
- S corporation
- Limited liability corporation
- Cooperative
- Other: explain
- Community based non profit
- Not applicable

Other (please specify)

Food Hub Resources

11. Which of the following business types best describes your business currently? Please select one.

- Sole proprietorship
- Partnership
- S corporation
- Limited liability corporation
- Cooperative
- Community based non profit
- Other: explain
- Not applicable

Other (please specify)

Food Hub Resources

7. Demographic and Contact Information

1. What is your name and full address? To be eligible for the drawing you must fill out this information.

Name	<input type="text"/>
Title	<input type="text"/>
Business/Organization	<input type="text"/>
Street	<input type="text"/>
City	<input type="text"/>
State	<input type="text"/>
Zip Code	<input type="text"/>

2. In which age group do you belong? Please select one.

- 21 and Under
- 22 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 to 74
- 75 to 84
- 85 and Over

3. Gender. Please select one

- Male
- Female

4. Race. Please select one

- "White"
- "Black or African American"
- "Native American"
- "Latin American or Hispanic"
- "Asian/Pacific Islander/Indian subcontinent"

Other (please specify)

Food Hub Resources

7. Demographic and Contact Information

1. What is your name and full address? To be eligible for the drawing you must fill out this information.

Name	<input type="text"/>
Title	<input type="text"/>
Business/Organization	<input type="text"/>
Street	<input type="text"/>
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State	<input type="text"/>
Zip Code	<input type="text"/>

2. In which age group do you belong? Please select one.

- 21 and Under
- 22 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 to 74
- 75 to 84
- 85 and Over

3. Gender. Please select one

- Male
- Female

4. Race. Please select one

- "White"
- "Black or African American"
- "Native American"
- "Latin American or Hispanic"
- "Asian/Pacific Islander/Indian subcontinent"

Other (please specify)