

MEASURING THE ENVIRONMENTAL SUSTAINABILITY OF FARMERS' MARKETS:
TWO CASE STUDIES FROM CLARK COUNTY, WASHINGTON

By

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Abstract

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Farmers' markets are growing in number and in attendance across the United States. As this trend is likely to continue, evaluating the sustainability of farmers' markets is important. Sustainability includes social, economic, and environmental components. While much research has been conducted regarding the social and economic benefits of farmers' markets, few studies have investigated the environmental aspects of farmers' markets. I use qualitative and quantitative research methods to evaluate the environmental footprint of two farmers' markets in Clark County, Washington. Rapid market assessments (which include customer counts, dot surveys, and observations) were used as well as interviews and vendor surveys. The waste stream, carbon footprint, vendor growing practices, water and energy use, and environmental education of the Battle Ground Farmers' Market and the Camas Farmers' Market were investigated. Data show that while both markets are environmentally sustainable in some areas, there are many ways the markets could improve their overall environmental sustainability. This research offers a comprehensive environmental sustainability checklist which researchers and farmers' market managers can use to evaluate current sustainability efforts.

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CHAPTER ONE

Introduction

Food is essential to survival, yet today consumers have increasing apprehensions regarding the large-scale global agricultural and food system. Some concerns are health related such as the safety of genetically modified organisms (GMOs) and chemical inputs to food; others stem from potential cost increases due to the current production based largely on fossil fuels and government subsidies. The existing large-scale agricultural system is reliant on an abundance of cheap petroleum, which scientists are now estimating will not last much longer. Some scientists calculate peak oil production to occur around 2011, while others offer another 40 years of petroleum at current rates (Howden, 2007). In addition to health and economic concerns, some consumers are displeased with environmental degradation caused by today's global food system. As monocropping is the norm, increased use of chemical fertilizers and pesticides is necessary which often unintentionally harms untargeted species leading to a loss of biodiversity as well as polluting water sources and degrading soil fertility. Also, global transport of food consumes much fuel, emitting large amounts of CO₂ into the atmosphere contributing to poor air quality and climate change. Yet other consumers have ethical concerns regarding modern large-scale agriculture. Treatment of animals on large feedlots attracts attention, as do human rights issues regarding potentially corrupt and abusive farming systems internationally.

Alternative food production methods are becoming essential due to health, economic, environmental, and ethical concerns associated with conventional large-scale agriculture. Consumer demand for more sustainable agriculture practices is growing in the United States. Increasing debt of many small and medium-sized farms is a significant issue, as they cannot keep

up with the costs of new technology that aids mass production. This phenomenon is known as the technological treadmill, and has caused many farmers to go out of business (Van Chantfort, 1985). Small farmers often cannot compete within traditional industrial marketing arenas, as they cannot supply the appropriate size, color, quantity, and uniformity standards that commercial farms can (Payne, 2002).

The United States Department of Agriculture (USDA) defines a small farm as “less than \$250,000 gross receipts annually, on which day-to-day labor and management are provided by the farmer and/or the farm family that owns the production or owns, or leases, the productive assets” (USDA, 1998: 5). In the U.S., approximately 92% of all farms are classified as small farms (Ostrom, 2005). During the 1990s the number of small farms was declining as ownership and control was becoming more concentrated with large-scale agribusiness (Economic Research Service, 1998). However, the USDA (2009a) reports 1% more small farms in 2007 than in 2002. The largest increase is seen in farms making less than \$10,000 annually, while the largest decline (7%) is seen in farms making between \$100,000 and \$249,999 annually (USDA, 2009a).

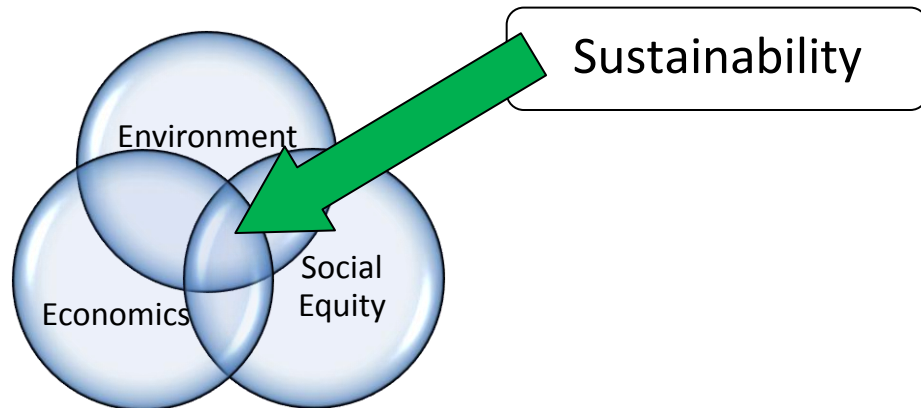
With all the above-mentioned concerns, many consumers are looking for a change in the U.S. agriculture system. McKibben (2007) explains that “more” is no longer “better,” and believes instead we need to envision food production on a different scale, counter to large-scale agricultural methods. He suggests thinking locally. To stay in business, many growers are using local direct marketing alternatives. Direct marketing eliminates the middle steps between the grower and the consumer so that a much higher percentage of the customer’s dollar goes back to the grower. Examples of direct marketing include road-side farm stands, u-pick operations, Community Supported Agriculture (CSA) programs, and farmers’ markets.

My research focuses on farmers' markets. Before I discuss the literature on farmers' markets, this introductory chapter will review two important concepts: sustainability and direct marketing. Discussion of these concepts will provide the necessary context for the information regarding farmers' markets that I will present in the remainder of this thesis. In the final section of this chapter I provide an organizational "roadmap" for the thesis.

Sustainability

Sustainability is a fundamental element in discussions surrounding current patterns of mass production and consumption, as well as potential alternatives. A commonly accepted definition of sustainability is: "[meeting] the needs of the present without compromising the ability of future generations to meet their own needs." This definition was agreed upon by the World Commission on Environment and Development in 1987 (United Nations NGO Committee on Sustainable Development, 2005). To meet the needs of all generations, there are three main interrelated components to sustainability: economic factors, equity issues, and environmental aspects. For a system to be sustained indefinitely, all three of these components must be balanced. As depicted in Figure 1.1, sustainability occurs where the three circles overlap. If a system is truly sustainable, then it can be sustained forever. However, because the time scale of *forever* cannot be measured, sustainability is more of a process or goal (Ikerd, 2008). Another way to conceptualize sustainability is to think about regeneration rates. If society uses resources faster than they can regenerate, then the system is not sustainable. With conscious effort, steps can be made toward a sustainable society.

Figure 1.1. Model of sustainability including economics, social equity, and the environment.



Because the time scale of sustainability is conceptually forever, considering long-term costs and benefits is crucial. Although short-term gains can be made in any of the three sustainability realms, lacking long-term perspective will prohibit sustainability because one realm cannot exist independently of the others. Ikerd (2008: 100) suggests “asking... every decision we confront, will the consequences be ecologically sound, economically viable, and socially responsible?” Along with a long-term perspective, ecological sustainability requires a systemic understanding of indispensability of ecosystems for human life as opposed to a piecemeal approach, and the understanding of the built-in limits to human impacts that the ecosystem can sustain (Edwards, 2005).

For the three components discussed above to actualize into sustainability, public education is needed. Edwards (2005) explains:

Education is the catalyst for helping everyone understand the dynamic nature of the interrelationship of the Three Es [environment, equity, economy].

Through education we gain knowledge with which to overcome the cognitive and normative—and hence emotional—obstacles to understanding our global dilemma. Through education, sustainability can become firmly established

within the existing value structure of societies while simultaneously helping that value structure evolve toward a more viable long-term approach to systemic global problems (p. 23).

As Edwards argues, education is essential to sustainability. Therefore, if a transition to sustainable communities is to occur, educating the public is a crucial component. Within the broader spectrum of community sustainability, food systems are a major component. Therefore a transition to sustainable food systems must include public education regarding sustainable agriculture.

Sustainable agriculture takes the model of sustainability and applies it to food production. This concept came about in the 1980s as an alternative to conventional agriculture (Lyson, 2004). Unlike conventional agriculture which focuses on speed, quantity, and profit, sustainable agriculture emphasizes cooperation, permanence, quality, and beauty (Lyson, 2004). Perhaps the largest difference is conventional agriculture's main concern of economic gains, whereas sustainable agriculture is more holistic, taking into account the environmental and community impacts as well as the economic considerations. However, sustainable agriculture is much more than a checklist of specific practices. Because agriculture varies by region, season, water sources, and micro-climates, so does the sustainable practices of those systems. As long as underlying sustainability goals are present, and actions are being made toward a sustainable future, then progress is happening. Because agriculture is imperative for human survival, sustainable agriculture has the potential to make great strides toward earth's overall sustainability.

Direct Marketing

As mentioned above, many small-scale farmers are switching to direct marketing to better balance the components of sustainability. Due to the growing number of issues associated with large-scale global commercial food production, customers and growers alike are turning to alternative marketing arrangements. There are many forms of farmer-to-consumer direct marketing available, including Community Supported Agriculture programs (CSAs), roadside stands, u-pick operations, and farmers' markets. Benefits accrue to both the grower and the consumer with direct marketing opportunities when considering the economic, equity, and environmental aspects of the system. Because of its local appeal, direct marketing is a concept that often accompanies sustainable agriculture.

Benefits of Direct Marketing

One benefit of direct marketing for producers is an increase in income. Using conventional methods of production and distribution, a grower sells his/her produce to a packing house or processor who then transports it to a wholesaler who then sells it to the grocery store who then sells it to the consumer. The grower may only see as little as 8 cents per consumer dollar spent (Robinson and Hartenfeld, 2007; Ron Gonsalves, personal communication March 2009). Today's conventional agricultural system is designed in a manner that pays set wages at every step along the food distribution chain before paying the farmers the remaining amount. The farmers' share of the food dollar has dropped dramatically in recent decades, as compared with 33 cents in 1975 and 21 cents in 1993 (Robinson and Hartenfeld, 2007). Direct marketing eliminates all of the middlemen between the grower and the consumer, so nearly the entire consumer's food dollar goes back to the grower. Hunt (2007) presents supporting data with his

research on Maine growers selling at farmers' markets. These growers reported higher incomes than those for other farmers in Maine, as well as an income equal to or greater than that of farmers nationally.

Consumers also benefit from direct marketing opportunities, as relationships develop with growers and there is a transparency in production methods. Direct marketing provides a chance for consumers to meet the producers of their food, ask questions about production methods, and in some cases tour where the food is produced. In many situations, the power of this dialogue to influence behavior flows in both directions. This interaction can influence what the farmer grows or how they grow it, as well as educate the customers about growing practices. Therefore, direct marketing allows customer demand for environmentally sound growing practices to influence the grower's methods more rapidly than is the case for longer food supply chains (Hunt, 2007).

Direct marketing exhibits environmental benefits as well. Most direct marketing methods supply quality produce to consumers within the same region. The average meal in the United States travels 1,500 miles to reach the consumer's plate (McKibben, 2007), whereas buying locally produced food significantly reduces the distance food travels. Moreover, by offering a feasible marketing alternative, more small-scale farmers are able to continue producing food, which provides environmental benefits such as keeping farms in production, saving natural habitats, and preventing potential land development (Fisk, n.d.). Fisk (n.d.) suggests this open space is a significant indicator of "green food." Hunt (2007) found that the vast majority of customers at Maine's farmers' markets agreed or strongly agreed that shopping at farmers' markets supports agricultural open space and purchasing local products is an effective method of preserving Maine's rural landscape (Hunt, 2007). By keeping local farmers in production, more

food is grown in the local vicinity, thus contributing to food security as well as environmental stewardship.

Organization of the Thesis

Although there are various forms of direct marketing, I will focus on farmers' markets. More specifically, my research centers on the environmental impacts and sustainability of two case study markets in southwestern Washington State. The remainder of this thesis consists of four chapters. Chapter Two will provide an overview of literature regarding farmers' markets, especially the social, economic, and environmental sustainability of farmers' markets. As Chapter Two will show, there is extensive knowledge of the social and economic benefits of farmers' markets, but research on environmental impacts is limited. Chapter Three provides details about my research design and methods. I explain my use of qualitative and quantitative methods to assess environmental impacts and sustainability of the two case study markets. Chapter Four presents an analysis and discussion of my research findings. In the final chapter, I summarize my main findings and suggest ideas for future research.

CHAPTER TWO

Literature Review

Now that the foundational concepts of sustainability and direct marketing have been articulated, I review the academic literature on farmers' markets in this chapter. First, an overview of farmers' market trends nationally is presented, followed by a discussion of the social, economic, and environmental components of farmers' markets.

