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Socioeconomic geography of organic agriculture in the United States, 2007-2012

Hui-Ju Kuo
Iowa State University

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Socioeconomic geography of organic agriculture in the United States, 2007-2012

by

Hui-Ju Kuo

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

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Major: Sociology

Program of Study Committee:
David J. Peters, Major Professor
Carmen M. Bain
Jan L. Flora
Frederick O. Lorenz
Stephen G. Sapp

Iowa State University

Ames, Iowa

2015

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ABSTRACT

Recent trends have shown that organic agriculture in the United States may longer form a homogeneous group. To better understand the spatial pattern of organic farming, the overall research objective is to examine organic agriculture and its ecological, technological, and socioeconomic correlates based on an agroecosystem framework combining Hernandez’s model and Flora and Flora’s community capitals framework.

Using multiple measures of organic agriculture at the meso-scale during the period between 2007 and 2012, results from cluster analysis indicate that the typology of \( N=3,069 \) counties includes a majority of Low Intensity places, two groups of Moderate and High Intensity clusters that have seen a relatively large concentrate of organic farms and sales, and a small number of counties in clusters of Growing Farms and Growing Sales are rapidly expanding in place dominated by conventional agriculture.

Through multinomial logistic regression, regional differences of organic farming are strongly associated with environmental factors such as climate and topography. Although technology employment has little effects on organic production, organic intensive places tend to have more diverse farm operations by having more women operators and direct sales to people and the community. Results show mixed support to link organic production systems with better socioeconomic settings. Places with moderate organic activity generally are more ethnically diverse and better educated. Nevertheless, they tend to have high dependency ratio. Places with high intensity organic production have higher labor force participation and higher community engagement; they also have higher rates of poverty. Further, organic
market expansion is also associated with the services economy, for moderate intensity places tend to have more services occupations and organic service enterprises.

To identify significant patterns of organic spatial dependence, a local indicator of spatial association (LISA) using G* statistic is used to examine local pocket of spatial concentration. Results indicate that organic hot spots are primarily located in the New England, along the Pacific Coast, around the Northern Great Lakes, and in the Mountain West. In terms of organic geography, high (low) organic places tend to be located near other high (low) organic places.

Despite government support of organic farming has mostly been limited to creating a legislative standard and organic certification, the findings bring awareness that indirect political influences through the markets such as farm-to-school program are more likely to assist with the organic development. While higher intensive of organic production exhibits signs of conventionalization because they tend to be large-scale and capital intensive, the results didn’t find that smaller organic growers are been marginalized. By contrast, small- and middle-sized organic production tends to stay true to the traditional and movement-oriented organic.

To broadly capture the organic heterogeneity, this study suggests more analytical attention to complex interactions among environmental, socioeconomic, and political drivers, ranging from agricultural nature, such as historical geography, to local socioeconomic contexts and the corresponding community-embedded relations.
CHAPTER 1
INTRODUCTION

The development of organic agriculture was based on a range of ideals about farming beginning in the early 20th century. Generally, organic agriculture throughout the world had a provisional start as an alternative production system that promotes environmentally, economically, and socially sound production of food (Heckman 2006; Lotter 2003; Sligh and Christman 2003). The term “organic” is thought of as referring to “the farm as an organism, in which all the component parts - the soil minerals, organic matter, microorganisms, insects, plants, animals, and humans - interact to create a coherent system whole” (Lampkin 1994a), in sharp contrast to the simplification, specialization, industrialization and science-based rationality that often characterize conventional agriculture (Ikerd 1999; Lampkin 1990). More specifically, advocates perceive organic farming as a form of sustainable agriculture that reduces reliance on external inputs while increasing farm-derived renewable resources to enhance natural ecological process, environmental protection, food quality and economic viability (Lockie et al. 2006; Rigby and Caceres 2001).

Organic agriculture has experienced considerable growth since the 1980s in many regions of the world. It was the confluence of opposition to new biotechnologies, growing acceptance of environmentalism, food scares such as Mad Cow Disease, and ongoing international farm crisis that triggered the growth in consumer demand for certified organic produce (Lockie et al. 2006; Tovey 1997). In response to the demand, there were a large number of producers, processors, and retailers that have been attracted to the organic industry. Consequently, the organic sector is experiencing rapid changes in production and marketing strategies, which has begun to
restructure the agricultural system (Buck, Getz and Guthman 1997; Halloran and Archer 2008). In short, organic foods and organic agriculture have become important for consumers and society, for producers and markets, and for governments and policy.

Organic agriculture, from the perspective of green consumerism, is a powerful generator for positive social change because it encourages greater environmental awareness and responsibility among producers and consumers (Allen and Kovach 2000). Moreover, from the realm of agrarian-based rural development, organic farming is also thought to offer significant prospects for rural economy viability, social vitality, and community development (Kroma 2006; Marsden, Banks and Bristow 2002; Marsden, Banks and Bristow 2000; Padel, Lampkin and Foster 1999; Pugliese 2001; Smith and Marsden 2004; Tovey 2002; Tovey 1997). This body of literature pointed to the potentials of organic agriculture for a sustainable rural development. Besides the preservation of rural landscapes, an important emphasis is on production process, such as increasing dependence on local labor and rural business and avoiding exploitation of workers by the means of producing healthy food in a healthy managed environment. Taken together, this involves in rebuilding local and communal relations especially non-market social relations, which in turn creating an alternative lifestyle and alternative ways of relating to people and to nature. In this regard, the development of organic farming is much more than production, but it is also about social concerns because it is thought to play an important role in shaping and in reestablishing the rural context of people and communities.

Recent studies have shown that organic farming in the United States may no longer form a homogeneous group. While small farms continue to diversify their production methods and make their living through niche markets, there are a growing number of large operations becoming specialized in the mass production of high-profit organic crops (Buck, Getz and
Figure 1. Organic farms for $N=3,069$ counties in the United States, 2012

Figure 2. Organic sales for $N=3,069$ counties in the United States, 2012
Examining the share of farms that are organic in 2012 (Figure 1), we find concentrations in the Northeast in states such as Maine, Vermont, and New York; on the West Coast in California, Washington, and Oregon; and in the Mountain West and along the Northern Great Lakes. In general, organic agriculture has not been distributed evenly across the country. On the other hand, looking at the share of sales that are organic in 2012 (Figure 2), however, it does not show exactly the same geographic pattern as those high organic farms mentioned above. While counties of high organic sales are primarily located in states such as California, Oregon, Michigan, and Vermont, they are also dispersed in the South especially in Florida and Texas. Clearly, to better understand the development of organic agriculture, it is necessary to use multiple rather than single measures.

In addition to the economic components, the growing links between the environment, on-farm sustainability, food security and safety, labor, poverty, and social justice reflect an emerging systemic understanding of agriculture as an ecological and social activity (Fernandez et al. 2013). Building on uniqueness of place, the agroecosystem concept provides a framework to understand the complexity of modern agriculture that emerges from a broad social and cultural contexts (Rosset and Altieri 1997). In particular, current tendencies in the rise of alternative agrifood movements encourage researchers to outline the forces that are shaping the emerging global food situation. Among them, the growth and institutionalization of organic agriculture offers an excellent opportunity to access how well the agroecosystems structure and function along with this development.

The dynamics in organic agriculture in the U.S. seem to result from a range of environmental, social, economic, and political factors (Buck, Getz and Guthman 1997; Goodman 2000; Milestad and Darnhofer 2003; Youngberg and DeMuth 2013). The overall research
objective is to understand organic agriculture and its ecological, technological, and socioeconomic correlates based on an agroecosystem framework, taking into account place-based coevolution to understand the relationships among the diverse components of the organic production system. In practice, ecological factors used to explain organic farming include a range of natural amenity indicators. Technological factors include machinery, equipment, and production expenses such as fertilizer and chemicals. In terms of socioeconomic parameters, I refer to Flora and Flora’s (2008) model of agroecosystems as products of communities mediated by factors conceived as human, cultural, social, political, and financial/built capital to generate a range of social and economic indicators. In general, by looking at each organic farm as an agroecosystem itself, we look for the ways they are organized within the context of a broad socioeconomic system, the ways how communities create the change and work together.

In the organic literature, few studies have investigated multiple measures of organic agriculture nationally; and few have examined the socioeconomic settings in explaining the regional diversity of organic farming across meso-scale geographies. Existing studies are limited by using smaller geographic regions that are not national scope (Constance, Choi and Lyke-Hogland 2008; Guptill 2009; Guthman 2004a; Sheahan et al. 2012); using single year measures that do not show changes in organic farming (Brown and Eades 2006); using a single measure of organic farming rather than multiple measures that include acres and sales (Taus, Ogneva-Himmelberger and Rogan 2013); using personal characteristics of individual producers or consumers rather than a systems approach to explain organic conversion (Stofferahn 2009; Zepeda and Li 2007).

To address these gaps, this research examines the spatial clustering of organic agriculture and its environmental and socioeconomic correlates at the meso-level in the United States. The
first objective is to identify and describe the classification of organic agriculture at the county-level. Cluster analysis is used to create a statistically valid typology that identifies distinct patterns of organic agriculture in terms of organic farms and organic sales. I hypothesize that organic agriculture is clustered in certain regions. The second objective is to statistically identify the ecological, technological, and socioeconomic factors affecting the organic agriculture clusters. Multinomial logistic regression is used to determine which factors drive membership into organic agriculture typology at the county-level. Based on the agroecosystem framework, I hypothesize that organic intensive counties will have better socioeconomic supports by being more ethnically diverse, better educated, and having lower poverty and higher community engagement. The third objective aims at identifying significant patterns of organic spatial dependence. A local indicator of spatial association (LISA) using Getis-Ord $G_i^*$ statistic is used to identify organic hot (cold) spots and a regular logistic regression is used to determine which ecological and socioeconomic factors affect the spatial clustering of hot (cold) spots. As organic farming has a history of legislated regulation, the fourth objective is to investigate whether state-level policy helps or hinders the development of organic agriculture. Studies argued that the regulatory mechanisms and agribusiness penetration have contributed the organic sector to a more pragmatic and industrial fashion towards the conventional model (Buck, Getz and Guthman 1997; Guthman 2004a; Guthman 2004b). Thus, the fifth objective is to investigate the “conventionalization” thesis and the process of “bifurcation.” The key question is to know whether organic production across the national landscape increasingly adopts a dual-structure of smaller, traditional producers and larger, capital intensive operations.

Understanding the spatial pattern of organic agriculture and its correlates is important for a few reasons. First, an examination of the spatial distribution of organic agriculture is crucial to
further our understanding of the ecology of how U.S. farming is organized. Since the nature of organic agriculture itself embodies an evolving set of traditional ecological knowledge, land management practices, as well as an environmental social movement, the geographic distribution of organic farming implies the variation of orientation to human-nature relations. Therefore, this research would make a contribution in terms of conceptual approach, linking agricultural restructuring to understanding whether the mode of food production is correlated with the positive socioeconomic settings in the community. Second, this study is somewhat unique in terms of data, examining the spatial distribution of organic agriculture by using county-level data for the entire U.S. over time. Organic practices are often closely related to landscape heterogeneity and a range of social and cultural diversity partly due to the agroecological differences that occur from the farm-scale to the community and to the region (Vos 2000). However, current research has not examined how rising or decreasing organic farming at the national-scale is systematically distributed across meso-scale place. Third, this research is also unique in terms of methods, using cluster analysis to identify distinct patterns of organic farming across counties with multiple measures. This avoids the problem of using arbitrary criteria to identify high or low intensity organic places by basing the thresholds on the unique distribution of the data.
Defining Organic Agriculture

Essential ingredients in the development of the concept of organic agriculture are values expressing a general criticism of mainstream agriculture which aims at maximizing agricultural production by use of chemical fertilizers and artificial inputs (Best 2008; Goodman 2000; Kaltoft 1999). Most argue that the industrialization and specialization of agriculture in the 1940s served as a point of departure from conventional agriculture; and scientists and farmers began to look for a new paradigm (Treadwell, McKinney and Creamer 2003). The fact that organic agriculture challenges the ideologies at the heart of contemporary industrialized agriculture is crucial for the distinctiveness of organic farming both as a concept and as a social movement. This movement included joint efforts by different social actors such as farmers, consumers, scientists, states, and ordinary citizens, aiming at constructing a new type of interrelationship between agriculture and society. It is argued that the development of organic agriculture is strongly influenced by development in society at large (Guthman 2004a; Youngberg and DeMuth 2013). The rise of organic agriculture may be seen as part of the general social and political change, ranging from growing concerns of modern production agriculture, to a broad of societal reform thinking such as green movement and sustainability, and, finally, to a U.S. Department of Agriculture (USDA) study team on organic agriculture that helped organic farming move into the government agenda in the 1980s.

Tracking back to ideological leaders of organic agriculture, the roots of modern organic farming lie in the Austrian philosopher Rudolf Steiner’s work *Agriculture: A Course of Eight*
Lectures in 1924, where Steiner presented an alternative vision of agriculture in which he emphasized the significance of the natural forces that form the components within the farm as an organism (Lampkin 1994a). However, Sir Albert Howard is regarded by most as the founder of the organic movement. Born and educated in England, he directed agricultural research centers in India for 26 years and developed a system of composting that was widely adopted (Heckman 2006). Howard’s work on the role of organic matter in soil fertility was connected to the health of crops, livestock, and humans (Heckman 2006; Lampkin 1994a).

While Howard was a key figure in developing the concept of organic farming, this system of agriculture introduced by Howard was coined “organic” by Walter Northbourne to refer to a system “having a complex but necessary interrelationship of parts, similar to that in living things” in his 1940 classic Look to the Land (Heckman 2006). In the United States, businessman and publisher, J.I. Rodale, was an early convert to organic farming as a result of reading the works of Howard. Rodale diffused and popularized organic farming ideas through the hugely successful magazine Organic Farming and Gardening (Tate 1994). The success of the magazine then financed the establishment of Rodale Research, which pioneered organic farming research in the United States in the 1970s and 1980s (Tate 1994). Basically, both Howard and Rodale saw the conflict of organic versus non-organic agriculture as a struggle between two different visions of agricultural practices. Since the 1960s, wider concerns have emphasized the linkages between soil organisms that influence the quality of food and human health. Organic agriculture then slowly gained public attention.

In addition to the public concern for the negative impact of conventional agriculture on the environment, the 1960s and 1970s saw an upsurge in public attention for social justice as family farmers and farm workers began to question the social impacts of conventional
agriculture (Treadwell, McKinney and Creamer 2003). Along with the rise of capitalist patterns of industrial agriculture, corporate influence over farm production paved the way for expanding farm size which translated into lower food prices and profits for the corporate farms and food processors. As a result, farm structure shifted away from middle sized farms to larger ones. Loss of mid-sized family farms negatively impacted rural communities because they have traditionally constituted important foundations for rural community life, small business entrepreneurial innovation, and a wide range of agrarian values (Kirschenmann et al. 2008; National Research Council 2010). At the same time, however, large farms rapidly increased their share of total U.S. farm production value. Farms needed to expand in size in order to maintain profitability. Large farms required hired labor and the status and working conditions of migrant farm labors was another social concern of this era. Given changes in the structure of U.S. farms due to consolidation of agriculture and their related social issues, these criticisms had drawn further interest in the organic movement.

In Youngberg and DeMuth’s (2013) review of the development of organic agriculture in the United States, they summarized a few basic ideological concepts and core beliefs of organic agriculture. First, nature is capital. It was believed by organic advocates during the 1960s and 1970s that modern people failed to see themselves as a part of nature but as an outside force to dominate it. Second, soil is the source of life. That is, instead of increasingly depending on synthetic chemical fertilizers, pesticides, and petroleum-based production inputs, organic farmers argued that soil quality is the key to long term sustainable agriculture. The third one is the organic ethic. It is argued that organic farming is not only about the proper way to maintain soil quality or to structure a farm enterprise but also about how to evolve appropriate values and lifestyles in keeping with the realities and limitations presented by environment. Finally, the
quest of a greater degree of independence also became an important feature of organic farming. Use of on-farm resources would enable farmers to produce healthy crops with little reliance on petrochemical industry. Use of local marketing cooperatives and direct-farm sales would help people free from large, impersonal, and interdependent food retail and distribution systems.

In general, organic ideology included not only a set of values about farming techniques and agronomic principles, but also ideals for local food production, regional development, and employment. These include the lower use of nonrenewable resources, preservation of landscapes, increasing dependence on local labor, greater use of direct local marketing, and rebuilding communal relations especially non-market social relations.

**Organic versus Sustainable Agriculture**

However, organic agriculture is not the only alternative to conventional production systems that had been advocated. For example, sustainable agriculture seeks to create integrated and resource equitable farming systems. In the context of agricultural production, Ikerd (1993) defined sustainable agriculture as “capable of maintaining their productivity and usefulness to society over the long run. Such systems... must be resource-conserving, economically viable, socially supportive, commercially competitive, and environmentally sound.” Conceptually, some have argued that throughout much of the 1980s use of the words organic and sustainable are viewed synonymous because the goal of sustainability has long been an important element of organic ideology (Jamison and Perkins 2010; Lampkin 1994a; Youngberg and DeMuth 2013). There is no real dispute that sustainable agriculture and organic farming are closely related terms.

Operationally, definition of sustainable agriculture is somewhat problematic because there are conflicts among sustainable farmers over how to achieve sustainability, due to different
regions, background, economic and social characteristics (NationalResearchCouncil 2010). Therefore, what distinguishes organic agriculture from sustainable agriculture is that organic farming practices are well-defined and codified as law. With growing consumer demand and public interest in organic food and farming, interests in justifying expectations and establishing standards for organically produced foods also increased (Vogl, Kilcher and Schmidt 2005).

Beginning in the early 1970s, the number of organic associations organized by organic farmers expanded rapidly. For example, the California Certified Organic Farmers formed in 1973 was one of the nation’s first organizations certifying organic farms in the mid-1970s. By the mid-1980s, a number of private firms were also beginning to enter the field of organic certification that documented production practices.

From 1979 to 1990, organic farming was clearly gaining a new level of legitimacy and recognition at a national level in the United States (Youngberg and DeMuth 2013). For example, California was the first state to pass the Organic Food Act that provided a legal definition of “organic” in 1979 (Guthman 2004a). Meanwhile, facing criticism from conventional and industrial agriculture over organic farming methods, throughout much of the 1980s, organic farming advocates broadened their approach and began supporting the term “sustainable agriculture” to invite respect for organic agriculture, an attempt to keep alive and push for a less chemically-intensive and more holistic approach to agriculture (Treadwell, McKinney and Creamer 2003; Youngberg and DeMuth 2013). The organic movement sought to expand the meaning of sustainability to include not only environmental and ecological benefits, but also issues such as social justice, farm worker safety and security, animal welfare, and the development of rural communities. When the organic community began to focus its attention on
organic certification and other aspects of the organic foods marketplace, however, governments had taken over a major role in defining organic farming by creating legal standards.

The 1990 National Organic Foods Protection Act was passed by the US Congress to establish a USDA organically produced label that would give uniformity and credibility to organic products (DeLind 2000). As the establishment of federal organic certification standards drew considerable public attention to organic food and farming, it also raised the financial stakes for most participants in the organic industry, and inadvertently created a larger and much more visible stage of organic policy issues. Therefore, as argued by Youngberg and DeMuth (2013), by 1990 organic agriculture had reached a crossroads. One road was labeled “certified organic” that seemed to be gaining visibility, acceptance, and support from the consumer community. The other way, labeled “sustainable”, has come to support a less-pure form of organic agriculture which concerned many traditional issues such as soil and water quality, social justice, and rural community development. In fact, a single decade later the politics of agriculture had greatly altered the definition and purposes of organic farming. The political economy criticism of the dynamic of organic agriculture is examined latter in this research. Organic agriculture was now exclusively on the road labeled certified organic.

The Structural-Functional Perspective

To understand and explain the emergence of organic agriculture, there are a few concepts in the sociological literature addressing this issue. First, the concept of organic farming is based on an ideology built from a systems perspective. A fundamental feature of organic practices is rooted in the science of ecology. That is, the idea of organic farms is usually considered a complex organism whose component parts interact in a state of equilibrium to produce sufficient yields and to react as a whole to external ecological and socio-economic stimulus (Lampkin
1994a; Lampkin and Measures 1999). In this regard, this organismic idea is not very different from traditional form of sociological theory stemming from the works of Durkheim. Agricultural holding as an organism performs an independent, self-regulating, integrated, and coherent whole, in which a number of different organs fulfill different functions and interact with each other to create an ecologically, environmentally, economically, and socially sustainable production system.

Generally, the growth in organic agriculture beginning in the 1970s emerged out of a confluence of social developments (Guthman 2004a; Treadwell, McKinney and Creamer 2003). Through on-farm resource conservation, organic agriculture acts as a system that hosts numerous actors together to preserve the equilibrium and stability of the agricultural system. As a branch of environmental sociology, ecological modernization theory sees producers acting in concert with market signals and instruments of the state to favor the development of technologies that protect the environment (Huber 2000; Murphy 2000). From this perspective, Obach (2007) argues that the historical development trajectory of organic farming follows a pattern of social processes in which organizations, entrepreneurs, market forces, and the state act together to advance ecological sustainability. While organic movements played a constructive role in educating the public and impelling innovation, it was market economies and enlightened entrepreneurs that facilitated widespread use of organic practices (Dimitri and Greene 2002; Halloran and Archer 2008; Padel 2001). Since then, interests in organic methods from the agricultural sector along with state support in the form of federal standards then led to a surge in organic production (Obach 2007). For ecological modernization theorists, it is the fundamental reorganization of the social and economic order that allows for environmental progress toward ecological sustainability.
Figure 3. Organic agriculture institutions in context (Adopted from Lynggaard 2001)

Systems thinking sees agriculture as a self-organizing structure, in which different system components interact to produce wholeness. Through institutional analysis, some literature has focused on the institutional environment of the organic sector to explain the introduction of organic practices into the agricultural sector. For example, Lynggaard (2001) and Michelsen’s (2001a) article have presented a model that depicts the relationships between individual farmers and the institutional environment in which organic farming operates (Figure 3). According to the institutional perspective, the state, the market, and civil society are grouped together to create particular patterns of farming.