Farmers' Markets

While all forms of direct marketing potentially increase the grower's percentage of the food dollar and provide opportunities for customers to ask questions while decreasing environmental impacts, my research focuses on farmers' markets. Farmers' markets can be viewed as a keystone in rebuilding local food systems, which makes them unique compared to other forms of direct marketing (Gillespie et al., 2007). Farmers' markets bring together and support social and economic components of a community: the local skills and resources of producers, the needs and preferences of consumers in the area, and community development goals. Where fragmentation and homogenization have destroyed the local food system, farmers' markets have the power and capacity to bring back a prosperous local food production and marketing system that unifies and thrives on local resources and diversity (Gillespie et al., 2007). The main way farmers' markets achieve this shift is through the visibility of local food, which stimulates community awareness of local food sources. Awareness is fundamental to re-localizing food systems (Gillespie et al., 2007). Although not a new concept, farmers' markets are becoming increasingly popular in the United States. In the past three decades, the number of

U.S. farmers' markets has increased from 1,200 in 1980 ("Rus in urbe," 1999) to approximately 4,685 in 2008 (Shaffer and Cox, 2008), a 290% increase.

Because farmers' markets are growing nationally, investigating the sustainability of farmers' markets is important in determining what role they play in the larger sustainability movement. Once again, sustainability has three main components (social, economic, and environmental) as well as the educational element that encompasses all elements (Edwards, 2005). Discussed below is the literature regarding the sustainability of farmers' markets. While there is much written about the social, community, and economic impacts of farmers' markets, research on the environmental impacts of markets is lacking. I argue a more holistic approach, which includes research on environmental sustainability, is needed to fully understand the impacts farmers' markets have in communities.

Social Sustainability

The literature on farmers' markets offers much support for the social equity component of sustainability. Farmers' markets are well known for their social atmosphere. Robinson and Hartenfeld (2007) explain that farmers' markets are social in nature, and relationships that otherwise may not occur are happening because of the unique atmosphere farmers' markets offer. They explain:

At farmers' markets people mingle with those like and unlike themselves.

They are places where a Baptist might exchange pleasantries with a Buddhist or a Rastafarian with a Methodist, a carpenter with a banker, a teacher with a janitor, an Asian-born grower of apples with a Hoosier selling native Korean

flowers. There are few places left where the many differences of our social worlds mingle so genuinely (Robinson and Hartenfeld, 2007: 9).

Gillespie et al. (2007) highlight the importance of the exchange of ideas, values, and thoughts at farmers' markets along with the exchange of goods and services. They emphasize the "entwining of the economic and the social is a crucial keystone process of farmers' markets" (Gillespie et al., 2007: 78).

While enjoying the social atmosphere, customers have a chance to ask market vendors about fair treatment of workers and animals and other justice issues surrounding food today. Producer-consumer interactions are the cornerstone of a farmers' market, and typically the most popular growers are those who "provide entertaining conversation, a bit of education about their produce and some indication of interest in their customers" (Corum et al., 2001: 76). Lawson et al. (2008) found that cooperation among vendors at farmers' markets were quite high, indicating another argument for the social benefits of farmers' markets. Rather than a competitive atmosphere, farmers' markets foster cooperation.

Research has also been conducted regarding the characteristics of farmers' market customers (Hunt, 2007; Govindasamy et al., 1998). Understanding customer demands, attendance patterns, and purchasing behavior at farmers' markets is important for many reasons. First, it can help individual markets understand their audience so they can target advertising to additional populations. Second, it assists growers with knowing what products are in high demand. Third, it provides data that helps the community realize how significant the farmers' market is in terms of attendance and economic impact. Govindasamy et al. (1998) report characteristics of customers in New Jersey during the 1996 market season. Approximately two thirds of respondents visited a farmers' market once per week or bi-weekly, and the same

percentage of customers reported attending between two and four different markets during the market season. Nearly all customers expected the quality of produce at the farmers' market to be better than other retail outlets, with quality and freshness of produce the top two factors affecting consumers' purchasing decisions (Govindasamy et al., 1998). Also, 80% of respondents cared where the produce they purchased was grown (Govindasamy et al., 1998). This statistic suggests that local food movements are growing, which aligns with the trends of increasing numbers of farmers' markets in the past decades. Although these customer data hint at environmental values and behaviors, the environmental impacts of farmers' markets have not been thoroughly explored.

Measures of environmental attitudes are being measured elsewhere, however. The Ocean Project (2009) recently conducted an environmental attitude survey of 22,000 adults across the country, the largest study of its kind. The Ocean Project results indicate that the environment still does not rank as a "top of mind" concern, yet when prompted, the public believes protecting the natural environment is important. Also, 79% of people surveyed used word of mouth in the last month to learn more about the environment (Ocean Project, 2009). Therefore, farmers' markets can be a crucial link in raising environmental awareness to customers because of markets' vibrant social component.

According to Govindasamy et al. (1998: 18), 90% of farmers' market customers surveyed in New Jersey agreed that "freshness and direct contact with farmers are the main factors that drive people to farmers' markets," 90% agreed that "farmers' markets help support local agriculture," and 68% agreed that farmers' markets boost local economies by attracting customers to downtown areas. In terms of demographics, New Jersey customers were largely

female (83%), 62% were college graduates, 84% considered themselves Caucasian, and the mean household size reported was 2.72 people (Govindasamy et al., 1998).

Another social benefit of farmers' markets includes donations to local food banks and other outlets for people in need. The donations of fresh produce can be very beneficial to low-income families, as fresh produce is more expensive than other forms of food, and is also lacking in supply at food banks. Therefore, farmers' market donations of unsold fresh produce to local food banks contribute to improved community health and food security (Gillespie et al., 2007; B. Jaeckel, personal communication, October 2009). Many states also have programs that accept governmental Electronic Benefit Transfer (EBT) payments, such as food assistance programs at farmers' markets. This allows people in need to access fresh wholesome produce from markets, contributing to overall community health.

It is well recognized that relationships among customers and vendors are built and strengthened within farmers' markets. The demographic trends of farmers' markets are also documented, as well as the community food security benefits from donations to local food banks from farmers' markets. Research strongly suggests that farmers' markets assist in creating stronger communities with higher social equity. Although customers may be drawn to markets for their unique communal aspect, they also often realize the economic and environmental benefits of farmers' markets, as discussed in the following sections.

Economic Sustainability

There are many economic benefits of farmers' markets. Hughes et al. (2008) examined farmers' markets in West Virginia and found that they greatly contributed economically to the region. Even after taking into account sales lost primarily from grocery stores, farmers' markets

still contributed 82 jobs (43 full time equivalent jobs), \$1.075 million in output, and \$653,000 in Gross State Product (GSP). Farmers' markets succeed at keeping local dollars in the immediate community because the farmers who sell at markets are typically local.

Because farmers' markets are often in city centers or urban areas, farmers' market customers typically spend additional money at local businesses nearby on market days (Brown and Miller, 2008). Across the country, research indicates monetary overflow into the community from farmers' market shoppers. Shoppers studied at Oregon farmers' markets spent between \$4,400 and \$38,400 extra dollars in the community per market community on any single market day (Lev, Brewer, and Stephenson, 2003). This dollar range is likely impacted by market size, customer demographics, day of the week, and market location. Three markets in Howard County, Maryland were studied, and an estimated \$965,788 were spent in one season at neighborhood businesses from market overflow, on top of the \$192,000 spent at the market for the season (Myers, 2004).

One must also ask whether farmers' markets vendors make enough income to support themselves. Research shows that only about one fourth of vendors use farmers' markets as their sole source of income. For example, one survey found that only 30% of Iowa farmers' market vendors made over \$5,000 per season, indicating farming is most likely a part-time job for supplemental household income for farmers' market vendors (Varner and Otto, 2008). This information is important to consider when determining the overall sustainability of farmers' markets. If farmers do not make enough money to continue selling at markets, then a market's livelihood will be threatened. However, Hunt (2007) found that the top reason for selling at farmers' markets was having a direct relationship with customers, whereas more profit from the market was rated as most important by only 36% of vendors. For some farmers, selling at

farmers' markets is the least profitable outlet compared with other forms of direct marketing (Pollan, 2006). Therefore, non-monetary benefits of farmers' markets appear to be significant as well as monetary rewards. However, the small farmers selling at farmers' markets for additional household income may have no other marketing outlets.

Another economic benefit of farmers' markets is business incubation support. Often, small businesses start at farmers' markets and then expand beyond the market once they have established customer relationships and refined their products based on experimentation and feedback (Gillespie et al., 2007). Because of their typically central locations, farmers' markets provide a large customer base for farm products, which is advantageous to growers, as they can develop marketing skills and customer relations, expand opportunities for other forms of direct marketing such as CSAs and selling direct to restaurants, and receive a very high price return on produce (Zenz et al., 2005).

Feenstra et al. (2003) reports that nearly 80% of vendors found farmers' markets to provide the best opportunity for business development when compared to other possible marketing outlets. While some vendors used a farmers' market as the primary outlet for their new business, other vendors used the market as a place to expand existing operations (Feenstra et al., 2003). Perhaps farmers' markets allow a space for businesses to grow in an environmentally sustainable manner, but this has not been well researched. However, in combining research from Hunt (2007) who examined the influence customers can have on growers at farmers' markets, I suggest that if more customers at the markets are environmentally aware, demand for sustainable products will increase, and therefore new and growing businesses utilizing farmers' markets as a platform for growth may develop in a more environmentally friendly manner.

Regarding the economic aspect of farmers' markets, there are many helpful guides for establishing a successful farmers' market. For example, a University of Kentucky Cooperative Extension Service publication states: "The first step in planning and establishing a farmers' market is to consider its economic feasibility" (Stegelin, 1997: 2). All previous research establishes the economic gains of farmers' markets, including money staying in the local community, market spending overflow on market days, increased incomes for growers, and business incubation opportunities. However, without all three realms of sustainability (social, economic, and environmental) in consideration, a market will not succeed long-term.

Environmental Sustainability

While all elements of sustainability are important and connected, comparatively little research exists on the environmental sustainability and impacts of farmers' markets. While comprehensive environmental research regarding farmers' markets is lacking, several environmental elements have been studied in a piece-meal fashion. These elements include zero-waste campaigns, keeping farmers in production, organic certification of vendors, and the waste stream.

Zero-waste markets make environmentally conscious efforts on-site regarding waste. One example of a zero-waste farmers' market comes from Berkeley, California. Three Berkeley markets have banned plastic bags and containers in an effort to reduce waste and encourage composting (Bhattacharjee, 2009). Single-use high-density polyethylene bags (HDPE) pose major health risks for humans, wildlife, and the environment via production methods and the longevity of the product persisting in the environment. These bags can take up to 1,000 years to break down, and the chemicals from the product can stay in the environment for much longer

(Ecology Center, 2009). The Berkeley markets are also asking vendors to charge customers 25 cents per compostable bag made from renewable products to encourage customers to bring their own reusable bags to the market (Ecology Center, 2009).

In Boulder, Colorado, the farmers' market offers only two disposal choices for customers: co-mingled recycling or composting. Therefore, all vendors offer only compostable eatery, and the market partners with the non-profit Eco-Cycle, who manages the waste stream from the market. After two years of implementation, 13,520 pounds of waste have been saved from the landfill (Institute for Local Self Reliance, 2009). Eco-Cycle buys plates, cups, straws, forks, etc. in bulk made from compostable products such as corn, wheat, and sugarcane, and then re-sells them to vendors. Signage at every booth reminds customers of the zero-waste policy, as well as clearly labeled recycling and composting receptacles (Eco-Cycle, 2006). Similarly, the Mill City Farmers' Market was the first market in Minnesota to become a zero-waste market. This transition was made possible through a partnership with Eureka Recycling, thus allowing the market to compost and recycle (Mill City Farmers' Market, 2008). Composting companies then sell the compost for profit, bringing an economic gain as well as environmental benefits (Institute for Local Self Reliance, 2009). Although there are some recommendations regarding waste management at farmers' markets and model markets to learn from, little research has been conducted regarding the environmental sustainability of farmers' markets on a broader level.

Where composting is not the norm, food waste accounts for approximately 14% of the entire municipal solid waste (Griffen et al., 2009). A considerable amount of food waste occurs at the consumer level compared with food production, processing, and distribution of food. Griffen et al. (2009) found that 72% of one upstate New York County's food waste was sent to the landfill, while only 25% was composted and 3% was diverted to emergency food assistance

programs. With landfills filling rapidly, reducing the food waste that goes to a landfill can help prevent earlier filling of landfills (Griffen et al., 2009).

Another aspect of farmers' market environmental sustainability is the role markets play in keeping small- and medium-scale farmers in production. By providing a marketing outlet for small farmers, farmers' markets contribute to keeping farmers in production. Thus, markets help to preserve rural farmlands and open space (Bryson, 2007; Fisk, n.d.) as well as saving natural habitats and preventing potential development (Fisk, n.d.). While keeping farmland in production has environmental benefits, farming itself can also have environmental impacts.

One way to evaluate the environmental impact of farming is to consider whether or not a farm is certified organic. To become certified organic and label products as such, a grower must undergo an annual inspection by a certifying agency and use approved materials that are thought to not harm humans, animals, or soil life (Organic Gardening, 2009). Records of all inputs used on the farm must be kept, and an organic farm management plan must be created. National organic standards prohibit many materials and practices including toxic synthetic pesticides and fertilizers, genetically engineered (GE) seed and materials, sewage sludge as fertilizer and fresh manure. Moreover, organic animals must be fed 100% organic diets, and antibiotics and growth hormones in meat and poultry are not allowed (Organic Gardening, 2009).

Farmers' markets near urban areas tend to have high demand for organic produce, and customers who strongly desire organic produce generally are more interested in "social and environmental issues within agriculture, such as the relationship of agriculture to human and animal health, sustainable development, water scarcity, environmental pollution, and wildlife protection" (Kremen et al., 2004: 6). Some market managers report that larger numbers of organic vendors make it easier to expand the size of the farmers' market. Also, education about

sustainable agriculture practices and fresh food preparation are the main elements most likely to increase additional customer and conventional grower interest in organic production (Kremen et al., 2004). Demand for organic produce at farmers' markets and other marketing outlets are substantial and growing across the country (Kremen et al., 2004).

Although organic produce is typically thought to be better for the environment than conventional agriculture, organic production is not the only possible sustainable food production method. Duram (2000) reports that many political, economic, social, and ecological factors influence organic farming decisions. On the other hand, not all non-organic farmers are harming the environment. Fairweather et al. (2009) found clusters of conventional farmers in sheep and beef farming, dairy farming, and horticulture in New Zealand who all expressed pro-environmental behaviors.

Clearly there is a need for conducting additional research on the full environmental footprint of farmers' markets. While the above literature is a good starting point, much more needs to be done. Zero-waste markets, keeping small-scale farmers in production, organic certification and other growing practices are all important to consider, and should be included in a more holistic market study approach. Public education is also essential for the transition from ideas to action.

Public Education

Farmers' markets are well positioned as educational sites focused on local food and environmental sustainability because markets already have a broad and steady customer base. One issue that demands more educational attention from farmers' markets is the waste stream, especially food waste. To reduce household food waste from entering landfills, Griffen et al.

(2009) argue that farmers' markets are an appropriate venue to educate customers regarding the ecological and nutritional impacts of food waste. Some methods of landfill food waste reduction include education about reducing excess food purchases, efficient storage and preparation of food, saving and reusing leftovers, and composting (Griffen et al., 2009).

Hunt (2007) analyzes consumer and farmer interactions and discusses the benefits this exchange can have on all three components of sustainability. Understanding the link between social, economic, and environmental factors at farmers' markets is important. Because farmers' markets provide a platform for social interaction and community building, they already have the infrastructure to enable environmental learning, support, and activism. In his study of eight Maine farmers' markets, Hunt (2007) reports that 98% of customers had fun at the farmers' market, and 48% of respondents had visited the farm where their produce was grown. Customers who enjoy the market are more likely to return, leading to increased time spent at a farmers' market and allowing more opportunities for increasing sustainable agriculture knowledge. The concept of "agricultural literacy" refers to knowing how one's food is produced. Through the direct customer and producer interaction found at farmers' markets, agricultural literacy is increased (Lyson, 2004).

One way to measure educational success is through transformative learning. According to Kerton and Sinclair (2009), transformative learning represents a change of consciousness and therefore transforms how the learner perceives and makes sense of the world. In other words, does the knowledge one learns change one's way of thinking critically about the world? Transformative learning and sustainability are closely linked because "the adoption of more sustainable lifestyles requires a fundamental shift in our values and behavior" (Kerton and Sinclair, 2009: 2). Kerton and Sinclair (2009) analyzed interactions between customers and

growers through three different types of organic farming direct marketing options: a farmers' market, a CSA, and a learning farm where the farmer provides on-farm educational activities. All but one of the respondents from all marketing models identified learning new things via purchasing organic food through the above mentioned methods. However, the respondents who purchased food from the farmers' market reported a lower degree of learning compared with the other two direct marketing models. This may have been due to the nature of farmers' markets, where the customer is not physically at the location where food is grown, making it harder to fully grasp all the food production process entails (Kerton and Sinclair, 2009).

Although farmers' markets can play a critical role in environmental education, markets can also act as springboards for other learning opportunities, such as farm tours hosted by vendors. Transformative learning is necessary for citizens in a community striving for sustainability. However, farmers' markets do not show the most successful results of transformative learning compared with CSAs and learning farms. In my research, I hope to identify what farmers' markets are currently doing for environmental education and outreach.

Farmers' Markets in Washington State

In Washington, there are more than 125 farmers' markets (Washington State Farmers' Market Association, 2009a). However, this number only accounts for members of the Washington State Farmers' Market Association (WSFMA). There are more than the reported 125 markets operating state-wide, but they may choose not to be a WSFMA member or they are ineligible due to association requirements. Membership of the WSFMA requires various qualifications, such as:

- Must be in at least the second year of operation

- No less than five vendors who are farmers selling their own farm products
- No commercial items, no second-hand items, and no imported items will be sold by any vendor
- No franchises allowed
- The total gross sales of other (non-produce) vendors shall not exceed the annual gross sales of produce vendors (WSFMA, 2009b)

Membership offers advertising, support and consultation, and networking opportunities.

WSFMA encourages markets that are attractive and accessible to growers, and serves a mission to “support and promote vibrant and sustainable farmers markets in Washington State” (WSFMA 2009c). WSFMA wants every Washington resident to have access to a farmers’ market, as they assist with healthy communities through providing a sense of belonging and connection. WSFMA promotes farmers’ markets to support sustainable local food systems via economically and environmentally healthy farms (WSFMA 2009c). Although the WSFMA realizes the importance of sustainability through community development, economics, *and* the environment, research is lacking regarding environmental impacts of Washington farmers’ markets. As discussed above, farmers’ markets are growing in number and popularity; therefore analyzing all three elements of sustainability within farmers’ markets will inform the public about necessary changes to ensure thriving and sustainable farmers’ markets and communities.

In recent years, several research projects on Washington farmers’ markets have been initiated. First, the WSFMA completed a two-year WSDA Specialty Crop Grant in June 2009. The research for this grant included eleven rapid market assessments (RMAs) conducted throughout the state to gain knowledge about customer information, flow of farmers’ markets, and marketing avenues utilized (J. Aitchison, personal communication November 2009).

Second, the Cascade Harvest Coalition is involved with an ongoing study to determine successful methods of retaining customers, especially infrequent ("Tier 2" or "non-core") customers to keep farmers' markets growing in number and sales (Cascade Harvest Coalition, 2009). Third, WSU researchers have secured USDA funding for research on the capacity of markets to generate income, improve the environment, and provide community assets; the barriers to market participation for minority and limited resource farmers; and strategies to enhance markets' organizational structure and viability (J. Goldberger, personal communication January 2009).

Additional social research in Washington found that the Seattle farmers' markets alone donated over 40,000 pounds of fresh produce to local food banks in 2007 (Cascade Harvest Coalition, 2009). Many markets in Washington now accept Women, Infants, and Children (WIC) vouchers, Senior Farmers Market Nutrition Vouchers, and Supplemental Nutrition Assistance Food Program vouchers. This is another avenue for low income families to have access to nutritious fresh produce. In 2008, approximately \$1.4 million of produce was sold at Seattle area farmers' markets through these programs (Cascade Harvest Coalition, 2009).

Farmers at the farmers' markets in Seattle alone represent 5,300 acres of cultivated land in Washington, and state-wide 89% of all farms are small farms (Bryson, 2007). Because of farmers' markets as a marketing outlet, thousands of farmers across the state are able to stay in business and prevent suburban sprawl from encroaching onto their farmland, thus pointing at an environmental benefit in Washington. Although there is farmers' market research occurring in Washington, the environmental component of farmers' markets is only a small sector of this research, if present at all. For farmers' markets to continue well into the future, all three aspects of sustainability must be present: social, economic, *and* environmental.

The *Washington State Farmers' Market Manual* (Ostrom and Lyons, 2007) offers 69 pages of guidelines for best practices within farmers' markets, yet only three of those pages address environmental sustainability of farmers' markets. Environmental recommendations within the manual include incorporating environmental education into the mission and values of the market, and emphasizing sustainability in press releases and other public outlets. Another set of suggestions focus on reduction of waste and includes tips such as educating vendors and shoppers to use fewer plastic bags and creating canvas reusable bags for the shoppers to buy. Sampling and taste tests at markets are another area where reduction of waste can occur. Rather than using a paper plate or napkin per sample, the manual recommends just a toothpick. Reusing at the market is also emphasized as a waste management strategy. The market can encourage shoppers to reuse produce boxes and plastic bags from week to week, encourage vendors to invest in reusable plastic produce totes (rather than cardboard boxes every week), and have information available for customers wanting to learn more (Ostrom and Lyons, 2007).

Recycling is another waste management priority. The *Washington State Farmers' Market Manual* recommends that every market have on-site recycling with clearly labeled bins, and markets should encourage vendors to switch to recyclable or compostable packaging and serving products. Typically, there are still waste items, so having a proper number of waste receptacles in convenient locations is also important. It is recommended that market staff monitor the trash and recycling regularly to ensure no overflow. Vendors typically create large amounts of waste compared to customers, and most markets have a policy that includes vendors removing their own trash from the markets (Ostrom and Lyons, 2007).

Because food is a major part of farmers' markets, composting is an obvious component of waste management. In Washington, however, most communities do not have a composting

facility that would enable composting at farmers' markets to be practical. However, creativity and partnerships can lead to a compost removal program, thus eliminating even more waste from the farmers' market. In order for a farmers' market to be a zero-waste program, reducing, reusing, recycling, and composting all must be present (Ostrom and Lyons, 2007). While these recommendations exist, there is little known about implementation of waste reduction strategies at Washington farmers' markets.

My Research

Because of the lack of research on the environmental sustainability of farmers' markets, my research focus will be on the environmental aspects of farmers' market sustainability. Building on the fragmented environmental research discussed above, I use a holistic approach to analyze the environmental impacts associated with farmers' markets in Washington State. This holistic approach includes research on the physical market itself, the vendors, and the customers. For the purposes of my research, I use Payne's (2002: 173) definition of a farmers' market: "a common facility or area where multiple farmers/growers gather on a regular recurring basis to sell a variety of fresh fruits, vegetables, and other farm products directly to customers." Although many methods have been employed individually in environmental research, my research draws on both qualitative and quantitative methods including interviews, observations, rapid market assessments (RMAs), and surveys.

I conduct two in-depth case studies in Clark County, Washington, to measure the environmental sustainability of farmers' markets. My primary research question is: can these markets continue with their current environmental practices into the future? I compare the two

markets regarding environmental components of sustainability. Through various methods, I evaluate:

- 1) the solid waste stream of the markets (composting, garbage, recycling, and reusing) as well as implementation of waste management strategies recommended in the *Washington State Farmers' Market Manual*;
- 2) the carbon footprint of the market;
- 3) the growing practices of vendors at the farmers' markets, including certified organic production and other sustainable production methods;
- 4) water and energy use and conservation; and
- 5) environmental education available at the farmers' markets.

Just as the concept of sustainability requires a holistic approach including the environment, economy, and equity; measuring the environmental component of farmers' markets must also include a holistic evaluation of the waste stream, carbon footprint, food production methods, and other factors. My research will provide useful information for farmers' markets and communities, in addition to serving as a model for gathering environmental data from farmers' markets. I now describe my research design and methods (Chapter Three) before presenting my research findings (Chapter Four) and conclusions (Chapter Five).

CHAPTER THREE

Research Design and Methods

This thesis draws on two in-depth case studies carried out in Clark County, Washington. I combined several research techniques—interviews, rapid market assessments (i.e., customer counts, dot surveys, and observations), and vendor surveys—to understand the ecological footprint of farmers’ markets. I investigated not only the physical and regulatory context of farmers' markets (e.g., physical location; availability of garbage cans, recycling bins, parking, and public transportation; regulatory procedures; bylaws; etc.), but also the activities of and interactions between vendors and customers. This chapter includes discussion of my case study markets and research methods.

Case Study Markets

Little research has been conducted on farmers’ markets, especially the environmental impacts and sustainability of farmers’ markets. Therefore, I decided to conduct two in-depth case studies to better understand the environmental aspects of farmers’ markets. Case studies are a preferred research method when examining contemporary events and phenomena, and when the researcher has little control over associated behavioral events (Yin, 1994). In general, this comprehensive research strategy “relies on multiple sources of evidence, with data needing to converge in a triangulating fashion” (Yin, 1994: 13). Because a thorough investigation of environmental components of farmers’ markets has yet to be done, case studies are the best research method to employ. To control for county regulations and Washington State Farmers' Market Association (WSFMA) membership, I chose two WSFMA-member markets in the same

county. The case study markets are the Battle Ground Farmers' Market and the Camas Farmers' Market, both located in Clark County, Washington. Each of these markets has fewer than 30 vendors and a large percentage of produce vendors. In 2009, the Battle Ground Farmers' Market was in its fifth season, while the Camas Farmers' Market was in its second season.