First, the food market domain concerns the demand-supply relationship between producers who are willing and able to adopt organic farming practices and consumers who want to buy organic products. In addition, retailers, wholesalers, processing and distribution firms are also dominant actors. For the organic food market, numerous studies have examined the factors that underlie organic farmers’ conservation practices and attitudes. Findings in the U.S. have shown that urban backgrounds, high levels of education, being younger, and having less farming
experiences were found as socio-demographic characteristics of organic farmers (Comer et al. 1999; Duram 1999; Lockeretz 1995; McCann et al. 1997; Stofferahn 2009). There is some indication that gender is a factor in the decision to convert to organic farming as female farmers seem more open to the practice (Burton, Rigby and Young 1999; Padel 2001), but overall the empirical evidence from the U.S. is scarce.

Moreover, while perceived profitability and economic risks were found to be concerns for both organic and conventional farmers, organic farmers expressed a greater awareness of and concerns for environmental-ethical problems and long-term agricultural sustainability than their conventional counterparts (McCann et al. 1997; Saltiel, Bauder and Palakovitch 1994; Stofferahn 2009). Studies also identified high managerial transition costs, risks of conversion-related investments, limited information for organic farming production and marketing, and lack of infrastructure for transport, handling, and packaging organic produce as obstacles of transition to organic production methods (Kuminoff and Wossink 2010; Lohr and Salomonsson 2000; Walz 1999; Walz 2004).

In spite of focusing on the comparison between adopters and non-adopters of organic farming in majority of the research, a few studies further argued that it is important to consider the stage of adoption of organic farming in the respective countries at the time adoption had been reached (Lapple and Rensburg 2011; Padel 2001; Parra-Lopez, De-Haro-Gimenez and Calatrava-Requena 2007). Their findings reveal that factors affecting organic adoption play a different role for early and late adopters, particularly with regard to socioeconomic characteristics, communication behavior, and attitudes of the farmer. For example, in the study of diffusion and adoption of organic farming in the southern Spain, Parra-Lopez, De-Haro-Gimenez, and Calatrava-Requena (2007) found that early adopters have less risk aversion, have
more contact with informal sources of information, have a more favorable opinion about organic agriculture, and are more dependent on agriculture, but have less experience with it. In general, given organic farming has been shaped as a technological innovation in agriculture, these studies attempt to explain the adoption behavior of individuals by looking at their personal characteristics, the time factor, and the characteristics of the innovation itself based on the diffusion of innovations framework.

On the other hand, consumer demand is also an important factor used to examine the equilibrium for the food market domain. With the rapid growth in consumer demand of organic products in the last two decades, there have been a number of studies investigating who are organic shoppers and what characteristics are associated with their organic food demand. In general, findings suggested that consumers are more likely to purchase organics are female (Byrne et al. 1992), younger (Zepeda and Li 2007), white (Huang 1996; Ott 1990), have children at home (Huang 1996; Thompson and Kidwell 1998), higher-educated (Huang 1996; Ott 1990; Thompson and Kidwell 1998; Zepeda and Li 2007), and are employed in service and white-collar occupations (Jolly 1991). Moreover, Thompson and Kidwell (1998) showed that higher income is significant in explaining organic food purchased, while Goldman and Clancy (1991) and Jolly (1991) found no income differences. Since these studies were done over a range of different products, retail outlets, and different times and regions in the U.S., the link between socio-demographic variables and organic purchase is often mixed (Hughner et al. 2007). To better understand organics consumption, as Krissoff (1998) argued, having geographic, socioeconomic, and demographic cross-sectional and time-series data on actual sales across different marketing settings would provide a stronger basis for analysis of consumer demand for organics.
Second, the farming community domain concerns the professional aspects of farming including farmers’ unions and advisory service organizations. For the organic farming community, studies indicated that farmers’ associations, advisory boards, and research institutions that offer training in organic agriculture improve organic practices through their support for farming management practices and organic marketing (Bloom and Duram 2007; Kroma 2006; Lynggard 2001; Nerbonne and Lentz 2003). When farmers shift from conventional to alternative systems of production, it reflects an interactive process in which groups of social actors develop practices and values that enable them to manage production systems in sustainable ways (Kroma 2006). This interactive and participatory process based on a mode of learning and action is referred to social learning in the agricultural knowledge system (Roling and Wagemakers 1998; Woodhill and Roling 1998). As Kroma (2006) argues, social capital in such context becomes an important dynamic of farmer groups and networks because of its inherent features of trust and reciprocity, which can increase confidence and reduce uncertainty.

Finally, the agricultural policy domain which concerns public intervention, such as government policies, state regulations, and standard setting authorities, into the organic farming sector also explained particular patterns of organic farming. One the one hand, the development of organic standards and public certification which aims to create consumer confidence and to facilitate market access to farmers has been an important instrument for the growth of organic agriculture (Daugbjerg 2012; Howard and Allen 2006; Klonsky 2000; Padel, Lampkin and Foster 1999). However, a number of analysts have noticed the potential industrialization of organic agriculture and the expansion of the agribusiness dominating organic product; and expressed concerns about the paradox of regulatory mechanisms of organic agriculture (Buck, Getz and Guthman 1997; DeLind 2000; Goodman 2000; Guptill 2009; Guthman 1998; Guthman
2002; Guthman 2004b). These critiques from the political economy perspective are examined later.

From the institutional perspective, an important aspect of organic agriculture concerns the formulation of its values, norms, and rules regarding environment, farming, food production, and society that challenge the basis for mainstream agricultural organizations and institutions (Michelsen 2001b). To act in accordance with social development, according to Pugliese (2001), organic farming offers a viable way to combine four functional linkages between rural and organic systems, namely: innovation, conservation, participation, and integration. That is, organic farming represents an innovative way of envisioning and practicing agriculture and, at the same time, animating rural communities. Through its concepts that adhere to the equilibrium and stability of agricultural systems, organic farming proposes a conservative process of change. To identify local needs and solutions, local people’s involvement and participation is a key factor to the realization of organic spirits. In this context, organic farming provides an opportunity to integrate the territory with other sectors of the economy, contributing to the growth of the local system as a whole.

In general, the systems thinking and institutional analysis of the emergence of organic agriculture mentioned above are grounded in structural functionalism, which is a theoretical tradition in sociology. Functional perspectives view human society as an integrated complex system which consists of a set of stable patterned relationship units. Social structure refers to a combination of connected and interdependent parts which are organized to make up a society. The functionalist idea of social structure presumes that society performs certain functions to keep it going. As Tovey (1997:23) says, “In eating food which has been reared, slaughtered, processed and delivered to our table in a particular way, we are reproducing particular social structures and
particular moral and cognitive ideas.” In fact, organic farming not only aspires to balance ecological and social goals with livelihood diversity, but also to produce a certain kind of society that reacts as a whole to external socioeconomic stimulus. According to Parsons (1951), through socialization and institutionalization, cultural patterns become internalized as part of the actor’s orientation system. On the one hand, actors act in terms of their interests, personalities and physical objects. On the other hand, institutionalization involves the integration of the social system level and directs the orientation of actors in social roles generally.

Even though Parsons talked much about actors, it was from the perspective of the system. Through its primary concerns as the large scale of social structures and their interrelationships, the functional perspective advances our understanding about how the social system motivates the actors and how social orders are maintained in the society. In other words, for an actor to achieve social objects and for a social system to function, we would need to focus on the relationship between actors and social institutions in the discussion of social system. Accordingly, when we try to understand the dynamics of organic agriculture and modern agriculture, the discussion of agricultural system would be much embedded in the context of culture, economy, politics, international trade, and global division of labor.

The Critical Perspective

However, the functional perspective is limited in explaining social change and conflict, as well as explaining rapid changes in organic agriculture. In fact, early degradation of soil fertility and ecological crises were already of great concern to Karl Marx. Through emphasis on the depletion of the natural fertility of the soil and the critique of how industry and agriculture combined to degrade nature and the worker under capitalism, Marx’s theory of “metabolic rift” offers an important foundation for the analysis of the natural environmental context of human
social development (Foster 1999). According to Foster (1999) and Schneider and McMichael’s (2010) argument, Marx employed the concept of metabolic rift to describe the double separation of: (i) agriculture from its biological foundation, that is, the alienation of nature in existing forms of reproduction; and (ii) humans from nature, that is, the contradictory and nonsustainable character of the rift between nature and society. With the expansion of capitalist modes of production, Marx’s critique provided insights into the ecological dimensions in historical capitalism; and the changing relations between human and nature in the sense of the appropriation of nature and labor process.

In the Marxist sociology of agriculture, the capitalist mode of agriculture not only alienates nature from humans in the form of nonsustainable reproduction, it also alienates human beings in the exploitative labor process when social relations are incompatible and conflicting with each other. In this regard, “commodity fetishism” emerges as one of the key concepts in Marx’s critique, describing the concealed social relations embedded in the production of a particular commodity. Instead of perceiving value as something that is created by particular social relations, commodity fetishism justifies the mystification that the source of profits inheres in the material commodities themselves. According to Allen and Kovach (2000), it is perhaps the organic sector that could contribute to a broader movement leading to collective actions that highlight defetishization in the agrifood system insofar as it “direct the attention of consumers away from decontextualized products and towards the processes that bring those commodities into being” (p. 226-227). From this perspective, it is possible for organic agriculture to create progressive change against the capitalist mode of production and reveal the true understanding of the relations between human and nature.
Although there is potential for the organic market in its defetishization in order to counter trends in the industrialization of agriculture, a body of literature in recent decades has found that there is a phenomenal disjuncture between representations of organic agriculture and the political economy of organics provision (Buck, Getz and Guthman 1997; Guthman 1998; Guthman 2002). The recent focus on the expansion of the organic industry and agribusiness in organic products has been questioned as compromising the core values of organic agriculture and its ability to maintain ecological metabolism and social equity. A number of analysts have warned that organic agriculture seems to be practiced in a more pragmatic and industrial fashion towards the conventional farming model as agribusiness capital penetrates the organic community and its markets (Best 2008; Flaten et al. 2006; Guptill 2009; Hall and Mogyorody 2001).

The first detailed analysis about the “conventionalization” argument in the U.S. is provided by Buck, Getz, and Guthman (1997) in their examination of the structure of organic vegetable commodity chains in northern California. They argued that large agribusiness is finding ways to industrialize organic production by specializing in the mass production of high value crops and by taking over the most profitable aspects of organic commodities through value-added processing. These trends in organic production abandoned many of the ecologically-oriented practices and though marginalized smaller alternative organic producers. Accordingly, the conventionalization thesis stresses how organic agriculture appears to be reshaping itself in the image of capital and is therefore undergoing many of the same structural changes as conventional agriculture did decades earlier. As agribusiness capital is penetrating into organic agriculture, two generalized economic threats to organic producers from agribusiness have been specified. Drawing from the work of Goodman, Sorj, and Wilkinson (1987), Buck, Getz, and Guthman presented the threats from agribusiness in California’s organic sector. The first of these
is the “appropriation” of parts of the overall production process that lend themselves to industrial techniques or artifacts. One indication of “appropriationism” is as organic agriculture is increasingly being pulled into upstream markets for inputs, it has become possible for farmers to practice factory-like production by purchasing off-farm commodity inputs instead of organic inputs developed on farm (Buck, Getz and Guthman 1997; Guthman 2004a; Guthman 2004c).

The second way that underpins agribusiness expansion is through “substitution” of agricultural inputs or end-products with cheaper industrial ones (Carolan 2012; Goodman 1999). With the increasingly flexibility available for food processing firms to source the cheapest inputs, one example of “substitutionism” is the burgeoning sectors in processing, marketing, and retailing organic food for the value adding advantages (Buck, Getz and Guthman 1997; Guthman 1998).

While the notion of conventionalization has been taken up in a number of studies, a variety of potential dimensions of change in the organic sector including concentration, delocalization, and reorganization of organic commodity chains that characterized the bulk of organic production and trade have also been observed (Guthman 2004a; Lockie et al. 2006). As a result of conventionalization, the growth of the market for organic sector tends to precipitate a process of “bifurcation”: on the one hand, there are large operations specializing in the mass production of a few high growth, high profit crops, and/or processed organic food for the quasi-mass market and appealing to health and safety; and on the other hand, there are small scale artisan producers who diversify their strategies and grow a variety of crops for local markets and appealing to organicism, political change, and novelty (Buck, Getz and Guthman 1997; Guthman 2002; Lockie and Halpin 2005). This binary distinction describing the bifurcation of organics has been called “conventional” versus “artisanal” (Buck, Getz and Guthman 1997), “export/commercialized” versus “lifestyle/domestic/small-scale” (Coombes and Campbell 1998),
“organic lite” versus “deep” (Guthman 2004c), “corporate commercial” versus “sustainable” (Gliessman 2004b).

While many studies in different national contexts have been showing concerns about the overall reshaping of organic agriculture within a conventional mold, there is little consensus as to how serious a threat these changes are to the long-term development of organic agriculture (Hall and Mogyorody 2001). For example, in the case of Ireland, Tovey (1997) indicated that organic farming is being assimilated into environmental conservationalism, which makes it much less effective as a critique of conventional forms of food production on the farm. Despite the increasing involvement of agribusiness in organic agriculture, studies from New Zealand observed that when there was a major growth in export-oriented organic production, agribusiness then was not attempting to target the existing small-scale producers, which created space for the development of locally oriented organic movement. (Campbell and Liepins 2001; Campbell and Coombes 1999; Coombes and Campbell 1998). In the case of Ontario, Canada, Hall and Mogyorody (2001) found that the degree of conventionalization is dependent on a particular product. While there was little indication of specialization, capitalization, or mechanization among vegetable and fruit farms, the conventionalization argument carried more weight when they looked at field crop farming. In the U.K., Smith and Marsden (2004) pointed out that behind the over-supply of organic products is growing evidence that the evolution of organic supply chains might be entering a phase characterized by the traditional farm-gate price-squeeze. Despite considerable polarization in the economic scale of organic producers, studies from Australia showed no evidence that larger organic producers held significantly different values and beliefs to smaller organic growers; nor were larger organic growers poised to capture greater market share through faster rates of expansion, or any less likely to support local consumption.
through sales direct to consumers (Lockie and Halpin 2005). Through examining the organic
dairy sector in Norway, Flaten et al. (2006) indicated that on average organic newcomers are
more pragmatic and tend to adopt business-oriented farming than old guard farmers. In the study
of Germany, Best (2008) suggested that the current situation exhibits signs of incipient
conventionalization, however, trends are only valid for a fraction of new organic farmers.

Overall, there were tendencies so-called “conventionalization” in regions mentioned
above. Yet these tendencies are very much different in each region. As Darnhofer et al. (2010)
indicated in their review of the conventionalization debate, the first critique of the
conventionalization thesis centers around the question of whether such development observed in
California can be identified in other regions. Actually, the various contributions to the debate
have shown that a conventionalization of organic farming is still constrained. The second critique
deals with validity of the conventionalization thesis, that is, whether conventionalization affects
all farms equally, or whether there might be a process of “bifurcation” of the organic sector. To
more accurately illustrate the “conventionalization” argument, a general conclusion thus points
to a need for more empirical data comparing different farm types, commodities, marketing
channels, regions, and historical contexts (Bellon and Lamine 2009; Best 2008; Darnhofer et al.
2010; Langer 2002).

Despite recent trends showing that there are changes within organic farming, not every
departure from the practices of the organic pioneers is an indication of convergence between
organic and conventional farming. For example, while in most countries the average farm size of
organic farms is smaller than conventional ones, across the European Union organic farms have
been larger than conventional farms since the late 1980s (Lampkin 1999). The average size of
organic agricultural holdings for the EU-27 in 2007 was 37 ha, compared to 13 ha for all
agricultural holdings (Rohner-Thielen 2010). A general hypothesis thus suggested that the increase of average organic farm size during the diffusion process is possibly related to changes in the structure of the agricultural industry and a point of stabilization of farm size may occur (Padel 2001). That is, these trends might simply represent a pattern of the maturation of the organic industry. Accordingly, as Darnhofer et al. (2010) argued, while conventionalization has been linked to increased farm sizes, not every instance of scale increase necessarily indicates conventionalization. Rather, studies should focus on how organic farming is changing, taking care to capture the whole range of changes.

Turning back to the U.S., a few studies have investigated the conventionalization debate based on empirical studies in different regions of this country. Through an exploratory qualitative study of organic milk value chain in upstate New York, Guptill (2009) supports the conventionalization thesis in that organic milk has become a highly commodified value chain; and the federal organic standards have facilitated the participation of agribusiness corporations in ways that alter the economic landscape for the whole sector. However, there is also evidence that emerging cost-price pressures have pushed some producers into the movement side of organics, forging more self-reliance and localized connections along the value chain, which outlines a counter-trend to conventionalization. Guptill then recommended that a further understanding of the geography of the organic dairy chain would reveal much about the socioeconomic facets that condition decision-making by all participants in the sector. In the case of organics in Texas, Constance, Choi, and Lyke-Ho-Gland (2008) found mixed support for the conventionalization debate. Through comparing certified organic and non-certified organic producers, their findings showed the certified respondents are often larger, use indirect markets, and are economically motivated compared to their counterparts. Certified producers also have been farming longer,
farm full-time, and use more non-family labor. However, there are no significant differences between these two groups regarding length of time farming organically, path to organic farming, tenure pattern, or plans for expansion.

As organic agriculture seems to be moving away from “farm in nature’s image” (Soule and Piper 1992) and its original principles due to ever-larger agribusinesses dominating organic production, processing, and trade, critiques have expressed concerns about the paradox of regulatory mechanisms of organic agriculture. On the one hand, the development of organic farming production standards and public certification has been an important instrument for the growth of organic farming, for the harmonization inherent in standards and regulations aims to create consumer confidence and mutual recognition, and to facilitate market access to farmers in the market (Daugbjerg 2012; Howard and Allen 2006; Klonsky 2000; Padel, Lampkin and Foster 1999). On the other hand, regulations and certification standards have created barriers such as the high costs of certification that tend to favor entry into the sector by more highly capitalized and large scale producers. They also lead to greater opportunities for agribusiness capital to convert the activities of farming into a larger industrial complex through appropriationism and substitutionism, which eventually create a total opposition to the whole idea of organic farming and its local identity (DeLind 2000; Guthman 2004b; Vogl, Kilcher and Schmidt 2005).

In the US, the most obvious manifestation of the erosion of standards and regulations that has generated a palpable sense of loss within the organic movement was a proposal released by USDA in 1997 to introduce national standards for organic production that allowed the so-called Big Three – genetically engineered organisms, irradiation, and sewage sludge in organic practices (Guthman 2004a; Vos 2000). The disjuncture between this proposal and the recommendations made by the National Organic Standards Board in 1995, the latter of which
better reflected the expectations of the organic community, made the USDA receive nearly 300,000 public comments voicing concerns over the regulations (Goodman 1999; Klonsky 2000). When the new federal rule was finalized in 2002, its definition of organic production reflected closely to what the existing organic industry envisioned (Greene and Kremen 2003; Guthman 2004a; Guthman 2004c; Lockie et al. 2006). That is, up until the implementation of the federal rule, the unique evolution of organic regulations and certification decisions were often driven by market considerations.

One of the major aspects which separates organic agriculture from many of the other alternative agricultural approaches is that it has a history of legislated regulation and its production standards and certification procedures are codified. In fact, the skill of active organic farming management based on traditional sustainable agriculture and farmers’ knowledge, which have been embedded in local cultures and their ethical values, have lost importance in the public discussion within the organic movement. It is argued that the evolution of organic standards have had wide-ranging impacts on the organic sector, making a significant difference in determining who can participate in organic production and which methods of production will be used (Rigby and Caceres 2001; Vogl, Kilcher and Schmidt 2005). Therefore, the question of what is organic involves more than merely making the system measureable and verifiable, increasingly it has involved significant contestations over knowledge within networks of power (Guthman 2004a; Morgan and Murdoch 2000).

In sum, it is argued that the codified definition of organic farming has focused on an input-oriented instead of process-oriented management of sustainable production (Buck, Getz and Guthman 1997; DeLind 2000). According to Deaton and Hoehn (2005), the technical specifications and definitions used to grade an organic product are based on acceptable inputs
and methods, rather than the quality of an intermediate or end product itself. As a result, the regulatory system is likely the factor in facilitating the proliferation of agribusiness entrants and legitimizing agribusiness capital accumulation. As regulatory mechanisms function to bolster agribusiness, they have made the organic commodity opposite to the organic identity, and in turn, many of the rules and regulations that define organic production have ultimately narrowed the field of what organic agriculture addressed.

In contrast to the ecological modernization perspective which offers an optimistic assessment that argues social movements, market forces, and the state act together to advance an environmentally sound method of farming, the treadmill perspective suggests that social processes innate to capitalist democracies will undermine any potential environmental benefits derived from the organic movement (Obach 2007). In examining central actors in the organic system based on the treadmill perspective, it is capital that exploits any profitable social development due to the competitive pressure inherent in market economies. This can be seen in marketplace characteristics of the organic sector. In 2000, for example, 49 percent of all organic products were sold in conventional supermarkets while only 3 percent through direct marketing (Dimitri and Greene 2002), fundamentally undermining the environmental promise of the organic movement. As capital began to recognize the profit potential, the state then played an active role in rationalizing the organic market, which in turn aids large corporate interests and creates burdensome for small-scale producers in terms of the costs of registration and certification. Taken together, given the overall logic of capitalism favors economic expansion, it is argued that treadmill process tends to erase environmental gains over time.

In general, the political economy approach in analysis of the dynamic of organic agriculture discussed above essentially uses Marxist frameworks of change to identify the macro-
socioeconomic and institutional underpinnings of the emergence of organic agriculture through the struggle between organic arena groups with differential power bases. Some of the concepts are more obvious to production-centered perspectives and some are more focusing on diffuse forms of power and on struggles over knowing and growing organic. Overall, the political economy approach and its regulatory analysis tradition combined indicate the key factors important for the understanding of agricultural transformation: (i) the ways in which the farmer is integrated into the market circuits of production and consumption; (ii) the effects of socioeconomic structure on the agricultural system; and (iii) the role of the state and agencies in shaping farmers’ political responses (Friedmann 1991; Kenney et al. 1989).

In general, the political economy and regulatory concepts in explaining the emergence and dynamic of organic agriculture are grounded in the broader sociological analysis of critical theory. Critical theory turns our attention to see how human activities and society itself had come to be the way they are and what is currently the case with its critical thinking which aims at the structure of society and the particular historical circumstances. As capitalist market relations and values are penetrating more and more areas of our social lives, critical perspectives have produced analyses of the basis features of contemporary capitalist societies and of how the economic-political consequence shape the social processes, values, power, and ideologies. They provide criticisms and alternatives to support the liberation of the individuals from a system of economic exploitation and repression; and opens up the possibilities for the realization and development of individual potentialities and a better society.

The Symbolic Interactionalist Perspective

Despite the political economy of organic agriculture has rendered visible the industrial capital and state power that drive changes in organic production, however, much of this work
conceals an unacknowledged notion of reflexive consumption and loses a well-rounded illustration of the complex relationships between nature and society. First, the major drawback of this analysis is that in it, as Busch and Juska (1997) stated, “the subjects of those actions, people, tend to disappear. Instead structures, corporations, states, legislatures start to act, to function, to forbid, to promote, etc (p. 691).” However, such structural categories cannot act on their own. In fact, to understand human action and social experience, the first priority would be to explain the conduct of human beings. Human being emerges and acts only within the process of social interaction and through social relationships. In contrast, critical political economy contains no individual actors and it never explains why it is that people enroll in corporate or state that lead to their ultimate dependence. The political economy perspective may help to identify the distribution of social goods and highlight the formation of commodity complexes, but it is limited to explain how and why the social goods are distributed in particular ways (Busch and Juska 1997).

Therefore, the limit of structuralist political economy in describing the emergence of organic agriculture is that human agency and reflexive consumption are often regarded as neglected categories, for which it has become somewhat unsatisfactory in defining and interpreting social and spatial diversity of organic agriculture. Through disclosing social differentiation in the value construction of food for an understanding of the organic “context”, some phenomenological intellectuals have begun to introduce the analysis concerning the importance of changes in the sociocultural perceptions of food consumption and the symbolic meaning of organics (Arce and Marsden 1993). In fact, organic farming may mean different things to different people. For example, in the critique of codified organic agriculture, farmer-activist Bill Deusing (1995) argued that pre-regulation organic farming “allowed many of us to
associate it with certain important characteristics of scale, locality, control, knowledge, nutrition, social justice, participation, grower/eater relationships and the connections with schools and communities” (p.24). In other words, the true organic farming is placed on local ecological knowledge, local cultures and their ethical values and beliefs, the trust in interpersonal relationships, and daily interactions informed by wisdom locally generated and grounded in place. Therefore, as Vos (2000) stated, organic agriculture encompasses an enormous range of social, cultural, and natural diversity across space and time. One the one hand, practices of organic agriculture are closely related to landscape heterogeneity (Bunce, Ryszkowski and Paoletti 1993). On the other hand, this kind of place-based knowledge becomes the basis of politics and philosophy, which in turn represents a fundamental worldview and cultural ethos as well as unique orientation to people-nature relations (Vos 2000).

Typically, organic agriculture has included a spiritual dimension of certain concepts about the human relation to nature. Organic movement has aimed not only at “farm in nature’s image” and at reaching a sustainable farming with social and environmental diversity, but also at an ideal context for fostering “a more intimate and genuine relationship with food of which it retrieves the full sensory and symbolic value (Pugliese 2001:117).” While the assumption of political economy of agriculture tends to treat nature as essentially passive in the face of socioeconomic processes and as resources to be transformed, Goodman (1999) turns to an actor-oriented perspective to get a better grasp on the complex combinations of nature and society in the agrifood studies. This theoretical view he adopts is the “actor-network theory” which rejects the distinction between “nature” and “society” and explores the human agency as “an emergent property of networks, of collectives that express the ontological unity of humans and nonhuman entities in the principle of their co-production (Goodman 1999:26).” Accordingly, “agency is a
collective, networked outcome” (Goodman 2001:93) performed by non-dualist material and social associations.

Basically, actor-network theory is a flexible, content-specific paradigm that are able to examine complex and interdependent relationships and situations involving networks composed of both social and natural entities. Actor-networks treats not only humans are able to act but also nonhumans such as machines, architectures, plants, animals, and institutions are accepted as the source of action. Therefore, in effect, actor-network theory is a methodological and conceptual approach that sees the society as made up as patterned networks of heterogeneous associations, in which agency is conceptualized as the collective and relational capacity of humans and nonhumans to act (Busch and Juska 1997; Latour 1993; Murdoch, Marsden and Banks 2000). In Law’s (1992) words, “the term actor-network – an actor is also, always, a network” (p. 384). From the actor-network perspective, action is dependent on relations, “role, function, and identity are thus relational attributes, negotiated during the various ‘moments’ of translation, rather than predetermined (Goodman 1999:27).” Power, in this regard, involves in establishing networks and the amount of work in holding the various alliances, associations and heterogeneous means together. In light of the actor-network analysis, the meaning of organics would be mirrored in nature-society co-productions, labor processes and discourses in organic farming, and the networks in their heterogeneity.

Symbolic interactionalism for a long time has emphasized the negotiated nature of social life. Symbolic interactionists view human beings as “living organisms”, according to Mead (1922), we not only recall the experiences to understand what happened to us, but we also find ourselves living of others to adjust ourselves, defining the situation we are in, interpreting the social environment, and understanding what living is all about. For symbolic interactionists, it is
social interaction not personality, thinking not norms, being actively involved in not passively controlled by the surroundings, that human being constitutes a living person. Moreover, social interaction, which is characterized by symbols and cooperation, also develops culture. Culture, from the symbolic interactionist perspective, is a “shared understanding” which helps people fit together and act collectively (Becker 1986). Through the shared understanding and the interpretation of the particular meaning recognized by people who share a culture, social members are able to orient themselves and make sense of themselves. However, unlike symbolic interactionist perspective that tends to focus on the process of negotiation to face-to-face interaction among individuals, the network approach allows us to extend the notion of social interactions and to examine heterogeneous networks in which the activities of nonhumans may count for as much as the activities of humans.

The Agroecosystem Framework

Agriculture is meant to satisfy human needs of food. However, it is evident that nature and society emerge as intertwined organizational forms. Agricultural systems cannot be viewed as production activities driven mainly by economic pressures. Emerging as a response to the negative externalities of conventional agriculture, the agroecology approach has contributed to the development of the concept of sustainability in agriculture (Altieri 1987). According to Altieri (1989), in its early stage, agroecology has been variously defined as the ecology of agriculture, being used to study, diagnose, and propose alternative low-input management of agroecosystems. Its whole-systems approach and knowledge of dynamic equilibrium has provided a theoretical basis for sustainability.

Although agroecology initially dealt primarily with crop production and farm ecology, in recent decades an important influence was followed by a more integrative concepts and methods
from the social sciences (Hecht 1995; Mendez, Bacon and Cohen 2013; Wezel et al. 2009). The
field of agroecology then evolved toward a system-based, transdisciplinary, and
multidimensional approach to better understand the complexity of agriculture that emerges from
unique social and cultural contexts. According to Francis et al. (2003), agroecology is defined as
an integrative study of the ecology of entire food systems, encompassing ecological, economic
and social dimensions. Building on principles of ecology and uniqueness of place, “agroecology
can provide methods for broadening the focus to analyzing all components of the food system
and how they interact.” On the one hand, agroecology is the study of ecological processes in
agriculture, with a view towards making agriculture sustainable in ecological terms. On the other
hand, it is a complex science that provides the foundation for linking the ecological, economic,
social, and cultural aspects of agricultural production in the food systems.

Relatedly, a primary foundation of agroecology is the concept of ecosystem, defined as a
functional system of complementary relations between living organisms and their environment,
which in space and time appear to maintain a steady yet dynamic equilibrium (Gliessman 2004a;
Gliessman 2007). In other words, an ecosystem has structural components with particular
relationships that together take part in dynamic processes. In an agricultural setting, an
agroecosystem is created when human manipulation and alternation of ecosystems take place for
the purpose of establishing agricultural production (Gliessman 2007). In practice, when we
consider farm systems as agroecosystems, this concept then provides a foundation for
understanding the interactions and relationships among the diverse components of the agrifood
production system.

According to the agroecosystem concept, as Gliessman (2004a) argued, we need to
reestablish an awareness of the strong ecological foundation upon which agriculture originally
developed and ultimately depends. To conceptualize the interactions among ecological and social factors of agroecosystems, a number of researchers have developed models to illustrate these complex relationships. First, Gliessman (2007) presented a model (Figure 4) and suggested that a sustainable agroecosystem develops when components from a broad social and ecological foundation are combined into a system with a structure, function, and coevolution that reflects the interaction of human knowledge and preferences with the ecological components of the agroecosystem.

![Diagram of sustainability](image)

**Figure 4. The interaction among the social and ecological components of sustainable agroecosystems (Modified from Gliessman 2007)**

Second, drawing upon Norgaard’s (1984; 1994) coevolutionary agricultural development perspective, Gauthier and Woodgate (2001) proposed a model of socioenvironmental relations (Figure 5) in which they emphasize how nature (the ecological foundation of agroecosystems) makes society while simultaneously social systems also influence the fitness of particular environmental systems. To explain the coevolutionary character of agroecosystems, they applied Anthony Giddens’ “structuration” in understanding the link between social structures and
change. The structuration concept indicates the process through which actors in society are creating the structures they will be acting within. On the one hand, agency is not the experiences of the individual actor but the “reflexive monitoring of action”; on the other hand, structure is not the existence of social totality but “both constraining and enabling” of individual actors. In this respect, it is the structuration process that enables social systems to coevolve with environmental systems. Furthermore, since agency and structure is a “duality,” this brings an important element of socioenvironmental relations: they are heterogeneous across time and space. As a result, a historical and context specific perspective, as Gauthier and Woodgate suggest, is essential in understanding relationships between the physical and social dimensions of agroecosystems.

![Diagram of Socioenvironmental Relationships and Dynamic](Modified from Gauthier and Woodgate 2001)

Third, to study the structure of an agroecosystem at any one level of the spatial hierarchy (e.g., field, farm or landscape), Francis et. al (2004) indicated that it is important to recognize the multiple characteristics that define agriculture at that level and how the factors interact to lead to multifunctionality. As shown in Figure 6, Francis et al. proposed a framework to better
understand the multidimensional characteristics of resources in an agroecosystem. They used several examples to explain the complexity of the system. In the natural systems domain, the interaction between climate and geochemical resources is found by the loess soil along the Missouri River in Nebraska and Iowa were deposited over millennia by wind-blown soil particles originating farther west. In the social systems domain, the link between economic and culture is found by a comparison of industrial farms that raise commodity crops across thousand acres with the small family farms growing vegetables on a few acres. In addition, there are interactions between the natural and social systems. For example, the link between soil productivity and economic resources is found by the relative wealth of farms in areas with fertile soils such as central Illinois compared with those with weathered soils on hills in southern Missouri. Overall, this model shows how agroecosystems are structured through an awareness of the importance of multifunctional landscapes.

Figure 6. Multidimensional characteristics of resources in an agroecosystem (Modified from Francis et al. 2004)
Finally, both Francis et al. (2003) and Gliessman (2007) mentioned that in the 1970s, the Mexican agronomist and ethnobotanist Efraim Hernandez X. defined agroecosystems as the outcome of constant coevolution among ecological, technological, and socioeconomic factors (Figure 7). In this model, each factor influences the agroecosystem while at the same time interacting with the others. Through this framework, Hernandez explained why modern agriculture have sacrificed its ecological foundation to respond to market pressures that dominated development thinking of the time, while the socioeconomic axis was reduced to a purely economic one and an entire culture of agriculture was being lost (Francis et al. 2003; Gliessman 2013). In short, our understanding of agricultural activities should then integrate multiple social contexts with which agroecosystems function. As an agricultural sector, organic farming is an approach which is not confined to production alone. By contrast, organic farming needs to be understood as a dynamic system with many interacting parts including environmental, technological, and socioeconomic components.
The Community Capitals Framework

Moreover, to bridge the link between community development and agroecosystems, Flora and Flora (2001; 2008) proposed a community capitals framework (Figure 8) to show how social factors influence the context under which agroecosystems evolve and are maintained. To analyze the interaction of people with agroecosystems, they suggest communities are a useful lens for viewing changes in agroecosystems.

![Community capitals framework](image)

**Figure 8. Community capitals framework (Modified from Flora and Flora 2008)**

Every community has resources within it. When resources or assets are used to create new resources, they become “capital.” First, human capital consists of the knowledge, skills, abilities, education, leadership, self-esteem, and health of people as well as their ability to strengthen community and access outside resources within a community. In particular, as sustainable agriculture is an approach that maximizes economic benefits while maintaining environmental quality, it is argued that this approach is human capital intensive and encourages new scientific developments (Zilberman, Khanna and Lipper 1997). Since organic movement is
often associated with a reorientation of economic action through social embeddedness
caracterized by knowledge, innovation, and social learning (Kroma 2006; Morgan and Murdoch
2000; Padel 2001), extant studies tends to link organic production systems with better individual
attributes. In general, for activities performed around natural and environmental issues usually in
terms of place, Flora (2001) suggested that successful agroecosystem would start from human
capital which recognizes the skills and abilities of local people, and built social capital which
increased communication and networks would promote initiative and responsibility.

Second, social capital is made up of the interconnections among people and organizations
through norms of reciprocity, collective identity, working together, and mutual trust,
representing a lubricant within a community that makes the enhancement of the other capitals
relatively easier. In particular, bonding social capital refers to bring people together who already
know each other with the goal of building community cohesion; and bridging social capital
involves establish new ties that bridge among organizations and communities to provide new
information and access additional social networks (Burt 2004; Flora 2004; Flora and Thiboumery
2006; Granovetter 1985). Through an example of a change process implemented in Nebraska,
HomeTown Competitiveness, Emery and Flora (2006) found that social capital, both bonding
and bridging, is the critical resource that reversed the downward spiral of loss to an upward
spiral of hope, a process they call "spiraling-up." They concluded that social capital can
contribute to the development of other forms of community capital through expanding human
capital in the way local people see themselves as part of the community, increasing social capital
assets by youth involvement in the leadership, and finally the modified cultural capital provided
ongoing funding to support non-traditional leaders, and fostered economic outcomes.
Third, financial and built capital includes debt capital, investment capital, savings, tax revenue, tax abatements, grants, physical installations and facilities, and infrastructure that support productive activities and the accumulation of other capitals in a community. In particular, diverse and healthy economics can help maintain services and business, and contribute to self-sufficiency and community prosperity by encouraging linkages to better market signals and more efficient ways of utilizing labor and capital (Flora 2001; Flora 2004). In the organic economy, while most studies emphasize a complex set of reasons for conversion consisting of personal, farm-related, and sometimes institutional factors, the main motivations for organic farming are sometimes connected with financial support and farm management reasons. As the perceived technical difficulties, the uncertainty of organic food markets, and current economic hardship are usually the primary factors which deters producers from adoption, it is argued that financial support through subsidized research, the supply of organic market services, and the establishment of commercial infrastructures would promote organic conversion (Greene and Kremen 2003; Kaufmann et al. 2011; Walz 2004).

Fourth, cultural capital generally determines people’s understanding of the world, their behavior, values, norms, beliefs, what they take for granted, and possible alternatives for social change, representing ethnically specific, and intra-communal notions of change. In the farming community, cultures are constantly being contested and redefined particularly in response to social changes and policy framework (Haggerty, Campbell and Morris 2009; Sutherland and Darnhofer 2012). For the organic sector, financial capital is important to the organic conversion, but, as Sutherland stated (2013), formal conversion usually reflects re-weighting of forms of cultural capital because conversion to organic farming is expected to lead to the modification or adoption of new farming symbols. Since organic movement has been including a spiritual
dimension of concepts about the environmental beliefs, values, attitudes, and norms, conventional and alternative agriculture would represent distinct paradigms which correspond to different worldviews (Abaidoo and Dickinson 2002).

Fifth, political capital reflects access to power to influence certain activities and constrain others, and affects how decisions are made in the community and how outside resources are brought in to achieve goals. For the agricultural production systems, social and political environments have tremendous influence on how they operate. For example, regulations usually have a direct effect on farm economics through federal farm programs; and they can also affect agricultural production through government food and nutritional programs, and price and income support programs which target specific commodities (Halloran and Archer 2008; Hendrickson et al. 2008). As organic agriculture has a history of legislated regulations, policy support consisting of the certification program and legislation within the state might become an important factor contributing to the organic development.

Finally, natural capital refers to those assets that abide in a location including the environment, landscape, natural resources, and amenities, representing the ecological productive base for the growth of other forms of capitals. Natural capital is included in this research in terms of ecological factors. Overall, the community capitals framework suggests that agroecosystems with multiple community benefits are more likely to be sustainable than agroecosystems which enhance only one of the capitals.

The Distribution of Organic Agriculture in the United States

Although the organic sector is still less than one percent of U.S. farmland, certified organic cropland increased from 1.22 million acres in 2000 to 3.09 million acres in 2011. For the total certified organic cropland in 2011, almost half of organic cropland is in the western United
States (28 percent in Pacific states and 21 percent Mountain states). The Corn Belt (including states of Indiana, Illinois, Iowa, Missouri, and Ohio), which is 22 percent of all U.S. cropland, has only 10 percent of certified organic cropland in 2011. In other words, the geographic distribution of cropland by region is considerably different for certified organic agriculture than for the entire United States agriculture.

On the other hand, the differences between commodities grown in the organic sector and the whole agricultural sector might help in understanding the crop diversification of organic agriculture. For example, cropland in produce (vegetable, fruit and tree nuts) accounts for 10% of organic certified acreage in 2011, but accounts for only 7% of all U.S. cropland. These organic fruits and vegetables are highly concentrated on farms in the Pacific region. The top producer of organic fruits and vegetables is California, followed by Washington, Florida, Arizona, and Oregon. Grains (including corn, wheat, oats, barley, sorghum, rice, millet, and rye) and soybeans account for 65% of total U.S. cropland, but only 31% of certified organic acreage. Although organic grains and soybeans produced around 543,000 acres in 2000 have increased over 944,000 acres in 2011, they are grown mostly in the Midwest as the same region for conventional ones. The regional development of organic production is similar to conventional commodities, suggesting that regional comparative advantages for organic crops are in effect (Klonsky and Tourte 1998).

In general, adoption of organic farming is highest for specialty crops. For example, while about one quarter of 1 percent of the U.S. corn and soybean are grown organically in 2011, around 2.5 percent of the dry peas and tomato crops and 4.5 percent of all major fruit crops are certified organic. Among vegetable crops, about 12 percent of lettuce and 14 percent of carrots are grown organically, and a third of the organic vegetable acreage is devoted to “mixed
vegetables”, which is a mixture of numerous vegetables grown on a small farm. In fact, the markets for organic fruits and vegetables have been developing for decades in the U.S. and these crops are grown organically in more states than any other type of commodity (Dimitri and Greene 2002). Still, fresh produce is the top-selling organic category in retail sales (Greene and Ebel 2012).

Although certified organic soybean acreage more than doubled from 82,000 acres in 1997 to 174,000 acres in 2001, organic soybeans in the U.S. has been stagnant since the early 2000s. In 2011, growers in 32 states produced about 132,000 acres of certified organic soybeans. Minnesota is the top producer, followed by Iowa, Michigan, Arkansas, and New York. While conventional farming does better in the wetter Corn Belt, studies indicated that organic farming tends to outperform in the drier areas because of the better drought tolerance of organic crops (Lotter 2003; Welsh 1998). Studies in the Midwest also found organic soybean production was economically superior than conventional systems even without price premiums, due to higher yields in drier areas or periods and lower input costs (Dimitri and Greene 2002; Welsh 1999). However, although organic soybeans are competitive with conventional soybeans, the lack of growth in soybean production is related to many reasons such as economic costs due to a 3-year transition period until the farm is eligible for organic price premiums, fewer organic marketing outlets, heavy managerial requirements, fear of criticism from neighbors, lack of government infrastructure support, subsidies for ethanol that increase demand for conventional supplies, and competition from the Japanese and other fast-growing international export markets (Greene et al. 2009; Greene and Kremen 2003).

More recently, it is widely believed that the debate over genetically modified organisms (GMOs) and the recombinant bovine growth hormone (rBGH) controversy has spurred the
consumer demand for organic dairy products (Buttel 2000; DuPuis 2000). With the growth of demand for organic dairy, organic milk production has expanded rapidly on large operations located in nontraditional areas of the South and West (McBride and Greene 2009; McBride and Greene 2010). In 1997, organic dairy operations are lead by New York, Wisconsin, Minnesota, Pennsylvania, California, and Maine, following a path similar to conventional production (Greene 2000; Lotter 2003; McBride and Greene 2010). In 2005, more than 80% of organic dairies are located in the Northeast and Upper Midwest regions, but these operations are small and less productive than those in the West, which held only 7% of organic dairy farms but contained 31% of organic milk cows (McBride and Greene 2009). California, Wisconsin, New York, and Texas are now the leading organic milk producing states, accounting for shares of 23%, 13%, 11%, and 9% of organic milk cows in 2011.