Clark County Demographics

Located in southwest Washington, Clark County has the second-largest growth rate in the state (Exploring the Clark County Food System, 2008). See Figure 3.1 for a visual representation of the county location. Battle Ground and Camas are the second and third largest cities in the county, respectively, and are experiencing significant growth (Exploring the Clark County Food System, 2008). The county population was 345,238 in 2000 (U.S. Census, 2000c) and 431,200 in 2009 (OFM, 2009). Because of recent development in the county, less farm land is available. The USDA (2009b) reports that 19.5% of the land in Clark County is in farms, compared with the statewide total of 35.2%. In 1954, there was 208,000 acres of farmland in the county (Exploring the Clark County Food System, 2008), compared to an estimated 78,359 acres in 2007 (USDA, 2009b). The majority of farms in Clark County are less than 50 acres. In 2007 there were nearly four times as many farms with less than 50 acres than farms larger than 50 acres, with 83% of the total farms less than 50 acres (USDA, 2009b). The total number of farms in 2007 was 2,101, up from 1,596 in 2002 (USDA, 2009b). The recent trend for more but smaller farms in Clark County means new farms need marketing outlets. Moreover, with less farmland available in the county, combined with a growing population demanding more food, farmers' markets may play an increasingly important role. Therefore, measuring the environmental aspects of farmers' markets is important as these markets are likely to continue to grow.

City Demographics

The demographic characteristics of Battle Ground and Camas are somewhat different. Camas is located on a major highway and near Vancouver, while Battle Ground is located between Vancouver and the small rural communities of Yacolt and Amboy (see Figure 3.2). According to the 2000 U.S. Census, the median household income was \$45,070 for Battle Ground and \$60,187 for Camas. The 2009 populations are estimated to be 17,150 for Battle Ground and 16,950 for Camas (OFM, 2009). Table 3.1 reports demographic data for each city as well as Clark County.

Figure 3.1. Counties of Washington, with Clark County in yellow.



Figure 3.2. Map of Clark County, showing relative locations of Battle Ground and Camas.



Table 3.1. Demographic Data for Battle Ground, Camas, and Clark County

Parameter	Battle Ground	Camas	Clark County
2009 Estimated Population	17,150	16,950	345,238
2000 Median Household Income	\$45,070	\$60,187	\$51,196
2000 Educational Attainment (Population 25 years and over)			
High school graduate or higher (%)	85.6	92.5	87.8
Bachelor's degree or higher (%)	16.5	31.1	22.1

Data source: U.S. Census, 2000a; U.S. Census, 2000b; U.S. Census, 2000c; OFM, 2009

Semi-Structured Interviews

Interviews were conducted with market managers, city officials, and community members in Battle Ground and Camas. City officials were selected based on position. I attempted to interview the mayor of each city, but if they were not available then the city administrator was asked. Regarding community members, I attempted to gain a diversity of viewpoints surrounding farmers' markets. Therefore, I interviewed farmers involved with direct marketing but not currently participating in farmers' markets, as well as farmers' market managers. Topics of discussion ranged from costs and benefits of farmers' markets, how farmers' markets contribute to communities, their relationship with farmers' markets, and other environmentally related campaigns going on in the area (See Appendix A for a list of interview questions).

. The interviews were semi-structured and lasted between 15 and 60 minutes. Interviews were recorded with written consent from interviewees. In total, seven interviews (i.e., two market managers, two city officials, and three community members) were conducted. Information from these interviews helped me gain a well-rounded picture of farmers' markets in Clark County.

Rapid Market Assessments

At each market, a rapid market assessment (RMA) was conducted. An RMA involves attendance counts, dot surveys, and a qualitative assessment (Lev, Stephenson, and Brewer, 2007). The RMAs were originally scheduled to be conducted at each market during the same week to control for seasonal produce, weather, and area activities that can impact attendance counts and customer demographics. It is important to realize that market attendance fluctuates weekly, and the RMA results represent only specific market days. The Battle Ground Farmers' Market is every Saturday, while the Camas Farmers' Market is on Wednesdays. Therefore, the

RMAs were scheduled for Battle Ground on a Saturday and the following Wednesday at Camas. However, due to extreme temperatures in Clark County, the Camas Farmers' Market was closed the week that the RMA was scheduled. The Battle Ground Farmers' Market RMA had already been conducted, and the Camas Farmers' Market RMA then took place two weeks later. Therefore comparing data from the two RMAs is a bit more challenging as the date is no longer a control.

Customer Counts

Customer counts are an important measure of farmers' market activity. The number of people attending the market can be an indicator of the market's impact as a social center in the community. Customer counts can also be used to estimate total sales and sales spillover and, therefore, inform current and future vendors about the benefits of exposure from the farmers' market (Lev et al., 2007). Customer counts involve counting adult customers on their way into the market at all possible entry points. A person with a hand-held tally counter is assigned to each entrance for twenty minutes in the middle of each hour that the market is open. The counts are then multiplied by three to obtain an estimate for the number of customers during each hour at the market (Lev, Brewer, and Stephenson, 2008). The Battle Ground Farmers' Market has five possible entrance points, while the Camas Farmers' Market has two.

Dot Surveys

Dot surveys are a practical tool for gathering customer data at farmers' markets. These surveys are quick and colorful, as questions are written on big paper set up on easels. Customers respond to questions by placing one dot sticker per question on the answer that fits best for them.

One objective of this approach is to contribute to the fun atmosphere of a farmers' market rather than detracting from it as other survey methods often do. One drawback is that correlations cannot be found between a respondent's answer to one question and his/her answer to another question. However, this issue has not been a significant problem in previous dot surveys (Lev et al., 2007). Also, response rates are typically much higher for dot surveys compared with a traditional paper survey (Lev et al., 2007), leading to more accurate results overall as the sample size is larger. Figure 3.2 shows a customer participating in the dot survey at the Camas Farmers' Market.

Figure 3.3: Customer participating in a dot survey, Camas Farmer's Market, 2009



One set of dots was given to each willing “buying group.” A “buying group” is defined as a group of people who share an income and came to the market together. The "buying group" approach is different from customer counts which focus on all entering adults (Lev et al., 2008). The five dot survey questions and answer categories used at both markets are shown on Table 3.2. Questions for dot surveys should be clearly written, and all customers should fit into one answer category per question (Lev et al., 2008).

Table 3.2. Dot Survey Questions and Answer Categories

1. How far away from the market do you live (in miles)?						
0–5	6–10	11–15	16–20	20+	Just visiting	
2. How did you get here?						
Walk	Bike	Public transportation	Personal vehicle	Carpool	Other	
3. “When I buy products (not just food) I try to consider how my purchase will affect the environment” (strongly disagree to strongly agree)						
1 = strongly disagree	2	3	4	5	6	7 = strongly agree
4. How often do you shop at this market?						
First time	Every week	Every other week	Once a month	Visitor		
5. What brings you to the farmers’ market?						
Fresh produce	Support local producers	Atmosphere	Music	Health	All of the above	Other

The questions in Table 3.2 were chosen for specific reasons. All of them provide information regarding the markets' environmental sustainability. Question #1 is about the distance the customer lives from the market. If customers are traveling great distances to reach the market, then that may not be very environmentally sustainable because of increased fossil fuel consumption and greenhouse gas production. How the customers travel to the market (Question #2) is significant for similar reasons. Reliance on public transportation, biking, walking, and/or carpooling may be more environmentally friendly than driving personal vehicles.

Question #3 was designed to measure the environmental perspectives of customers at farmers' markets. I was particularly interested in whether or not individuals were coming to the market because they already shop in an environmentally friendly manner. The desire to make purchases with environmental consequences in mind may lead people to shop at farmers' markets where local, organic products are readily available. However, if customers are not already making buying decisions based on environmental reasons, then farmers' markets can educate consumers about the ecological (and other) benefits of farmers' markets. Question #5 also attempts to understand why people shop at farmers' markets.

Question #4 measures the frequency of attendance at the farmers' market. If customers attend the market regularly, they are more likely to purchase more from the market, thus contributing to the longevity of the market. Repeat customers have many other benefits discussed in the literature review, such as keeping local farmers in production and preventing land development.

Vendor Surveys

A double-sided, one-page survey was distributed to every vendor at the Battle Ground and Camas Farmers' Markets within a two week time period. The survey was designed to collect data on vendor behavior, focusing on waste, carbon emissions, production practices, energy, and water. There were two categories of food vendors at the case study markets. The first category includes vendors of prepared foods (e.g. sandwiches, gyros, burritos) and value-added products (e.g., honey, jams, bread). These vendors will be referred to as "value added and prepared food vendors" throughout the remainder of this thesis. The second category includes vendors who grow their products (e.g., fruits and vegetables, meat). These vendors will be referred to as "growers" or "grower vendors." The two categories of vendors received different surveys. Vendors not selling edible products were not surveyed. Questions about growing practices were based on Jussaume, Ostrom, and Jarosz's (2003) survey of Washington farmers. Please see Appendix B for the value-added and prepared food vendor survey and Appendix C for the grower vendor survey.

Observations

My research also included frequent observations at the Battle Ground and Camas Farmers' Markets. Each market was visited at least three times throughout the 2009 season. During each visit, I observed market flow and layout, customers' conversations about the market, type and number of vendors present, reusable bag usage, recycling facilities, the availability of public transportation, and related items. All observations were recorded and incorporated into my final analysis reported in Chapter Four.

Conclusion

Having described my research design and methods in detail, I turn now to my research findings. Because my case study research design entailed various qualitative and quantitative methods, Chapter Four will draw on key findings and discuss them in the context of environmental sustainability. I will also compare my data with previous research.

CHAPTER FOUR

Findings

This chapter presents the findings from my research on farmers' markets in Clark County, Washington. The chapter includes seven sections: 1) Market Descriptions, 2) Waste Stream, 3) Carbon Footprint, 4) Farmer Growing Practices, 5) Water and Energy, 6) Environmental Education, and 7) Comparison of Markets. Within each section, I present qualitative and quantitative data for the Battle Ground and Camas Farmers' Markets.

Market Descriptions

To properly convey information regarding the markets, descriptions of each market's location, vendor make up, management structure, and times of operation are necessary. The two markets investigated are the Battle Ground Farmers' Market, located in Battle Ground, WA, and the Camas Farmers' Market, located in Camas, WA.

Battle Ground Farmers' Market

The Battle Ground Farmers' Market began in 2005, and was known as the "Old Town Saturday Market." The original location was in downtown Battle Ground, but moved to Battle Ground Village in 2008 due to space constraints. Battle Ground Village is a privately owned space designed for multi-use, including homes, shops, restaurants, and the public library. This location is not on the main road into Battle Ground, but a few blocks southeast from downtown. The market takes place every Saturday from 9 am to 3 pm from late April through October. The organizational structure of the market is a non-profit organization with three board members,

including one paid Executive Director of the organization. The market is a weekly event hosted by the organization.

This market is a combination of grower vendors, value-added and prepared food vendors, and craft vendors. Items allowed for sale at the market must be hand-made, home grown, hand crafted, value added, and/or original. No franchises, manufactured commercial items, or reselling of goods is allowed. The number of vendors on a given market day varies. Based on my site visit observations, three to six grower vendors are present on any given market day, as well as three to five value-added vendors (i.e. honey, toffee, chocolates, and salsa). There are also two prepared food vendors: one that sells hot dogs and Icees and another that sells Texas BBQ. Along with the food vendors, the Battle Ground Farmers' Market consists of craft vendors as well. The number of craft vendors ranges from four to eight, selling products such as wind chimes, wooden furniture and products, pottery, art, and sewn goods.

My grower vendor surveys yielded results from seven respondents. Of those respondents, five vendors sell at this market weekly, and five vendors also sell at other farmers' markets. The range of years selling at farmers' markets is from 1 to 15 years (median = 4 years). Regarding the prepared food/value added vendors, there were four survey respondents. All four of these vendors report selling at the Battle Ground Farmers' Market weekly, while two vendors also sell at other farmers' markets. The number of years selling at farmers' markets ranges from 1 to 9 years (median = 3 years).

Camas Farmers' Market

The Camas Farmers' Market was established in 2008. It occurred seasonally on Saturdays on 5th Avenue between Birch Street and Cedar Street. In 2009, the market was moved

to Wednesdays from 3 pm to 7 pm, from May 27 to September 30. The location also changed to 4th Street between the public library and city hall, in the heart of downtown Camas. The market is governed by a board of eight members (all volunteer positions). Shortly after the 2009 season closed, the Camas Farmers' Market received 501(c)3 non-profit status.

The Camas Farmers' Market was established as a food-only market, and therefore has no craft vendors. The number and type of vendors fluctuates weekly, but typically there are approximately eight grower vendors, seven to nine value-added vendors (including four bread and pastry bakers, toffee, pickled goods, coffee, nuts, and mushrooms), and three prepared food vendors offering Greek food, Cajun cuisine, and Mexican food. There is also one vendor selling meats, and another vendor selling eggs. The only two vendors not selling food sold flowers.