Previous research has demonstrated that the growth of organic agriculture has not been distributed evenly across the country instead concentrating in certain regions. Employing measures of spatial concentration and association based on data from the 2002 USDA Census of Agriculture, Brown and Eades (2006) found that counties with the largest location quotients for organic production were often located in the western United States, especially California, Washington, and Oregon, the Great Plains states, New England, and Mid-Atlantic States. When these values were adjusted to represent organic agriculture’s percentage of a county’s total agriculture, central cluster counties were most likely to be found in New England. Similar results also found in Taus, Ogneva-Himmelberger and Rogan’s (2013) study in which measures of spatial concentration based on data from the 2007 USDA Census of Agriculture on organic farms showed that the highest rates of conversion were clustered in the western United States, especially California, Washington, Oregon, and also on the East Coast in New England. Other
studies also found statistically significant spatial autocorrelation in certified organic operations
(Marasteanu and Jaenicke 2013), certified organic processors and handlers (Jaenicke et al. 2009),
and organic supply chains (Hooker and Shanahan 2012). Overall, these studies indicated that
some form of clustering is present within the organic industry and some factors exist which make
organic agriculture more apt to grow in certain regions rather than others.

To understand the spatial clustering of organic farming, a growing number of studies
focusing on the role of spatial effects in the adoption process of organic agriculture indicated that
“edge-effect externalities”—spatial externalities whose marginal impact decrease as distance
from the border generating the negative impact increases—have influenced the location and
production patterns of certified organic farms (Lewis, Barham and Robinson 2011; Parker and
Munroe 2004; Parker and Munroe 2007). According to the spatial effects analysis, spatial
dependence of organic agriculture is usually attributed to agglomeration economies associated
with cost reductions when borders are shared with a compatible land use. Besides reduced
production costs, agglomeration economies also stem from better access to skilled labor,
information, and improved service and input suppliers. For the cases of organic agriculture in
Ireland and Honduras, social acceptance and social conformity are also found to play an
important role in the adoption decision of farmers (Lapple and Kelley 2013; Wollni and
Andersson 2014). Generally, as organic production expands, “neighborhood effects” such as
presence of organic farmers in a region have a significant influence on organic conversion (Lohr
and Salomonsson 2000; Taus, Ogneva-Himmelberger and Rogan 2013).

Studies also found that regional differences in organic production could result from the
agricultural geography of the nation of its variable soil conditions, farm structure, ecosystem, and
land values. First, farm size may affect adoption of new technology or activity for various
reasons (Bagi and Reeder 2012). On the one hand, larger farms may benefit from economies of scale, thereby making some activities more profitable than on a smaller farm. On the other hand, farm survival is more likely to be the issue for operators of small farm. If a new activity is necessary for the farm to survive, the farmer may have little choice but to adopt. McCann et al. (1997), Saltiel, Bauder and Palakovitch (1994), and Tavernier and Tolomeo (2004) found that alternative and organic farms tend to be smaller than conventional farms. However, using data from the 2007 Agricultural Resource Management Survey, Bagi and Reeder (2012) did not find any link between farm size and farmer involvement in organic production. Through a geographically weighted regression analysis, Taus, Ogneva-Himmelberger and Rogan (2013) suggested significant variation in the relationship between average farm size and organic adoption rates, indicating that farm size is an important conversion factor but only in some parts of the country.

A farm’s geographic location reflects soil quality, topography, natural amenities, and climate, which in turn can affect the economic viability of farm operations. Since flat land and certain soil types are more conducive to intensive agriculture while steep slopes and hilly terrain are disadvantages to intensification and mechanization, it is believed that farmers in areas with lower potential for intensification are more likely to adopt organic farming (Schmidtner et al. 2012; Wollni and Andersson 2014). Moreover, low-performance farms with low yields have a stronger incentive to switch to organic farming than farms with high returns. For example, empirical studies by Pietola and Lansink (2001) in Finland and Schindtner et al. (2012) in Germany reveal that organic farms are more likely to be located in low-yield regions than in more fertile areas. Through factor analysis describing the topography, climate, soils, farm type, and population characteristics of spatial aggregation of organic farming in England, Gabriel et al.
(2009) also found that organic farming tends to be in marginal areas with a lower agricultural potential. In the U.S., Buck, Getz and Guthman (1997), Duram (2000), Guthman (2000), Saltiel, Bauder and Palakovitch (1994), Vos (2000), and Youngberg and DeMuth (2013) suggested that natural resources, landscape heterogeneity, and regional climates seem to be related to the success of alternative and organic agriculture; and also their regional cropping strategies or adoption of input practices. This current study adds to the work by examining the agro-ecological factors associated with the geography of organic farming in the United States.

Moreover, location also affects farm access to transportation systems, cooperative extension services, and regional development strategies. For example, urban versus rural location can make a difference particularly for farm activities that rely heavily on urban consumers. Through analyzing the spatial concentration of organic production, Eades and Brown (2006) and Hooker and Shanahan (2012) indicated that market access and the locations of organic market sectors including retail outlets, processors, and handlers are strongly influenced the distribution of organic adopters. As consumption of organic food is skewed geographically with heaviest demand in urban areas, some studies found that organic agriculture is associated with urban and metropolitan areas (Brown and Eades 2006; Klonsky 2000), while Bagi and Reeder (2012) found that proximity to urban customers is an advantage only for direct marketing farms.

**Synthesis of Concepts**

In my dissertation, the main theoretical base for understanding the regional differences of organic agriculture is an agroecosystem framework combining Hernandez’s model and Flora and Flora’s model presented in Figure 9. Looking back at Hernandez’s diagram (Figure 7), it is assumed that the ecological, technological, and socioeconomic components are dominant factors influencing local agroecosystems. In an attempt to integrate community dynamics, I refer to
Figure 9. The factors influencing the agroecosystem of organic agriculture

Flora and Flora’s model (Figure 8) of agroecosystems as products of communities mediated by factors conceived as human, social, financial/built, cultural, and political capital to generate a range of socioeconomic indicators. In doing so, these community capitals are conceived as local values, knowledge, innovation, economic well-being, political institutions, and social relations that construct socioeconomic factors influencing the development of organic farming.

In general, I choose the agroecosystem framework presented in Figure 9 to better understand how ecological, technological, and socioeconomic community settings explain the regional variations of organic agriculture for several reasons. First, agroecosystem framework is recognized within the sociology of agriculture, for its emphasis on the role of social systems. When we consider farm systems as agroecosystems, we are looking at the complex set of interactions that is more than a farming activity, but instead is a set of ecological, economic, social, and cultural interactions determining the process that sustains agricultural production (Gliessman 2004). As it is the fact that agroecological principles lie at the center of organic agriculture, the concept of agroecosystem in particular has utility for examining organic farming
issues. In this respect, agroecosystem analysis has both an empirical basis as well as a level of substantive content necessary to synthesize such an effort. Second, agroecosystems analysis provides insights concerning possible multiple causality and feedback mechanisms in the structure of agriculture (Flora 2001; Rickerl and Francis 2004). As mentioned above, this framework allows a number of dimensions central to the understanding of dynamics in agriculture. In this respect, the social effects on organic farming through their influence on resources available to local access and control, and the evolving interdependence between organic agriculture and rural communities are issues can be properly interpreted using agroecosystem analysis. Third, this approach emphasizes the importance of place-based coevolution. Through agricultural production activities, it is believed that communities and agroecosystems are interdependent components that influence one another in a coevolutionary process of change (Klooster 2001). Specifically, as behaviors, decisions, and socioeconomic settings that impact agroecosystems are embedded in communities, community-level measurement becomes valuable. In this respect, agroecosystem analysis involving the interplay between social, economic, and environmental process of the agricultural system would help explain organic production at the community level.

However, the agroecosystem framework still has limitations in explaining the interactions and relationships among the diverse components of the agricultural production system. Although the agroecological perspective provides foundation for linking ecological and socioeconomic aspects of agricultural production in the food systems, as Norgaard (1984) stated, one advantage is that this approach exposes some weakness in ecological thinking where economists and natural scientists might have more clear ideas about natural resources as separable inputs to production processes. For example, issues such as the flow of energy and materials from their
resources through production to the consumer, and nutrient dynamics and cycling are part of the equation (Francis et al. 2003; Gliessman 2004a).
Measuring Organic Agriculture

Conceptually, organic agriculture can be defined in many ways. It is argued that contemporary organic farming is based on a number of approaches, which have blended over time to produce the current school of thought (Bavec and Bavec 2007; Lampkin 1994a). To empirically distinguish between organic and non-organic farms, researchers in previous studies chose either self-definition by the farmers themselves; or chose certification by a particular standards organization (Lampkin 1994b). As Lampkin pointed out (1994b), on the one hand farmers defining themselves as organic may not necessarily meet accepted production standards for organic agriculture; and on the other hand, standards containing requirements and prohibitions may not necessarily meet common objectives of the organic movement. However, since governments have taken a major role in defining organic by creating legal standards, it has been argued that a clear-cut organic distinction may be based legal certification and accreditation systems.

As Rigby and Caceres (2001) stated, the history of legislated regulation makes a discussion of what organic agriculture is relatively easier because producers must comply with published standards. In other words, these defined standards build a foundation on which organic debate can be based on. For the purpose of investigating organic agriculture across the national landscape, I choose to define organic agriculture and organic production as those certified organic agriculture based on U.S. Department of Agriculture criteria. USDA excludes noncertified production for the difficulty in “determining whether or not uncertified producers
are farming organically according to a defined set of production criteria” (Greene and Kremen 2003).

For this research using secondary data conducted by U.S. Department of Agriculture, census respondents were instructed to report certified organic production if they had organic production according to U.S. Department of Agriculture’s National Organic Program (NOP). According to the federal rule finalized in 2002, organic production is “a production system that is managed in accordance with the Act and regulations in this part to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity (National Organic Program 2014b).” The Organic Foods Production Act of 1990, or the Act, established the NOP and its authority to enforce agricultural products sold, labeled, or represented as “organic” within the U.S. The Act prohibits the use of synthetic chemicals in organic production and handling from organic farm land to which any prohibited substances have been applied during the three years immediately preceding the harvest of the agricultural products (USDA 2005).

Data of certified organic agriculture was taken from the 2007 and 2012 Census of Agriculture (NASS, USDA). The Census of Agriculture is recognized as the leading and official source of statistical information regarding United States agricultural production. The Census has been conducted since 1840 and currently is collected once every five years. The 2012 Census of Agriculture is the latest county-level data regarding organic agriculture. According to USDA NASS (2014b), to account for “any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the census year,” NASS develops a Census Mail List (CMT) of agricultural operations that potentially meet the farm definition, collects information from those records, reviews the data, creates computer routines to correct or complete the requested information, and provides census estimates of the characteristics of farms and farm
operators at the national, State, and county levels. It is the only source of uniform and comprehensive agricultural data for every state and county in the U.S. In 2002 Census of Agriculture, it is the first time organic sales data were collected and published. In the 2012 Census of Agriculture, the item of acres used for organic production was deleted. Overall, Census of Agriculture provided a wealth of information on the organic sector, and has allowed policymakers, researchers, farmers, and consumers to better understand the structure of organic farming in the U.S.

The units of analysis are counties in the 48 contiguous states, with Alaska and Hawaii being excluded due to their unique economies and geographies. Broomfield County in Colorado is dropped because of unavailability of natural amenities data. This results in $N=3,069$ counties for analysis. Organic agriculture is measured using organic farms and organic product sales, as a share of total farms and sales, in each county for 2007 and change between 2007 and 2012. I converted these individual values into their corresponding standard scores to remove scale differences. In addition, since cluster analysis is sensitive to outliers and extreme scores, I Winsorized or censored the data by limiting the maximum standardized score at 5 (less than 1% of counties have z-scores greater than 5). Winsorizing seeks reduce non-normal distribution by keeping extreme cases in the data, rather than dropping them.

One issue with the Census of Agriculture is missing organic sales data to avoid disclosing information about individual farms. To better deal with the missing data, I ran a number of different methods, compared the results, then selected the best method to impute missing cells. First, since incomplete sales data accounts for about 30% of cases in both years, usually because the county has organic sales but for only 1 or 2 farms, list-wise deletion would discard a sizable number of cases that may bias the analysis. Second, mean imputation is also less than ideal because substituting missing cells with the mean likely overestimates the true values, and again is likely to bias the analysis. Third, multiple imputation using Bayesian regression for 1000
iterations was also employed to estimate missing cells, but the coefficients of variation were too large (> 0.5) indicating the imputation was not reliable. Finally, my method is to impute the missing sales for organic production according to the share of organic farms. I subtracted the sum of reported county organic sales from the state total to obtain the sum of non-disclosed sales for the state. I then allocated the non-disclosed sales to counties based on their share of organic farms. The advantage is to maintain the true state total which ensures I should not overestimate or underestimate too far from the true values. Moreover, as the missingness depends on observed information and the number of farms is a robust predictor of sales, imputing the missing sales according to their farm ratio is a logical strategy.

**Operationalizing Agroecosystem Framework**

My main theoretical base for understanding the regional differences of organic agriculture is an agroecosystem framework combining Hernandez’s and Flora and Flora’s model presented in Figure 9. Looking back at Hernandez’s diagram (Figure 8), it is assumed that the ecological, technological, and socioeconomic components are dominant factors influencing local agroecosystems. In an attempt to integrate community dynamics, I refer to Flora and Flora’s model (Figure 7) of agroecosystems as products of communities mediated by factors conceived as human, cultural, social, political, and financial/built capital to generate a range of socioeconomic indicators. In doing so, these community capitals are conceived as local values, knowledge, innovation, economic well-being, political institutions, and social relations that construct socioeconomic factors influencing the development of organic farming. In general, through this model in Figure 9 I hypothesize ecological, technological, and socioeconomic factors as a whole aim at introducing organic farming to respond to organic ideology and market pressures.
Data of explanatory variables was taken from the 2012 Census of Agriculture (NASS, USDA), the 2008-2012 American Community Survey (ACS, Census Bureau), the Natural Amenities Scale (ERS, USDA), the Social Capital Index (NE-RCD, Penn State U.), the Organic Pages (Organic Trade Association), and the Farm-to-School Program (NASBE). The ACS provides county-level population and socioeconomic information. ACS data represents average values for each year between 2008 and 2012 rather than point-in-time estimates. The Natural Amenities Scale measures the environmental characteristics of the county and includes climate, topography, and water area. The Social Capital Index measures dimensions of social capital through various proxy indicators, including density of associations, voter participation, census form response rates, and density of non-profit organizations (Rupasingha, Goetz and Freshwater 2006). The Organic Pages provides the name and address of organic support enterprises in OTA-defined categories including association, manufacturer, broker, distributer, and retailer. The National Association of State Boards of Education provides state school health policy database which enables examination of the state policy of the farm-to-school program.
In practice, most concepts can be measured as indicators of the agroecosystem context using existing secondary data in the ecological, technological and socioeconomic areas. First, ecological factors used to explain organic farming include temperature, sunlight, humidity, water area, and topography. Second, technological factors contain machinery, equipment, and production expenses including fertilizer, lime, soil conditioners, chemicals, gasoline, fuels, and oils. However, as Gliessman (2007) argued, social parameters of agroecosystem function remain difficult to identify and measure. Through community capitals framework, Flora and Flora suggest that general indicators around the community capitals would be useful and parsimonious. These socioeconomic indicators include (1) age, education, and labor force participation that generally reflect knowledge, skills, and abilities of local people defined as community human capital; (2) poverty, income inequality, occupational categories, farm types, and organic service enterprises that generally reflect diverse and healthy economies defined as community financial and built capital; (3) an aggregated index whose components include density of associations and non-profit organizations, voter turnout, and response rate to government survey that generally reflect strengthened relationships, innovation, and communication defined as community social capital; (4) minority population, migration experience, and female operator that generally reflect values, norms, beliefs, and possible alternatives for social change defined as community cultural capital; (5) state-level policy and state organic certifying agents that generally reflect power to encourage certain activities and constrain others and to determine access to resources defined as community political capital. In general, by looking at each organic farm as an agroecosystem itself, we look far beyond an agricultural production for the ways they are organized within the context of a broad socioeconomic system, the ways how community respond to the change and work together.


**Statistical Procedures**

To achieve the first objective of the study, hierarchical agglomerative cluster analysis is used to identify and describe the classification of organic agriculture at the county-level.

Agglomerative cluster analysis is a multivariate statistical procedure that starts with data containing information about a sample of entities and attempts to reorganize them into relatively homogenous groups, primarily to create classifications and typologies (Everitt et al. 2011). In this analysis, squared Euclidean distance is used to measure distances between clusters and counties based on standard scores of the percent organic farms and percent organic sales for 2007 and its change from 2012. The formula for squared Euclidean distance is based on the Minkowski generalized distance metric and is given in equation 1, where $d_{ij}$ is the distance between counties $i$ and $j$, $x_{ik}$ is the value of the $k^{th}$ standard score of organic agriculture measurement for the $i^{th}$ county, and $x_{jk}$ is the value of the $k^{th}$ standard score for the $j^{th}$ county (Everitt et al. 2011). Clusters and counties are joined together using Ward’s minimum variance method, which seeks to minimize the within-cluster sum of squares by merging two clusters from the previous generation, $E$, until all counties are grouped into one cluster. The formula for Ward’s method is presented in equation 2, where $\bar{x}_{m,k}$ is the mean of the $m^{th}$ cluster for the $k^{th}$ standard score; and $x_{ml,k}$ is the score on the $k^{th}$ standardized value ($k=1…p$) for the $l^{th}$ county ($l=1…n_m$) in the $m^{th}$ cluster ($m=1…g$) (Everitt et al. 2011). As the Ward’s method is sensitive to outliers, I Winsorized standard scores larger than five in order to maintain high organic counties but to alleviate the effects of skewness due to extreme outliers.

$$d_{ij} = \left( \sum_{k=1}^{p} |x_{ik} - x_{jk}|^2 \right)^{1/2}$$  \hspace{1cm} (1)
\[ E = \sum_{m=1}^{g} \left( \sum_{i=1}^{n_m} \sum_{k=1}^{p} \left( x_{m,k} - \bar{x}_{m,k} \right)^2 \right), \text{ where } \bar{x}_{m,k} = \left( \frac{1}{n_m} \right) \sum_{i=1}^{n_m} x_{m,k} \]  

(2)

To achieve the second objective of the study, multinomial logistic regression is used to statistically identify the ecological, technological, and socioeconomic factors affecting the organic agriculture clusters. This technique is appropriate for analyzing nominal-level dependent variables with no implicit ordering; and runs a series of logit models comparing membership in one category of the dependent variable versus a reference category (Verbeek 2008). Maximum likelihood using Fisher scoring is employed to estimate logits (change in the logistic distribution function) and odds-ratios (percent change in the odds), which measures the effect predictors have on a county being in one cluster over another. The multinomial logistic model is presented in equation 3, where the log odds \( \pi \) for a given county \( i \) is the probability \( P \) of being in the analysis cluster \( j \) of the dependent variable \( y \) over the reference cluster \( r \), given the predictive model \( Z \). For each analysis cluster of the dependent variable, the technique produces a set of logit estimates \( b \) for each socioeconomic predictor \( x \) in the model (Verbeek 2008).

Spatial dependence is controlled using a lagged spatial autocorrelation parameter \( \rho \) that is weighted by its nearest neighbors \( w \) and applied to the analysis cluster \( y \).

\[ \pi_{ijr} = \ln \left( \frac{P_{ijr} = E(y_{ijr} = 1|Z_{ijr})}{P_{ir} = E(y_{ir} = 1|Z_{ir})} \right) = b_{ij} + b_{ij} x_{ij} + \cdots + b_{ij} x_{ji} + \rho \cdot w_{ij} \]  

(3)

The multinomial dependent variable consists of the organic agriculture clusters identified in the hierarchical agglomerative cluster analysis. Natural amenity predictors include winter amenities (warmer January temperature and more January sunlight), summer amenities (cooler July temperature and lower July humidity), and landscape amenities (greater water area and greater topographic variation). Technological predictor is on-farm production expenses including market value of machinery and equipment, and input purchases of fertilizer, lime, soil
conditioners, chemicals, gasoline, fuels, and oils. Farm type predictors include size of farm, net income per farm, farms with women operators, farms selling directly to individuals for human consumption, farms selling to Community Supported Agriculture (CSA) arrangements, farms by legal status, and tenure pattern. Farm size and net income are larger numbers, so they are normalized to z-scores to make the odds-ratios interpretable.

Demographic predictors include population density per 100 people square mile, whether the county is in a metropolitan area or adjacent to one, minority population that is non-white or Hispanic, populations age 17 and younger and 65 and older, migration into the county from elsewhere over the past five years, and high school degree non-completers and college graduates for the population aged 25 years or more. Socioeconomic predictors include population below the poverty line, Gini coefficient of income inequality, labor force participation, and employment in various occupational groups for the population 16 years and older by place of residence. Occupational categories are normalized to z-scores to make the odds-ratios interpretable.

Organic service enterprises include organic associations, manufacturers, distributors, retailers, and brokers. The social capital is measured by an aggregated index whose components include density of associations, voter turnout, response rate to government survey, and density of non-profit organizations (Rupasingha, Goetz and Freshwater 2006).

To correct for spatial dependence in the multinomial logistic model, spatial lags are calculated using k=4 nearest neighbor weights. Spatial lags prevent the dependent variable from being affected by neighboring values, which may cause the residual to be spatially correlated. Although a number of different weights can be employed, this analysis follows the advice of Chi and Zhu (2008) who find that using k-nearest neighbor weights avoids creating too few (rural) or too many (urban) neighbors, and is unaffected by geographic “islands” due to missing data. The
reason I choose the 4-nearest neighbor weights because it provides the highest spatial
autocorrelation along with a high level of statistical significance. Assumptions of the
multinomial logistic model are met except high correlations ($|r| > 0.7$) between predictor
variables poverty rate and labor force participation, indicating moderate multicollinearity. A few
outlying cases may be marginally predicted by the logistic regression solution.

The third objective is to assess the presence of organic spatial clusters and to identify
local pocket of spatial concentration. A local indicator of spatial association (LISA) using Getis-
Ord $G_i^*$ statistic is to test whether counties with either high or low organic intensity values
identified in the hierarchical agglomerative cluster analysis cluster spatially. The $G_i^*$ statistic
shown in equation 4 is a distance-based statistic used to test whether a particular county $i$ and its
surrounding counties have higher than average values on organic intensity ($x$), where $x=1$-5 are
categories of low, growing farms, growing sales, moderate, and high intensity of organic
agriculture. In the equation, $s$ is the standard deviation of the $x$ values, and $w_{ij}(d)$ is equal to 1 if
county $j$ is within a distance of $d$ from county $i$, and 0 otherwise.

$$G_i^* = \frac{\sum_j w_{ij}(d)x_j - W_i^* \bar{x}}{s \left\{ n S_i^* - W_i^* \bar{x}^2 \right\}^{1/2}}, \text{ where } W_i^* = \sum_j w_{ij}(d) \text{ and } S_i^* = \sum_j w_{ij}^2 \tag{4}$$

For statistically significant ($p<0.01$) $G_i^*$, the larger the score is, the more intense the spatial
clustering of high organic (hot spot); the smaller the score is, the more intense the spatial
clustering of low organic (cold spot). This results in $N=1,831$ counties of statistically significant
hot (cold) spots of organic agriculture. A logistic regression is then used to predict membership
in organic spatial clusters based on ecological, technological, and socioeconomic factors. The
binomial dependent variable consists of the organic hot (cold) spot clusters identified in the $G_i^*$
statistic. The predictors are the same as those mentioned above except net income per farm, high
school degree non-completers, labor force participation, and employment in production and transportation occupations, to avoid multicollinearity in the logistic model.

Fourth, to investigate whether regulatory mechanism helps or hinders the development of organic agriculture, multinomial logistic regression is also used to predict membership in the organic clusters based on state-level policy variables. One predictor is whether the county in that state has state organic program or state certifying agent. There is currently one state organic program in California and there are 16 state certifying agents in Colorado, Idaho, Iowa, Kentucky, Maryland, Montana, Nevada, New Hampshire, New Jersey, New Mexico, Oklahoma, Oregon, Rhode Island, Texas, Utah, and Washington. The other state-level variable is state farm-to-school policy. The key question is to know whether state certification and political influences through community support improve the marketing of organic commodities.

The final objective is to examine the “conventionalization” thesis and the process of “bifurcation.” Conventionalization refers to the process by which organic agriculture increasingly abandons many of the ecologically-oriented practices, takes on the characteristics of mainstream industrial agriculture, and thus marginalizes smaller organic producers. The key variables used in examining the conventionalization thesis include technology employment, capital intensity, marketing channel, ownership structure, and tenure pattern. As a result of conventionalization, the organic sector tends to precipitate a process of bifurcation. To examine the bifurcation process, the key question is to know whether the organic market consists of a dual-structure of larger, industrial operations and smaller, movement-oriented producers.

To better present the link between theoretical concepts and their indicators, the summary is presented below in Table 1.
Table 1. Summary of theoretical concepts and indicators

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Indicators</th>
<th>Source of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological factors</td>
<td>Winter amenities (Jan. temperature &amp; Jan. Sunlight)</td>
<td>ERS, USDA</td>
</tr>
<tr>
<td></td>
<td>Summer amenities (July temperature &amp; July sunlight)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Landscape amenities (water area &amp; topography)</td>
<td></td>
</tr>
<tr>
<td>Technological factors</td>
<td>Machinery, equipment &amp; production expenses (market value of machinery and</td>
<td>NASS, USDA</td>
</tr>
<tr>
<td></td>
<td>equipment, and input purchases of fertilizer, lime, soil conditions,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>chemicals, gasoline, fuels, and oils)</td>
<td></td>
</tr>
<tr>
<td>Socioeconomic factors:</td>
<td>Populations density, Age 17&amp; younger and age 65&amp; older, No high school</td>
<td>ACS, Census Bureau</td>
</tr>
<tr>
<td></td>
<td>degree, College degree or higher, Labor force participation</td>
<td></td>
</tr>
<tr>
<td>Social capital</td>
<td>Social Capital Index</td>
<td>NE-RCD, Penn State University</td>
</tr>
<tr>
<td>Financial/Built capital</td>
<td>Farm size, Net income per farm, Farms selling to individuals, Farms selling</td>
<td>NASS, USDA;</td>
</tr>
<tr>
<td></td>
<td>to CSAs, Corporate farms, Tenant operators; Poverty rate, Gini coefficient,</td>
<td>ACS, Census Bureau; OTA</td>
</tr>
<tr>
<td></td>
<td>Professional Occupations, Service Occupations, Natural Resources &amp; Trade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Occupations; Organic service enterprises</td>
<td></td>
</tr>
<tr>
<td>Cultural capital</td>
<td>Women operators; Minority population, Migration 5 years ago</td>
<td>NASS, USDA; ACS, Census Bureau</td>
</tr>
<tr>
<td>Political capital</td>
<td>State organic certifying agents; State farm-to-school program</td>
<td>NOP; NASBE</td>
</tr>
</tbody>
</table>
CHAPTER 4

RESULTS

Identifying Organic Agriculture Clusters

The first objective seeks to identify and describe clusters of organic agriculture across socioeconomic and geographic space. Results of the cluster analysis indicate the $N=3,069$ counties can be clustered into five groups based on standard scores of the percent organic farms and percent organic sales in 2007 and its change from 2012, accounting for 62 percent ($R^2=0.622$) of the original variance in the data. This is deemed an adequate solution since it approximates an optimal solution for five groups ($E(R^2)=0.659$). Based on the information presented in Table 2, the results indicate the presence of five clusters based on loss of information diagnostics. The distance statistics show a loss of information (indicated by jumps) at stage 4, and taking the previous stage indicates five clusters. Breaks in Mojena value at stage 3 and 6 indicate a four or seven cluster solution. Relatively high values of pseudo $F$ indicate the presence of eight, five, or four clusters. To validate the solution, cluster analysis is run using average linkage method and it generally produces similar cluster groupings. All the assumptions of cluster analysis are met, except some moderate outliers are included in the data.

Means of the organic agriculture indicators across the five organic clusters is presented in Table 3. First, the **High Intensity** cluster consists of 97 counties (3.16% of total) that have very high rates organic farms and sales in 2007, being 3.4 and 2.2 standard deviations above average, respectively. However, the **High Intensity** cluster saw slower growth in organic farms between 2007 and 2012. In other words, counties in the **High Intensity** cluster have a large yet declining concentration of organic farms, and a high concentration of organic sales. Second, the 387
Table 2. Hierarchical agglomerative cluster analysis of organic agriculture for \(N=3,069\) counties in the United States, 2007-2012

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Distance</th>
<th>Slope</th>
<th>(R^2)</th>
<th>((E) R^2)</th>
<th>((p) F)</th>
<th>((p) t^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>0.007</td>
<td>0.263</td>
<td>0.877</td>
<td>0.805</td>
<td>1551.79</td>
<td>116.871</td>
</tr>
<tr>
<td>14</td>
<td>0.014</td>
<td>0.963</td>
<td>0.863</td>
<td>0.798</td>
<td>1482.77</td>
<td>1332.99</td>
</tr>
<tr>
<td>13</td>
<td>0.014</td>
<td>0.021</td>
<td>0.849</td>
<td>0.790</td>
<td>1435.84</td>
<td>153.674</td>
</tr>
<tr>
<td>12</td>
<td>0.014</td>
<td>0.030</td>
<td>0.835</td>
<td>0.781</td>
<td>1407.40</td>
<td>72.800</td>
</tr>
<tr>
<td>11</td>
<td>0.015</td>
<td>0.079</td>
<td>0.820</td>
<td>0.771</td>
<td>1390.46</td>
<td>526.086</td>
</tr>
<tr>
<td>10</td>
<td>0.018</td>
<td>0.167</td>
<td>0.802</td>
<td>0.760</td>
<td>1374.72</td>
<td>342.993</td>
</tr>
<tr>
<td>9</td>
<td>0.019</td>
<td>0.086</td>
<td>0.782</td>
<td>0.747</td>
<td>1374.32</td>
<td>159.111</td>
</tr>
<tr>
<td>8</td>
<td>0.021</td>
<td>0.063</td>
<td>0.762</td>
<td>0.731</td>
<td>1396.67</td>
<td>283.911</td>
</tr>
<tr>
<td>7</td>
<td>0.036</td>
<td>0.742</td>
<td>0.725</td>
<td>0.712</td>
<td>1348.65</td>
<td>82.566</td>
</tr>
<tr>
<td>6</td>
<td>0.045</td>
<td>0.247</td>
<td>0.680</td>
<td>0.689</td>
<td>1304.62</td>
<td>54.415</td>
</tr>
<tr>
<td>5</td>
<td>0.059</td>
<td>0.305</td>
<td>0.622</td>
<td>0.659</td>
<td>1259.08</td>
<td>1603.57</td>
</tr>
<tr>
<td>4</td>
<td>0.069</td>
<td>0.178</td>
<td>0.553</td>
<td>0.618</td>
<td>1261.74</td>
<td>1075.91</td>
</tr>
<tr>
<td>3</td>
<td>0.107</td>
<td>0.540</td>
<td>0.446</td>
<td>0.552</td>
<td>1234.42</td>
<td>1026.24</td>
</tr>
<tr>
<td>2</td>
<td>0.154</td>
<td>0.441</td>
<td>0.293</td>
<td>0.391</td>
<td>1268.21</td>
<td>1059.42</td>
</tr>
<tr>
<td>1</td>
<td>0.293</td>
<td>0.906</td>
<td>0.000</td>
<td>0.000</td>
<td>-</td>
<td>1268.21</td>
</tr>
</tbody>
</table>

Table 3. Intensity of organic agriculture by clusters for \(N=3,069\) counties in the United States, 2007-2012

<table>
<thead>
<tr>
<th>Intensity of Organic Agriculture</th>
<th>(A) Low Intensity</th>
<th>(B) Growing Farms</th>
<th>(C) Growing Sales</th>
<th>(D) Moderate Intensity</th>
<th>(E) High Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Counties</td>
<td>2402</td>
<td>161</td>
<td>22</td>
<td>387</td>
<td>97</td>
</tr>
<tr>
<td>Organic Agriculture Measure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farms 07(z-score)</td>
<td>-0.292(^{CDE})</td>
<td>-0.325(^{CDE})</td>
<td>0.034(^{ABDE})</td>
<td>0.967(^{ABCE})</td>
<td>3.383(^{ABCD})</td>
</tr>
<tr>
<td>Sales 07(z-score)</td>
<td>-0.174(^{DE})</td>
<td>-0.146(^{DE})</td>
<td>-0.214(^{DE})</td>
<td>0.363(^{ABCE})</td>
<td>2.231(^{ABCD})</td>
</tr>
<tr>
<td>(\Delta)Farms 07-12(z-score)</td>
<td>-0.070(^{BDE})</td>
<td>2.346(^{ACDE})</td>
<td>0.063(^{BE})</td>
<td>-0.242(^{ABE})</td>
<td>-0.821(^{ABCD})</td>
</tr>
<tr>
<td>(\Delta)Sales 07-12(z-score)</td>
<td>-0.060(^{BCE})</td>
<td>0.032(^{ACDE})</td>
<td>4.269(^{ABDE})</td>
<td>-0.075(^{BC})</td>
<td>-0.140(^{ABC})</td>
</tr>
</tbody>
</table>

NOTE: Scheffe’s test indicates significant differences at \(p<0.05\) between groups.

counties (12.6% of total) in the *Moderate Intensity* cluster are 1.0 and 0.4 standard deviations above average in terms of organic agriculture in 2007, with little change in farms or sales over
the five year period. By contrast, the majority of counties in the U.S. fall in the Low Intensity cluster where organic agriculture is largely absent, accounting for 2402 or 78.3% of all counties. Notably, the Growing Farms cluster includes 161 counties (5.25% of total) that have low rates of organic measures in 2007, but saw organic farms grow 2.3 standard deviations faster than the national rate between 2007 and 2012. The Growing Sales cluster consists of only 22 counties (0.72% of total) that have low rates in organic sales for 2007, but saw extreme growth in sales around 4.3 standard deviations above average. The distinct Growing Farms and Growing Sales clusters suggest that a small number of counties are rapidly expanding their organic agriculture sector.

From the preceding discussion it is clear that high organic agriculture is clustered in a small number of counties, while most other areas of the United States have relatively low and average rates. Figure 10 maps the location of the organic agriculture clusters derived from the cluster analysis. Moran’s I indicates a high degree of positive spatial correlation between the organic agriculture clusters (I=0.485), meaning that high (low) organic places tend to be located near other high (low) organic places.

In terms of geography, counties in the High Intensity and Moderate Intensity cluster are primarily located along both coats of the U.S. First, organic agriculture is concentrated in major metropolitan areas of New England, and in smaller metro areas running from Maine south to Pennsylvania. Second, organic production is also concentrated in metropolitan areas along the Pacific Coast of California, Washington, and Oregon. Moving into the interior of the nation, organic is also found in rural areas having desirable natural amenities such as the Northern Great Lakes (Minnesota, Wisconsin, and Michigan), along California-Nevada border, around the Rocky Mountains (Idaho, Utah, and Colorado), and in Arizona and New Mexico. Notable is the
relative absence of organic agriculture in the southern states. These results showed a certain degree of spatial clustering activity in organic agriculture. By contrast, counties in the Growing Farms cluster tend to be located in rural or smaller metro areas of the Midwest (Nebraska, Iowa, Missouri, and Ohio), the South Atlantic (Georgia, North Carolina, Florida, and Tennessee), and the Northern Great Plains (North Dakota and Montana). The presence of Growing Farms and Growing Sales counties in the Midwest and the South provides evidence that organic agriculture has expanded rapidly in place dominated by conventional agriculture.

**Describing Organic Agriculture Clusters**

Besides their spatial distribution, high organic agriculture clusters also have different ecological, technology employment, and socioeconomic characteristics that set them apart from lower intensity clusters. Mean differences across clusters are presented in Tables 4 through 9. In
Table 4. Natural amenity characteristics by organic agriculture clusters for \( N = 3,069 \) counties in the United States

<table>
<thead>
<tr>
<th>Standard Scores</th>
<th>(A) Low Intensity</th>
<th>(B) Growing Farms</th>
<th>(C) Growing Sales</th>
<th>(D) Moderate Intensity</th>
<th>(E) High Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warmer Jan. temperature</td>
<td>0.068(^{DE})</td>
<td>-0.122</td>
<td>0.402(^{DE})</td>
<td>-0.292(^{AC})</td>
<td>-0.402(^{AC})</td>
</tr>
<tr>
<td>More Jan. sunlight</td>
<td>0.070(^{D})</td>
<td>-0.038(^{D})</td>
<td>-0.091</td>
<td>-0.355(^{A})</td>
<td>-0.166</td>
</tr>
<tr>
<td>Cooler Jul. temperature</td>
<td>-0.173(^{CDE})</td>
<td>-0.044(^{DE})</td>
<td>0.585(^{AE})</td>
<td>0.712(^{ABE})</td>
<td>1.377(^{ABCE})</td>
</tr>
<tr>
<td>Lower Jul. humidity</td>
<td>-0.038(^{D})</td>
<td>0.005</td>
<td>0.220</td>
<td>0.187(^{A})</td>
<td>0.187</td>
</tr>
<tr>
<td>Greater water area</td>
<td>-0.023(^{DE})</td>
<td>-0.065(^{DE})</td>
<td>0.466</td>
<td>0.370(^{AB})</td>
<td>0.689(^{AB})</td>
</tr>
<tr>
<td>Topographic variation</td>
<td>2.343(^{DE})</td>
<td>2.248(^{DE})</td>
<td>2.682</td>
<td>3.150(^{AB})</td>
<td>3.691(^{AB})</td>
</tr>
</tbody>
</table>

NOTES: Scheffe’s test indicates significant differences at \( p<0.05 \) between clusters.
Topography 1= Plains; 2=Tablelands; 3=Plains with Hills or Mountains; 4=Open Hills and Mountains; 5=Hills and Mountains

Table 5. Technology employment by organic agriculture clusters for \( N = 3,069 \) counties in the United States

<table>
<thead>
<tr>
<th>$1000/Farm (unless otherwise noted)</th>
<th>(A) Low Intensity</th>
<th>(B) Growing Farms</th>
<th>(C) Growing Sales</th>
<th>(D) Moderate Intensity</th>
<th>(E) High Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of machinery &amp; equipment</td>
<td>127.612(^{DE})</td>
<td>146.409(^{CDE})</td>
<td>75.206(^{B})</td>
<td>96.713(^{AB})</td>
<td>89.890(^{AB})</td>
</tr>
<tr>
<td>Trucks &amp; tractors (number)</td>
<td>3.664(^{BE})</td>
<td>3.933(^{ACDE})</td>
<td>3.090(^{B})</td>
<td>3.521(^{B})</td>
<td>3.329(^{AB})</td>
</tr>
<tr>
<td>Fertilizer, lime &amp; soil conditioners</td>
<td>15.338(^{BD})</td>
<td>20.249(^{ADE})</td>
<td>7.294</td>
<td>9.669(^{AB})</td>
<td>10.493(^{B})</td>
</tr>
<tr>
<td>Chemicals</td>
<td>8.974(^{D})</td>
<td>11.542(^{D})</td>
<td>3.638</td>
<td>6.227(^{AB})</td>
<td>7.969</td>
</tr>
<tr>
<td>Gasoline, fuels &amp; oils</td>
<td>8.804</td>
<td>10.852(^{D})</td>
<td>5.065</td>
<td>7.655(^{B})</td>
<td>8.422</td>
</tr>
</tbody>
</table>

NOTES: Scheffe’s test indicates significant differences at \( p<0.05 \) between clusters.

terms of natural amenities, \textit{High Intensity} places tend to have colder and darker winters, cooler summers, and are more likely to have sizable bodies of water. The topography is also more varied, with hills and mountains interspersed with plains, compared to mostly tablelands found in lower organic places. This confirms the research that regional differences of organic agriculture
are associated with landscape heterogeneity and natural amenities (Gabriel et al. 2009; Guthman 2000).

In terms of technology employment, organic intensive counties tend to spend less money on purchasing on-farm machinery and equipment compared to low organic places. They also tend to use fewer trucks, pickups, and tractors; and spend fewer production expenses on fertilizer, lime and soil conditioners. Compared to low organic cluster, *Moderate Intensity* places tend to employ fewer chemicals and consume less gasoline, fuels and oils. This suggests that organic intensive places are less dependent on technology for agricultural production. Notable is the *Growing Farms* cluster is likely to have more technology employment.

In terms of farm type and operator characteristics, while the average age of principle operator is not significantly different among organic clusters, counties in the *High Intensity* cluster tend to have more farms with women operators, farms selling directly to individuals, and farms selling directly to community supported agriculture (CSA) organizations. Organic intensive places also tend to hire more farm labors, indicating they more frequently use labor-intensive practices. However, most farms in organic intensive places are less likely to be family operations, and instead are more likely to have corporative or partnership operations. Perhaps as a result, organic intensive places have much higher farm valuations compared to low organic places.

Although organic intensive places have higher farm valuations, they didn’t tend to specialize in high profit crops. By contrast, operations in the *Moderate Intensity* cluster tend to market lower value of agricultural products and, perhaps as a result, obtain lower net cash farm income compared to low organic places. Operators in the *High Intensity* cluster are more likely to be full owners or tenants. Further, the results show that more intensive organic production is
Table 6. Farm type and operator characteristics by organic agriculture clusters for N=3,067 counties in the United States

<table>
<thead>
<tr>
<th>Percent of Base (unless otherwise noted)</th>
<th>Intensity of Organic Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(A) Low Intensity</td>
</tr>
<tr>
<td>Farm size (acres)</td>
<td>664.402^D</td>
</tr>
<tr>
<td>Value of land &amp; buildings per acre ($1000)</td>
<td>3.877^E</td>
</tr>
<tr>
<td>Value of agricultural products per farm ($1000)</td>
<td>200.944</td>
</tr>
<tr>
<td>Net income per farm ($1000)</td>
<td>48.828^D</td>
</tr>
<tr>
<td>Hired farm labor (number)</td>
<td>1.029^BDE</td>
</tr>
<tr>
<td>Women operators</td>
<td>29.061^CDE</td>
</tr>
<tr>
<td>Age of principle operator (years)</td>
<td>59</td>
</tr>
<tr>
<td>Farms selling to individuals</td>
<td>5.440^CDE</td>
</tr>
<tr>
<td>Farms selling to CSAs</td>
<td>0.472^DE</td>
</tr>
<tr>
<td>Farms legal status: Family/individual</td>
<td>85.939^DE</td>
</tr>
<tr>
<td>Partnership</td>
<td>6.864^DE</td>
</tr>
<tr>
<td>Corporation</td>
<td>5.422^DE</td>
</tr>
<tr>
<td>Other</td>
<td>1.774^DE</td>
</tr>
<tr>
<td>Tenure: Full owner</td>
<td>66.340^DE</td>
</tr>
</tbody>
</table>

NOTES: Scheffe’s test indicates significant differences at p<0.05 between clusters. Other farms include legal status for cooperative, estate or trust, institutional, etc.

linked to larger farm sizes, as the average number of acres farmed in high intensity counties is nearly double that found in moderate counties. This somewhat refutes the agrarianist vision of organic movement for which organic farming is often portrayed as small-scale and family-operated farms, suggesting a symbiotic relationship between large and small organic farms.