Nine grower vendors responded to the vendor surveys. All nine of these vendors report selling at the Camas farmers' market weekly, while seven vendors also report selling at other farmers' markets. The number of years these vendors have been selling at farmers' markets ranges from 1 to 30 years (median = 5 years). Eleven value added/prepared vendors responded to the survey. Results indicate that all eleven vendors sell at this market weekly, while seven vendors also sell at other farmers' markets. These vendors have been involved with farmers' markets from 1 to 10 years (median = 3 years).

Market Attendance

While Clark County is growing rapidly, it is still a largely rural area. This makes market attendance a challenge, as people are not centrally located. According to the Camas and Battle Ground market managers and the WSFMA Director, obtaining new customers is critical for farmers' market success, but also a challenge. Retention of current customers is also important.

The more a customer frequents the market, the more likely they are to buy local produce and learn more regarding local food systems and sustainable agriculture. Based on customer counts during the RMA, the Battle Ground Farmers' Market has approximately 1,014 customers per market day, while the Camas Farmers' Market has approximately 576 customers per market day. However, these attendance numbers are only representative of that day's market, as attendance fluctuates based on what crops are in season, other events occurring in the region, weather, and other factors.

I used customer dot surveys to measure how often customers visit the market. Table 4.1 below shows the results. The Chi-Square test reveals a statistically significant difference between the two markets' customer frequency. Table 4.1 shows that Camas has more regular customers. Nearly 52% of Camas respondents report shopping every week or every other week compared to only 27% at the Battle Ground market. However, across the state of Washington the number of customers visiting markets weekly is more similar to the Camas data than the Battle Ground data. For example, dot survey data from the Puyallup Sunrise Village Farmers' Market indicate

Table 4.1. Frequency of customer visits to Battle Ground and Camas Farmers' Markets.

Frequency	Battle Ground		Camas	
	N	%	N	%
First Time	68	43.0	43	30.5
Every Week	20	12.7	43	30.5
Every Other Week	22	13.9	30	21.3
Once a Month	33	20.9	15	10.6
Visitor	<u>15</u>	<u>9.5</u>	<u>10</u>	<u>7.1</u>
Total	158	100.0	141	100.0
χ^2				22.113
P-value				0.000

that 33% of respondents shop weekly and 31% shop every other week (WSFMA, 2009d). At the Walla Walla Farmers' Market, 51% of respondents reported shopping at least every other week (WSFMA, 2009d).

The data in Table 4.1 also indicates that the Battle Ground Farmers' Market had more first time customers compared to the Camas Farmers' Market (43% compared to 30%). Word of mouth is the main form of advertising for farmers' markets (WSFMA, 2009d). Perhaps Battle Ground customers attend and then tell their friends, thus increasing the first time shoppers. Alternatively, perhaps customers attend the market, are not fully satisfied, and do not return, therefore decreasing returning customer rates. It is likely that customers attending regularly at the Camas Farmers' Market use word of mouth to tell additional people about the market. Although the Camas market does have more regular customers, both market managers reported a desire for more customers. The Battle Ground Farmers' Market is situated in a more rural area, and this may contribute to a lack of customers as well; perhaps more area residents grow food for themselves because of the location (A. Lawrence, personal communication, August 2009).

Waste Stream

The first environmental topic I will discuss is the waste stream of the farmers' markets. In my market analysis, I attempt to capture more than just the mechanical and procedural happenings at the markets, but also what the vendors do before they arrive at the markets, as well as the attitudes and behaviors of market customers. Analyzing the waste stream of farmers' markets has four components: composting, garbage, recycling, and reusing.

Composting

Because a large portion of farmers' market products are food items, composting is an especially significant component of the waste stream to consider. Food waste occurs at all stages of food production and consumption, including growing, harvesting, packaging, transporting, selling, consuming, and disposing of food. However, it is the disposal of unsold food and composting options at the markets that I focus on in this section.

At the farmers' markets studied, most vendors do not throw away food that does not sell at the market. All vendors have multiple outlets for food that does not sell at the market. Of the fifteen applicable grower vendors, only one reports directly throwing away food. However, this vendor first tries to use as much as possible for cooking. Ten vendors use the unsold food to feed their immediate family; seven vendors use the food waste as food for animals/livestock; five vendors give food away to friends, family, neighbors, or other vendors; five vendors compost the food waste; four vendors give left-over produce to a food bank; and only one vendor reports saving the product to sell at another market, most likely due to the short shelf life of perishable fresh items sold at markets.

The prepared food and value-added vendors on the other hand generally save unsold products for the next market. Nine of the fifteen respondents report saving unsold goods for other markets or returning products to inventory; four vendors report donating food; two vendors report integrating the product into other uses; and only one vendor reports throwing away unsold product, and only after using whatever they could for the upcoming weekend.

Overall, vendors at the farmers' markets are not throwing away unsold food products. Throwing food away was the least frequently used method of food disposal. Both markets contain vendors that thoughtfully dispose of unsold product through donations to food banks,

friends, and family; consuming it themselves; composting; feeding to livestock; and saving for future sale. It makes sense that after all the time and effort vendors put into products, they would not want it to be wasted via compost or trash. Small-scale farmers are actively involved in the production of food, thus they likely regard it much differently (i.e., desiring to minimize waste) compared to large-scale commodity growers.

Neither the Battle Ground nor the Camas Farmers' Markets have on-site composting receptacles, thus any food waste produced at the market is sent to the landfill. Factors contributing to the lack of on-site composting facilities may be market location and lack of partnerships. Waste from the Camas Farmers' Market is handled by the City of Camas, which does not offer a composting program. The Battle Ground Farmers' Market takes place at a private location, and only on-site garbage cans are provided. At the Camas market, however, there is a vendor selling worm bins, thus promoting home composting. The Battle Ground market has no equivalent vendor. Model markets nationwide such as the Boulder, Colorado, and Mill City, Minnesota Farmers' Markets have created successful partnerships with local composting agencies (Institute for Local Self Reliance, 2009; Mill City Farmers' Market, 2008). More locally, the waste station at the Olympia Farmers' Market is another good model, as it offers receptacles for trash, compost, and recycling (A. Wesockes, personal observation, 2009). Both the markets studied are relatively new (Battle Ground was in its 5th season, and Camas in its 2nd season), so perhaps as they become more established, more time and effort can be committed to issues such as waste stream management. The *Washington State Farmers' Market Manual* acknowledges the lack of composting facilities in the state, but still recommends composting as a waste reduction strategy (Ostrom and Lyons, 2007).

Garbage

The term “garbage” is used here to include all waste that is landfill bound. Both markets have many on-site garbage cans. At the Battle Ground Farmers’ Market, the garbage cans are permanently fixed in place throughout Battle Ground Village, the privately owned area where the market takes place. In Camas, the city provides large garbage bins on wheels for the farmers’ market use. At both markets, many vendors also have small garbage cans by their booths. Both markets appear to have an appropriate number of garbage cans in appropriate locations, as recommended by the *Washington State Farmers’ Market Manual* (Ostrom and Lyons, 2007).

While the number of garbage cans is sufficient, waste reduction strategies could be implemented via choice of vendor serving materials (e.g., cups, plates, utensils) and packaging (e.g., boxes, jars, wrapping). In the prepared food and value added vendor surveys, vendors were asked to indicate the types of packaging materials they use. Four Battle Ground Farmers’ Market vendors responded to these questions. One vendor uses plastic, one uses paper, two use aluminum, and one uses glass. None of the vendors use polystyrene packaging or compostable materials. Therefore, if the Battle Ground Farmers’ Market were to implement a recycling program, it is likely that some of the packaging (plastic, aluminum, glass, and paper) could be recycled, depending on food contamination. Vendors were also asked if they attempt to reduce packaging and food waste. At the Battle Ground Farmers’ Market, responses include: “Try to reuse as much as possible. Recycle all I can” (BG2), and “We buy as much as we can in bulk” (BG4). This suggests that minimal packaging is used, and a recycling program would reduce the material going to the landfill.

The responses from Camas Farmers’ Market vendors differ slightly from Battle Ground Farmers’ Market vendor responses with regards to vendor utensils and packaging materials.

Seven vendors responded to the questions regarding packaging. Five report using plastic packaging, four use paper, three use compostable (corn/starch) products, and two use aluminum. None of the vendors used polystyrene packaging. Based on current vendor packaging, recycling and composting could prevent unnecessary waste from entering the garbage. Responses regarding attempts to reduce packaging and food waste for Camas vendors include: “Some packaging is compostable” (C1), “The more you waste, the more money you waste, and it takes up space” (C8), “Developing a program for refillable coffee tins; eliminates paper waste from retail packaging” (C9), and “Yes, food waste and packaging. Waste is time and money” (C6). This last response captures the essence of the farmers’ market ideology. This vendor, contrary to current capitalist ideology of mass production, consumption, and disposal, indicates another way of thinking in which resources cannot be taken for granted and wasted. While most vendors are consciously attempting to reduce waste, one vendor says, “This is the one we have to compromise on, as a very small business” (C2). Using compostable materials is beneficial, but having composting receptacles on-site would allow these products to properly decompose. Polystyrene is not used at either market. This is advantageous environmentally because polystyrene takes thousands of years to decompose, much longer than other materials such as paper.

Recycling

Recycling is another aspect of the waste stream. However, neither market has recycling facilities available. Therefore, all recyclable material is disposed into the garbage cans, leading to more unnecessary waste going to the landfill. Both the City of Battle Ground and the City of Camas have recycling programs; therefore implementation of recycling at the markets should not

be difficult. The *Washington State Farmers' Market Manual* recommends that farmers' markets have on-site recycling (Ostrom and Lyons, 2007), yet the Battle Ground and Camas Farmers' Markets have not implemented this recommendation. Based on vendor surveys, vendors are already using some recyclable packaging products. Once on-site recycling programs are implemented, providing options and alternative ideas to vendors for replacing disposable products with recyclable or compostable materials (also recommended by Ostrom and Lyons, 2007) would be helpful in decreasing garbage.

Reusing

Minimizing waste initially through reusable products is another waste reduction strategy. I focus on two different reusable materials: shopping bags and beverage containers. Reusable shopping bags are available for customers at both markets, as recommended by the *Washington State Farmers' Market Manual* (Ostrom and Lyons, 2007). At the Battle Ground Farmers' Market, canvas bags are printed with the market logo and for sale at the manager's booth. The bags are aesthetically pleasing, but comparatively small to the ones offered at the Camas Farmers' Market. At the Camas market, customers participating in the debit/credit card program receive one free large reusable shopping bag with the market's logo printed on it. I observed more customers using reusable shopping bags and baskets at the Camas market compared to the Battle Ground market. More specifically, the market-sponsored bag was seen in use only at the Camas market. This suggests that the combination of larger bags with market-sponsored bag give-aways helps promote reusable bag usage.

Reusable totes are important environmentally, but the logo on the bag can also play a role in advertising. If a customer receives a bag from the market and uses the bag elsewhere, then the

customer is essentially advertising the farmers' market wherever the bag is presented. This is a marketing strategy associated with word of mouth exposure. If the market is promoted at more locations, market attendance may rise, thus leading to the associated environmental benefits of farmers' markets discussed in the literature review.

Reusable beverage containers can also reduce waste. Of the vendor responses, there is one vendor at each market that offers a monetary discount for customers with a reusable mug. Providing an incentive for reusable beverage containers can encourage customers to partake in this action.

Summary

Farmers' markets have the potential to create change in the larger culture, thus farmers' market behavior can be a seed for the larger community. If the farmers' market takes positive environmentally conscious steps regarding the waste stream, it is likely that these actions will be replicated in the community. Farmers' markets are community centers that have the power to create environmental change through their social atmosphere. Therefore, both case study markets need improvements regarding the waste stream to increase environmental sustainability. While garbage cans are easily accessible and numerous at both of the markets, the Battle Ground and Camas Farmers' Markets offer neither composting nor recycling programs on-site. If these options became available, vendors could be encouraged to transition fully to compostable or recyclable packaging and serving materials. While both markets have reusable bags available, the Camas market has implemented a more successful program for customers regarding bag distribution, and the size of the bag is comparatively larger. Both markets also lack in reusable beverage containers.

Carbon Footprint

Calculating a market's carbon footprint can be challenging, as there are many factors to consider. Because of this, I will not attempt to calculate the amount of CO₂ emitted per market per season. Rather, I will highlight and discuss the important components associated with carbon emissions. This section will deal largely with transportation issues such as distance traveled by vendors and customers to the market, modes of transportation, and market design and location.