In terms of community demographics, Moderate Intensity cluster tends to have larger populations that are located in or are adjacent to metropolitan areas, compared to lower intensity clusters. Organic intensive counties tend to have fewer younger people and are better educated,
Table 7. Demographic characteristics by organic agriculture clusters for N= 3,069 counties in the United States

<table>
<thead>
<tr>
<th>Percent of Base (unless otherwise noted)</th>
<th>(A) Low Intensity</th>
<th>(B) Growing Farms</th>
<th>(C) Growing Sales</th>
<th>(D) Moderate Intensity</th>
<th>(E) High Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (number) † 71,095D</td>
<td>61,864D</td>
<td>165,958</td>
<td>275,950ABE</td>
<td>136,570D</td>
<td></td>
</tr>
<tr>
<td>Population density (sq.mi) † 205</td>
<td>122</td>
<td>214</td>
<td>345</td>
<td>523</td>
<td></td>
</tr>
<tr>
<td>Metropolitan † 31.724D</td>
<td>31.677D</td>
<td>45.455</td>
<td>51.163AB</td>
<td>36.082</td>
<td></td>
</tr>
<tr>
<td>Metro adjacency † 66.528D</td>
<td>67.702D</td>
<td>90.909</td>
<td>81.137AB</td>
<td>65.979</td>
<td></td>
</tr>
<tr>
<td>Age 17 &amp; younger 23.500DE</td>
<td>23.634DE</td>
<td>22.768</td>
<td>22.505ABE</td>
<td>21.288ABD</td>
<td></td>
</tr>
<tr>
<td>Families with kids 40.860</td>
<td>40.710</td>
<td>39.364</td>
<td>40.944</td>
<td>40.788</td>
<td></td>
</tr>
<tr>
<td>Migration 5 years ago 32.195</td>
<td>34.426</td>
<td>33.615</td>
<td>32.489</td>
<td>32.313</td>
<td></td>
</tr>
<tr>
<td>College degree or higher 5.178D</td>
<td>5.141D</td>
<td>5.760</td>
<td>6.528AB</td>
<td>6.188</td>
<td></td>
</tr>
</tbody>
</table>

NOTES: Scheffe’s test indicates significant differences at \( p<0.05 \) between clusters. Least squares means reported holding constant population, except when denoted by †

with fewer high school non-completers and more college graduates. In terms of socioeconomic differences, High Intensity and Moderate Intensity organic clusters generally have higher median incomes, lower poverty, and more participation in the labor force. For example, comparing the High and Low intensity clusters we find large differences in median incomes ($51,696 versus $44,310), poverty rates (14.58% versus 16.73%), and labor force participation (46.52% versus 43.34%), but there are no differences in income inequality. More intensive organic agriculture places tend to have fewer people employed in natural resource and trade occupations, while lower intensive place have more of these jobs. Rather, most people in organic places are employed in higher skilled professional occupations or in lower skilled services ones. This
Table 8. Socioeconomic characteristics by organic agriculture clusters for N= 3,069 counties in the United States

<table>
<thead>
<tr>
<th>Percent of Base (unless otherwise noted)</th>
<th>(A) Low Intensity</th>
<th>(B) Growing Farms</th>
<th>(C) Growing Sales</th>
<th>(D) Moderate Intensity</th>
<th>(E) High Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median HH income ($1000)</td>
<td>44.310&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>44.749&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>45.317</td>
<td>50.210&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>51.696&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>Poverty</td>
<td>16.732&lt;sup&gt;D&lt;/sup&gt;</td>
<td>15.895</td>
<td>15.001</td>
<td>14.452&lt;sup&gt;A&lt;/sup&gt;</td>
<td>14.580</td>
</tr>
<tr>
<td>Gini coefficient(G)</td>
<td>0.436&lt;sup&gt;D&lt;/sup&gt;</td>
<td>0.429</td>
<td>0.429</td>
<td>0.429&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.441</td>
</tr>
<tr>
<td>Labor force participation</td>
<td>43.344&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>43.426&lt;sup&gt;E&lt;/sup&gt;</td>
<td>43.421</td>
<td>44.760&lt;sup&gt;A&lt;/sup&gt;</td>
<td>46.524&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>Professional Occps.</td>
<td>29.920&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>29.933&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>30.750</td>
<td>32.630&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>34.317&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>Service Occps.</td>
<td>17.934&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>17.565&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>18.864</td>
<td>18.665&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>19.113&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>Sales &amp; Office Occps.</td>
<td>22.571</td>
<td>22.275</td>
<td>23.828</td>
<td>22.805</td>
<td>22.697</td>
</tr>
<tr>
<td>Natural Resources &amp; Trades Occps.</td>
<td>13.309&lt;sup&gt;D&lt;/sup&gt;</td>
<td>13.508&lt;sup&gt;D&lt;/sup&gt;</td>
<td>12.332</td>
<td>12.166&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>13.114</td>
</tr>
<tr>
<td>Production &amp; Transportation Occps.</td>
<td>16.266&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>16.718&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>14.227</td>
<td>13.734&lt;sup&gt;ABE&lt;/sup&gt;</td>
<td>10.759&lt;sup&gt;ABD&lt;/sup&gt;</td>
</tr>
<tr>
<td>Social capital index</td>
<td>-0.023</td>
<td>0.078</td>
<td>-0.394</td>
<td>-0.026</td>
<td>0.353</td>
</tr>
</tbody>
</table>

NOTES: Scheffe’s test indicates significant differences at p<0.05 between clusters. Least squares means reported holding constant population.

Table 9. Organic support enterprises by organic agriculture clusters for N= 3,069 counties in the United States

<table>
<thead>
<tr>
<th>Number of Services</th>
<th>(A) Low Intensity</th>
<th>(B) Growing Farms</th>
<th>(C) Growing Sales</th>
<th>(D) Moderate Intensity</th>
<th>(E) High Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Association</td>
<td>0.004&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>0.006&lt;sup&gt;E&lt;/sup&gt;</td>
<td>0.000</td>
<td>0.018&lt;sup&gt;A&lt;/sup&gt;</td>
<td>0.041&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>0.040&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>0.025&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>0.227</td>
<td>0.313&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>0.402&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>Distributer</td>
<td>0.009&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>0.012&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>0.000</td>
<td>0.098&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>0.103&lt;sup&gt;AB&lt;/sup&gt;</td>
</tr>
<tr>
<td>Retailer</td>
<td>0.005&lt;sup&gt;DE&lt;/sup&gt;</td>
<td>0.000&lt;sup&gt;D&lt;/sup&gt;</td>
<td>0.045</td>
<td>0.072&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>0.062&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>Broker</td>
<td>0.005&lt;sup&gt;D&lt;/sup&gt;</td>
<td>0.000&lt;sup&gt;D&lt;/sup&gt;</td>
<td>0.000</td>
<td>0.039&lt;sup&gt;AB&lt;/sup&gt;</td>
<td>0.041</td>
</tr>
</tbody>
</table>

NOTES: Scheffe’s test indicates significant differences at p<0.05 between clusters.
suggests that organic intensive communities are less dependent on agriculture for employment, but are more dependent on the services economy.

In terms of organic service enterprises, findings clearly show that organic intensive places tend to have more organic associations which aim to support and promote organic industry through research, certification, education, and advocacy. Organic intensive places also have more organic manufacturers, organic distributors, organic retailers, and organic brokers. This suggests that marketing channel and market access would influence the adoption of organic production, especially when organic operations tend to have more difficulty locating the manufacturers, processors, and distributors necessary for their specialized agricultural products. Consequently, this implies that the effects of spatial clustering are more notable for the organic sector than for the conventional production industry. On the one hand, spatial clustering of organic agriculture is usually attributed to agglomeration economies associated with accessing organic knowledge and information, skilled workers, input suppliers, and marketing outlets as the literature suggested (Marasteanu and Jaenicke 2013; Schmidtner et al. 2012). On the other hand, organic market expansion in part depends upon and is influenced by the non-farm industrial promotion, probably associated with the services economy.

**Predicting Organic Agriculture Clusters**

The second objective seeks to statistically identify the ecological, technological, and socioeconomic factors associated with the organic agriculture. Multinomial logistic models used to predict membership in organic agriculture clusters versus membership in the *Low Intensity* cluster are presented in Table 10. This model shows a strong association between predicted and observed cluster membership ($pR^2_{\text{Max}} = 0.506$). Moreover, we fail to reject the null hypothesis of good fit ($\chi^2_{\text{Deviance}} = 3079.614, p=1.0$), indicating the model discriminates well among organic
agriculture clusters. Classification accuracies are high for the Growing Farms cluster (96.9%) and the Growing Sales cluster (86.4%) but relatively low classification accuracies for the High Intensity cluster (47.4%). In short, this model exhibits moderate to strong fit to the data. In addition, spatial lags indicate that a county’s odds of being in the organic intensive clusters are increased if it is adjacent to other organic intensive clusters, providing further evidence that organic agriculture is spatially dependent.

There are several environmental and socioeconomic factors that exert an impact on classifying counties between clusters. First, more desirable winter amenities (warmer and sunnier in January) decrease the odds of being in the Moderate Intensity and Growing Farms clusters by 26.5 and 26.8 percent, respectively. By contrast, more desirable summer amenities (cooler and less humid in July) increase the odds of being in the Moderate Intensity and Growing Sales clusters by 32.4 and 150 percent, respectively. More desirable landscape amenities (more varied topography and water) increases the odds of being in the High Intensity cluster by 93.9 percent. In short, organic agriculture tends to be located in area with harsher winters and milder summers, dominated by rolling hills and water. Natural amenities did make a strong impact on categorizing counties engaged in intensive organic agriculture production. Since flat land are more conducive to intensive agriculture while steep slopes and hilly mountain is a disadvantage to mechanization, it is assumed that farmers of lower potential for intensification are more likely to adopt organic farming (Schmidtner et al. 2012; Wollni and Andersson 2014).

Despite organic agriculture reduces reliance on external inputs, results show that technology employment has little effects on organic agriculture, indicating both low and high organic places adopt machinery, equipment, and production inputs such as fertilizer, lime, soil conditioners, chemicals, gasoline, fuels, and oils. In terms of farm type factors, membership in
Table 10. Multinomial logistic regressions of organic agriculture clusters on natural amenity, technological, and socioeconomic covariates

<table>
<thead>
<tr>
<th>Intensity of Organic Agriculture</th>
<th>Growing Farms $\exp(b)$</th>
<th>Growing Sales $\exp(b)$</th>
<th>Moderate Intensity $\exp(b)$</th>
<th>High Intensity $\exp(b)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept ($b$)</td>
<td>0.004*</td>
<td>0.000*</td>
<td>0.000***</td>
<td>0.000***</td>
</tr>
<tr>
<td>Winter amenities</td>
<td>0.732*</td>
<td>1.843</td>
<td>0.735*</td>
<td>1.115</td>
</tr>
<tr>
<td>Summer amenities</td>
<td>1.047</td>
<td>2.548*</td>
<td>1.324†</td>
<td>1.499</td>
</tr>
<tr>
<td>Landscape amenities</td>
<td>0.854</td>
<td>1.205</td>
<td>1.040</td>
<td>1.939†</td>
</tr>
<tr>
<td>Machinery, equipment &amp; production expenses</td>
<td>1.001</td>
<td>0.996</td>
<td>1.000</td>
<td>1.003</td>
</tr>
<tr>
<td>Farm size ($z$)</td>
<td>1.114</td>
<td>0.133</td>
<td>0.774</td>
<td>1.085</td>
</tr>
<tr>
<td>Net income per farm ($z$)</td>
<td>1.085</td>
<td>1.321</td>
<td>1.130</td>
<td>0.913</td>
</tr>
<tr>
<td>Women operators</td>
<td>1.004</td>
<td>1.024</td>
<td>1.057**</td>
<td>1.128***</td>
</tr>
<tr>
<td>Farms selling to individuals</td>
<td>1.064**</td>
<td>1.127*</td>
<td>1.112***</td>
<td>1.170***</td>
</tr>
<tr>
<td>Farms selling to CSAs</td>
<td>0.976</td>
<td>1.208</td>
<td>1.557***</td>
<td>2.306***</td>
</tr>
<tr>
<td>Corporate farms</td>
<td>1.067**</td>
<td>0.969</td>
<td>0.989</td>
<td>1.002</td>
</tr>
<tr>
<td>Tenant operators</td>
<td>0.950*</td>
<td>0.912</td>
<td>0.986</td>
<td>1.015</td>
</tr>
<tr>
<td>Population density ($100$ population /sq.mi)</td>
<td>0.981</td>
<td>0.977</td>
<td>0.971*</td>
<td>0.962†</td>
</tr>
<tr>
<td>Minority population</td>
<td>1.004</td>
<td>0.992</td>
<td>1.014*</td>
<td>1.019</td>
</tr>
<tr>
<td>Age 17 &amp; younger and age 65 &amp; older</td>
<td>1.096**</td>
<td>1.244*</td>
<td>1.121***</td>
<td>1.062</td>
</tr>
<tr>
<td>Migration 5 years ago</td>
<td>1.018**</td>
<td>1.005</td>
<td>0.990</td>
<td>0.999</td>
</tr>
<tr>
<td>No high school degree</td>
<td>1.066**</td>
<td>1.061</td>
<td>1.032</td>
<td>1.011</td>
</tr>
<tr>
<td>College degree or higher</td>
<td>1.064†</td>
<td>1.144</td>
<td>1.170***</td>
<td>1.055</td>
</tr>
<tr>
<td>Poverty rate</td>
<td>0.961</td>
<td>0.962</td>
<td>0.962</td>
<td>1.137**</td>
</tr>
<tr>
<td>Gini coefficient</td>
<td>0.670</td>
<td>0.551</td>
<td>0.678</td>
<td>0.870</td>
</tr>
<tr>
<td>Labor force participation</td>
<td>0.973</td>
<td>1.118</td>
<td>1.040</td>
<td>1.145**</td>
</tr>
<tr>
<td>Professional Occps. ($z$)</td>
<td>0.925</td>
<td>0.903</td>
<td>1.102</td>
<td>1.342</td>
</tr>
<tr>
<td>Service Occps. ($z$)</td>
<td>0.808*</td>
<td>1.389</td>
<td>1.320**</td>
<td>1.218</td>
</tr>
<tr>
<td>Natural Resources &amp; Trades Occps. ($z$)</td>
<td>0.850</td>
<td>0.830</td>
<td>1.085</td>
<td>2.101***</td>
</tr>
<tr>
<td>Organic service enterprises</td>
<td>0.783</td>
<td>1.186</td>
<td>1.215*</td>
<td>1.094</td>
</tr>
<tr>
<td>Social capital ($S$)</td>
<td>1.070</td>
<td>0.879</td>
<td>1.052</td>
<td>1.368**</td>
</tr>
<tr>
<td>State organic certifying agents</td>
<td>0.844</td>
<td>1.488</td>
<td>1.043</td>
<td>0.870</td>
</tr>
<tr>
<td>State farm-to-school program</td>
<td>0.866</td>
<td>1.309</td>
<td>1.380*</td>
<td>1.503</td>
</tr>
<tr>
<td>Spatial lag ($p$)</td>
<td>1.100</td>
<td>1.008</td>
<td>2.445***</td>
<td>4.384***</td>
</tr>
</tbody>
</table>

Model Fit

| Percent Correct Classification | 96.89 | 86.36 | 46.51 | 47.42 |
(Table 10 continued)

<table>
<thead>
<tr>
<th>Information Criteria</th>
<th>-2LL Cov 3079.614</th>
<th>$\chi^2_{Null}$ 1535.922***</th>
<th>$\chi^2_{Pearson}$ 11989.930</th>
<th>Moran’s I 0.485***</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\chi^2_{Distance}$ 3079.614</td>
<td>$pR^2_{Max}$ 0.506</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Odds-ratios exp(b) significant at † $p<0.1$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Spatial lag uses k=4 nearest neighbor weights.

both moderate and high intensity clusters is increased by having more women farmers (5.7 and 12.8%), more direct sales to consumers (11.2 and 17.0%), and more sales to CSAs (55.7 and 130.6%). Notable is farms selling directly to individuals for human consumption from roadside stands, farmers’ markets, pick-your-own sites, etc. has had substantial effects on the development of organic agriculture in both farms and sales. The Growing Farms cluster tends to have more corporate farms (6.7% odds increase) and fewer tenant operations (5.0% odds decrease), but ownership structure and tenure pattern does not affect the two intensive organic clusters.

Demographically, population densities have marginal effects on organic agriculture, indicating that both low and high organic agriculture places include urbanized areas. Greater ethnic diversity is also marginally linked to organic agriculture, increases odds by 1.4 percent for moderate intensity places. Although high school non-completers have little effects on high organic places, Moderate intensity places tend to have more college graduates, increasing the odds of membership by 17.0 percent. Notable is the relatively more at-risk populations are associated with Growing Farms cluster, such as youth, elders, new migrants, and high school non-completers. This suggests that the growing farms organic counties might share different demographic and socioeconomic settings with early and existing organic counties.

Socioeconomically, the link between economic well-being and organic agriculture is mixed, with moderate organic agriculture associated with lower poverty, yet high organic
agriculture is associated with high deprivation (13.7% odds increase). High intensity places have better labor force participation rates (14.5% odds increase) than low intensity ones, yet no association is found for moderate organic places. In terms of employment, the results indicate a strong associate between lower skilled services occupations and moderate organic farming (32.0%); and between natural resources and trades occupations and high organic farming (110.1%). Moderate intensity places tend to have more organic service enterprises including organic associations, manufacturers, distributors, retailers, and brokers, increasing the odds of membership by 21.5 percent. A strong positive associate between social capital and high intensity places is also found (36.8%). The results support a growing belief that social capital promotes socially collective action and community well-being, which in turn influences economic growth and development of communities (Rupasingha, Goetz and Freshwater 2006).

**Spatial Dependence of Organic Agriculture Clusters**

The third objective is to assess the presence of organic spatial clusters and to identify local pocket of spatial concentration. A local indicator of spatial association (LISA) using Getis-Ord Gi* statistic is useful to detect geographic clusters of organic agriculture based on organic intensity identified in the hierarchical agglomerative cluster analysis. Through cluster analysis, a county identified as high intensity is interesting, but may not be a statistically significant organic hot spot. To be a significant organic hot spot, a county will have a high value and be surrounded by other counties with high values as well. Therefore, one advantage of these local statistics is to determine whether a particular region is relatively homogeneous, allowing the identification of hot (cold) spots (Anselin 1995).
Figure 11. Local $G^*$ statistics of organic intensity for $N=3,069$ counties in the United States, 2007-2012

Figure 12. Spatial clusters of organic agriculture using local $G^*$ statistics ($p<0.01$) for $N=3,069$ counties in the United States, 2007-2012
Figure 11 presents results of the local $G_i^*$ statistic and Figure 12 maps the location of organic spatial clusters, where statistically significant ($p<0.01$) high values indicate organic hot spots and statistically significant ($p<0.01$) low values indicate organic cold spots. First, organic hot spots consist of 267 counties (8.70% of total) are located in the New England, along the Pacific Coast, around the Northern Great Lakes, and in the Mountain West in states such as Idaho, Arizona, and Colorado-Utah-New Mexico border. By contrast, organic cold spots consist of 1,564 counties (51% of total) are primarily located in the Midwest and the South. The local statistics are also useful in uncovering isolated hot spots of increased organic incidence. These isolated hot spots can be found in the South Atlantic (Virginia, North Carolina, and Florida), the Midwest (Iowa and Ohio), and in Kansas and Texas, which confirmed evidence that organic agriculture has expanded in place dominated by conventional farming.

To analyze the ecological, technological, and socioeconomic factors associated with the organic spatial pattern, a binomial logistic regression model used to predict membership in the organic hot spot versus membership in the organic cold spot is presented in Table 11. This model shows a strong association between predicted and observed spatial cluster membership ($pR^2_{\text{Max}} = 0.717$). Moreover, we fail to reject the null hypothesis of good fit ($\chi^2_{\text{Deviance}} = 572.034$, $p = 1.0$), indicating the model discriminates well among organic spatial clusters. Classification accuracies are high for the cold spot cluster (98.4%) but relatively lower accuracies for the hot spot cluster (72.3%). In short, this model exhibits strong fit to the data.