Customer Travel

Farmers' markets have a reputation of representing local farmers and customers. But, how far are the customers and vendors traveling to reach the market? One dot survey question aimed to discover how far the customers travel for the market. Shorter distances have smaller environmental impacts. Table 4.2 shows the distance customers travel to reach the markets. Chi-square results reveal no statistically significant difference between the Battle Ground and Camas Farmers' Market customers. In Battle Ground, 71.9% of customers travel ten or fewer miles to

Table 4.2. Distance Traveled by customers to Battle Ground and Camas Farmers' Markets.

Distance	Battle Ground		Camas	
	N	%	N	%
0-5 Miles	83	51.9	83	58.0
6-10 Miles	32	20.0	25	17.5
11-15 Miles	20	12.5	17	11.9
16-20 Miles	8	5.0	4	2.8
20+ Miles	3	1.9	4	2.8
Just Visiting	14	8.8	10	7.0
Total	160	100.0	143	100.0
χ^2				2.299
P-value				0.806

reach the market, and 75.5% of Camas customers travel ten or fewer miles to the market. The majority of customers at both markets are traveling within five miles of the market (51.9% in Battle Ground and 58.0% in Camas), making the location of the markets very local for customers. Because of the close proximity of the majority of shoppers to the market, this may allow for more environmentally friendly transportation options for shoppers.

Second, the mode of transportation used by market shoppers is crucial for evaluating the markets' carbon footprints. Walking and biking emit no greenhouse gases, whereas carpooling, personal vehicles, and city buses are associated with greenhouse gas emissions. The more greenhouse gases emitted, the worse the environmental impact. Table 4.3 shows the number of respondents using each mode of transportation. Unlike the results for distance traveled to the market, the Chi square test reveals a statistically significant difference between the two markets regarding customers' mode of transportation to the farmers' market.

The Camas Farmers' Market has three times more people who walk to the market compared to the Battle Ground Farmers' Market (see Table 4.3). The Battle Ground Farmers' Market has ten times more people who carpool to the market compared to the Camas Farmers'

Table 4.3. Mode of Transportation used by customers to travel to Battle Ground and Camas Farmers' Markets.

Transportation	Battle Ground		Camas	
	N	%	N	%
Walk	8	5.0	22	15.4
Bike	2	1.3	2	1.4
Public Transit	2	1.3	0	0
Personal Vehicle	123	77.4	114	79.7
Carpool	23	14.5	2	1.4
Other	<u>1</u>	<u>0.6</u>	<u>3</u>	<u>2.1</u>
Total	159	100.0	143	100.0
χ^2				26.742
P-value				0.000

Market (see Table 4.3). These differences are most likely related to the location of the markets. The Battle Ground market is not near the downtown area, and thus not as centrally located. As a result of location, driving may be more necessary to reach the Battle Ground market, and carpooling is more environmentally friendly than everyone driving their own personal vehicles. The Camas market, in contrast, takes place in the heart of downtown Camas, between the public library and city hall. The market's central location facilitates walking to the market. Walking is better for the environment compared to vehicle travel because no CO₂ emissions occur when walking. Therefore, location can play a significant role in a farmers' market environmental footprint. If the location is near residential areas and in a pedestrian-friendly area, foot travel is easily promoted as an alternative to vehicle travel.

Vendor Travel

How far the vendors travel to the market with their goods is another important component in determining how "local" each market is. The distance traveled by grower vendors at the Battle Ground market ranges from less than one mile to 180 miles, with an average of 32 miles (median = 6 miles). The distance traveled by grower vendors for the Camas market ranges from 3 miles to 180 miles, with an average of 45 miles (median = 30 miles). Regarding prepared food and value added vendors, Battle Ground market vendors travel between 6 miles and 100 miles, with an average of 31 miles (median = 8.5 miles), while the Camas vendors travel range from less than a mile to 50 miles, with an average of 14 miles (median = 8 miles).

The Battle Ground Farmers' Market has a lower average distance for grower vendors, while the Camas Farmers' Market has a lower average distance for prepared food and value added vendors. The average distance traveled did not exceed 45 miles for any category of

vendors, and the median distance traveled did not exceed 30 miles; indicating that the vendors at both markets are representing the local area. However, it is also important to note the range of distance among vendors. While some vendors travel less than one mile to the market, others travel up to 180 miles.

Proximity to Other Transportation Options

If the market is located close to public transportation and bike racks, then those methods of transportation can be encouraged. The Camas Farmers' Market is located approximately three blocks away from a bus station. The bus route goes from Vancouver to Camas and continues on to Washugal, but does not travel throughout all of Camas. Because the majority of customers are coming from within five miles, riding the bus may not be practical for Camas Farmers' Market customers. There is also a bus route that goes from Vancouver to the Battle Ground Farmers' Market location. On Saturdays (Battle Ground's market day), the bus runs about every 90 minutes. Careful planning is necessary, and once again most of the customers are coming from within a five mile radius, where public transportation is limited.

Bike racks are necessary for encouraging bike transportation. Customers need a place to safely store bikes while shopping at the market. Both markets have sufficient bike racks available. However, one issue with bike transit is the limited capacity for storage, thus minimizing products that can be purchased by a bike customer. Perhaps the markets could create wagon rental programs or sell affordable bike wagons. This would enable customers to bike to the market without limiting their purchases. Another option could be a home delivery service to residents of nearby neighborhoods.

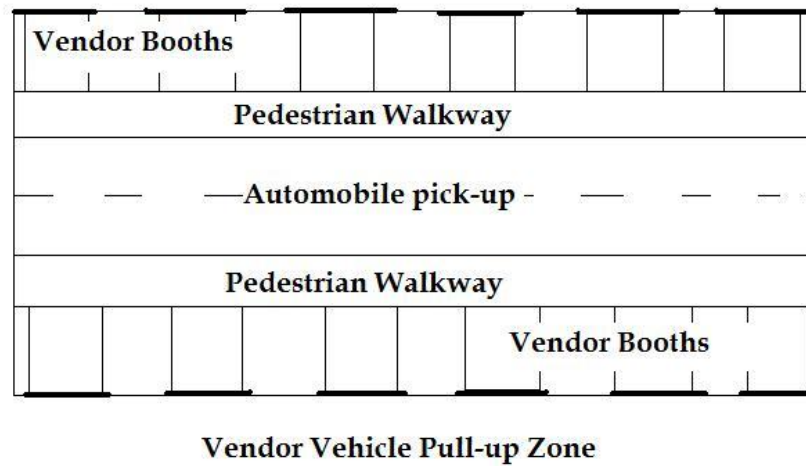
Market Design

Both markets are designed with appropriate availability of nearby parking. The markets are strictly for pedestrians during market hours. The Battle Ground Farmers' Market takes place in the Battle Ground Village, with some vendors set up on sidewalks in front of shops and others in a "U" shape around a fountain. The Camas Farmers' Market is set up on one street block that the City of Camas closes weekly for the market. The vendors line up on both sides of the street, with the customers walking in the center of the street. Neither market has a permanent structure. All the vendor booths at both markets are set up and taken down each market day.

Current culture is heavily based on individual transportation, as seen in the percentage of customers arriving at the markets in personal vehicles (77% of Battle Ground customers and 79% of Camas customers). Therefore, parking close to farmers' markets is important for customers. If parking is limited, people are less likely to shop at the market. Various farmers' market models exist that encourage automobiles. For example, an interviewee who is a previous farmers' market vendor and current farm operator believes that customers need to be able to drive through the market in order to pick up large amounts of produce, such as boxes of fruit. He argues that the main purpose of farmers' markets is to move large quantities of product, and therefore the best way to do this is via drive-up loading lanes. His vision includes a different market design altogether. Figure 4.1 presents this vision of vendors parking their trucks by the stalls, pedestrian walkways in front on vendor stalls, and an automobile drive-through lane to pick up purchases.

While this idea may promote product movement, it also may change the market atmosphere, and would also require both the Battle Ground and Camas markets to change locations. Although the majority of customers currently use personal vehicles, farmers' markets

Figure 4.1. Concept of market layout for most efficient product movement.



are a platform to encourage other modes of transportation and decrease automobile usage. To better the community, farmers' markets can promote more environmentally friendly methods of transportation. While the traditional carpool, bike, and public transportation options have environmental benefits, first it is important to realize what barriers exist for customers to practice more environmentally friendly transportation options. For example if people live very close by, but are unwilling to walk because they are worried about carrying purchases back home, the market could create some sort of wagon lending system. Or, if the customers are not within walking distance, a shuttle/carpool could go between neighborhoods and markets.

Growing Practices

Farmer growing practices also play a significant role in environmental sustainability, as they keep farmland in production and farmers' market growers typically participate in more environmentally conscious growing practices. The Battle Ground Farmers' Market grower vendors represent approximately 90 acres, and the Camas Farmers' Market grower vendors represent approximately 232 acres. While these amounts may appear small, they are still quite

significant in preserving open space (Bryson, 2007; Fisk, n.d.) in the Clark County area. It is likely that the Camas grower acreage is higher than the Battle Ground grower acreage because the Camas market has more grower vendors than the Battle Ground market.

As discussed in Chapter Two, growing certified organic products is one method of working toward sustainability, but certainly not the only option. In fact, none of the 16 vendors surveyed at either market were certified organic. Although Kremen et al. (2004) claims that demand for organic produce is growing nationally, my data does not show this trend at the markets studied. Reasons given by vendors at the Battle Ground and Camas Farmers' Markets for not certifying as organic included a) did not want to give the government money or go through all the "red tape" (N=4); b) it was not necessary because the farm was too small or relationship with customer was enough (N=4); c) too expensive (N=2); and d) farmer did not adhere to all the organic guidelines (N=1).

Based on vendor responses, it appears that becoming certified organic may not be the most practical option for small-scale farmers, the typical vendor base at farmers' markets. One vendor explains that becoming certified is "too difficult and not worth the effort. Most people don't care as long as [it's] naturally grown" (C8). Another vendor feels that the current organic certification is "designed for brokers and wholesalers, not true to what 'organic' really means these days" (BG2). Indeed, the organic certification process does take much time and resources for the farmer, which may not be worth it for the small-scale grower. However, observations revealed that a section of the public associates only organic with environmentally beneficial. Therefore products not labeled organic will not be purchased. One customer expressed her disappointment at the Camas Farmers' Market because it indeed lacked certified organic produce. However, certified organic produce is not the only measure of environmental

sustainability. Seeing this gap in some customer attitudes, I argue that farmers' markets could increase public education about the benefits of local produce (see the "Education" section for more on this).

Sustainable Agriculture Practices of Produce Vendors

While organic certification is one measure of environmental sustainability, there are other ways to evaluate the environmental impacts of growing practices. Table 4.4 below shows the percentage of vendors at each market using selected agricultural practices. All of the agricultural practices listed are considered environmentally friendly.

Of the Battle Ground Farmers' Market vendors, the most frequently utilized sustainable agricultural practices are crop rotation, using compost or manure as fertilizer, biological pest control, and testing soil for nutrients. Six out of seven respondents (86%) use each of these practices. A majority of Battle Ground Farmers' Market grower vendors also use direct seeding (71%), intercropping (71%), drip irrigation (57%), cover crops (57%), and soil conservation (57%).

Table 4.4. Percentage of grower vendors using selected agricultural practices.*

Agricultural Practice	Battle Ground		Camas	
	N	%	N	%
Crop Rotation	6	86	8	100
Compost/Manure as Fertilizer	6	86	6	75
Biological Pest Control	6	86	6	75
Test Soil for Nutrients	6	86	5	63
Direct Seeding	5	71	4	50
Intercropping	5	71	4	50
Drip Irrigation	4	57	6	75
Cover Crops	4	57	5	63
Soil Conservation	4	57	3	38

*There were seven respondents from the Battle Ground Farmers' Market and nine respondents from the Camas Farmers' Market.

All of the Camas Farmers' Market vendors surveyed use crop rotation (100%), and 75% used compost or manure as fertilizer, drip irrigation, and biological pest control. Only 38% of Camas vendors incorporate soil conservation into their growing practices. Soil conservation appears to be the least common agricultural practice. This may be due to the ambiguity of the practice. Soil conservation can take many forms and is often unique to each farm. In addition, other growing practices (e.g., drip irrigation, composting) may contribute indirectly to soil conservation.

Of the nine sustainable agriculture growing practices included in the study, soil conservation is the only practice not used by the majority of vendors at one market. For every other practice, the majority of farmers at both markets participate in sustainable behavior. Certainly, there are opportunities to increase sustainable growing practices among vendors; however, the findings suggest farmers at both markets are consciously partaking in environmentally friendly growing practices.

Grower vendors at both markets were also asked if they used genetically modified organisms (GMOs). GMOs are a recent development, which have debatable environmental impacts. Vendors from both markets acted unanimously. Not a single grower at either market uses GMOs. Labeling GMO products is not required in the U.S., thus there is virtually no way for consumers to know if a product contains GMOs unless it is clearly marked as *not* containing GMOs. The exception to this is if it is certified organic, as organic food cannot contain GMOs. Producer-consumer interaction at farmers' markets can facilitate knowledge exchange about GMOs. The data regarding GMO usage at these markets may be a relief to customers who are searching for GMO-free food. Although vendors are not certified organic, the Battle Ground and Camas Farmers' Markets are good places to purchase GMO-free produce.

Meat and Dairy

Meat, dairy, and egg farmers were also asked about their sustainable practices. However, there was only one meat vendor at the Camas market, and zero at the Battle Ground market. While questions were asked regarding rotational grazing, use of hormones and non-therapeutic antibiotics, and pasture-fed animals, the meat vendor chose to respond only to the question about pasture-fed animals. The respondent does in fact feed her animals on a pasture. Based on the lack of meat and dairy vendors at the markets, it is difficult to make general claims regarding the environmental sustainability of this component of the case study markets.

A large barrier contributing to the lack of meat and dairy vendors at farmers' markets in Clark County is the high associated fees. For a first-time farmers' market vendor, there is a \$625 minimum fee paid to the county in order to sell meat and dairy items. This fee amount is extremely high compared to other counties in Washington as well as other states in the U.S. (C. Walker, personal communication, February 22, 2010). Many potential vendors are unwilling to pay a high cost up front when their income from the market is not known. Currently community members and area farmers' markets are working with the county to implement a change in the fee structure (A. Foster, personal communication, November 23, 2009).

Water and Energy

I attempt to evaluate how much water and energy the markets consume, as well as conservation practices. Once again, I include on-site water and energy, as well as vendor behavior off-site. The physical markets use very little energy, as both markets take place outdoors, using canopies for shade and shelter. Therefore, no energy is necessary for lighting or heating buildings.

Prepared food and value-added vendors were asked, “*Do you attempt to conserve energy and water?*” Combining responses from both markets, twelve vendors responded. Eleven (or 92%) attempt to conserve energy or water off-site. Responses contain a wide range of conservation practices, from personal behavior to methods of production. Responses include: “Use fluorescent lights, carry water bottle (do not use disposable water bottles), water gardens on timers early [in the] morning with soaker hoses” (BG2); “Only use what we need, turn off equipment when not in use” (BG3); “we use only what’s needed to run our business” (BG4); “Baked products have local water only. We conserve by washing dishes/foods in three compartment sink” (C1); “Wood fired brick oven is very energy conservative, little water used other than content and essential amount for cleaning” (C2); “Yes—habit” (C6); “We don’t use electricity and not much water” (C8); and “Best practices concerning [coffee] roasting processes conserve electricity and other resources” (C9).

Overall the collected data demonstrate that farmers’ market vendors use water and energy consciously and efficiently. This may be due to the scale of operation of vendors who sell at farmers’ markets. Many vendors also report using the market for advertising and business incubation (confirming research of Gillespie et al., 2007; Zenz et al., 2005; and Feenstra et al., 2003). It is plausible that the vendors will continue water and energy conservation as their business may expand. Therefore, farmers’ markets may indirectly contribute to the expansion of environmentally sustainable businesses.

Environmental Education

Farmers’ markets may be well situated for community education, especially regarding sustainable food systems and the environment. Farmers’ markets can be a platform for educating

the public on the benefits of local food as well as environmentally sustainable practices. This education is considered imperative for sustainability (Edwards, 2005). Below are my findings on customer attitudes toward the environment, and each market's role in environmental education.

Environmental Behavior of Customers

To measure the environmental consciousness of customers, I used a dot survey question to ask customers how strongly they agreed or disagreed with the statement, "*When I buy products (not just food) I try to consider how my purchase will affect the environment.*" The response scale ranges from 1 = strongly disagree to 7 = strongly agree. Table 4.5 shows that Battle Ground customers have comparatively higher counts for the lower responses (1 through 4), whereas the Camas customers had comparatively higher counts for the higher responses (6 and 7). Lower responses indicate less environmental concern when making purchases, whereas higher responses indicate more environmental concern. The Chi-square test indicates that the Camas Farmers' Market has a more environmentally conscience customer base compared to the Battle Ground Farmers' Market.

Table 4.5. Environmentally Conscious Purchasing Behavior of Farmers' Market Customers.

Environmental Attitude	Battle Ground		Camas	
	N	%	N	%
1 = Strongly Disagree	13	8.5	7	5.0
2	13	8.5	9	6.4
3	23	15.0	12	8.5
4	38	24.8	32	22.7
5	27	17.6	24	17.0
6	38	24.8	28	19.9
7 = Strongly Agree	<u>1</u>	<u>0.7</u>	<u>9</u>	<u>20.6</u>
Total	153	100.0	141	100.0
χ^2				33.890
P-value				0.000

Perhaps customers at the Camas market became more environmentally conscience after attending the farmers' market and their associated educational programs or, more likely, the market already draws a more environmentally conscious customer base. Camas has a higher income population compared to Battle Ground, so there may be a link between demographics and environmental awareness or behavior.

Education and Outreach Programs

Each market has its own mission statement, and the inclusion or exclusion of education and outreach stated in their mission is reflected through on-site activities. The Battle Ground Farmers' Market does not formally mention education as part of its mission, while the Camas Farmers' Market states as part of its mission to "Provide education and inspiration for growing, preparing, and eating healthy foods...[and] to work with community organizations in furtherance of our mission" (Camas Farmers' Market, 2008). On-site educational programs differed greatly between the two markets. The Battle Ground Farmers' Market had a market manager's booth, where the manager was available to answer customers' questions; however there were no formal educational outreach efforts. In contrast, the Camas Farmers' Market had a more diverse education program. The market included a children's booth, chef demonstrations, WSU Master Gardeners, and special events. While not all of the programs were directly environmentally related, they likely helped increase attendance at the markets, thus contributing to sustaining local food systems. The children's booth had weekly themes and activities to suit various ages. Some weeks the activity was directly related to food such as planting seeds and painting with fruit, while other weeks it was more general children's activities including sidewalk chalk and

play dough pies. One customer commented during the dot survey that he brings his family to the market weekly because of the children's activities.

Chef demonstrations also occur weekly at the Camas Farmers' Market. A local chef demonstrates how to prepare creative and healthy dishes using ingredients available for sale at the market that day. This form of education encourages customers to buy products they would not normally purchase, and provides an incentive to attend the market regularly. Kremen et al. (2004) suggest that fresh food preparation education is likely to increase additional customer interest in organic or sustainable food production.

The WSU Master Gardeners is a program that trains "volunteers to be community educators who provide science-based information on horticulture and environmentally sound gardening practices" (Washington State University, 2010). Master Gardeners have weekly representation at the Camas market. The market also co-sponsored a viewing of *Good Food* (a film about sustainable food and farming in the Pacific Northwest) at the Camas Public Library.

The Camas Farmers' Market also hosts approximately one special event per month throughout the season. These events included All Things Pie (pie making and eating contests), a Veggie Derby (where kids make derby cars out of vegetables and race them down a ramp), Berry Days (a celebration of berries), the Most Marvelous Mutt Contest, and a cookbook and gardening book swap. These events create an extra attraction once a month to draw additional people to the market and to enhance the energy and community feeling, although they are not directly related to environmental education. Along with the monthly events, the Camas Farmers' Market has an annual Farm-to-Table Gala. The Gala is a fundraiser for the market, and guests enjoy local and freshly prepared meals, live local music, and stories from the market season. The fundraiser is

also a way to educate attendees about local food and how the market encourages and supports local farmers.

Summary

The Camas Farmers' Market has created and utilizes many more partnerships leading to additional educational programs compared to the Battle Ground Farmers' Market. My data show that Camas customers are more environmentally conscious whereas Battle Ground customers exhibit less environmentally oriented behaviors. Possible explanations for this behavior could be a) the Camas Farmers' Market environmental education program is successful in transformative learning, or b) the demographics of the area contribute to environmental behaviors. Nevertheless, both markets can serve as important platforms to increase customer education on environmental sustainability.

Research indicates that transformative learning occurs more frequently when visiting a farm compared to a farmers' market (Kerton and Sinclair, 2009). This is plausible because while on a farm, one is able to observe and potentially participate in many more aspects of food production, as opposed to seeing only the end product. However, both the Battle Ground and Camas Farmers' Markets currently lack market-sponsored on-farm activities such as vendor farm tours (except for the Camas Farmers' Market annual gala). Nor has either market implemented food waste education, as recommended by Griffen et al. (2009).

Farmers' markets are not the only successful direct marketing avenue. However, I argue that they are a strong platform to increase initial knowledge and interest surrounding sustainable food systems. This is due in part because most people have a basic understanding of farmers' markets. There are also many vendors in one location. Once a customer is at the market, they

have many opportunities to talk to growers and learn more about the local food system. After this occurs, customers may be more inclined to join a vendor's CSA, bring their friends to the market, or go on a farm tour. All of these additional opportunities will increase the customer's awareness of local food. Without the farmers' market as a platform for this growth, community members are less likely to join other direct marketing opportunities, thus limiting sustainability education.

Market Comparison

Table 4.6 compares the overall environmental sustainability of the Battle Ground and Camas Farmers' Markets. It is important to note that sustainability is more than a checklist of procedures, as the road toward sustainability requires constant improvements and adaptations based on local, national, and global situations and needs. Nevertheless, Table 4.6 is a useful model for measuring a market's sustainability at a given point in time. This type of table also allows for a tally of areas where improvement is necessary.

Table 4.6. Environmental components of sustainability, Battle Ground and Camas Farmers' Markets.

Environmental Components	Battle Ground	Camas
Waste Stream		
Garbage	Medium Sustainability	Medium Sustainability
Recycling	Low Sustainability	Low Sustainability
Composting	Low Sustainability	Low Sustainability
Reusing	Low Sustainability	Medium Sustainability
Carbon Footprint		
Customer Distance	High Sustainability	High Sustainability
Customer Mode of Transportation	Low Sustainability	Low Sustainability
Vendor Distance	Medium Sustainability	Medium Sustainability
Availability of Alternative Transportation	Medium Sustainability	Medium Sustainability
Growing Practices	Medium Sustainability	Medium Sustainability
Water and Energy Conservation	Medium Sustainability	Medium Sustainability
Environmental Education	Low Sustainability	Medium Sustainability

I use three different categories regarding progress each market is making toward various aspects of environmental sustainability. The three categories are low sustainability, medium sustainability, and high sustainability. *Low Sustainability* indicates that current procedures and/or behaviors are not environmentally beneficial, and will not be sustainable. *Medium Sustainability* signifies procedures and/or behaviors that may be sustainable, but could also be improved upon. *High Sustainability* refers to procedures and/or behaviors that can and should continue as is, for their environmental impact is very low and able to persist with current patterns long term.

Overall, the markets' environmental footprints are similar. Table 4.6 shows the same rating for both markets regarding garbage cans, recycling, composting, customer distance traveled, customer mode of transportation, vendor distance traveled, availability of alternative transportation, growing practices, and water and energy conservation. The two markets differed in reusing and environmental education. Overall there are many ways both markets could improve environmental sustainability, including implementing suggestions regarding the waste stream outlined by Ostrom and Lyons (2007) as well as environmental education programs suggested by Griffen et al. (2009). Ostrom and Lyons (2007) suggest recycling and composting at farmers' markets, as well as adequate numbers of garbage cans, and encouraging reusable shopping bags. Griffen et al. (2009) suggest farmers' markets as an appropriate venue for educating customers on ways to reduce food waste such as proper storage, cooking methods, leftover use, and composting.

Conclusion

As I discussed in Chapter Two, research on the environmental impacts and sustainability of farmers' markets has been quite limited and piecemeal. My research in Clark County,

Washington, has attempted to fill this gap. While my case study markets do not represent every market in the county, state, or nation, my findings offer insight into the environmental impacts and sustainability of farmers' markets. My approach, findings, and recommendations can help others who seek to measure and improve market sustainability. Now that I have discussed my findings in detail, the final chapter will summarize my key findings, mention limitations of my study, offer suggestions for future research, and discuss my research contributions.

CHAPTER FIVE

Conclusion

Farmers' markets often play an integral role in community food security and well-being. They are also becoming more popular in the U.S., as the numbers of farmers' markets nationwide has grown dramatically in recent decades. Looking at farmers' markets through the lens of sustainability is important in determining the future potential for markets. Sustainability includes three components: social, economic, and environmental. There has been much written regarding the social and economic benefits of farmers' markets, but the environmental impacts have not been thoroughly analyzed. Therefore, I attempted to fill this gap through case studies of two markets in Clark County, Washington. I utilized observations, interviews, RMA methods, and surveys to create a holistic approach to analyzing the environmental sustainability of farmers' markets.