First, in terms of ecological factors, more desirable summer amenities (cooler and less humid in July) increase the odds of being organic hot spots by more than 250 percent. More desirable landscape amenities (more varied topography and water) increase the odds of membership by 69.1 percent. In short, organic hot spots tend to be located in area with milder
Table 11. Logistic regression of organic spatial clusters on natural amenity, technological, and socioeconomic covariate

<table>
<thead>
<tr>
<th>Spatial Clusters of Organic Agriculture</th>
<th>Membership Odds versus Organic Cold Spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>exp(b)</td>
<td></td>
</tr>
<tr>
<td>Intercept (b)</td>
<td>0.000**</td>
</tr>
<tr>
<td>Winter amenities</td>
<td>0.901</td>
</tr>
<tr>
<td>Summer amenities</td>
<td>3.840***</td>
</tr>
<tr>
<td>Landscape amenities</td>
<td>1.691*</td>
</tr>
<tr>
<td>Machinery, equipment &amp; production inputs</td>
<td>1.005***</td>
</tr>
<tr>
<td>Farm size (z)</td>
<td>0.974</td>
</tr>
<tr>
<td>Value of land &amp; building per acre (z)</td>
<td>1.283*</td>
</tr>
<tr>
<td>Women operators</td>
<td>1.090***</td>
</tr>
<tr>
<td>Farms selling to individuals</td>
<td>1.271***</td>
</tr>
<tr>
<td>Farms selling to CSAs</td>
<td>1.981***</td>
</tr>
<tr>
<td>Corporate farms</td>
<td>0.951†</td>
</tr>
<tr>
<td>Tenant farming</td>
<td>0.989</td>
</tr>
<tr>
<td>Population density (100 population/sq.mi)</td>
<td>0.950***</td>
</tr>
<tr>
<td>Minority population</td>
<td>1.021*</td>
</tr>
<tr>
<td>Age 17 &amp; younger and age 65 &amp; older</td>
<td>1.143**</td>
</tr>
<tr>
<td>Migration 5 years ago</td>
<td>0.975*</td>
</tr>
<tr>
<td>College degree or higher</td>
<td>1.160***</td>
</tr>
<tr>
<td>Poverty rate</td>
<td>0.945†</td>
</tr>
<tr>
<td>Gini coefficient</td>
<td>0.501</td>
</tr>
<tr>
<td>Professional Occps. (z)</td>
<td>1.214</td>
</tr>
<tr>
<td>Service Occps. (z)</td>
<td>1.466*</td>
</tr>
<tr>
<td>Natural Resources &amp; Trades Occps. (z)</td>
<td>0.864</td>
</tr>
<tr>
<td>Organic service enterprises</td>
<td>1.239†</td>
</tr>
<tr>
<td>Social capital</td>
<td>1.169</td>
</tr>
<tr>
<td>State organic certifying agents</td>
<td>1.179</td>
</tr>
<tr>
<td>State farm-to-school program</td>
<td>3.794***</td>
</tr>
<tr>
<td>Model Fit</td>
<td></td>
</tr>
<tr>
<td>Percent Correct Classification</td>
<td>72.28</td>
</tr>
<tr>
<td>Information Criteria</td>
<td></td>
</tr>
<tr>
<td>$-2\text{LL}_{\text{Cov}}$</td>
<td>572.034</td>
</tr>
<tr>
<td>$\chi^2_{\text{Deviance}}$</td>
<td>572.034</td>
</tr>
<tr>
<td>$\chi^2_{\text{Null}}$</td>
<td>948.820***</td>
</tr>
<tr>
<td>$\chi^2_{\text{Pearson}}$</td>
<td>1826.303</td>
</tr>
<tr>
<td>$p_{\text{R}^2_{\text{Max}}}$</td>
<td>0.717</td>
</tr>
<tr>
<td>NOTE: Odds-ratios exp(b) significant at †p&lt;0.1, *p&lt;0.05, **p&lt;0.01, ***p&lt;0.001.</td>
<td></td>
</tr>
</tbody>
</table>
summers and dominated by rolling hills and water. Natural amenities not only made a strong impact on categorizing counties engaged in intensive organic agriculture production, they did influence the spatial clustering activities for organic farming.

In terms of technology employment, machinery, equipment, and production inputs have little effects on organic hot spots (0.5% odds increase). In terms of farm type factors, greater farm valuations increase the odds of being organic hot spots by 28.3 percent. This supports the literature suggesting that high land values did affect what can be grown profitably, pushing organic growers to match the commercial agriculture development for that region (Brown and Eades 2006; Guthman 2004a). In research of organic operation in California, Guthman (2004a) pointed out that there is a degree of path dependence brought to organic farming, in which land values take signals from technological innovation to consumer demand to regional land use development, and create a single index of expectations. As a result, economic pressure on high-value farmland has had effects on the necessity of growing high-value crops such as organic products to gain price premium. In short, regional farm valuations then have constrained what can be grown, how fast, how much, and by what methods.

Besides, organic hot spots are less likely to have corporate operations. Moreover, membership in organic hot spots is increased by having more women operators (8.6%), farms selling directly to consumers (26.6%), and farms selling to community supported agriculture (CSA) arrangements (100.1%). This implies organic producers and agricultural direct marketers are likely to be involved together in a regional community, increasing the local concentration of organic production as a hot spot. These diverse farm operations not only made substantial effects on the development of organic agriculture, they did strengthen the spatial clustering activities for organic farming. This perhaps supports the idea that farming community with institutional
supports of social networks and infrastructure would improve organic practices (Kroma 2006; Milestad et al. 2010). For example, greater access to technical support and marketing information might increase the feasibility and decrease the perceived risk of organic conversion. Since local food networks are assumed to have high levels of social embeddedness and relations of regard, these dense farming networks tend to establish regional norms for organic production.

In terms of community demographic, organic hot spots tend to have lower population density and fewer new immigrants, decreasing odds by 3.6 percent and 2.4 percent, respectively. They also tend to have high dependency ratio (13.9% odds increase), meaning organic hot spots have larger shares of youth and elders. Moreover, greater ethnic diversity and more college graduates are also linked to organic hot spots, increase odds by 1.9 percent 15.6 percent, respectively. Socioeconomically, organic hot spots are associated with lower poverty (-5.6% odds reduction). In terms of employment, a strong positive associate between services occupations and organic hot spots is also found (48.5% odds increase). Organic hot spots tend to have more organic service enterprises including organic association, organic manufacturers, organic distributors, organic retailers, and organic brokers. This provides evidence that organic spatial clustering depends on and is influenced by the non-farm industrial promotion associated with the services economy. While state organic program and state certifying agents have little effects on organic hot spots, state farm-to-school policy encouraging school food services to purchase locally grown foods did strongly promote regional development of organic production. In general, organic hot spots did share different social contexts with organic cold spots, implying these factors have made organic ideals be easier in some regions than in others.
The fourth objective is to investigate whether state-level policy helps or hinder the development of organic agriculture. According to the federal rule, organic farmers and processors must be certified by a state or private agency accredited under national standards. Specifically, state organic program and state certifying agent responsible for enforcement of the federal regulation play a critical role in serving their state’s organic certification; and assist with the marketing of organic commodities (National Organic Program 2014b). There is currently one state organic program in California, and 16 USDA-accredited state certifying agents (typically Departments of Agriculture) providing organic certification services to operations within their states. These state certifying agencies and their corresponding information are listed in Table12.

First, California operates a State Organic Program, which allows this state to mandate additional requirements than the National Organic Program due to specific environmental conditions or the necessity of production and handling practices in that State (National Organic Program 2014b). California State Organic Program is responsible for enforcement of the federal Organic Foods Production Act of 1990 (the Act), and the California Organic Products Act of 2003. Looking back to the legislative history of organic production in California, the California Certified Organic Farmers formed in 1973 was one of the nation’s first organizations certifying organic farms. California was the first state to pass the Organic Food Act that provided a legal definition of “organic” in 1979. However, through examining the California code of regulation, the effects of California Organic Foods Act (COFA) was highly controversial because the state stood by the natural/synthetic criterion, promoting effective fertilizing materials essential for the production of food and fiber, for example (Guthman 2004a; California State Organic Program 2014). From the political economic perspectives, it is argued that the COFA’s purpose is not to
<table>
<thead>
<tr>
<th>State Organic Program</th>
<th>Date of Authorized</th>
<th>Organic Registration Fee</th>
<th>Organic Intensity Low/Moderate/High (% counties)</th>
</tr>
</thead>
<tbody>
<tr>
<td>California (CDFA)</td>
<td>n.a.</td>
<td>Registration fee is a percentage of gross organic sales</td>
<td>13.8/56.9/24.1</td>
</tr>
<tr>
<td>State Certifying Agent</td>
<td>Date of Authorized</td>
<td>Organic Certification Fee</td>
<td>Organic Intensity Low/Moderate/High (% of counties)</td>
</tr>
<tr>
<td>Colorado (CDA)</td>
<td>October 16, 2002</td>
<td>First application fee $400. Base fee is based on farm size, minimum $400. Additional categories are each $200. Inspection fee is $34 per hour, and mileage rate is $0.25/mile.</td>
<td>65.1/19.0/12.7</td>
</tr>
<tr>
<td>Idaho (ISDA)</td>
<td>April 29, 2002</td>
<td>Application fee is based on annual gross organic sales, minimum $125. Inspection fee is based on the inspector’s time and travel at a rate of $35.00 per hour and $0.555 per mile.</td>
<td>40.9/27.3/9.1</td>
</tr>
<tr>
<td>Iowa (IDALS)</td>
<td>April 29, 2012</td>
<td>Application fee $100. Inspection fee $275. Certification fees are based on the types and quantities of crops, minimum $150.</td>
<td>85.9/6.1/0</td>
</tr>
<tr>
<td>Kentucky (KDA)</td>
<td>January 13, 2006</td>
<td>Base (first) application fee $250 Additional categories are each $125</td>
<td>96.7/0/0</td>
</tr>
<tr>
<td>Maryland (MDA)</td>
<td>April 29, 2002</td>
<td>Application fee $500.</td>
<td>69.6/30.4/0</td>
</tr>
<tr>
<td>Montana (MTDA)</td>
<td>April 29, 2002</td>
<td>First application fee $150. Base fee is based on annual gross organic sales, minimum $165. Assessment fee is 1% of gross sales of organic products. Inspection fees are billed at cost of service, plus 10% administrative fee.</td>
<td>73.2/14.3/0</td>
</tr>
<tr>
<td>Nevada (NVDA)</td>
<td>--</td>
<td>First application fee $150. Certification fees are based on estimated gross organic sales, minimum $150. Inspection fee is $65 per hour, and mileage rate is $.55/mile.</td>
<td>70.6/11.8/11.8</td>
</tr>
<tr>
<td>New Hampshire (NHDAMF)</td>
<td>April 29, 2002</td>
<td>Certification fee $100. Inspection fee is a minimum $50 and increases incrementally with actual production area.</td>
<td>0/70.0/30.0</td>
</tr>
<tr>
<td>New Jersey (NJDA)</td>
<td>April 12, 2007</td>
<td>Base (first) application fees are based on gross organic sales, minimum $285. Additional organic production area is each $40 if site is within ten miles of the main operation. If additional sites are greater than ten miles, $25 per hour driving time will be added to the additional site fee.</td>
<td>38.1/57.1/4.8</td>
</tr>
<tr>
<td>New Mexico (NMDA)</td>
<td>April 29, 2002</td>
<td>First application fee $250. Assessment fee is three-fourths of one percent of the first million dollars of gross organic sales, plus seventy-five one thousandths of one percent of the gross organic sales over one million dollars.</td>
<td>63.6/33.3/3.0</td>
</tr>
<tr>
<td>Oklahoma (ODAFF)</td>
<td>December 6, 2002</td>
<td>Certification fees are based on farm size, minimum $200.</td>
<td>100/0/0</td>
</tr>
</tbody>
</table>
(Table 12 continued)

<table>
<thead>
<tr>
<th>State</th>
<th>Certification Agency</th>
<th>Date</th>
<th>Fee Details</th>
<th>NOP Approved Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oregon (ODA)</td>
<td>August 10, 2009</td>
<td>First application fee $250. Certification fee is $92 per hour including review, inspection, and travel time.</td>
<td>36.1/50.0/8.3</td>
<td></td>
</tr>
<tr>
<td>Rhode Island (RIDEM)</td>
<td>October 22, 2002</td>
<td>Certification fee $200.</td>
<td>40.0/40.0/20.0</td>
<td></td>
</tr>
<tr>
<td>Texas (TDA)</td>
<td>April 29, 2012</td>
<td>Application fee $55. Certification fees are based on acreage in crop-production, non crop-production, and greenhouse.</td>
<td>87.4/5.5/1.2</td>
<td></td>
</tr>
<tr>
<td>Utah (UDAF)</td>
<td>April 29, 2007</td>
<td>Certification fees are based on gross organic sales, minimum $100.</td>
<td>86.2/6.9/6.9</td>
<td></td>
</tr>
<tr>
<td>Washington (WSDA)</td>
<td>April 29, 2012</td>
<td>First application fee $470. Renewing certification is based on annual gross organic sales, minimum $200.</td>
<td>20.5/53.8/17.9</td>
<td></td>
</tr>
</tbody>
</table>

Note: -- NOP accreditation documents indicate that the Renewal Assessment of the NVDA resulted in four noncompliances, and the NOP issued a Notice of Noncompliance to NVDA on March 1, 2012.

...improve standards but enforcement; and the main purpose of the NOP approved program is to assume the responsibility of enforcing the Act which requires a substantial financial commitment, and promotes excessive organic growth (Bloom and Duram 2007; Guthman 2004a).

For state certifying agents, their general requirements for organic certification follow the USDA National Organic Program Final Rule. For example, for crop farms, in simplified terms the NOP regulations require: (i) 3 years with no application of prohibited materials prior to harvest of the first certified organic crop; (ii) implementation of an Organic System Plan, with proactive fertility systems; conservation measures; environmentally sound manure, weed, disease, and pest management practices; and soil building crop rotation systems; (iii) use of natural inputs and/or approved synthetic substances on the National List; (iv) no use of prohibited substances, genetically engineered organisms (GMOs), sewage sludge or irradiation; (v) use of organic seeds, when commercially available; (vi) use of organic seedlings for annual crops; (vii) restrictions on use of raw manure and compost; (viii) maintenance of buffer zones,
depending on risk of contamination; (ix) no residues of prohibited substances exceeding 5% of the EPA tolerance (Riddle and McEvoy 2006).

According to the regulation, studies have argued that the 3-year transition period is a large economic cost and often hinders farmers from converting to organic methods (Bloom and Duram 2007; Greene et al. 2009). The high cost of certification might also create barrier for organic conversion especially for small scale producers. The certification process, usually takes within three months of applying, includes a few steps: producers submit application and fees, certifying agents review application materials, conduct an on-site inspection, review inspection report and supporting documents, and decision of certification is made. To renew certification, producers need to provide annual update and fees to certifying agent. Overall, through examining the state certification policy, it confirms the literature suggesting that government support of organic farming in the United States has mostly been limited to creating a legislative standard and regulations for certification (Bloom and Duram 2007; Youngberg and DeMuth 2013).

Despite the state certifying agents are geared toward providing assistance to the marketing of organic commodities, however, results show little support that state certifying agents promote the growth of organic farming. The presence of state certifying agent increases the odds being in Moderate Intensity cluster but decreases the membership in High Intensity cluster; and both effects are not significant. The possible explanation is that these USDA NOP accredited state certifying agents began to serve the state’s organic community at different times; and thus might exert different influence. For example, the Idaho State Department of Agriculture is one of the nation’s first accredited certifying agencies, which has been providing certification services since 2002. One might expect that the ISDA is likely to certify more operations compared to later accredited state certifying agents; and assist more consumers in locating
organic products, producers, and handlers in that state. As a result, state of Idaho is more likely
to have higher organic production.

Recently, the USDA and some states started programs toward promoting financial and
technical support for organic growers. For example, the 2008 Farm Act increased mandatory
funds for the Organic Certification Cost-Share Program, providing reimbursements of up to 75
percent of annual certification costs, up to a maximum of $750 per year per category of
certification, for organic producers in the 12 Northeast states (CT, DE, ME, MD, MA, NH, NJ,
NY, PA, RI, VT, WV) plus Hawaii, Nevada, Utah, and Wyoming are eligible to participate
(National Organic Program 2014a). The state government financial support for organic
conversion is expected to help farmers defray certification costs, and boost more recent organic
conversion.

On the other hand, state-level marketing support through requiring public schools to
serve locally grown foods finds membership in Moderate Intensity cluster is increased by having
state farm-to-school policy (38.0% odds increase). Organic hot spots are also strongly associated
with state farm-to-school program, increasing odds by nearly 300 percent. The state farm-to-
school program in 27 states (AK, AL, CA, CO, CT, DE, FL, GA, IA, IL, MA, MD, ME, MI, MS,
NM, NY, OK, OR, PA, SC, TN, TX, VA, VT, WA, WI) became effective between 2002 and
2013. New York was the first state requires its Department of Agriculture and Markets to
establish, in cooperation with the commissioner of education, a farm-to-school program to
facilitate and promote the purchase of New York farm products by schools, universities and
other educational institutions (NASBE 2014).

In general, the connection between school meals policy and organic farming provides
evidence that organic producers are closely associated with community involvement, market
access, and local food networks. Overall, state-level policy did influence the development of organic farming. While government support of organic agriculture has mostly limited to organic certification, the findings clearly show that organic producers might need more regionally specific information and assistance through the market.

**Conventionalization and Bifurcation of Organic Agriculture Clusters**

The fifth objective is to examine the “conventionalization” thesis and the process of “bifurcation” between larger, industrial-scale operations and smaller, movement-oriented organic producers across the national landscape. Despite many studies in different regional contexts have been showing concerns about a conventional mold of organic agriculture, the results show mixed support to the conventionalization thesis which argues that organic agriculture increasingly takes on the characteristics of industrial agriculture; and then marginalize smaller organic producers.

In terms of scale and farm type characteristics, this study seems to find a symbiotic relationship between large and small farms. While *Moderate Intensity* and *Growing Sales* clusters might have smaller acreages, high intensity organic production is more likely to have larger farm sizes. *Moderate Intensity* and *Growing Sales* clusters tend to employ less technology including agricultural chemicals, and they are more likely to have family operations. By contrast, more intensive organic production is linked to higher farm valuations selling higher values of agricultural products; and they also tend to have corporative operations and tenant operators. In general, the *High Intensity* cluster exhibits signs of conventionalization because they tend to be large-scale and capital intensive. However, the results didn’t indicate the marginalization of smaller organic growers. By contrast, the clusters of *Moderate Intensity* and *Growing Sales* are showing more traditional and movement-oriented organic farming. Moreover, organic producers across these clusters are strongly associated with direct marketing and community support which
represents deep notions of sustainability. Overall, the conventionalization of the organic sector across the national landscape is still constrained.

To better examine the bifurcation process between the “Big Organic” (large scale, industrial, and capital intensive) and the “Little Organic” (small scale, traditional, and sustainable,) organic scales are measured using organic size and organic sales, which are average acres and average sales per farm, in each county for 2007. I converted these two indicators into their corresponding standard scores and sum these together to measure the scale of organics. The Big Organic consists 437 counties (14.2% of total) that have larger farm size and higher sales, being more than 0.5 standard deviations above average. The Little Organic consists of 1171 counties (38.3%) that have smaller farm size and lower organic sales, being less than -0.5 standard deviations below average. Mean differences of technology employment and farm type characteristics across organic scales are presented in Table 13.

The findings clearly show that Big Organic counties tend to spend more money on purchasing on-farm machinery and equipment, and use more production inputs such as fertilizer, chemicals, and gasoline, fuels, and oils. This suggests that compared to Little Organic, Big Organic is more likely to show industrial mold of agriculture because they are more dependent on technology for agricultural production. Further, larger scale organic production is linked to higher capital intensity, as the average net farm income in Big Organic counties is more than double that found in small scale organic farming, and Big Organic counties are also more labor intensive. Most farms in Big Organic places are more likely to have corporative or partnership operations. They are less likely to be full owners, and instead are more likely to be tenant operator. In other words, Big Organic and Little Organic farms tend to share different ownership structure and tenure patterns.
Table 13. Technology and farm type characteristics by organic scales for \(N=2,114\)† counties in the United States

<table>
<thead>
<tr>
<th>Percent of Base (unless otherwise noted)</th>
<th>Scale of Organic Agriculture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Little Organic</td>
</tr>
<tr>
<td>Value of machinery &amp; equipment ($1000/farm)</td>
<td>96.185 MB</td>
</tr>
<tr>
<td>Fertilizer, lime &amp; soil conditioners ($1000/farm)</td>
<td>10.543 MB</td>
</tr>
<tr>
<td>Chemicals ($1000/farm)</td>
<td>5.556 MB</td>
</tr>
<tr>
<td>Gasoline, fuels &amp; oils ($1000/farm)</td>
<td>5.800 MB</td>
</tr>
<tr>
<td>Net income per farm ($1000)</td>
<td>30.676 MB</td>
</tr>
<tr>
<td>Hired farm labor (number)</td>
<td>1.097 MB</td>
</tr>
<tr>
<td>Farms selling to individuals</td>
<td>8.863 B</td>
</tr>
<tr>
<td>Farms selling to CSAs</td>
<td>0.749 B</td>
</tr>
<tr>
<td>Farms legal status: Family/individual</td>
<td>86.855 MB</td>
</tr>
<tr>
<td>Corporation</td>
<td>5.268 MB</td>
</tr>
<tr>
<td>Other</td>
<td>1.675 MB</td>
</tr>
<tr>
<td>Tenure: Full owner</td>
<td>70.337 MB</td>
</tr>
<tr>
<td>Part owner</td>
<td>23.579 MB</td>
</tr>
<tr>
<td>Tenant</td>
<td>6.084 MB</td>
</tr>
</tbody>
</table>

NOTES: † 955 counties (31.1% of total) are dropped without organic farms. Scheffe’s test indicates significant differences at \(p<0.05\) between clusters. Other farms include legal status for cooperative, estate or trust, institutional, etc.

However, despite Big Organic counties have fewer farms selling directly to individuals and farm selling to community supported agriculture (CSA) arrangements, we do find that organic production in Moderate Organic and Little Organic places tends to adopt direct marketing and community support practices. Again, this provides evidence that Big Organic has taken on the characteristics of industrial agriculture; however, this didn’t marginalize smaller organic producers. In particular, small- and middle-sized organic production tends to stay true to the traditional, sustainable, and movement-oriented organic; and they might still play an
important role in the organic economy. Overall, the results find mixed support to the bifurcation thesis arguing that organic production in the U.S. increasingly adopts a dual-structure of smaller, traditional producers and larger, capital intensive operations. Since the 2007 Census of Agriculture is the latest county-level data accounting for organic acres nationally, more empirical analysis of updated data would further our understanding in this discussion.
Organic agriculture has its roots in a critical attitude towards the capitalist development of farming practices and constitutes an ecological production system that fosters resource cycling, promotes environmental awareness, and encourages rural economy viability and social vitality. In particular, organic agriculture movement has been driven by both organic producers and consumers concerned about the ecological implications of food production and the health effects associated with food consumption. As with other businesses, agricultural producers respond to economic incentives and disincentives, internal and external policies; and make decisions to maximize their economic benefits (Halloran and Archer 2008). As one segment of the agricultural, the development of organic agriculture in the United States in particular is much market-driven and has relied on state and industry promotion (Halloran and Archer 2008; Lohr and Salomonsson 2000).

Organic agriculture in the U.S. has undergone enormous growth since the 1980s. Certified organic crop acreage more than doubled between 2000 and 2011, and organic production has spread to every state and commodity subsector. While the overall adoption of organic farming is still low, adoption of organic systems is highest for specialty crops (Greene and Ebel 2012). For example, produce and dairy have been fast growing subsectors. On the other hand, the pace of organic expansion has being slow in some commodities such as soybeans and cotton. The possible reason is that grain and feed crops in the U.S. usually associated a variety of financial and other risks with organic production (Greene et al. 2009; Klonsky 2000). The geographic distribution of commodities grown in the organic sector also indicates that
organic production has been layered upon existing crop specialization and the sociocultural relations they embody (Guthman 2004a).

Despite the agrarianist vision has been so potent within organic movement for which it embraces the idea that small-scale and family-operated farms provide the basis of economic security and farmer independence (Guthman 2004a; Meares 1997; Strange 1984), nevertheless, recent trends have shown that organic agriculture may no longer form a homogeneous group. The heterogeneity in organic farming seems to result from major factors including the establishment of government rules, the logics of agricultural capitalism, and the power of market dynamics (Buck, Getz and Guthman 1997; Goodman 2000; Milestad and Darnhofer 2003). In short, the development of organic agriculture could be seen as part of the general social and political change, embedded in the agricultural geography of the nation and a broader socio-institutional complex.

To better understand the spatial pattern of organic farming, this research investigates multiple measures of organic agriculture and examines its ecological, technological, and socioeconomic correlates across meso-scale geographies over time. Using data taken from the Census of Agriculture, organic agriculture is measured using organic farms and organic product sales, as a share of total farms and sales, in each county for 2007 and change between 2007 and 2012. Methodologically, using cluster analysis to identify distinct patterns of organic farming with multiple measures avoids the problem of using arbitrary criteria to identify high or low intensity organic places by basing the thresholds on the unique distribution of the data. The focus on the study of socioeconomic factors associated with organic farming extends beyond farmers and consumers’ individual decision-making to include the social and community relationships involved in the organic production.
The results indicate that the typology of organic agriculture includes a High Intensity cluster that have seen a relatively large concentrate of organic farms and sales, a Moderate Intensity cluster that have seen above average and little change in farms and sales over the five year period, a Growing Farms cluster saw high growth in farms with low base, a small number of counties in cluster of Growing Sales saw extremely growth in sales, and a majority of Low Intensity places where organic farms and sales are largely absent. The distinct Growing Farms and Growing Sales clusters suggest that a small number of counties are rapidly expanding the organic agriculture sector.

The regional distribution of organic agriculture concentrates primarily in metropolitan areas in the Northeast and the Pacific Coast, and in rural areas having desirable natural amenities such as the Northern Great Lakes and the Mountain West. Despite the relative absence of organic agriculture in the southern states, the presence of growing farms and growing sales counties in the Midwest and the South provides evidence that organic agriculture has diffused rapidly in place characterized by conventional agriculture. A local indicator of spatial association also found isolated hot spots located in the South and the Midwest. In general, “neighborhood effects” did play an important role on organic conversion as the literature suggested (Parker and Munroe 2004; Parker and Munroe 2007; Taus, Ogneva-Himmelberger and Rogan 2013). Further, the results show that spatial clustering of organic agriculture has been observed in place dominated by conventional farming.

Adoption of organic agriculture has been uneven across regions in the U.S. To explore changes in the modern agriculture, the science of agroecology has become a powerful tool in analyzing food systems when coupled with an understanding of how change occurs in society (Gliessman 2013). On the one hand, agroecology has its foundation in agrarian social thought
that emerged as a response to the negative externalities of the processes of agricultural industrialization; on the other hand, with its ecosystem foundation, agroecology today has evolved toward an approach focusing on the social, economic, and political drivers that seeks to provide insight on the systems level and contribute to sustainable societies. In this respect, the agroecosystem framework provides a valid foundation for understanding the interactions and relationships among the diverse components of the organic production system.

To see organic agriculture as a complex social-ecological system, an agroecosystem analysis using Hernandez’s model with reference of Flora and Flora’s community capitals framework which bridges the link between community development and agroecosystems is used to understand how ecological, technological, and socioeconomic components explain the regional variation of organic agriculture. First, in terms of ecological factors, organic intensive places tend to have milder summers, sometimes harsh winters, and more desirable landscapes. When looking at the presence of spatial clusters, organic hot spots also tend to be located in area with milder summers and dominated by rolling hills and water. The explanation is that in areas where there are constraints to arable farming, such as topography or climate, producers are less likely to gain efficiency and profitability from industrial practices, therefore, are more likely to adopt organic farming that can attract market premium. In general, results from this study find strong link between organic agriculture and natural amenities. Results support literature suggesting that lower agricultural potential predisposes conversion to organic production, and it may further create regions with a high prevalence of organic agriculture (Gabriel et al. 2009; Pietola and Lansink 2001; Schmidtner et al. 2012).

Second, in terms of technology employment, the results show that machinery, equipment, and agricultural chemicals have little effects on organic agriculture, indicating that both low and
high organic places adopt mechanical technology and production inputs. This implies that
despite some organic growers have been better able to stay true to organic spirits, relying on crop
rotations and reducing reliance on external inputs, however, there are some growers who convert
to organic production might inherit existing cropping conventions and technical supports that
evolve around the well-defined specializations. Since the adoption of technology has historically
been developed to address the problems and concerns raised by market competition, regulations
and funding for research and development, and social pressures, it is suggested that farmers in
the U.S. frequently feel pressured to incorporate technology into their production system
(Hendrickson et al. 2008). In the organic sector, as Guthman argued (2004a), organic production
systems have been sensitive to existing landscapes, farm structures, and production practices;
and these cropping conventions would ultimately shape organic futures.

In terms of socioeconomic components, factors conceived as human, social,
financial/built, cultural, and political capitals are used to explain the regional differences of
organic agriculture. First, community human capital recognizing education, knowledge, skills,
health, and experiences generally reflects the abilities and potential of local people that
contribute to self-improvement and strengthen agroecosystems. Since organic movement is often
associated with a reorientation of economic action through social embeddedness characterized by
knowledge, innovation, and social learning (Kroma 2006; Morgan and Murdoch 2000; Padel
2001), extant studies tends to link organic production systems with better individual attributes.
The findings show moderate support to the literature. Organic intensive places generally show
more positive individual attributes by being better educated for more college graduates; and by
having higher labor force participation. Nevertheless, they tend to have high dependency ratio.
The explanation is that since urbanization has marginal effects on organic farming, organic
intensive counties in rural areas might have larger shares of youth and elders. The other possible explanation is that as the U.S. population is aging, becoming more wealthier and more ethnically diverse, these demographic and income changes are expected to lead to increased demand for higher food quality and variety (Blisard et al. 2002).

Community financial/built capital which includes money, access to funding and wealth, infrastructure, and delivery system in a community generally reflects diverse and healthy economies that contribute to the growth of an agroecosystem. The findings clearly show that organic intensive places tend to have more diverse farm operations by having more direct agriculture sales to people and the community. The concurrence of organic producers and agriculture direct marketers implies they are likely to display similar or cooperating production types. For organic farmers market their products directly to consumers much more frequently than conventional farmers do (Dimitri and Greene 2002), this perhaps supports the idea that farming community with institutional support of social networks, infrastructure, and marketing outlets would improve organic practices (Kroma 2006; Milestad et al. 2010). In other words, “neighborhood effects” not only plays an important role on organic conversion in terms of physical distance between farms, but it may also potentially take effect in terms of marketing strategies among producers. Despite studies showed concerns about concentration and delocalization of organic commodity chains (Buck, Getz and Guthman 1997; Guptill 2009), this research still find organic producers are strongly associated with direct marketing and community support which represents deep notions of sustainability.

In addition, the link between economic well-being and organic agriculture is somewhat mixed. Communities with high organic activity seem to show higher household income, while they are associated with high deprivation. Organic hotspot communities in general show lower
poverty rates, yet there are no differences in income equality. On the other hand, the agriculture sector does not work in isolation from the broader economy, but in part depends upon and is influenced by the non-farm sector. The findings clearly show that organic intensive places tend to have more service enterprises such as organic manufacturers, distributors, retailers, and brokers. This confirms the literature suggesting that access to more marketing channel and market outlets did encourage organic farming (Greene and Kremen 2003; Lohr and Salomonsson 2000; Peterson, Kastens and Ross 2007). As one might expect, high intensity places are more likely to have jobs in natural resources and the trades occupations (agriculture, construction, maintenance, and repair). However, for moderate intensity places, rather they are more likely to be specialized in services occupations (healthcare, food serving, and personal services). A strong positive associate between organic hotspot communities and services occupations is also found. This suggests that organic production is not only driven by the food market, but also related to other industrial promotion such as the services economy.

As we have seen, conversion to organic production goes beyond the farming techniques and agronomic principles, it involves a transformation of the landscape and a new set of social relations which concern conceptions, values, economic well-being, as well as knowledge and communication inscribed in social networks. It is assumed that community social capital recognizing the network of connections among individuals and organizations in a community and between communities generally reflects strengthened relationships and communication that can contribute to an agroecosystem’s multiple functions. The results clearly show that communities with high organic production generally have higher community engagement via social capital. This supports the literature suggesting that social capital enables a community’s prospects for achieving sustainable livelihood security because of its inherent features of trust,
cohesion, and reciprocity that can increase social confidence and reduce economic uncertainty (Getz 2008; Kroma 2006). Building social capital which promotes socially collective action and well-being within a community is a necessary part for community development; moreover, bridging social capital which forging new relationships with other communities in advance is necessary to obtain more regional resources and create regional reputation and norms (Flora 2004; Flora and Thiboumery 2006). In this respect, the ways communities are organized seem to impact how organic spirits are maintained. The findings clearly show that social support and community engagement via social capital did promote organic ideology.

Community cultural capital which includes values, norms, beliefs, and behaviors in a community generally reflects possible alternatives for communal and social change. While organic intensive places generally are more ethnically diverse, they are not positive associated with new immigrants. Previous studies have shown that organic agriculture has been attracting untraditional farmers by having urban backgrounds, being younger, and no farming background experiences people (Duram 1999; Lockeretz 1995; Stofferahn 2009). However, the empirical evidence on the relationship between female participation and organic conversion from the U.S. is scarce. As noted, the findings clearly show that organic intensive places tend to have more women operators. A key argument underlying the prediction of female involvement in alternative agriculture is that alternative farming often challenges the core principles of conventional production and creates more opportunities for female labor because it is less mechanized and is more depending on diverse production methods, local knowledge, and local markets (Feldman and Welsh 1995; Hall and Mogyorody 2007; Peter et al. 2000). In general, the results somewhat indicate that women’s involvement have been recognized in organic farming systems. However, as Hall and Mogyorody (2007) argued, the potential to alter gender relations
in agriculture may not be realized unless a more concerted effort to preserve organic farming as a social movement concerned with social justice, labor process, and gender equality.

Finally, community political capital which includes rules, policies, and regulations generally reflects the power determining the access to resources to achieve goals. Archer et al. (2008) suggested that political factors shape agricultural production system both directly and indirectly. Direct political influences are experienced by farmers through associated regulations that encourage certain activities and constrain other practices. Indirect political influences generally come through the markets via funds, research cooperation, and subsidies and government investment for agricultural production. While the results show state organic certifying agents have little effects on organic conversion, we did find state farm-to-school policy strongly encourage organic production. In other words, indirect political influences come through the markets via regulation mechanism which requires public schools to serve locally grown and locally processed food are more likely to assist with the marketing of organic commodities. While studies argued that organic standards and public certification have been an important instrument for the growth of organic farming, the findings might improve awareness of indirect political influences that impact organic production through school health policy and school meals program that encourage sustainable agriculture practices.

Overall, there are several key findings in this research that suggest opportunities and directions for future research on organic agriculture in the United States. First, organic agriculture has evolved into a highly heterogeneous system. In terms of organic geography, organic farming activities are spatial clustering, high (low) organic places tend to be located near other high (low) organic places. While there have been a large concentrate of organic farming continue to favor certain regions, we have seen a small number of counties of growing farms and
sales rapidly expanding in place dominated by conventional agriculture. In terms of organic scale and farm type characteristics, while organic farming is often portrayed as small- and family-operated farms, this study seems to find a symbiotic relationship between large and small farms. More intensive organic production is linked to larger farm sizes, higher farm valuations, and higher value of agricultural products. New entrant organic farms tend to have corporative instead of family operations; and they are less likely to have tenant operators. In terms of market structure, while we have seen the link between organic production and support enterprises such as manufacturer, distributor, retailer, and broker that contribute the organic industry, organic producers are closely associated with traditional direct marketing and community support which presents deep notions of sustainability.

While studies showed concerns about the industrial mold of organic agriculture, the results find mixed support to the “conventionalization” thesis and a “bifurcation” of organic producers characterized by large-scale, cooperative operations and small-scale, movement-oriented organic farmers. In general, while farms of high intensive organic production exhibit signs of conventionalization because they tend to be large-scale and capital intensive, however, we find little evidence indicating the marginalization of smaller organic growers. By contrast, moderate organic production and farms of growing organic sales are showing more traditional and movement-oriented organic farming because they are likely to employ less technology, and are strongly associated with direct marketing and community support. This implies that small- and middle-sized organic production tends to stay true to the sustainable organic; and they might still play an important role in the organic economy.

In short, this research clearly shows that the once homogeneous organic agriculture has evolved into a highly pluralistic system. Organic farming did change, but a more important
question is how organic is changing. Despite studies in different regional contexts showed concerns about the conventionalization of organic agriculture, there are more and more research casting doubts on universalistic interpretations of the linear trajectory of organic agriculture, and indicating that the changes within organic farming are not necessarily negative (Campbell and Liepins 2001; Campbell and Coombes 1999; Coombes and Campbell 1998; Lynggard 2001). To broadly capture organic farming’s transformative potential, as Darnhofer et al. (2012) argued, the debate must move beyond the constraints of the dualisms established by the conventionalization and bifurcation concepts, and to describe the full range of empirical organic heterogeneity. That is, organic agriculture needs to be understood as a dynamic system, to learn how they engage and respond to internal and external demands and social conditions.

Second, the focus on the study of agroecosystems extends the perspective beyond individual decision-making to include the ecological and socioeconomic relationships involved in the organic production. To interpret the regional variations of organic agriculture, the ecological system in terms of climate and topography explains the prevalence of organic farming. The other major basis of regional differences lies in the support from human capital, financial/built capital, social capital, cultural capital, and political capital in the community itself. When we look at regional pockets of organic hot spot, they generally show fewer at-risk populations and more positive socioeconomic support by being more ethnically diverse and having fewer new immigrants, more college graduates, lower poverty rates, higher service economic participation, and higher community engagement. In general, this clearly shows that the development of organic agriculture has been shaped by complex interactions among environmental, social, and economic drivers. The findings support a general hypothesis from extant literature suggesting “organic friendly” places based on their similarities to the
demographic and socioeconomic characteristics would be those most likely to support organic production (Brown and Eades 2006; Constance, Choi and Lyke-Ho-Gland 2008; Lohr, Gonzalez-Alvarez and Graf 2001). That is, for studies to reveal spatial patterns of organic agriculture and the factors that drive organic development, it is commonly agreed that the analyses have to be related to their specific context of socioeconomic geography.

Overall, the agroecology approach using Hernandez’s model works well in interpreting the regional variations of organic agriculture. It views agriculture and the food systems more generally as embedded in landscapes and a broader socio-institutional system. In particular, Flora and Flora’s community capitals framework representing the interaction of people with agroecosystems is useful in both conceptualization and operationalization of socioeconomic component that influences the development of organic production. The community capitals framework makes the case that the agroecological concept cannot be separated from social relations. Instead, agroecosystems are the product of human communities mediated by culture and technology (Flora 2001). However, while the study of agroecosystems is strong on structural concepts for linking ecological and socioeconomic components of organic production, it is weaker on research areas in social psychology such as issues of social perception and individual behaviors and attitudes towards organic food and organic farming; and its corresponding social interaction and social influence. Moreover, the findings from organic development also indicate that issues of gender and power between actors and the social relationships they possess to capital tend to be missed in the agroecology approach.

In relation to future studies in the sociology of food systems and agriculture, one advantage of the agroecology approach is its emphasis on the role of social systems, and the importance of place-based coevolution. On the one hand, this framework represents the linkage
between human and nature systems, showing how ecological, technological, and socioeconomic factors influence the context under which agroecosystems evolve and are maintained. On the other hand, the tradition of agroecology is its political-economic critique of conventional agriculture, incorporating the role of prevalent political-economic structures in the construction of the current agrifood system, while paying close attention to its ecological shortcomings (Carolan 2012; Sevilla Guzman and Woodgate 2013). Therefore, with its systems perspective and political-economic tradition, the agroecology approach would be helpful especially for research in the sociology of food systems and agriculture to address questions regarding commodity analysis, agrarian change, rural development, and national development and food sovereignty.

Finally, for social studies to link the impact of organic farming to the future agriculture and food systems, it offers a great opportunity to think broadly about how the civil society structures and functions along with these changes. Although government legislation can influence what farmers produce and by what methods, as Halloran and Archer stated (Halloran and Archer 2008), U.S. agriculture operates in a market driven economy. The findings clearly show that indirect political influences coming through the markets via school meals program strongly promote organic production as a form of sustainable agriculture practices that connects healthy food and community involvement. In relation to state-level agricultural policy, regulation mechanism in terms of state certification might have limited support for organic commodities. Instead, political influences focusing on market access and community food networks would not only lead to greater opportunities for local organic farms, but eventually fulfill the organic ideology and create its local identity.
In short, for future public policy to promote organic agriculture, organic producers might need more regionally specific information and assistance through the market. Since legislated regulation and organic standards tend to favor highly capitalized agribusiness, financial and technical support from state or national policy should pay more attention to small-scale farms in developing their economies. In particular, as school meals policy such as school lunch program and farm-to-school program is expected to provide more reliable and stable markets for small-scale, often organic farmers by enhancing the development of local food systems (Allen and Kovach 2000; Allen and Guthman 2006), the potential of farm-to-school program would provide the example for other institutional buyers, such as hospitals and local governments, to purchase alternative agrifood products that promote local food networks and community food security.

As noted throughout this research, organic agriculture in the U.S. has changed dramatically and the role of organic spirits is somewhat different today than in its beginning. Despite extant studies have seen tensions between the “Big Organic” (large scale, industrial, and capital intensive) and the “Little Organic” (small scale, traditional and sustainable) versions in the industry, organic agriculture and food usually represent a transformative approach combined production goals with broader social objectives (Bellon and Lamine 2009; Youngberg and DeMuth 2013). The capacity of organics relies on a conscious reflexivity. On the one hand, we have seen a growing awareness of the “reflexive consumption” in the food system and commodity chain addressing this power as a form of politics (Allen and Kovach 2000; DeLind 2000; Lockie and Halpin 2005). On the other hand, recognizing economic pressures on both conventional and organic farming, the recent organic question might need to pay more analytical attention to a broad range of dimensions, ranging from agricultural nature, such as historical geography, to local socioeconomic contexts and the corresponding community-embedded
relations. Although organic agriculture emerged out of a confluence of social developments, as Michelsen (2001) stated, it has developed its own identity and served a separate sector within agriculture. For organic agriculture representing a role either conform or confront to mainstream agriculture, it brings challenges and opportunities to the future agriculture and society.

While the focus on the study of agroecosystems provides foundation for linking ecological and socioeconomic components of organic production, limitations in this research are most from the data. First, since organic agriculture and organic production is defined based on USDA criteria, noncertified organic agriculture practices, for example those defined by farmers themselves, are excluded in the analysis. Second, there is a lack of organic specific demographic and socioeconomic data at the farm-level. Therefore, potential ecological fallacy might occur in the interpretation of statistical data where inferences about the individual organic farms are based on the analyses of aggregated county-level data. One possible solution to address this issue is by asking confidential farm-level data from NASS USDA. Third, to assess the conventionalization and bifurcation thesis, it is necessary to use multiple measures that include acres to better understand the organic development, though this item was deleted in the 2012 Census of Agriculture. In addition, as Sutherland (2013) stated, the exclusion of non-converting conventional farmers in the broader literature on organic conversion is also a problem. Since empirical research on what conventional farmers are like and their corresponding changes are rarely included in the debate, future studies should contain the context of changes to both organic and conventional farming practices. Finally, county-level data that didn’t capture the “mixed” growers who both own conventional and organic farms might make the analysis of the organic sector misread. Take Guthman’s (2004) study of California’s organic sector for example, for some of the mixed growers are operations of very large acreage, their organic practices might be
treated as smaller-scale production in the survey. In that case, a sizeable proportion of organic 
farming done by large-scale conventional growers might be buried within these statistics.
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