Summary of Findings

My research included five main areas of investigation. The first environmental component studied was the waste stream of the markets, which includes garbage, compost, recycling, and composting. My findings were then compared to the waste management recommendations set forth by the *Washington State Farmers' Market Manual* (Ostrom and Lyons, 2007). Both the Battle Ground and Camas Farmers' Markets had similar on-site waste management strategies. Neither market had on-site recycling nor compost receptacles, but plenty of garbage cans were available. Vendors were asked what materials they used for packaging and eatery, as well. Based on responses, it is likely that if recycling and composting were available

on site, much of the vendor materials could be removed from the garbage. Also, once recycling and composting are available, vendors could be encouraged to switch to fully compostable and/or recyclable materials. My findings showed that both markets could significantly improve their waste management, as only trash cans were available on site.

Second, the carbon footprint of each market was also evaluated. Data showed that customers were largely traveling within a ten mile radius to the market. However, personal vehicles were the major mode of transport to the market. Therefore, the carbon footprint of the market customers was quite high. Promoting alternative modes of transportation such as biking and walking is recommended. Additional research may be needed regarding customer barriers to more environmentally friendly transportation options, in efforts to overcome these obstacles. Vendor distance traveled was also measured, and the average distance traveled for both markets was less than 50 miles, while the range was from less than one mile to 180 miles. Overall, the markets represented vendors from a close proximity.

Third, vendor growing practices were analyzed. The first main finding regarding growing practices was that none of the market vendors were certified organic. However, when asked about other sustainable growing practices such as drip irrigation, compost as fertilizer, direct seeding, cover crops, and biological pest control, the majority of all vendors used these practices. My research indicates that organic is not the only sustainable food production method, as small farms represented at farmers' markets are choosing not to participate in the organic labeling process for various reasons. Explanations given by vendors regarding their choice to *not* become certified organic included the belief that certification was not necessary because of strong, trusting relationships with customers; not wanting to deal with high certification costs and governmental "red tape"; and not meeting all of the organic requirements. My findings allude to

issues with the current organic certification process, as well as continuing the debate of benefits and drawbacks of local and organic produce. The second main finding associated with vendor growing practices includes the use of GMO crops and seeds. None of the market vendors grew genetically modified crops. Because of the numerous issues and unknown outcomes of these crops, knowing these farmers' markets are places to purchase GMO-free produce is beneficial to the community. In general, the markets' farmers are mostly participating in sustainable agriculture practices.

Water and energy use and conservation was the fourth component of farmers' market environmental sustainability investigated. Both markets are open-air, and therefore use very little energy overall. At each market, there were only a few vendors that prepared food on-site and needed electricity. Most vendors expressed concern for excessive waste and therefore conserved water and energy whenever possible.

Finally, I evaluated the environmental behavior of customers, as well as the amount of environmental education occurring at the markets. Customers at the Camas Farmers' Market were significantly more environmentally conscious in purchasing behavior, compared to customers at the Battle Ground Farmers' Market. Regarding environmental education, the Camas Farmers' Market has various events throughout the season (e.g., WSU Master Gardeners, children's booth, and chef demonstrations) aimed to educate customers and promote the market. In contrast, the Battle Ground Farmers' Market does not have formal educational programming. While the Camas Farmers' Market has more opportunities and partnerships involved with education, both markets could improve their environmental education components through offering more on-site and off-site opportunities and outreach programs.

Limitations of the Study

While providing insightful data regarding farmers' markets, my research focused on only two case study markets. Although my findings may represent other markets in Washington and elsewhere, it is important to remember that each market is unique based on its socio-cultural, geographic, political, and economic surroundings. Additional limitations arise from the customer dot surveys and the vendor surveys, as discussed below.

Regarding the customer dot surveys, there are two main limitations. First, question #5 asked: "*What brings you to the farmers' market?*" Some of the answer categories were not applicable to the markets studied because the question was created prior to on-site market research. The categories were not mutually exclusive, as there was a category titled "all of the above." Therefore, the answers did not indicate the *main* component of the market drawing customers. For future research, I recommend clarifying this question and ensuring mutually exclusive and exhaustive categories.

Second, the dot survey question #1, "*How far away from the market do you live (in miles)?*" had answer categories broken into five mile segments; i.e. 0-5 miles, 6-10 miles, and so forth. In hindsight, breaking the "0-5 miles" category down even further would be beneficial. Such categories could include: "Less than one mile," "1-3 miles," and "4-5 miles." As more than half of the customers at each market lived within five miles of the market, knowing more specifically how far away they live would be beneficial. For example, if most customers live less than one mile away, walking could be more easily encouraged; yet if many of the customers live 3-5 miles away, biking to the market is more feasible. Knowing more specific distances of customers could assist the market overall in encouraging appropriate alternative modes of transport to the market.

There were also several limitations on the vendor surveys. First, my data showed that none of the growers selling at the farmers' markets were certified organic, although they all participated in numerous sustainable agriculture methods. That said, it would have been helpful to also ask growers if they used synthetic pesticides, fertilizers, and/or herbicides. While I suspect many do not use such inputs, knowing this information would help to better understand the sustainability of growing practices utilized by farmers' market vendors. Also regarding the vendor growing practices, the survey did not ask the vendors to specifically indicate if those growing practices were used on produce brought to the market. While this assumption is made in my analysis, the vendors may grow different crops or portions of crops using different methods, depending on marketing outlet. Also, definitions of the agricultural practices were not provided to survey respondents, thus respondents may have had differing interpretations of terms.

The second component of the vendor surveys that limited full analysis of environmental behaviors was question #5, "*What is the make, model, and year of the vehicle used to transport the produce to the market today?*" I had hoped to gain knowledge about how the vendors were arriving at the market. If they were choosing more fuel-efficient travel options, that would lead to more environmentally friendly outcomes. However, my attempt was not successful for many reasons. Even though the make and model of the vehicle was provided, I still did not know what condition the vehicle was in, which impacts fuel efficiency. Also, if the vendor was making many other stops to various outlets, a larger vehicle may be appropriate, while the same vehicle may not seem necessary just when considering their attendance at the market. Additionally, vendors bring differing quantities of produce, requiring different types of vehicles. This correlation between vehicle and amount of product brought to the market could not be examined based on vendor questions included in the surveys.

Upon reflection, the issue of how vendors arrive at the market is not fully explained in my research; and it is a very difficult concept to quantify. One possible alternative could be to ask vendors the fuel efficiency of the vehicle, but some vendors may not know the specific miles per gallon of their vehicle. One must then take into account gasoline or diesel, as they have varying environmental impacts as well. Even if these data were provided, more questions would need to be asked to determine if that vehicle was appropriate for the quantity of product being transported. While there were various limitations to my research regarding the dot surveys and vendor surveys, overall my methods and results yielded significant findings regarding the environmental sustainability of farmers' markets.

Research Contributions and Future Research

Based on the increasing popularity and numbers of farmers' markets, evaluating the social, economic, *and* environmental sustainability of farmers' markets is crucial. My research provides comprehensive data regarding the environmental impacts and sustainability of two case study markets in Washington State. More importantly, I offer a holistic "method" for evaluating a market's environmental contributions. Through dot surveys, customer counts, observations, interviews, and surveys, I captured many aspects of farmers' market sustainability, including the waste stream, carbon footprint, electricity and water usage, vendor growing practices, and environmental education. All of these components are important when considering overall market sustainability and community impact. This holistic approach will be useful for researchers, farmers' market managers, and others wishing to measure environmental sustainability and identify areas for improvement.

The research presented in this thesis could be extended in several ways. First, research could involve case studies of farmers' markets in different types of social, economic, and environmental settings. Second, studies could explore the relationship between socioeconomic status and environmental attitudes in different market locations. Third, research could investigate customers' waste disposal practices at home and perhaps follow the products sold at farmers' markets from the "cradle to grave."

While my research addressed the environmental sustainability components of farmers' markets, the social and economical issues associated with farmers' markets are also important when determining a farmers' market's overall sustainability. Farmers' markets are playing an integral role in reestablishing local food systems. By offering a direct marketing option as an alternative to the modern large-scale conventional agriculture system, farmers' markets assist in assuring local food security and thriving healthy communities.

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APPENDIX A

Semi-Structured Interview Questions

Farmers' Market Manager Questions

1. What is the history of this farmers' market?
2. How did you become involved?
3. What are your thoughts about this farmers' market in general?
4. What is the structure of the market (who oversees it, etc?)
5. What do you think are the biggest challenges for your market?
6. What is the biggest success of this market?
7. Do you shop at the farmers' market? Why or why not?
8. Do you think that farmers' markets are environmentally friendly in general? Why or why not?
9. Would you consider your market environmentally friendly?
10. Do you think the market can continue on well into the future?
 - a. In regards to economics, environment, and social issues
11. What would you like to see done differently regarding the market?
12. In your opinion, does the market fit into development plans and overall goals for the city?
13. What types of resistance and support have you received from the community?

Community Member Questions

1. What do you see as the pros and cons of farmers' markets?
2. Why do you not sell at Farmers' Markets?
3. Please share your input on the farmers' markets in Clark County
4. What are the pros and cons of other direct marketing avenues you participate in besides farmers' markets?
5. Do you think farmers' markets are sustainable? (Economically, environmentally, and socially)
6. If not, what would it take for it to become sustainable?

City Official Interview Questions

1. What type of support does the farmers' market receive from the city?
2. What are the pros and cons of the farmers' market in your opinion?
3. How does the market fit into this city's plans on a larger scale?
4. Do you shop at the farmers' market? Why or why not?
5. What would you like to see changed about the farmers' market?
6. What are the market's biggest strengths and weaknesses?

APPENDIX B

CLARK COUNTY FARMERS' MARKET VENDOR SURVEY

ALISON WESOCKES, Study Coordinator

School of Earth and Environmental Sciences, Washington State University

Thank you for taking the time to complete this survey. All answers will be kept confidential and anonymous. All published survey results will be based on combined data from all respondents, and neither your name nor your individual answers will be indicated.

Please circle or write in the best fitting answer for each question.

1. Do you sell at this market weekly? YES NO

2. Do you sell at other farmers' markets? YES NO

If yes, which ones?

3. How many years have you been selling at farmers' markets?

4. How many miles did the products you are selling travel to reach today's market?

5. What is the make, model, and year of the vehicle used to transport the goods to the market today? (Example: 1995 Ford Taurus)

6. Are you certified organic? YES NO

Why or why not? Please explain below:

7. Do you have other certifications besides organic? YES NO

If yes, which one(s)?

8. Why do you sell at farmers' markets? Please explain:

9. What happens to the food that does not sell at today's market? Please explain:

10. Do you attempt to conserve energy and water? YES NO

If yes, please explain below:

11. Do you attempt to reduce the use of toxic and hazardous materials? YES NO

If yes, please explain below:

12. Do you attempt to reduce waste (packaging and food waste)? YES NO

If yes, please explain below:

13. Do you use artificial flavors, colors, and/or preservatives? YES NO

14. What materials are your utensils, cups, plates, etc? Please check all that apply:

- ☐ Plastic
- ☐ Polystyrene
- ☐ Paper
- ☐ Compostable (corn/starch)
- ☐ Aluminum
- ☐ Other: _____

FOR BEVERAGE VENDORS ONLY:

15. Do you offer discounts for reusable mugs? YES NO

IF YOU HAVE ADDITIONAL COMMENTS, PLEASE WRITE THEM BELOW:

APPENDIX C

CLARK COUNTY FARMERS' MARKET VENDOR SURVEY

ALISON WESOCKES, Study Coordinator

School of Earth and Environmental Sciences, Washington State University

Thank you for taking the time to complete this survey. All answers will be kept confidential and anonymous. All published survey results will be based on combined data from all respondents, and neither your name nor your individual answers will be indicated.

Please circle or write in the best fitting answer for each question.

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If yes, which ones?

3. How many years have you been selling at farmers' markets?

4. How many miles did the produce you are selling travel to reach today's market?

5. What is the make, model, and year of the vehicle used to transport the produce to the market today? (Example: 1995 Ford Taurus)

6. Are you certified organic? YES NO

Why or why not? Please explain below:

7. Do you have other certifications besides organic? YES NO

If yes, which one(s)?

8. Why do you sell at farmers' markets? Please explain:

9. What happens to the produce that does not sell at today's market? Please explain:

Please answer the following questions regarding your farming practices.

10. How many acres do you farm?

11. Are farmers' markets the only marketing channel for your products? YES NO
If no, what other marketing channels do you use?

12. Do you use crop rotations? YES NO

13. Do you use direct seeding/no till methods? YES NO

14. Do you use cover crops? YES NO

15. Do you use intercropping/companion planting? YES NO

16. Do you use manure and/or compost as fertilizer? YES NO

17. Do you use drip irrigation? YES NO

18. Do you use biological pest controls? YES NO

19. Do you grow GM (genetically modified) crops? YES NO

20. Do you test soil for nutrients? YES NO

21. Do you take part in soil conservation/erosion control? YES NO

If yes, please explain how:

FOR MEAT AND DAIRY ONLY:

22. Do you use rotational grazing? YES NO

23. Do you use hormones or non-therapeutic antibiotics? YES NO

24. Are your animals pasture-fed? YES NO

IF YOU HAVE ADDITIONAL COMMENTS, PLEASE WRITE THEM BELOW: