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Choices and Preferences of Vermont Master Gardeners - Do Socio-Demographics Matter?

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CHOICES AND PREFERENCES OF VERMONT MASTER GARDENERS – DO SOCIO-DEMOGRAPHICS MATTER?

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ABSTRACT

This study was designed to characterize the choices, preferences and motivations of fruit and vegetable gardeners in Vermont, and to determine whether socio-demographic characteristics affect some of these choices, preferences and motivations. Using a survey of Vermont Extension Master Gardeners (EMGs), data were gathered over a 3-year period (2011-2013). The findings show over 90% of Vermont EMGs grew fruits and vegetables in private home gardens, and the most popular vegetables grown were tomatoes, herbs, and salad greens. Beans, cucumbers and peppers were also popular and over 40% of EMGs grew blueberries, apples, raspberries and strawberries. Approximately 10% of EMGs who had a garden during that period did not grow any fruit or berries, and the 10% of EMGs who did not garden at all cited lack of gardening space and time as their main constraints.

Vermont EMGs are concentrated around urban centers, however, their distribution is approximately proportional to the general population across the state. Vermont EMGs reflect the aging population of the State with 74% above the age of 50. In over 60% of households, females are make most of the gardening decisions and do most of the gardening work. Over 70% of the Vermont EMGs are college-educated, and live in households with incomes above $50,000. The most important motivations for gardening were 'Having a Taste of Homegrown Fresh' produce (ratings above 4.5/5) and 'Fun/Relaxation/Hobby.' Gardeners considered 'Food Safety' and 'Environmental Concerns' as important, while 'Saving Money' was not rated as highly as a motivation. EMGs prefer local plants and products and prefer to buy at local garden centers/supply stores. Over 70% rely on 'Books,' the 'Internet,' 'Extension,' 'Friends' and 'Print Articles' for gardening information, while videos and television are relied on by less than 10% of EMGs.

In all regression models estimated, demographic characteristics (age, education, gender of the gardening decision-maker, and annual household income) were found to have limited explanatory power ($R^2 \leq 0.1$) on EMGs' decision to garden, or the choice/motivation for where to purchase plants and gardening supplies. This finding suggests that Vermont EMGs may be an environmentally significant group whose motivations, preferences and choices might be better explained by their attitudinal and value norms rather than socio-demographic characteristics. This finding suggest that future research and educational programs should be designed and delivered according to these characteristics rather than the commonly used demographic ones.

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TABLE OF CONTENTS

Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER 1: INTRODUCTION

This chapter provides a brief background overview of the rationale for this research, a description of its objectives and a statement of the research hypotheses.

1.1. Background

Gardening is now widely recognized as an essential part of the global food system (World Health Organization, 1990) and in the United States, 35% (42 million) of all households are now growing some of their own food, up from 17% in 2008 (National Gardening Association, 2014). This upsurge in interest has resulted in a 40% increase in expenditure on food garden plants and supplies which now stands at over $3.5Billion. The demographics of gardeners are also changing and 76% of all new food gardeners are between the age of 18 and 34 years (National Gardening Association, 2014).

Recent events including hurricanes Irene and Katrina and the global recession of 2009 have resulted in an increased awareness of the vulnerabilities of the current highly consolidated, standardized and fossil-fuel dependent food system and have focused attention on the potential gardening may have in mitigating some of the negative impacts the current food system has on the environment, ecosystems and communities (Taylor and Lovell, 2014; McClintock et al., 2016).

While several studies have examined how gardening affects attitudes and motivations as well as health, the environment and human behavior (Ahern et al., 2011), very little is known about gardeners themselves or how their socio-demographic characteristics affect their gardening preferences and choices (Behe et al., 2010; Schupp and Sharp, 2012; Taylor and Lovell, 2014). Master Gardeners at the national and state-

levels constitute distinct consumer groups that can increase our understanding of gardeners and their choices, preferences and motivations (Brzuskek et al., 2010). They have considerable and comparable knowledge in sustainable gardening practices having received locally appropriate training at Land Grant Universities in order to be successful as gardeners themselves, and support their local communities effectively.

The success of the Master Gardener Program can be attributed to its ability to provide tailored information that meets the needs of its clients, maintaining close ties to the Land Grant Universities that generate new science-based horticultural knowledge, and extending reliable and constant outreach to new clientele with relevant gardening information, assistance and advice (McAleer, 2005; Tackle, 2015). As gardeners, Master Gardeners purchase plants and supplies for their own gardens, and as mentors and opinion leaders, affect the decisions of community members through their volunteer education and outreach activities. Master Gardeners currently number over 95,000 nationwide and there are over 900 active Vermont EMGs (University of Vermont Extension, 2017).

University Extension programs nationwide continue to face budget cuts that have resulted in reductions in the number of horticultural specialists and agents (Harder et al., 2005; University of Vermont Extension, 2011). This has led to a heavier reliance on volunteer programs such as the Master Gardeners in order to be able to fulfill institutional outreach education objectives. Despite its name and working closely with Extension, the Vermont Extension Master Gardener (EMG) program relies mostly on grants, its members and well-wishers for funding. Volunteers donate time and expertise to support

projects statewide. In 2015, for example, Vermont EMGs donated over 11,000 hours of their time and expertise to Vermont communities (UVM Extension Master Gardeners, 2016).

Vermont is a small rural state with few urban areas concentrated around Chittenden County and towns such as St. Albans, Montpelier and Rutland. With an aging population and a rural, mountainous topography, the state's economy is heavily reliant on small to medium-sized farms and businesses. According to the U.S. Small Business Administration (2017), businesses with fewer than 50 employees supply 96% of the state's private jobs. Policy makers seeking to understand the gardening sector and its role in the food system may find this information on gardeners useful in their service-delivery and program planning, as would the business-sector – including garden centers who supply the gardening plants and other gardening inputs.

There is therefore a need to better understand if and how socio-demographic characteristics affect gardeners' choices and preferences in what they grow, where they buy plants and gardening supplies, and how these characteristics affect their motivation to garden. The findings from this research may be beneficial to the Vermont Extension Master Gardener program that serves Vermont gardeners, as well as similar statewide programs, that are in search of ways of becoming more efficient in the use of their limited resources. Crucial insights from research on the contribution and potential impacts EMGs have on University and State-wide policy objectives can play an important role in justifying continued support for the Master Gardener program. Other stakeholders

including garden centers might also use this information to better understand their customers as they try to improve services and profitability.

1.2. Research Objectives

The objectives of this research are twofold. The first is to describe Vermont Extension Master Gardeners (EMGs) in terms of their choices, preferences and motivations for various decisions in their fruit and vegetable gardening. This description is based on Vermont EMGs' responses to a survey conducted over 3 year between 2011 and 2013. The second objective is to determine if the socio-demographic characteristics of Vermont Master Gardeners affect their preferences and choices in fruit and vegetable gardening.

The study provides an overview of the preferences, motivations, and choices of Vermont EMGs in fruit and vegetable gardening by presenting the summary results of the survey conducted over 3 years: 2011, 2012 and 2013. It then uses statistical analyses to determine if socio-demographic characteristics of Vermont EMGs (age, education, and gender of the gardening decision-maker and household income) affect their gardening motivations, choices and preferences, with respect to their reasons for gardening and where they purchase plants and supplies.

1.3. Research Hypotheses

The following are the research hypotheses:

1. Socio-demographic factors affect the level of importance Vermont EMGs attach to different reasons for gardening.

2. Socio-demographic factors affect the level of importance Vermont EMGs attach to different sources of gardening plants and supplies.

3. Socio-demographic factors affect the level of importance Vermont EMGs attach to different reasons for choosing where to purchase gardening plants and supplies.

1.4. Organization of the Thesis

The thesis is organized into six chapters. Following this Introduction is Chapter 2 which provides a Literature Review, Chapter 3 is the Methods and describes data collection procedures, variable definition and operationalization, and data analyses methods. Chapter 4 presents the Results; Chapter 5 is a Discussion of the Results, and Chapter 6 presents the study Conclusions and Implications.

CHAPTER 2: LITERATURE REVIEW

An upsurge in interest in fruit, vegetable and herb gardening is underway, and is occurring at a time when the world's population and urbanization are continuing to rise (Takano, 2005). Over 800 million people worldwide are currently estimated to be malnourished or undernourished, according to the United Nations World Food Program. Global urbanization is also changing the way people obtain food and where it is produced. Although cities comprise approximately 3% of the world's total land area, by the year 2050, over 60% of the world's population will be living in urban areas (United Nations, 2014). Currently, over 80 percent of the U.S. population live in urban areas (U.S. Census Bureau, 2010). This shift, coupled with a clearer appreciation of the negative impacts of our current industrialized world, has brought greater attention to gardening and home food production.

While the U.S. Department of Agriculture (USDA) has a formal definition for a farm – a place from which $1,000 or more of agricultural products are produced and sold in a year (Carlin and Crecink, 1979), there is no formal definition of a garden as an economic unit. From the definition of a farm, the USDA formulates programs and policies for farmers with a primary focus on commodity agriculture including grain, livestock, and fiber crops such as cotton. Farmers benefit from these designated federal programs which have funding appropriations, producer and market data tracking and assessment and monitoring mechanisms. In the case of feed crops, for example, federal funding is available to assess soil fertility, yields and historical price data, even a

database is maintained of feed producers at the local, state and national levels. Such is not the case with horticulture and gardening, edible or otherwise.

Although horticulture accounts for almost 40 percent of U.S. crop production, it lacks significant federally mandated programs or long-term budgetary appropriations for programming (Harris, 2015). This limits the ability of researchers to study and understand the sector, or find historical data to help track changes over time. Nationally, little is known about fruit and vegetable gardeners or the impact their socio-demographic characteristics have on gardening motivations, preferences and choices (Behe et al., 2010; Schupp and Sharp, 2012; Taylor and Lovell, 2014).

The National Gardening Association is a private organization that has for decades conducted research on gardening, including those growing fruit and vegetables. However, although their studies are national in scope, the data is proprietary and not available for public research use. Summary findings from their studies indicate that gardening is a $3.5 billion sector that is experiencing rapid growth with 1 in 3 households growing some of their own food. Between 2008 and 2013, those aged 55 years and older accounted for the largest proportion of gardeners (36 percent) but gardening among younger people (18-34 year olds) grew by 63% during that period (NGA, 2014).

2.1. Gardening Motivations

The reasons for gardening fruits and vegetables vary based on personal interest, resource availability and constraints, and past experiences. Socio-cultural practices and expectations can also have an impact on and individual's motivation to garden.

2.1.1. Health, Nutrition and Wellness

Among the most commonly cited reasons for fruit and vegetable gardening is a desire to improve health. Studies show that gardening does improve health and wellbeing including promoting a positive attitude and motivation (Carter et al., 2009; Ahern et al., 2011; Nolan et al., 2012). In urban areas community gardening provides a social avenue for interaction between neighbors, relieves stress and offers mild physical activity and exercise (Rodiek, 2002; Park, 2007; Smith, 2008). Among the elderly, gardening serves to reduce social isolation and provides opportunity for interacting with nature which, in some cases has profound health benefits (Hawkins et al., 2013) including reducing the risk of dementia (Simons et al., 2006).

Fruit and vegetable gardening promotes the consumption of more nutritionally healthy diets (Nolan et al., 2012; Chaufan, 2015). Childhood obesity in the United States has been termed a national health crisis with rates among 6-17 year olds having more than doubled in the last few decades (Nolan et al., 2012). Hands-on gardening, for example through school gardens tends to result in better nutrition among children and higher consumption of fruits and vegetables beyond what is achieved through theoretical nutritional education programs (Cotugna et al., 2012; Langellotto and Gupta, 2012; Nolan et al., 2012).

Furthermore, the experiences and memories created through gardening (Smith, 2008) can have enduring effects on food choices as young people develop a culture of health which in turn can reduce the risk of childhood obesity (Chaufan et al., 2015). In very young children (2-5 year olds), nutrient dense vegetables such as butternut squash

which is high in beta-carotene and Vitamin A, can be incorporated into the selection of garden plants for nutrient targeting in the diet (Faber et al., 2002).

Some of the healthful plants included in fruit and vegetable gardens also have medicinal properties (Bose and Laramee 2011; Yang et al., 2017). Among the Asian immigrant communities in the Burlington area of Vermont, for example, daikon radish *Raphanus sativus* is a valued vegetable, uncommon in western cuisine (Laramee and Waterman, 2015). High in Vitamin C, both the roots and leafy portions of daikon are used. Daikon is an important vegetable in these diets, but also has palliative effects aiding in digestion. It has also been found to be beneficial in cancer prevention similar to other plants in the brassica family (Force et al., 2007).

It is estimated that 80% of the world's population depends on herbal medications for their primary healthcare (Ekor, 2014). While culinary herbs have been a part of western diets for centuries, it is only in the last few decades that medicinal herbs have become mainstream (Ekor, 2014) and with the growth of the organic movement, many western gardeners are expanding their use of herbs in their diets for health and wellness (Saldivar-Tanaka and Krasny, 2004). In many indigenous cultures, medicinal plants are an integral part of the culture and are either grown in the garden or gathered from the wild. In the Ecuadorian Andes for example, gardens managed by women are largely devoted to medicinal plants (Finerman and Sackett 2003), and when access to healthcare facilities such as hospitals is limited by distance or a lack of resources, these medicinal plants become a vital component of the garden (Galluzzi et al., 2010; Yang et al., 2017).

The concept of wellness through gardening transcends the physical (exercise and nutrition) to the metaphysical, spiritual and social dimensions (Wright and Wadsworth 2014). Gardeners find intangible benefits including therapeutic connections with others in the community at an emotional and spiritual level (Ferrini, 2003; Sommerfeld et al., 2010). This is salient for older people who often otherwise are more likely to suffer social isolation and lack of inter-generational engagement.

Community gardens are particularly beneficial in creating neighborhood connections and attachment (Comstock et al., 2010; Adams, 2014; Wright and Wadsworth, 2014; Scheromm, 2015). These types of gardens can be traced back to the Industrial Revolution when an influx of people from rural areas created an urgent need to produce food in urban settings (Armstrong, 2000; Saldivar-Tanaka and Krasny, 2004). While many gardeners are initially drawn to community gardens by the opportunity to grow some of their own food, their motivation often expands to include addressing economic, social, cultural and environmental issues that affect their community (Saldivar-Tanaka and Krasny, 2004; Teig et al., 2009). Successful community gardens ultimately serve as a place for the community to grow food, while simultaneously 'growing' the community (Lawson, 2005; Wakefield et al., 2007). It is not uncommon to find gardeners remaining active in a community garden even after they have moved to homes in other locations (Holstein, 2016).

2.1.2. Food Security and Budgetary Considerations

Between 2012 and 2014, 13% of Vermont households were food insecure (Coleman-Jensen, 2010). While household income poses the biggest hindrance to

accessing food for the majority, immigrant households, such as the new Americans who have settled in Vermont from countries as diverse as Bhutan, Bosnia, Burma, Burundi, Congo, Iraq, Somalia, Sudan and Vietnam, face a more complex web of food security challenges. These range from adapting to new foods, as well as ways of accessing, preparing, and growing it. They do this as they are attempting to grapple with a new culture and language, and find ways to make an economic life to meet household budgetary needs. Many struggle to incorporate familiar foods from the home country while accessing what is available locally (Mares, 2017).

During periods of economic hardship and uncertainty, the need to secure household food supply and save money often becomes urgent (Galhena et al., 2013; Langelloto, 2014). Several periods that stand out historically include the Great Depression following the stock market crash of 1929 as well as World War I and World War II. After the market crash of 1929, relief gardens were promoted as a way to ensure food security (Tucker 1993) while during World War I and II, governments promoted so-called 'Victory Gardens' as a way for citizens to grow their own produce and supplement national food supply to mitigate the impact of shortages precipitated by limited manpower on farms and in transportation (Mok et al., 2014). Victory Gardens served both as a productive resource and a morale booster as citizens could participate in an essential way in the war effort. More recently during the global economic recession of 2009, First Lady Michelle Obama championed edible gardening as a way to foster food security and better nutrition (McClintock, 2010).

Food budgets of low income households are often constrained, limiting consumption of fresh fruit and vegetables (Johansson and Andersen, 1998; Taylor and Lovell, 2014; Mares, 2017). In rural areas where land is available, gardening can serve as a way to supplement food supply while generating cash through the sale of surpluses (Reyes-García et al., 2012; McClintock et al., 2016). In urban areas where land is more limited community gardens provide a place for such households to grow some fruits and vegetables (Eigenbord and Gruda, 2015; Poulsen et al., 2015). The actual net cash savings from gardening vary depending on geographic location, the amount of labor and the type of plants selected (Utzinger and Connolly, 1978; Stall, 1980; Stephens et al., 1980; Patel, 1991). However, leafy greens and tomatoes have been found to yield higher returns compared to other crop types (Gilbertie and Sheehan, 2010), as have strawberries, squash, peas and eggplants (Langelloto, 2014).

2.1.3. Environmental and Food Safety Concerns

Environmental and food safety concerns are a motivation for many gardeners to grow their own fruits and vegetables. In an effort to mitigate the impacts of the industrial food complex and globalization, these gardeners identify themselves with, such movements as 'locavore,' 'food justice,' 'food sovereignty,' 'local food' and 'slow food,' among others (Pollan, 2001; Zepeda and Deal, 2009). These gardeners' outlook is to attain a 'sustainable diet' - one which provides healthy and nutritious food in a way that contributes to biodiversity and ecosystem health in the places where they live and garden (FAO 2015).

In avoiding the use of Genetically Modified Organisms (GMOs), harmful pesticides and herbicides, these gardeners promote food safety, relying on local, organic inputs and gardening methods (Hertwich, 2005; Carlsson-Kanyama et al., 2003; Weber and Matthews, 2008; Kemp et al., 2012). An additional strategy for promoting ecosystem health in soils and the environment is the adoption of plants that have unique beneficial attributes. For example, daikon radish (*Raphanus sativus*) has the ability to improve aeration, water penetration and in turn enhance conditions for soil biotic life.

In urban areas where garden soils are often heavily compacted the bio-drilling capacity of the daikon radish can play an important role (Bose and Laramee, 2011; Laramee and Waterman, 2015). Another example of an important garden plant is Amaranthus (*Amaranthus spp.*), also known as 'African spinach', 'Chinese spinach', or 'pigweed'. This vegetable has C4 metabolism capabilities that enable it to grow efficiently in adverse conditions of heat and drought, prevalent in urban settings, while at the same time offering a superior source of vitamin C, riboflavin, niacin, and various micronutrients. Such plants not only add to the repertoire of local foods, but also serve important eco-functions (Wamsler, 2014).

While ecologically conscientious gardeners strive to incorporate beneficial plants that promote biodiversity (Bendt et al., 2012; Atkinson and Kim, 2015), they are wary of disrupting the fragile ecological equilibrium that exists between native plant species, land races and exotics (Burghardt et al, 2009). The constant threat of exotics becoming invasive and crowding-out ecologically important plants is one that requires vigilance (Seabloom, 2003; Wiederholt et al., 2015). However, this process is complicated since

consumption of fruits and vegetables, and the types of plants gardeners choose is determined by a complex set of factors, including environmental, socio-cultural, economic and demographic considerations, as well as access to resources (Pollard et al., 2002; Brzuszek et al., 2010).

2.2. Garden Plant Selection

Gardeners choose fruits, vegetables and herbs to grow based on their tastes and preferences yet are constrained in their selection by the resources available to them including bio-physical, personal or household, and the socio-cultural context where their gardening takes place (Loram et al., 2008; Herzog, 2016). Plants require appropriate bio-physical conditions in order to thrive and be productive. These include soil, water, light, air and biotic resources along with beneficial insects such as pollinators and micro-organisms that promote soil health and its ability to provide nutrients that support the garden plants. Soil pH, tilth and slope of the garden also affects the ability to have a garden and the types of plants that will thrive.

Vermont's geographic terrain is mountainous and wooded, and in many locations homes are built into hillsides without much space, soil or light adequate for growing a vegetable garden. Growing season length is affected by altitude and latitude, and gardeners farther north and at higher altitudes have a shorter growing season (USDA Gardening Zone 3) compared to those located at lower altitude and farther south (USDA Gardening Zone 5). Topographical and Gardening Zone Maps for Vermont are shown in Figure 1.

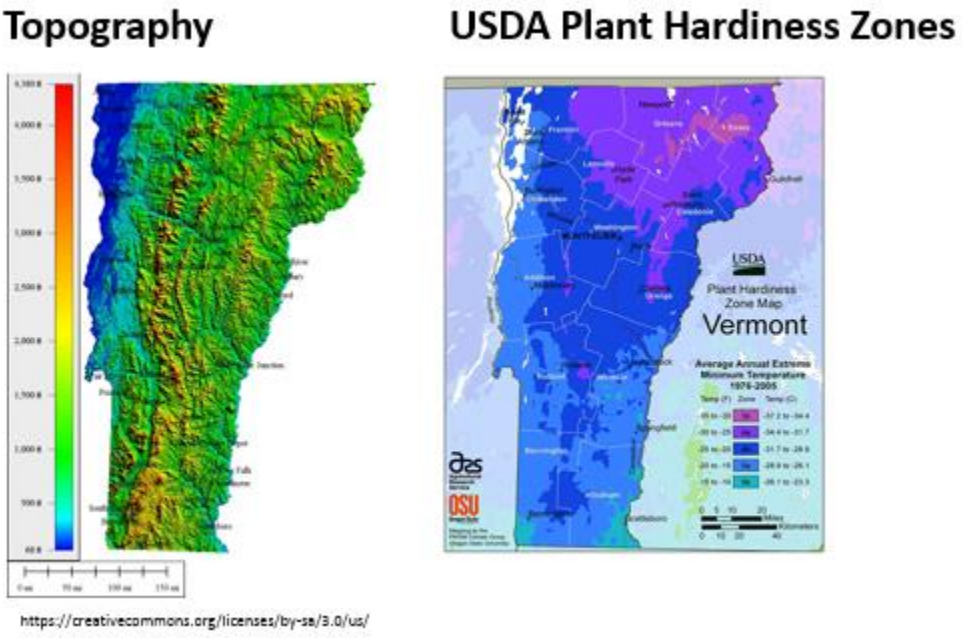

Figure 1. Vermont Maps - Topography and USDA Plant Hardiness Zones

While topography and climate alone do not preclude gardening, they make it challenging in the coldest of locations, especially when climate is coupled with poor soils and limited sunny locations. Topography, climate and plant hardiness affect plant choices and limit those that can grow (or the number of plantings) in the highest elevations. Gardeners sometimes use different strategies to extend the growing season, for example using cold-frames and other insulation methods. However, these can be costly and are considered by some to be too time consuming.

Another factor that affects plant choices is the quality of soils. This is especially important in urban areas where community gardens are established on soils that may be contaminated with heavy metals from previous use (Ramirez-Andreotta et al., 2013). Lead (Pb) is one of the most common contaminants, but others including copper (Cu),

nickel, (Ni), zinc (Zn), and aluminum (Al) may also exist (Pruvot et al., 2006; Bretzel et al., 2016).

Selection of fruits and vegetables that will be least likely to pose health risks is important, especially with regard to young children (Lanphear et al., 1998; Finster et al., 2004). For example, French beans and tomatoes have been shown to be 'low accumulators' of pollutants compared to lettuce and leaf radish (Kuboi and Yazaki, 1986; Alexander et al., 2006). Soil pH can be adjusted to reduce metal mobility and lower toxicity in certain vegetables, but this changes the biotic life of the soil, so periodic soil tests are necessary to ensure soils stay productive. In soils where contamination is not a concern, soils often still need to be amended to improve nutrient levels, porosity and water holding capacity.

2.2.1. Socio-Cultural Factors

There are few studies that document the types of plants in home gardens in the United States, and they are mostly focused on urban and community gardens among vulnerable populations including minorities, the elderly and the urban poor (Alkon and Mares, 2012; Taylor and Lovell, 2014; Zainuddin and Mercer, 2014). Conversely, home garden plant types and species diversity has been studied extensively in the Global South. These studies indicate that socio-cultural factors affect species richness and crop diversity in home gardens.

In the Peruvian Andes, for example, different ethnic communities cultivate specific medicinal plants (Perrault-Archambault and Coomes, 2008). Similarly, in the Ecuadorian Andes, gardens are mostly managed by women and largely devoted to

medicinal plants reflecting household demographics such as age and reproductive status (Finerman and Sackett, 2003). Exchange networks for seed and other planting materials between kin, relatives, close friends and neighbors rely on key mediators, mostly women, who are reputed to have extensive knowledge of local species and land races (Calvet-Mir et al., 2012; Reyes-García et al., 2012; Diaz-Reviriego et al., 2016).

2.2.2. Economic Factors

The goal of saving money is commonly cited as motivating gardeners to grow their own fruits and vegetables. However, this only holds true when the labor costs for gardening are not factored in, or when cash is not available to purchase the vegetables, hence they must be grown or consumption forgone. Retail prices at the grocery store reflect the lower cost of production attainable by commercial large-scale growers under the current food system regime. For gardeners seeking to save money, what in fact they are able to achieve is a reduction in cash expenditure when they have the time and skill to grow fruits and vegetables successfully (Scheromm, 2015). Often time responsibility for gardening tasks falls on those who have retired and therefore have more time to garden, or stay-at-home caregivers of young children. Additionally, those who have the disposable income and space, usually reflected in home ownership, are able to grow fruits and vegetables.

2.3. Gardeners' Retail Outlet Preference and Motivations

While studies on gardeners' purchase behavior are relatively few (Zaffou and Campbell, 2016), researchers find that gardeners purchase plants and supplies from a variety of retail sources including local garden centers, gardening supply stores, mass

merchandisers (or ‘big box’ stores), grocery stores and other retail outlets. Online purchasing from nurseries and other websites is also becoming increasingly important (Behe et al., 2008; Behe et al., 2013). Purchase decisions are influenced by price, convenience, advertising and promotion, and personal assessments of retail source with respect to quality, variety of products, and customer service.

For gardening centers and garden supplies stores, maintaining competitive prices is difficult due to the relatively high cost of producing fruit and vegetable plants (Caceres, 2005; Rihn et al., 2016). Gardeners who prefer local and organic products tend to be less sensitive to price (Li et al., 2007; Zaffou and Campbell, 2016) and this type of gardener is increasing in numbers with those aged between 18-34 now comprising 52% of buyers (Organic Trade Association, 2016).

2.3.1. Quality Perceptions

According to Lancaster's utility model (1966), consumers buy goods based on assumptions of the utility different attributes of the good will yield (Onozaka and Mcfadden, 2011). In purchasing plants, visual appearance is one of the important factors that gardeners consider (Kelley et al., 2001). However, many of the plant attributes gardeners seek cannot be visually determined. These credence attributes include whether plants were grown using organic methods and whether they are of ‘local’ origin (Hall and Dickson, 2011; Yue et al., 2011). Gardeners may be motivated to buy local plants, even at a premium price in order to support the local economy, or because they perceive the products to be of superior quality compared to non-local ones (Collart et al., 2013; Rihn et al., 2016).

For hardware gardening supplies, many gardeners perceive large retail stores as having the same quality of hardware and gardening supplies as the independent gardening centers - only at a lower price, hence they may buy some supplies if they are specialized or out of convenience in saving themselves a trip to the hardware store (Safley and Wohlgenant, 1995). Gardeners that choose local garden centers are drawn by their close proximity but may be discouraged by the limited selection of plants offered as the stores are often constrained by space. Customers also expect higher quality plants from independent garden centers and nurseries compared to what they expect from mass merchandisers (Geistlinger, 1994; Safley and Wohlgenant, 1995). The businesses that sell garden plants all vie for a limited number of customers, and they each try to do their best to attract new ones and retain those who are already loyal. Given the aging population in a state like Vermont, and a short gardening season, garden centers and gardening supply stores have to do everything they can to be profitable and able to stay in business from one year to the next (Hall and Dickson, 2011; Sturdivant, 2013). This requires knowing what gardeners are looking for and being able to offer it in the store.

Products that are locally grown or organic may attract a certain type of gardener, in particular those that perceive local and organic products to be more sustainable, healthy, and environmentally benign compared to their conventional counterparts (Raab and Grobe, 2005). Some gardeners rate ‘organic’ as more important while others rate ‘local’ higher (Yue et al., 2011; Hawkins et al., 2012; Campbell et al., 2015). In his theory of moral norms, Schwartz (1994) proposed that when individuals become aware of potential adverse consequences of their actions, assume responsibility and then take action to avert the

negative consequences, this can become a moral norm and affect future actions and choices.

As gardeners become more aware of the negative consequences of non-native plants, invasive species, food miles, and other environmental impacts, they may change their purchase behavior in preference of local plants and products (Harper and Makatouni, 2002). Other gardeners who choose local products may be driven to do so by a need to build community with like-minded shoppers or as a way to renew their trust in the food system (Zepeda and Deal, 2009).

2.3.2. Promotion and Advertising

Gardeners may be attracted to purchase from a particular retailer due to promotion and advertising. While promotion and advertising can increase consumer perception of products, it is not always successful in increasing sales (Collart et al., 2013). In-store promotions that highlight organic production methods can help differentiate vegetable and herb transplants and increase likelihood of purchase, however, the marketing landscape is changing rapidly with more online merchandisers who are able to deliver plants and products to gardeners eliminating the need for store visits (Humair et al., 2015).

2.3.3. Convenience

With in-store purchases, convenience in both location and the layout of merchandise are important to gardeners. While local garden centers often face space constraints, customers may still be drawn in if they are able to find an adequate stock of well cared-for plants clearly described by use of proper signage. Gardeners also express

a preference for stores that have knowledgeable staff that can advise them on plant and product choices, as this makes the shopping experience pleasurable and can help in establishing the reputation of the garden center while increasing sales (Safley and Wohlgenant, 1995).

2.4. Sources of gardening information

Gardeners seek out gardening information for a variety of reasons. These range from plant selection and purchase decisions, garden design, disease prevention and control, and even for inspiration and relaxation. The way information is relayed and accessed has been changing rapidly due to the transformation that Internet-based information technology has brought about (Kushlev and Proulx, 2016). Preference for gardening information is affected by convenience, cost and credibility of source (Varlamoff et al., 2002). Gardeners balance these criteria when selecting the source to rely upon.

2.4.1. Cost and Convenience

Varlamoff et al. (2002) identified four main categories of gardening information, namely ‘information that is available freely and conveniently, for example, from friends, neighbors, television and radio; information that can be obtained cost-free, but requires an individual to do some searching (for example, information available from extension Master Gardeners, libraries, county extension offices, nurseries and garden centers); information that has some cost associated, but is conveniently available (for example garden magazines and newspapers); and information requiring some cost but that is not conveniently available (for example from botanical gardens and Internet sources). At the

time of their study, Internet sources were relatively costly, but since then, technological advances have altered the information cost and access landscape dramatically lowering cost and increasing access for Internet-based sources.

Smartphones and similar mobile technologies are now ubiquitous. This has upended some of the more traditional sources, for example newspapers and print magazines. Using 'Smart' technology devices, information is now available instantaneously and at the point of need to most users (Kushlev and Proulx, 2016). In a study of U.S. and Canadian users, female gardeners were found to be more likely to use Smart technology for information searches, while males were more likely to make actual product purchases (Behe et al., 2013). While convenience is considered one of the most important attributes when determining where gardeners get information, credibility and trustworthiness of the source also affects what gardeners seek out and use.

2.4.2. Credibility and Convenience

Gardeners find information generated by land-grant universities and botanical gardens credible and trustworthy, yet they may be less likely to use it, preferring more convenient sources such as neighbors and friends (Meyer and Foord, 2008). Gardeners tend to trust information presented to them directly, and while an expert might be their first choice, friends and neighbors are still ranked high due to convenience. Information that is conveniently available at the point of purchase, for example at garden supply stores, may also be utilized more frequently (Niemiera et al., 1993).

Use of Internet technology and smartphones for information searches and purchases is becoming more common. Land-grant universities and other institutions that generate

reliable information should continue exploring more convenient ways to make the information they generate accessible to gardeners (Pew Research Center, 2012; Behe et al., 2013),

2.5. Socio-Demographic Characteristics and Gardening

2.5.1. Age

The age of gardeners has implications for their gardening choices and the preferences that they express. According to the National Gardening Association (2014), the majority of gardeners are above the age of 45, with younger people (18-34) being the majority of new entrants into home gardening. There is little information available regarding how age affects the choices gardeners make. However, we can surmise that since younger people may not have as high an income, or as large a home as older people, their choices may be different due to space and cost constraints.

A gardener's age may also affect garden size and choice of vegetables if there are young children in the home. The gardener's focus may be to provide vegetables that are suitable for the children, or to teach young ones how to garden themselves. Households with more young adults or individuals above 18 years of age are more likely to shop online that those with fewer adults in this age cohort (Behe et al., 2013). With age, gardeners may increase or decrease their gardening activities. If with age comes poor health and loss of mobility, gardeners may opt out of gardening altogether or limit the time devoted to it. On the other hand, older adults may be motivated to garden in order to get the benefits of social interaction and light exercise that promote good health.

2.5.2. Gender

Studies on home gardening show that the majority of home gardening activities are conducted by females (Howard, 2006), and that this is partly due to the gendered division of labor in households. For example, Reyes-García et al. (2010) found that gardens managed by women in the Iberian Peninsula have greater species diversity per unit area compared to those managed by men, and in north-east Spain, women gardeners had greater perception and valuation of the ecosystem services including participation in seed exchange networks (Calvet-Mir et al., 2012; Calvet-Mir et al., 2016). In Vermont, new immigrants, also exhibit gendered roles in gardening (Mares, 2017), and nationwide, among Master Gardeners, females are a significant majority (Takle et al., 2016).

2.5.3. Education

Education has been shown to affect gardening choices and preferences both directly and indirectly. Directly, it can affect the level of gardening knowledge simply due to exposure to information regarding the health benefits that gardening portends. Higher educated individuals also tend to have higher incomes, hence they are more likely to have the resources, including space in a private home yard, where they can garden. Studies show that young people who are exposed to gardening practically through school gardens are also more likely to acquire healthy food habits and with the skills and knowledge may themselves be motivated to grow their own fruits and vegetables.

2.5.4 Household Income

Household income has an effect on gardening choices because it affects the level of resources available to devote to gardening, including space for gardening and money

to purchase plants and gardening supplies. Studies show that the location of one's fruit and vegetable garden may be impacted by income levels. Among immigrant communities and low-income households, there is often a lack of access to private garden space. This leads to a reliance on public spaces which may be allotted for use as community gardens, where the quality of soils and access to other resources may be challenging (Armstrong 2000; Alloway, 2004). Among those with higher incomes, retirees who may have downsized to apartment living may also have limited access to gardening space, that is not related to their income. These individuals may also rely on community spaces for their gardening needs.

2.6. Extension Master Gardeners

The Extension Master Gardener (EMG) Program was started in 1972 by Washington State University faculty in an effort to increase educational outreach to the horticultural community of home gardeners in a cost effective manner. The program was successful in enlisting gardening enthusiasts willing to receive science-based training and then transmit that knowledge to their communities on a volunteer basis. EMG Programs are now well established in every state, the District of Columbia and some Canadian provinces following the same general principles (Schrock et al., 2000).

The time and effort devoted to different activities by Master Gardeners differs from state to state, based on the needs of the gardeners in the different locations and the resources available to the programs in each state (Bobbitt, 1997; Schrock et al., 2000). The goal of the program is to provide the locally-relevant science-based information for successful gardening practices which are ecologically sound (Schrock et al., 2000;

McAleer, 2005). The work of the MGs is therefore influenced by local growing conditions for fruits and vegetables which are in turn affected by agro-climatic factors including temperature (heat/cold), elevation, plant hardiness, day-length, and soils (Cathey, 1990; Gilmer, 2015).

Master Gardeners are motivated to join the program in order to further their own gardening knowledge (Takle et al., 2016) and to obtain the knowledge and skills needed to help others in their community through gardening (Schrock et al., 2000; Waliczek et al., 2002). Volunteers participate in a variety of region-specific projects in their communities where they demonstrate and promote sustainable horticultural practices in the growing of fruits, vegetables, herbs as well as ornamentals (Tessmann and Gressley 2011).

The Vermont Extension Master Gardener (EMG) program was started at the University of Vermont in 1991 and has since trained over 3,000 Vermonters in sustainable home horticulture. The program is organized into seven regional chapters serving the different counties as shown in Figure 2.

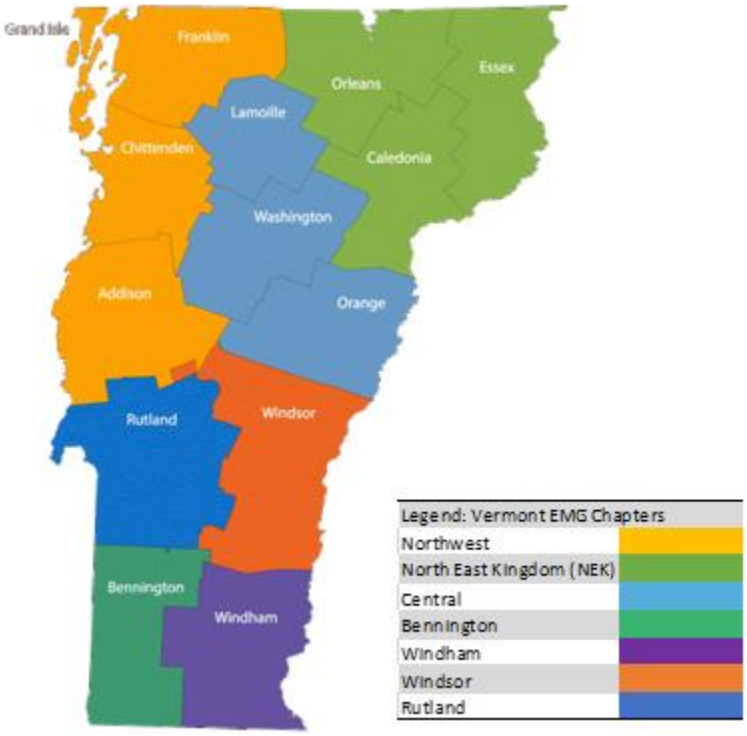

Figure 2. Map of Vermont showing Counties and EMG Regional Chapters

Many garden enthusiasts enroll to become EMGs out of a desire to enhance their personal knowledge and skills in gardening, while others are attracted by the prospects of acquiring skills and knowledge so they can help others in their community (Takle et al., 2016). Vermont EMGs are gardeners themselves and serve as a resource to their neighbors, family and friends through their personal gardening endeavors in their private home or backyard gardens, at community gardens, or at various venues and events where they provide gardening advice to those in attendance. These include, the Vermont Flower Show, farmers' markets and state and county fairs. EMGs also host chapter events that focus on the needs and priorities of the local chapters.

During the three years of this study (2011, 2012 and 2013) approximately 900 Vermont EMGs were active in volunteering, doing so through demonstrations and educational outreach in their local communities and around the state. Signature Vermont EMG projects include partnering with the 4H Association and Boys' and Girls' Clubs in fruit and vegetable gardening, preparation, and preservation. They also volunteer at community gardens located at schools and other institutions, serve at information booths and tables at farmers' markets and fairs throughout the state, and make outreach presentations at schools, libraries, and other venues around their local area.

Since 1991 when the program was started, Vermont EMGs have maintained a telephone helpline throughout the growing season where gardeners can call in with gardening questions and concerns responding to an average of 2,000 questions per year (University of Vermont Extension, 2014). To keep abreast of new research, each year the Master Gardener program offers numerous opportunities for continuous education facilitated by specialists from the University and industry experts who share information on new and emerging issues related to home and community gardening, as well as broader issues on how best to pursue their horticultural interests while protecting Vermont's natural resources including soils and waterways from harmful chemicals and invasive plants species.

CHAPTER 3: METHODS

Many of the benefits that lie behind the preferences, choices and decisions made by gardeners lack a market valuation. These include the choice of where to buy garden supplies and plants, preferences for certain information and even the choice of what plants to grow (Kendal, et al., 2012). In order to understand the implicit value gardeners attach to these benefits and the effect socio-demographic factors (age, income, education) have on them, non-market valuation methods need to be employed.

Random utility (Luce, 1959; McFadden, 1974) and consumer choice (Lancaster, 1966) theory provides the basis for this kind of study. Consumer choice theory posits that consumers derive satisfaction (utility) from the attributes of goods rather than the goods themselves. By stating their preferences (for example, through surveys), gardeners can rate the importance of different attributes and an analysis of these ratings can provide inferences into their valuation of the attributes. This theoretical framework forms the basis of the survey method used in this study. The data is then summarized to provide a profile of Vermont Master Gardeners with respect to their choices and preferences and their socio-demographic characteristics. Statistical analysis is then used to determine the differences between the level of importance attached to these choices and preferences by different socio-demographic groups. This is achieved using Analysis of Variance (ANOVA) on the choice variables and regression analysis which tests the effect of socio-demographic variables on the choice valuations.

3.1. Data Collection

The population for the study was the Vermont Extension Master Gardeners (EMGs) during the 2011-2013 period, who numbered approximately 900. Data were gathered using a web-based online survey which was administered to Vermont EMGs at the end of the growing season in 2011, 2012, and 2013. The survey was approved by the Office of Research Involving Human Subjects (Appendix 1) at The University of Vermont (UVM) and then pre-tested by groups of individuals interested in gardening (though not necessarily self-identified gardeners). For the pre-test phase, the draft survey was handed out at garden centers, including 4-Seasons Garden Center in Williston, Vermont and Depot Home and Garden in Essex Junction, Vermont. Gardening enthusiasts on two Montreal Botanical Gardens bus tours, and at the Vermont Flower Show in 2010 were also used to pretest the questionnaire. After the pre-test, minor revisions were made for precision and clarity.

The survey (Appendix 2) was administered to Vermont EMGs through the online survey software tool, SurveyMonkey®, between October-November of 2011, 2012 and 2013. The same survey was administered each year. During each cycle, the survey remained active for a period of 4 weeks, with one email reminder. This was considered a suitable survey period as the gardening season had just concluded, and it was expected that gardeners could clearly remember what they had grown and the decisions they had made throughout the season. The number of respondents was, 191 in 2011, 72 in 2012, and 158 in 2013. Due to a technical error by the researcher, in launching the survey in

2012, a number of responses were lost, hence the lower response rate. It was not possible to re-launch the survey due to the risk of respondent apathy and discouragement. Each survey asked the participant if they gardened the previous year, what they grew, size of their garden, where they purchased inputs, their sources of information, and demographic information. The survey was set up so one could not advance to the next question until they had completed key information entries. This ensured completion of surveys and eliminated the problem of incomplete responses. At the end of the survey period, the data were downloaded into a Microsoft Excel® file for analysis.

3.2. Data Description

The data gathered includes different types of variables – socio-economic variables, garden type and locational variables, as well as informational and attitudinal variables. The individual variables were measured using ordinal, interval, and nominal scales depending on what was appropriate for each. Socio-economic characteristics were measured using interval and nominal variables, garden type and locational characteristics were measured using nominal variables. Informational and attitudinal perspectives were measured using ordinal scales.

3.2.1 Socio-Demographic Variables

Data on the socio-demographic characteristics of Vermont Master Gardeners were gathered using Questions 20-25 on the Survey (Appendix 2) and **Error! Reference source not found.** describes how each of these variables were measured. The number in parenthesis refers to the question number on the survey questionnaire. 'Age' is an interval variable and refers to the age in years (less than 20, 20-30, 30-40… above 70) of the

gardening decision-maker in the household in years. Where garden-decision-making was done jointly or shared, the average age of the decision-makers was used (Q 20). 'Gender' of the gardening decision-maker is an ordinal variable with 3 choice categories; "male," "female," or "equally shared" where more than one gender served as a gardening decision-maker (Q 21).

Table 1. Socio-Demographic Variable Description

Socio-Demographic Variables	Variable Type	Description	Survey Question Number
Age (of garden decision-maker in years)	Interval	5 Categories, from Less than 20 to Greater than 70	Q 20
Gender (of garden decision-maker)	Categorical/nominal	3 Categories, Male, Female, or Equally shared	Q21
Education	Ordinal	8 categories, ranging from Less than High School,…., Graduate/Prof. degree	Q22
Annual Household Income ($)	Categorical/ordinal	5 categories, from <25K,….>100K	Q25

'Education' refers to the level of education attained by the gardening decision-maker (ordinal variable with 8 choices) ranging from "less than high school" to "completed graduate or professional degree" (Q22).

Household income is an interval variable with 5 categories ranging from 'less than $25,000', '$25,000-$50,000'…, to 'Above $100,000' (Q25). Most of the socio-demographic variables were organized in categories to encourage respondents to be

comfortable providing that information, without feeling intruded upon, which might have lowered response rates.

3.2.2. Gardeners Choices, Preferences and Motivations

The choice variables measure the choices Vermont Master Gardeners made with respect to the kind of garden they had, the types of vegetables and/or fruits they grew, and how much their spent on plants and supplies.

The preferences of gardeners include what they consider their most important sources of plants and gardening supplies, and sources of gardening information. These choice and preference variables are summarized in **Error! Reference source not found.**. 'Expenditure on Plants and Supplies' is an interval variable with the following categories: less than $100, $100- $250, $251- $500, $501-$750, $750-$1,000, and >$1,000 (Q4).

Table 2. Choices and Preferences of Vermont Master Gardeners

Choice Variable	Variable Type	Description	Survey Question Number
Expenditure on plants and supplies	Interval	6 categories, ranging from <$100,…, >$1000	Q4
Vegetable /Herb Grown	Categorical	Yes/No categories for having grown or not	Q13 and Q14
Fruit/Berry Grown	Categorical	Yes/No categories for having grown or not	Q15 and Q16
Information Sources	Categorical	Yes/No Variable if source was considered important/Not Important	Q9

Whether a gardener grew a particular 'Type of Vegetable/Herb' (Q13 and 14), or grew a 'Type of Fruit/Berry' (Q15 and 16) are dichotomous variables (Yes/No). Data on the 'Gardening Information Sources' Vermont gardeners consider to be important was gathered using a dichotomous variable (Yes/No) and with 10 choices of information sources, namely: Books, Extension, Friends, Garden Centers/Stores, Internet, Print Articles, Radio, Television, Videos, and "Other Sources" (Q9). Gardeners were also asked to rate in importance different motivations/reasons for having a garden and for choosing where to buy gardening plants and supplies. These variables are summarized in **Error! Reference source not found.**. For each choice, a gardener rated (on a 5-level Likert scale) how important that factor was to them as a motivation for gardening.

For example, a gardener might rate 'Saving Money' as "Very Important", and also rate the motivation of 'Fun/Relaxing/Hobby' as "Not Important". A similar 5-level Likert scale was used for gardeners' motivation for where to buy plants and gardening supplies. Gardeners ranked their attitude/perception of the various sources of plants and supplies on a 5 – level Likert scale ranging from 1 = "Not Important" to 5 = "Very Important". One of the variables that was NOT included in this list was 'Quality' – either of plants/garden supplies or of the stores themselves. This decision was informed by several factors. First, the concept of quality has been shown to be correlated to price. This correlation is itself ambiguous, either being negative or positive. In the case of positive correlation, buyers consider a higher product price to be a signal of a better 'quality' product (Scitovszky, 1945; Dodds et al., 1991). On the other hand, a negative correlation between quality and price can be found when buyers consider price as an

indicator of the ‘value’ of their purchase and ‘higher value’ is ascribed to a product whose quality attributes match the buyer’s perceptions of what those attributes are worth in terms of a ‘reasonable price.’

Table 3. Gardening Motivations and Choice of Retail Source for Plants and Supplies

Motivation to Garden	**Variable Type**	**Description**	**Survey Question Number**
Saving Money	Ordinal	5 levels of importance	Q17
Taste of Homegrown Fresh Produce	Ordinal	5 levels of importance	Q17
Food Safety Concerns	Ordinal	5 levels of importance	Q17
Fun/Relaxation/Hobby	Ordinal	5 levels of importance	Q17
‘Other Reasons’	Ordinal	5 levels of importance	Q17
Motivation for Choice of where to Buy Plants and Supplies			
Price	Ordinal	5 levels of importance	Q6
Convenience	Ordinal	5 levels of importance	Q6
Past Experience	Ordinal	5 levels of importance	Q6
Word-of-Mouth	Ordinal	5 levels of importance	Q6
Promotion and Advertising	Ordinal	5 levels of importance	Q6
Other Reasons	Ordinal	5 levels of importance	Q6

The aggregation of attributes in the concept of quality also makes this variable difficult to measure as a distinct characteristic upon which purchase decisions are based. Marketing research has identified eight dimensions of quality, ranging from performance, aesthetics and durability to perceived quality (Garvin, 1984). In the case of live products such as garden plants whose ultimate performance is a combination of many attributes analyzing ratings is unlikely to generate meaningful information upon which decisions can be made.

3.3. Data Analysis

Survey data on opinions is often collected using Likert rating scales such as the ones used in this study. The ordinal data yielded by these surveys can be analyzed as interval variables assuming that the variables are consistent within the range following Allen and Seaman (2007). All data analysis functions were performed using Microsoft Excel® 2013 for Windows®. The first step was to summarize the data in order to visually depict the characteristics of Vermont Master Gardeners with respect to their choices and preferences and motivations, and their socio-demographic characteristics. These summaries were generated for each of the data collection years: 2011, 2012, and 2013. Unfortunately, an error occurred during the launch of the survey instrument in 2012. This led to significantly fewer respondents than in 2012 (N=71) compared to the other two years 2011 (N=186) or 2013 (N=158). Fortunately we were still able to get some responses for each of the three years.

After a summary of the data was generated, the second step was to analyze the data to determine if socio-demographic (independent variables) were correlated. This

step was necessary in order to determine which socio-demographic variables could be included in the linear regression models that examined the impact of socio-demographic characteristics on gardeners' valuation of the level of importance attached to different reasons/motivations for choosing to garden.

3.3.1. Univariate Statistical Analysis

In order to determine if the means for different 'Reasons for Gardening' ('Food Safety,' 'Environmental Concerns,' 'Saving Money,' 'Fun/Relaxation' and 'Taste') are significantly different, Student t-statistics were estimated. The list of motivations did not include 'Quality'. Hence it was necessary to examine the open-ended responses to (Q7) where EMGs listed their 'Other' reasons for choosing where to buy garden plants and supplies.

Analysis of variance (ANOVA) is used to compare the means for continuously scaled variables to determine if these group means are different. As described above, by making the reasonable assumption that our data, based on a Likert Scale, is consistent, we are able to perform t-tests on the means of the variables in order to determine if they are statistically different.

3.3.2. Multivariate Regression Analysis

In order to identify which of the demographic variables (age, gender, education and household income) significantly affect the 'Reasons for Gardening', and the 'Choice of Sources of Garden Plants and Supplies', multivariate regression models (one for each of the 'Reasons for Gardening'), and one for each of the 'Choices of Sources of Gardening Plants and Supplies' were estimated. Multiple regression considers all the

independent variables simultaneously and quantifies each variable's effect when the others are held constant,

The model form being;

$$y = b_0 + b_1 x_1 + b_2 x_2 + \cdots b_n x_n$$

where y = dependent variable ('Reason for Gardening' – 'Save Money'),

x_i are the independent variables (socio-demographics, age, education, etc.)

b_0 is the y intercept and b_i, for $i = 1, \ldots, n$ are the partial regression coefficients.

The b_i –values, the partial regression coefficients, indicate the effect of that particular independent variable (e.g., age) upon the dependent variable (level of importance an EMG attaches to 'Large Retail Store' as a source of gardening plants and supplies') when all the other independent variables are held constant.

How well the model explains variations changes in the independent variables is determined by the model's goodness-of-fit and is represented by the R^2 value, the coefficient of determination, which ranges from one to zero. An R^2 of "1" would mean that the independent variables perfectly explain changes in the dependent variables. Since R^2 continues to increase as the sample size increases, the model's goodness-of-fit is more accurately reflected by the ***adjusted*** R^2, which takes into account the number of independent variables included in the model.

CHAPTER 4. RESULTS

This chapter presents the results of the three-year gardening survey of Vermont EMGs. The first part is a descriptive summary of the results of the 2011-2013 surveys. The second part presents the results of inferential statistical analysis (Analysis of Variance, *t*-tests and regression analysis) of the data that examines the effect of gardeners' socio-demographic characteristics on their 'Reasons for Gardening' and their 'Choice of Sources for Garden Plants and Supplies'

4.1. Summary of Survey Results

This section provides a summary of gardening choices, preferences and socio-demographic characteristics of Vermont EMGs who considered themselves fruit/vegetable gardeners in 2011-2013. The results are presented in the following order: 'Gardeners by Garden Type and Garden Location,' 'Reasons for Gardening,' 'Garden Size and Gardening Expenditure,' 'Plant Choices,' 'Sources of Plants and Gardening Supplies,' 'Sources of Gardening Information' and 'Socio-Demographic Characteristics of Gardeners.'

4.1.1 Garden Type, Size and Location

In all three years of the study, over 90% of respondents reported having a fruit or vegetable garden for two consecutive years (the current and previous year), with 100% (n=191) in 2011, 93% (n= 66) in 2012, and 94% (n=147) in 2013. These results are summarized in Figure **3**.

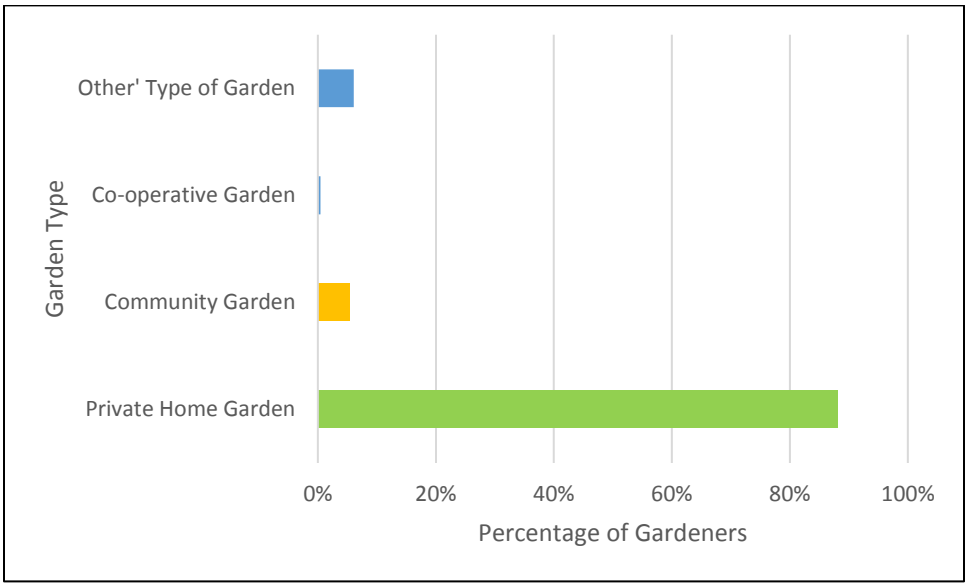

Figure 3. Vermont EMGs by Garden Type 2011-2013

Based on their home ZIP Code™, Vermont EMGs who had a garden between the years 2011-2013, live all across the state and the distribution of Vermont EMGs mirrors the overall population distribution quite closely. This finding suggests that Vermont residents have relatively similar access to Extension Master Gardeners living within their community. Chittenden, the most urban county (and where 25% of Vermonters reside) is home to the largest share of EMGs at 24.6%. It is followed by Washington County at (15.7%). Only 9% of Vermonters live in Washington County, but the presence of Montpelier, the state capital in the county might help explain the disproportionate representation of EMGs.

Table 4. Vermont Master Gardeners by Home County 2011-2013

Home County	Number	Percentage
Addison	44	10.6%
Bennington	14	3.4%
Caledonia	13	3.1%
Chittenden	102	24.6%
Franklin	12	2.9%
Grand Isle	4	1.0%
Lamoille	5	1.2%
Orange	14	3.4%
Orleans	9	2.2%
Rutland	38	9.2%
Washington	65	15.7%
Windham	53	12.8%
Windsor	36	8.7%
Massachusetts*	3	0.7%
New Hampshire*	2	0.5%
Total	414	100.0%

*Out of State Residents.

The larger percentage of EMGs are concentrated in the urban areas, consistent with others studies of Master Gardeners nationwide (Extension Master Gardener, 2010). A small percentage (1%) of Vermont Master Gardeners in the study reside out-of-state in Massachusetts and New Hampshire. As shown in Figure **4**, the percentage of EMGs by county is similar to the overall percentage of the general population, in all counties, except the county of Essex where there were no Master Gardeners that responded to the survey.

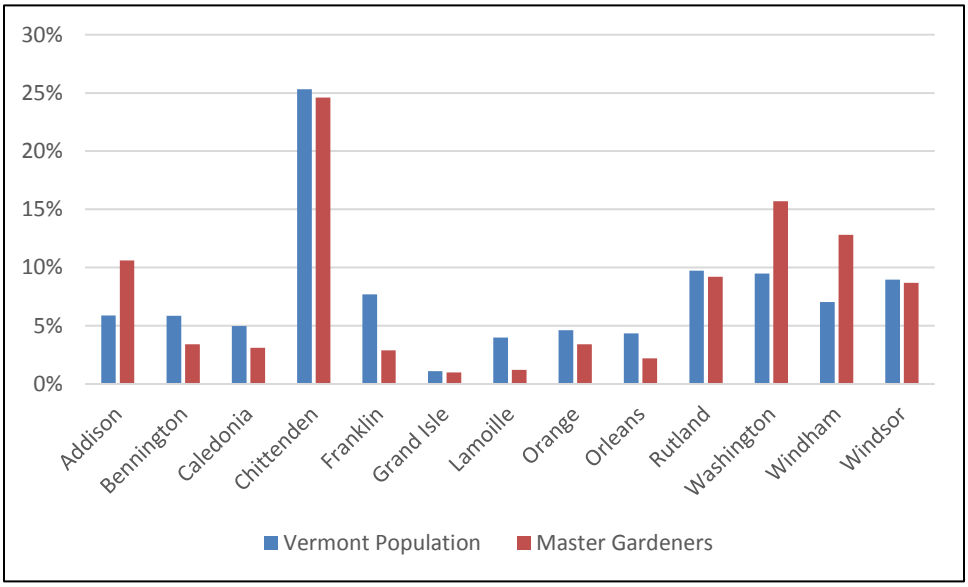

Figure 4. Vermont EMGs Relative to Population by County (2011-2013)

Most Vermont EMGs grow fruits and vegetables in 'Private Home Gardens' as shown in Figure **5**. On average 85% had private home gardens compared to 5% and 6% who were part of a Community Garden or CSA, respectively. Studies show that Community Gardens are mainly located in urban areas (Armstrong, 2000; Baker, 2004; Bendt et al., 2013). This finding might be somewhat predictable for a rural state such as Vermont where we can expect most people to be spatially dispersed, hence have a garden at home.

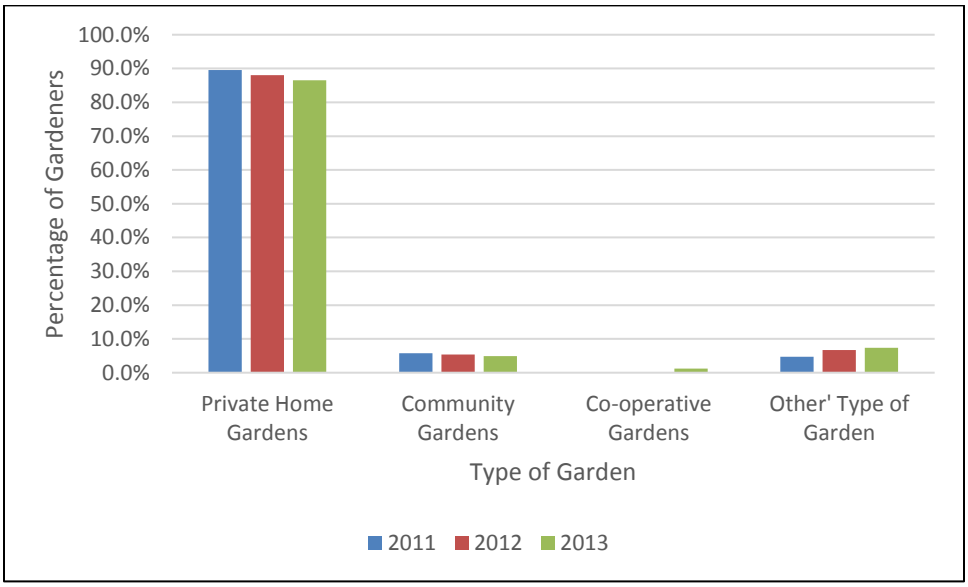

Figure 5. Vermont Master Gardeners by Garden Type 2011-2013

Figure **6** shows that 80% of Vermont EMGs who grew fruit and vegetables in 2011-2013 did so in gardens that were 1,000ft^2 or less in size and only 2.5% had gardens measuring over 10,000 ft^2. When we examine the distribution of gardens by size including measures of central tendency (mean, and median) the gardens EMGs tend to have gardens that are relatively small, measuring less than 500 square feet. These statistics have been calculated with the exclusion of the largest gardens which were not typical, and therefore were considered outliers at above 12,000 ft^2. Only 18.3% of the gardens are 1000 ft^2 or larger – and this is with the exclusion of the 7 very large that are over 20,000 ft^2. What this data suggests is that Vermont EMGs generally have private home gardens that are relatively small (below 500 ft^2) and there are very few large gardeners among the EMGs.

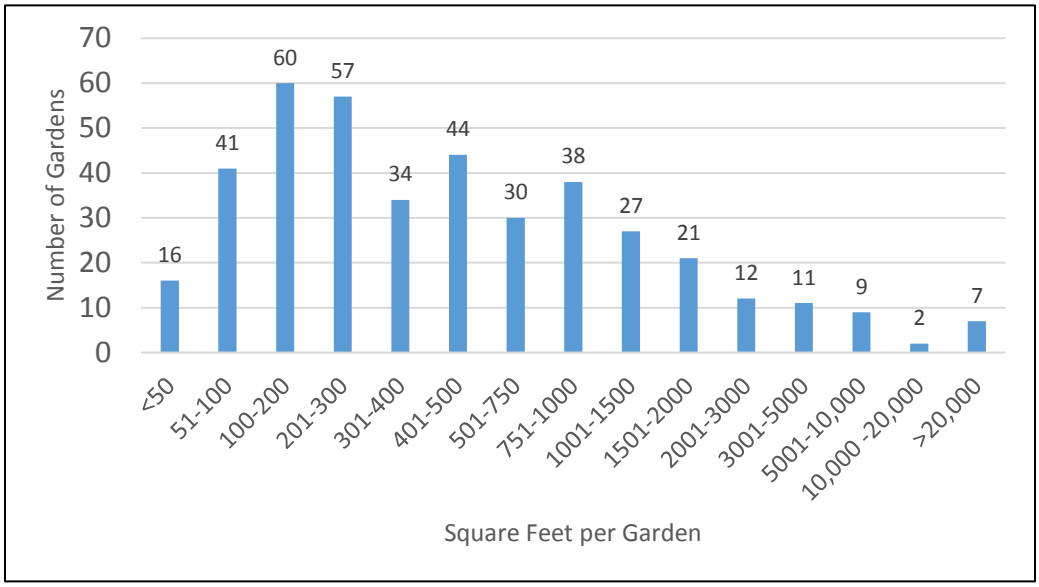

Figure 6. Vermont Master Gardeners – Garden by Size Categories 2011-2013 Error! Reference source not found.

The mean garden size of 922 ft^2 is the average size of gardens for the 400 gardens between 10 ft^2 and 12,500 ft^2. Since the term 'garden' is self-defined, it was necessary to set aside the largest size of these gardens in calculating the mean.

4.1.2 Vegetable and Fruit Choices

Vermont EMGs grew a wide range of vegetables and herbs between the years 2011-2013 as summarized in

. In each of the years, tomatoes, herbs and salad greens were the three top choices grown with over 90% of the gardeners growing tomatoes each year. Previous studies find tomatoes and salad greens among the most popular vegetables produced in gardens and also among the most cost-saving, where a gardener's motivation is to save money (Saldivar-Tanaka and Krasny, 2004; Langelloto, 2014).

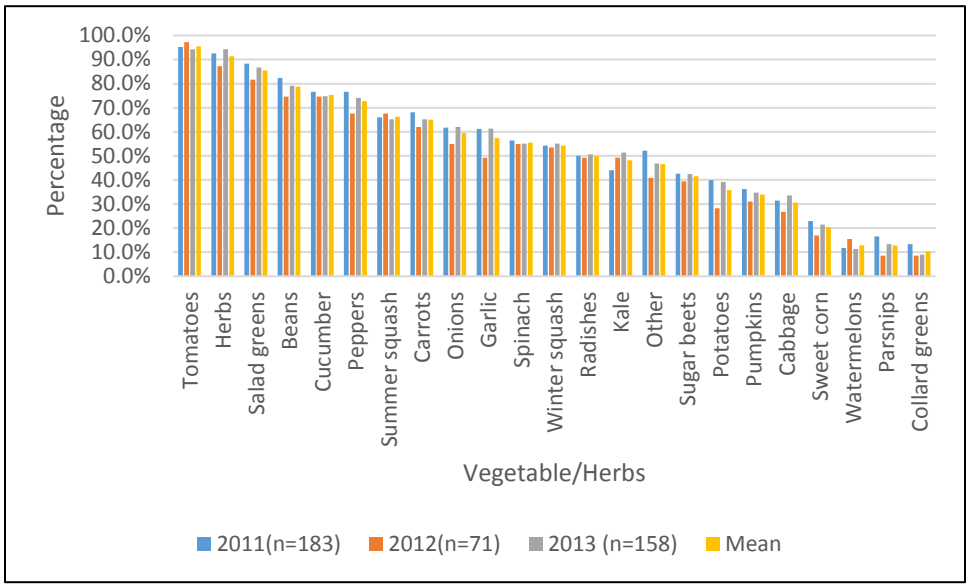

Figure 7. Vegetables and Herbs grown by Vermont EMGs 2011-2013

With respect to fruits and berries, Vermont Master Gardeners were asked how many trees or bushes they grew or had growing in their gardens in the survey year. These results are shown in **Error! Reference source not found.**. Blueberries, apples, raspberries and strawberries stand out as the favorites being grown by more than 1/3 of all EMGs each year. Approximately 7% of the EMGs did not grow any fruits or berries during the 2011-2013 period.

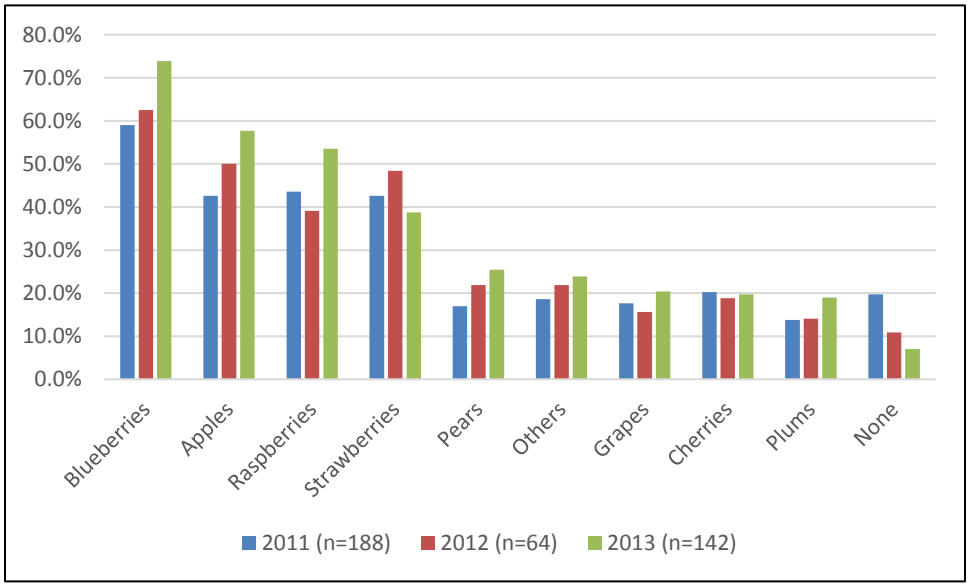

Figure 8. Fruits and Berries grown by Vermont EMGs 2011-2013

4.1.3 Important Reasons for Gardening

Studies have shown that people choose to garden for a variety of reasons. These reasons (Figure **9**) were presented to the Vermont EMGs who rated each by level of importance each year. All the reasons listed received a rating of at least three, hence can be considered to be of moderate importance to Vermont Master Gardeners. Comparing the ratings however shows that the most important reason for having a garden in all three years was 'Taste of Homegrown Fresh' with an average rating of 4.8/5 followed closely by 'Fun and Relaxation' with an average rating of 4.6/5. 'Saving Money' while still considered important, received the lowest rating in relative terms, at 3.2/5. In a subsequent open-ended question, Vermont EMGs were asked what 'Other Reasons' they had for gardening.

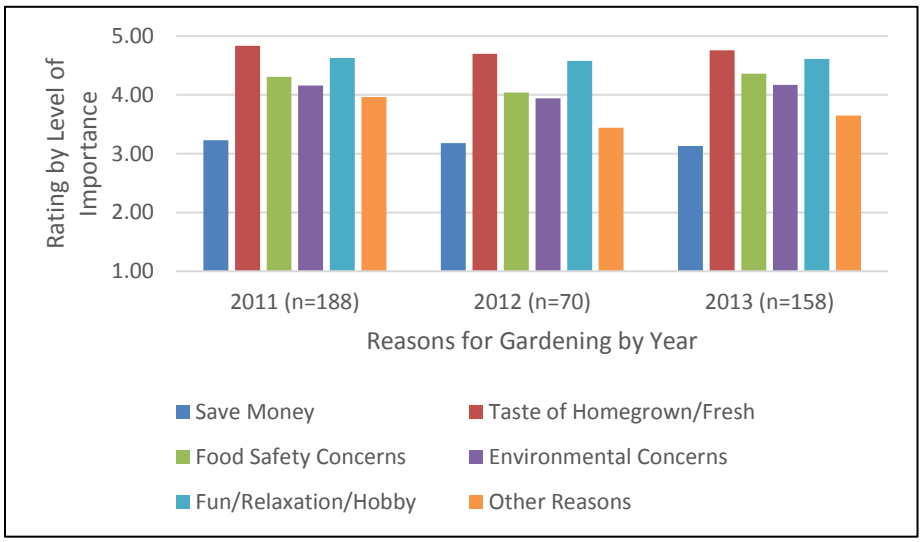

Figure 9. Reasons for Having a Garden among Vermont EMGs 2011-2013

These reasons included a desire for self-sufficiency, community and socializing, the need to grow fruits and vegetables sustainably, teach family members including children/grandchildren, and the desire to share fresh grown produce with others. While saving money has been shown to be an important motivation for gardening, it is especially true among low income and food insecure households (Utzinger and Connolly, 1978; Saldivar-Tanaka and Krasny, 2004; Wakefield et al., 2007; Langelloto, 2014; Eigenbrod and Gruda, 2015; McClintock et al., 2016). The findings here are consistent with these studies which show that households with higher incomes are more likely to be motivated to garden by other reasons including leisure, environmental and food safety concerns (Behe et al., 2010; Takle et al., 2016).

Vermont EMGs who did not have a fruit/vegetable garden were asked to rate factors they considered important in making the decision not to have a garden. Overall,

'Time', 'Gardening Space' and 'Other Reasons' were the most important factors that influenced the decision by EMGs not to garden that year. 'Other Reasons' were also cited by 57% as being very important. When asked (in an open-ended question) what some of those reasons were, the EMGs cited health and travel as the main 'other' reasons.

Lack of gardening space was also an important constraint to having a garden and was rated a 4/5 or 5/5 in importance level by 50% of the EMGs. The lack of gardening space has been found to be an important constraint to having a garden. This is especially important among older people who may be living in apartments after downsizing post retirement. While this question was not asked of the EMGs, it might be important to know the reasons why the gardeners lack space.

4.1.4 Gardening Expenditure

Expenditure on gardening plants and supplies is affected by a variety of factors, including the size of garden, their type of plant choices, as well as agro-climatic conditions which affect the inputs and amendments that might be required throughout the growing season (Pollard, 2002; Brzuszek et al., 2010; Behe et al., 2013). A gardener who is just starting out would also incur start-up costs and need to make investments in tools and fixtures that they would not need to purchase in subsequent years. Since the survey did not ask respondents how many years they had gardened, it is difficult to make inferences from their responses to this question. Most (79%) Vermont EMGs spent less than $250 on plants and supplies each year and only 1% spent over $1,000.

4.1.5 Sources of Plants and Gardening Supplies

Gardeners purchase plants and supplies from a variety of sources. Understanding how gardeners perceive these different sources is important for the retailers themselves and for other stakeholders in the gardening sector (Safley and Wohlgenant, 1995; Rihn et al., 2016; Zaffou and Campbell, 2016). Vermont EMGs were asked to rate different retailers by level of importance. The results of their ratings are shown in **Error! Reference source not found.**.

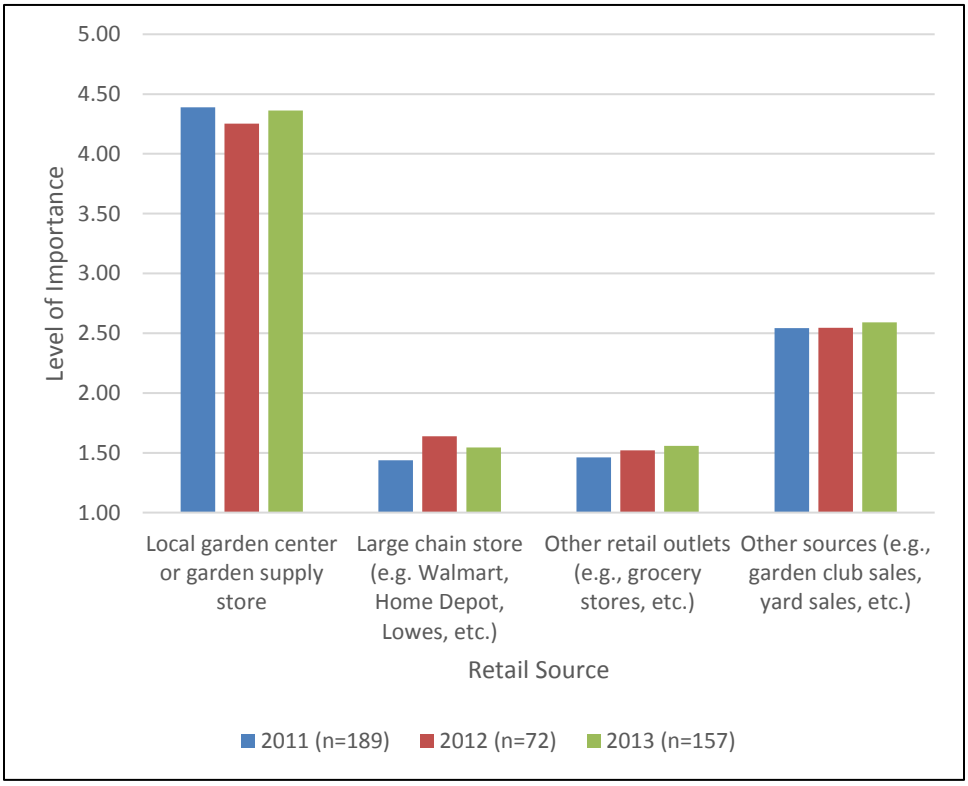

Figure 10. Ratings of Sources of Plants and Garden Supplies

Vermont EMGs had a clear preference for local garden centers/garden supply stores. Large chain stores were less preferred as were other retail outlets. Among the reasons for choosing particular sources for plants and supplies, EMGs were asked to rate

different attributes that affected their purchase behavior. Vermont EMGs cited 'Past Experience' as their most important factor in choosing where to buy plants and supplies. 'Convenience', 'Price' and 'Word-of-Mouth' were rated as moderately important, while 'Promotion and Advertising' were rated lowest in all years.

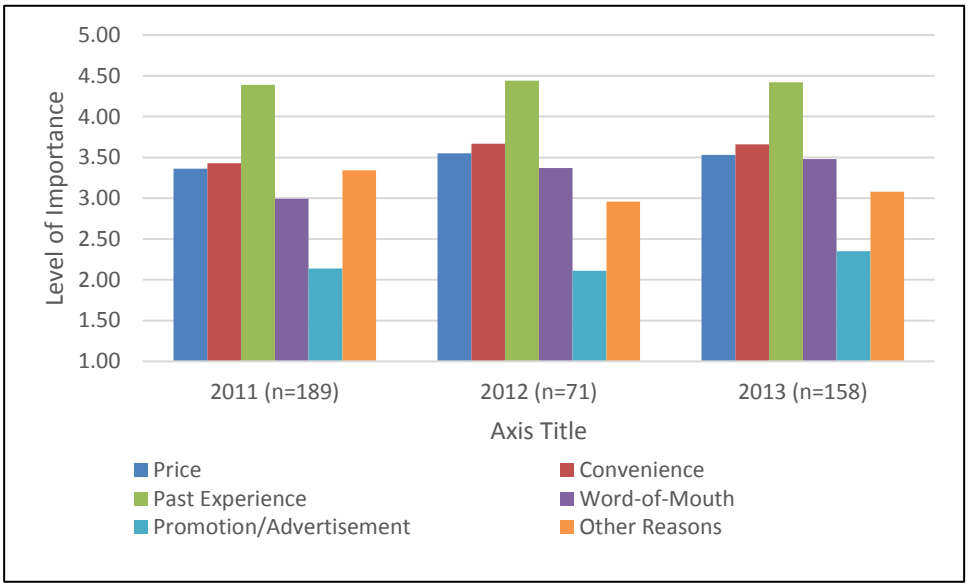

Figure 11. Factors Affecting Choice of Source of Plants and Supplies

Studies show that consumers consider different factors when deciding where to purchase garden plants and supplies (Safley and Wohlgenant, 1995; Behe et al., 2008). In all three years of the survey, Vermont EMGs listed family, friends and neighbors, local seed exchanges, mail catalogs and internet websites as important sources.

This is an important finding for retailers who are seeking to retain customers and attract new ones as it suggests that promotion and advertising may not be an effective way to attract Vermont Master Gardeners. Furthermore, as influencers and opinion leaders in the gardening community, EMGs' rating of 'Word-of-Mouth' as fairly

important might suggest that this is how they learn about reliable retailers, and probably how they are likely to transmit that information to other gardeners in their community.

'Promotion and Advertising' was rated even lower than 'Other Reasons' in being a factor that motivated the choice of where to purchase plants and gardening supplies. The two most important reasons cited were 'Quality/Reliability' and 'Local.' Studies have shown that conscientious consumers favor local and organic products (Yue et al., 2011; Campbell et al., 2013; Yang and Campbell, 2017).

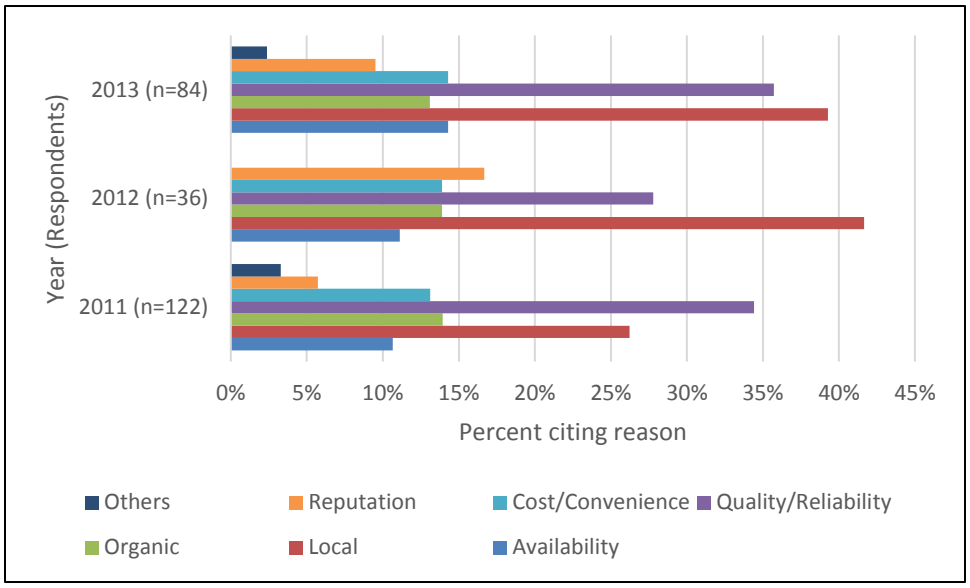

Figure 12. Reasons for EMGs Choosing where to buy Plants and Gardening Supplies 2011-2013

While there may be some ambiguity as to which attribute is more important to consumers with some rating 'organic' as more important than 'local' (Zepeda and Deal, 2009), the findings here indicate that Vermont EMGs favor the 'local' attributes over the

'organic' attribute when choosing where to buy gardening plants and supplies. This finding may be important for retailers who might benefit from having a loyal, local clientele, hence be shielded from competition from retailers outside the local area or non-local retailers, such as the mass merchandisers/box stores. By the same token, if EMGs are tied to 'local' sources, they may not be willing to purchase plants from suppliers outside their local area making it difficult for the very retailers to expand their businesses unless new local clients can be attracted.

4.1.6 Sources of Gardening Information

Information plays a crucial role in gardening decision-making (Behe et al., 2008). Vermont EMGs were asked to select the sources of information they relied upon from a list of possible sources. The results are summarized in

.

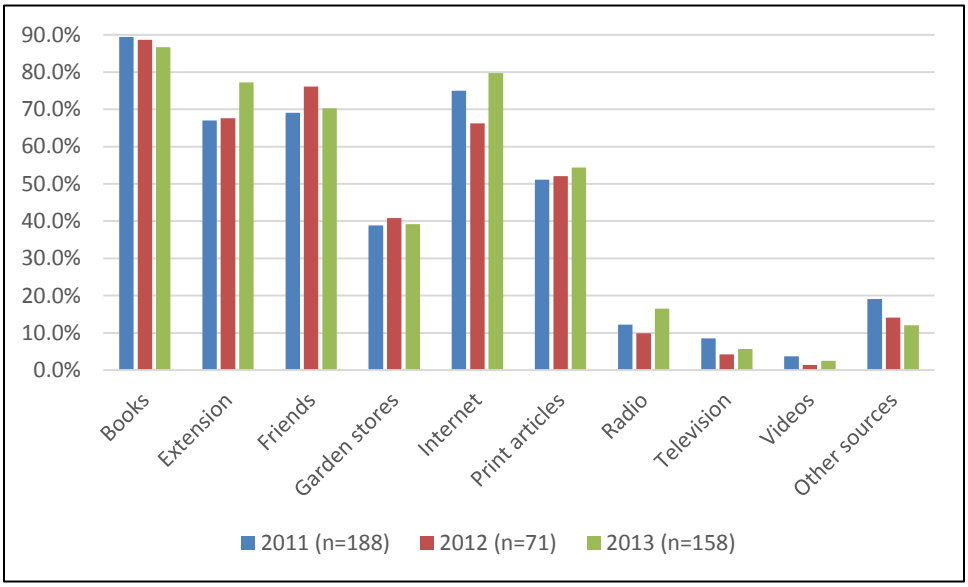

Figure 13. Main Sources of Gardening Information for Vermont Master Gardeners (2011-2013)

Over 85% of the EMGs listed ‘Books’ as an important source of information, followed by the ‘Internet,’ ‘Friends,’ and ‘Extension.’ It is noteworthy that there was an increase in use by EMGs of both the ‘Internet’ and ‘Extension’, while ‘Books’ had a slight decrease in percentage of users. This result may be indicative of changing preferences due to the increased access and lower cost of smartphones and other Internet-based information technology devices as suggested by Kushlev and Proulx (2016). ‘Extension’ experienced an uptick in the percentage of EMG users, which might suggest that more EMGs are aware of the resources available or that access has also improved.

The percentage of EMGs relying on television or videos for gardening information is below 10%, yet while radio users declined below 10% in 2012, the reliance on this source rebounded in 2013 and was above 15%. This result might indicate that there are some gardening radio shows that Vermont EMGs listen to, or might be explained by the lower survey response rate in 2012.

4.1.7. Socio-Demographic Characteristics

Socio-demographic characteristics including age, education, gender of garden decision-maker/garden worker, and household income affect gardening decisions and preferences (Pollard, 2002). Vermont EMGs’ socio-demographics show that 74% of EMGs were aged 50 and above with over 40% having completed graduate or some professional education. Seventy-nine (79%) have household incomes above $50,000 and the gardening decision-maker in 67% of the households was female.

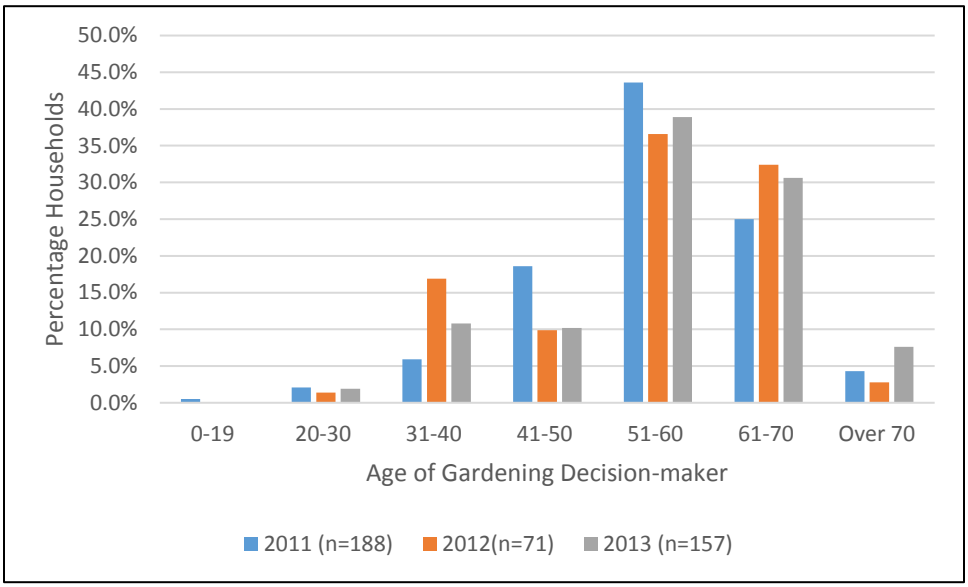

Figure 14. Age of Vermont EMGs - Gardening Decision-Makers 2011-2013

Age has been found to affect gardening choices and practices ranging from the choice of plants, size of garden, to the sources of information that are utilized in garden decision-making. As shown in Figure 14, less than 2% of the gardening decision-makers among EMGs were below 30 years of age, and remarkably, 5% are aged over 70 years. The age distribution is skewed towards the older side, and is consistent with gardening nationwide where 45% of gardeners are aged over 50 and although younger gardeners are increasingly taking up gardening at a faster rate than older people, they have a long way to go in closing the age gap.

Among Vermont Master Gardeners, females were the gardening decision-makers in 67.6% of the households in 2011, 69.0% of the households in 2012, and 68.2% of the households in 2013. In households where decision-making was equally shared (by gender), these proportions were 25.5% (2011), 22.5% (2012), and 19.7% (2013).

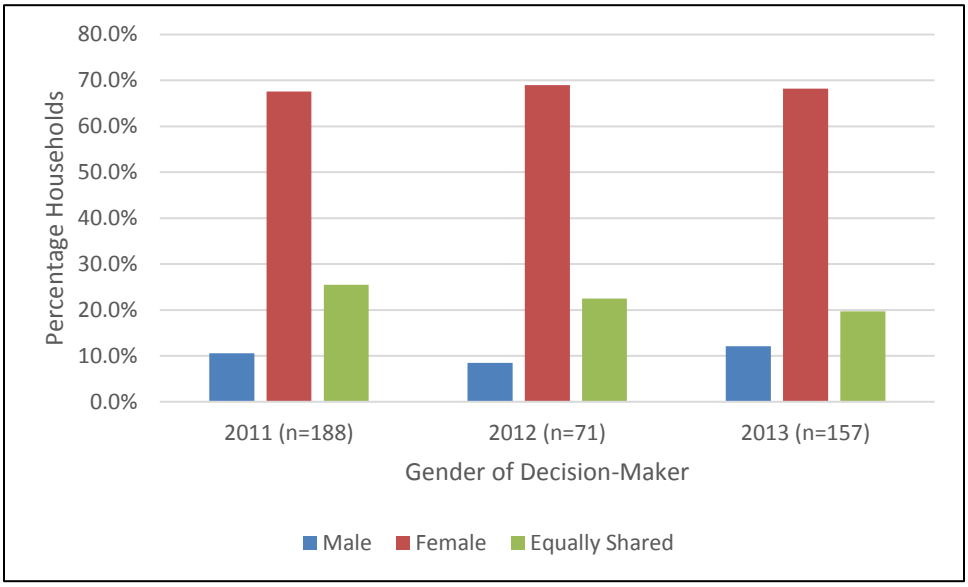

Figure 15. Gender of Gardening Decision Maker Vermont EMGs - 2011-2013

Households where males alone were the gardening decision-makers were proportionally few at 10.6%, 8.5% and 12.1%, for the three respective years between 2011and 2013 when compared to the other two categories ("Female", and "Equally-Shared").

Studies show that gender plays an important role in gardening choices and with some studies showing gender differences in the valuation of ecosystem services (Calvet-Mir, et al., 2016) motivations for gardening, and even the sources of gardening information that are utilized (Behe et al., 2016). Vermont EMGs were also asked to state the gender of the person who does most of the gardening work, and the responses, shown in Figure 16, indicate a very similar pattern to that of the gender of the Gardening Decision-Maker.

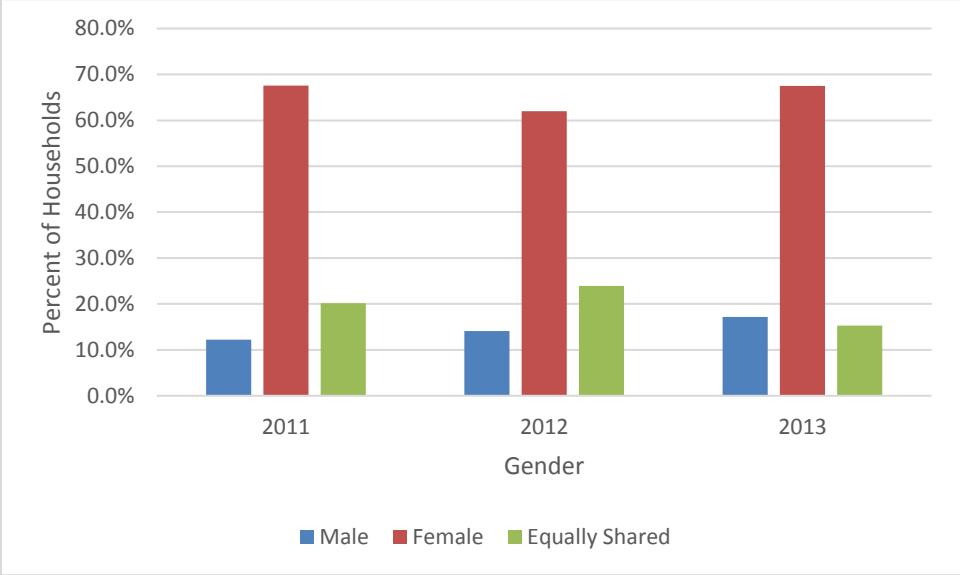

Figure 16. Gender Doing Most Gardening Work – Vermont EMGs 2011-2013

In 65% of the households females were reported to do most of the gardening work, with males doing most of it in 11% of the households. Gardening work was shared equally by gender in 17% of the households. The findings here suggest that most gardening decision-makers also do most of the gardening work, and since most of the gardening decision makers are female, then most of the gardening work among Vermont Master Gardeners is also performed by females. This finding is with previous studies that have shown that most of the Master Gardeners around the country are female (Takle et al., 2016).

Education has been shown to play an important role in household decision-making. Over the three years, 2011-2013, Vermont EMGs who grew fruits and vegetables had relatively high levels of education as shown in Figure 17.

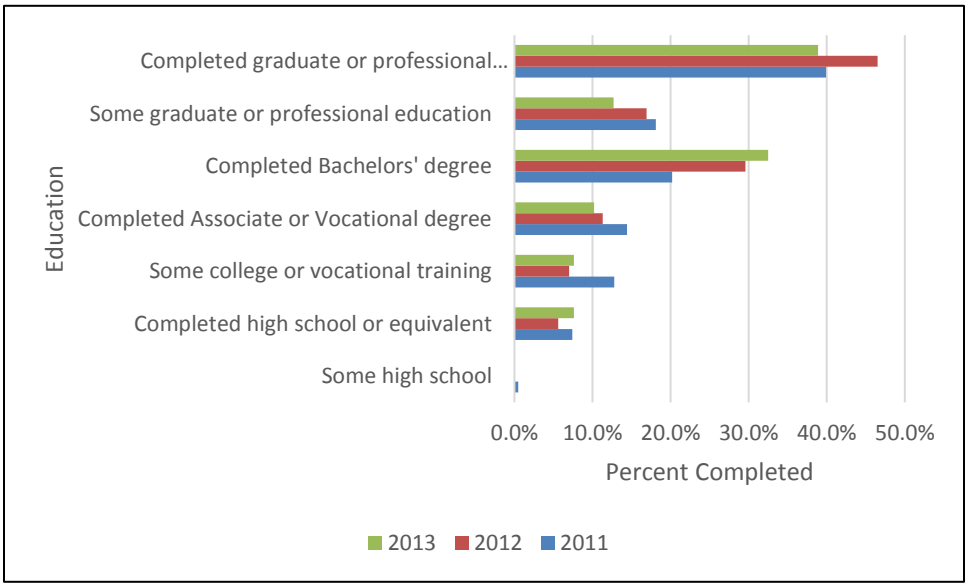

Figure 17. Education of Gardening Decision-Maker Vermont EMGs - 2011-2013

Vermont EMGs who gardened had relatively high education. In each of the three years, the sum of those who had completed a Bachelors' degree and beyond totaled over 70%. Despite being a rural state, Vermont consistently ranks high in the level of education when compared to other states in the country (Powers, 2004).

Income has been shown to be an important factor affecting consumer behavior as it affects the amount of discretionary income that is available for activities such as gardening which are often pursued for household food security among low income

households (Taylor and Lovell, 2014) or as leisure and a source of fun/relaxation among higher income households as shown in Figure 18.

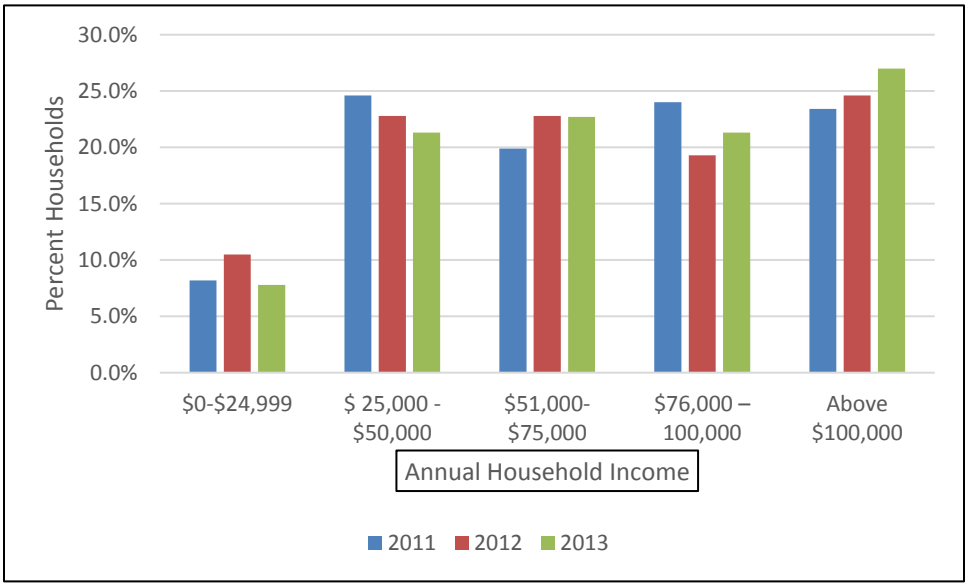

Figure 18. Annual Household Income among Vermont Master Gardeners 2011-2013.

4.2 Impacts of Socio-Demographic Factors on EMG Reasons for Gardening

4.2.1 Univariate Analysis-Reasons for Gardening

This section presents the results of the univariate analysis conducted to evaluate the impact of socio-demographic factors on Vermont EMGs decision to garden. The first step was to calculate the group means and variances for each of the 'Reasons for Gardening' based on their rating on the Likert scale of 1 – 5, where 1= Not Important; and 5 = Most Important. Next we conducted t-tests on the group means to determine if the group mean ratings for the different reasons were statistically different. These Mean ratings for the different reasons are shown in Table 5.

Table 5. Group Means and Standard Errors for EMG Ratings of Different Reasons for Gardening 2011-2013

Reason for Gardening	Mean Rating	Standard Error	N
Save Money	3.185	0.061	405
Taste of Homegrown	4.772	0.027	415
Food Safety	4.283	0.052	407
Environmental	4.129	0.055	404
Fun and Relaxation	4.613	0.034	411

Based on the ratings shown in Table 5, 'Taste of Homegrown' was rated by the largest number of gardeners (415) while ''Environmental' reasons was rated by the fewest at 404 gardeners. 'Save Money' had the lowest mean rating at 3.19/5 while 'Taste of Homegrown' had the highest mean rating at 4.77/5. This result suggest that the reason most Vermont EMGs garden is to have a 'Taste of Homegrown Fresh' fruits and vegetables, and that 'Saving Money' is not as important a reason for many of them.

The second step in the univariate statistical analysis was to test if the group means shown in Table 5 are statistically different. This was accomplished by calculating pair-wise t-statistics for all the group means. The t-test answers the question whether the reasons have significantly different impacts on EMGs decision to garden. The t-test results are show that pair-wise group means are all statistically different at $p \leq 0.05$, EXCEPT for the group mean ratings for 'Food Safety Concerns' and 'Environmental Concerns'. The correlation coefficients for the t-tests are shown in Table 6.

Table 6. T-Test of Difference between Means of Groups citing Different Reasons for Gardening

Reasons	Save Money	Taste of Homegrown /Fresh	Food Safety Concerns	Environmental Concerns	Fun /Relaxation
Save Money	1.000				
Taste of Homegrown /Fresh	0.252	1.000			
Food Safety Concerns	0.266*	0.379*	1.000		
Environmental Concerns	0.314*	0.318*	0.755*	1.000	
Fun/Relaxation	0.079*	0.221*	0.126*	0.196*	1.000

*statistically significant at $p \leq 0.05$

The correlation coefficients for the t-statistics shown in Table 6 indicate weak correlation between the pair-wise reasons for gardening for all but the 'Food Safety/Environmental Concerns' pair. These two groups are highly positively correlated at a value of 0.755 (since correlation coefficient values range between -1 to +1). Furthermore, the t-statistic for this pair of factors is significant at the 95% level. This implies that there is a 95% chance that an EMG who is motivated to garden by Environmental Concerns is likely to rate 'Food Safety Concerns' high as a motivator for gardening. All the other pair-wise correlation coefficients are fairly weak (well below the ±0.5 value) despite being statistically significant at the $p \leq 0.05$ (95% level of significance.

4.2.2 Univariate Analysis-Reasons for Choice of Source of Plants and Supplies

Master gardeners were asked to rate the reasons motivating their 'Choice of Source of Garden Plants and Supplies' On a Likert scale of 1 to 5, 1 being 'Not Important and 5 being Most Important'. Each EMG was requested to rate ALL the choices. The group means and variances for these ratings are shown on Table 7.

Table 7. Rating Means and Variances - Reasons for Choosing Source of Plants and Supplies

	Price	Word	Experience	Convenience	Promotion	Other
Mean	3.459	3.247	4.411	3.564	2.214	3.177
Variance	1.050	1.549	0.586	1.130	1.166	2.653
Observations	403	393	409	404	392	293

*Ratings range from 1= 'Not Important' to 5 = 'Very Important'

'Promotion' received the lowest rating (Mean =2.2/5) and also had the second lowest number of EMGs rating in (N=392). At the other end of the spectrum, 'Experience' was rated by the largest group of EMGs (N=409) and had the highest group mean at 4.4/5, and smallest variance, at 0.586. This results suggests that EMGs value 'Experience' above all the other options when choosing where to buy plants and garden supplies. The t-test results for the difference between group means are shown in Table 8. The t-test results as indicated by the level of correlation between the group means is overall weak with values ranging between ± 0.1- and 0.3. As discussed in the Methods Chapter, EMGs were NOT asked to rate 'Quality' as a factor for their choices. Studies show 'Quality' is a challenging factor to measure and that it is, among other things often correlated with 'Price' (Scitovszky, 1945; Dodds et al., 1991).

Table 8. Correlation Matrix t-test of Mean Differences between Reasons for Choosing Where to Buy

Reasons	Price	Convenience	Experience	Word-of-mouth	Promotion	Other
Price	1					
Convenience	0.338	1				
Experience	0.043*	0.094*	1			
Word-of-mouth	0.031*	0.054*	0.142*	1		
Promotion	0.231*	0.203*	-0.059*	0.259*	1	
Other	-0.079*	-0.159*	0.044*	0.047	0.074*	1
*statistically significant at $p \leq 0.05$						

Question 8 on the Survey was open-ended and gave the EMGs an opportunity to state any other reasons they had for choosing where to buy garden plants and supplies. We analyzed these data to determine the number who specifically cited 'Quality' and these results are shown in Table 9.

Table 9. Quality as a Factor for Choosing where to Buy Plants and Supplies

	Total EMG Respondents	Number Stating 'Quality'	Percentage of Total EMG Respondents
2011	186	25	13.44%
2012	71	7	9.86%
2013	158	15	9.00%
Total	415	47	11.33%

These results show that over the three years, an average of 47 (11%) of the EMGs in the study stated 'Quality' was an important factor in their decision of 'Where to buy garden plants and supplies'. This percentage is surprisingly low, given the general

assumption that most shoppers seek quality products and/or places to buy. In their open-ended responses, EMGs also mentioned other attributes that could be considered to be related to quality, namely, 'Organic' and 'Local'. While most did not distinguishing whether these factors described the store or its products (plants and gardening supplies), the finding is insightful.

Over the three-year period, 76 (18.3%) EMGs stated 'Local' was important. This was higher than the number who specifically stated 'Quality' as being important 47 (11%). The number stating 'Organic' as being important at 41 (9.6%) was also higher than those stating 'Quality'. In some cases, an EMG indicated two of these attributes (for example, 'Quality' and 'Local') and in a few cases all three attributes were stated as being important. This result strongly suggest there is ambiguity concept of 'Quality' when EMGs choose where to buy inputs and plants. However, being 'Local' and 'Organic' are clearly important to some Vermont EMGs.

4.2.3. Multivariate Analysis - Impact of Demographics on Vermont EMGs' Reasons for Gardening

In order to determine if socio-demographic factors affect the reasons that motivate EMGs to garden, we estimated linear regression models one for each of the reasons cited as being important in the decision to garden. The independent variables for each of the models were Age, Education, and Gender of Gardening Decision-maker and annual Household Income. The results for the five regression models are shown in Table 10.

Table 10. Regression Models- Impact of socio-Demographics on Reasons for Having a Garden

Dependent Variables					
	Save Money	Taste of Homegrown	Food Safety Concerns	Environmental	Fun/Relaxation
Independent Variables					
Intercept	4.191	4.087	4.645	4.5	4.469
Age of Gardening Decision-Maker	-0.007	0.007***	-0.001	-0.002	0.003
Education	-0.002	0.028	-0.089**	-0.033	-0.004
Household Income	0.000***	0	0.000**	0	0
Gender of Gardening Decision-Maker	0.11	0.108**	0.164*	0.052**	0.051
R2	0.107	0.051	0.042	0.015	0.007
Adjusted R2	0.096	0.04	0.032	0.004	-0.003
F- Statistic	0	0.001	0.004	0.254	0.625
Regression models were estimated for ratings values ranging from 1-5, where 1= 'least important', and 5 = 'most important'					
*Significant at p≤ 0.10					
**Significant at p≤ 0.05					
***Significant at p≤ 0.01					

The regression results indicate that none of the five models have a strong explanatory power as indicated by the R^2 and adjusted R^2 which, in all models, has a value of 0.1 or less, meaning that socio-demographic factors explain less than 10% of the variation in the weight gardeners place on any of the factors that drive their decision to garden. This suggests that there are other reasons not captured in these models that can explain the variation in ratings.

Despite the low explanatory power of the model (low R^2) some interesting findings may be gleaned from the signs of the coefficients in the models. For example, 'Age' of the Gardening Decision-Maker has a positive impact on the ratings for 'Taste of Homegrown/Fresh' and 'Fun and Relaxation/Hobby.' This suggests that the older the EMG, the more likely they are to be motivated to have a garden in order to have a 'Taste of Homegrown/Fresh' produce or 'Fun/Relaxation/Hobby.' Conversely, 'Age' is negatively associated with ratings for 'Save Money', 'Food Safety Concerns' and 'Environmental Concerns' suggesting that the older the EMG, the less likely they are to

be motivated to garden out of 'Food Safety' or 'Environmental Concerns.' 'Household income' also has a positive impact on the motivation to "Save Money" and 'Food Safety Concerns.'

4.2.4 Multivariate Analysis - Impact of Socio-Demographics on Choice of Source for Garden Plants and Supplies

Regression analysis of the impact of demographic factors on the choice where to buy plants and supplies are summarized in Table 11.

Table 11. Impact of Demographics on Preference for Source of Plants and Gardening Supplies

	Local Garden Centers/Supply Stores	Large Retail Stores	Grocery Stores	Other Sources
Observations	N= 364	N=356	N=357	N=360
Independent Variables				
Intercept	4.16	1.192	2.161	3.23
Age of Gardening Decision-Maker	0.003	-0.006	-0.014	-0.02
Education	-0.021	-0.021	0.039	0.022
Household Income	0	0.000***	0	0
Gender of Gardening Decision-Maker	-0.001	-0.134	0	0.141
R2	0.004	0.037	0.032	0.027
Adjusted R2	-0.007	0.026	0.021	0.016
F- Statistic	0.394	3.343	2.899	2.487

***Significant at p≤ 0.01

Based on the overall regression models' total variance measures, R^2, we can conclude that demographic characteristics explain only a very small percentage, less than 4 percent of the variation in ratings for why EMGs choose to buy plants and supplies at different stores.

Studies show that attitudinal or psycho-sociological variables including norms, beliefs and values for example those related to trust and perceived environmental impacts, can affect consumer behavior (Stern, 2000; Simha et al., 2017). These factors might better explain the variability in the EMG choices and preferences. In the univariate analysis section, this study shows that variables such as 'Local' and 'Organic' are important to some Vermont EMGs. The regression models suggest that these values and psychological factors might better explain the shopping patterns and decision drivers for Vermont EMGs suggesting the need for further research.

CHAPTER 5. DISCUSSION

This study's objectives were to characterize the choices, preferences and motivations of fruit and vegetable gardeners, and to determine whether their socio-demographic characteristics affect some of these choices, preferences and motivations. Using a survey of Vermont Extension Master Gardeners, data were gathered over a three year period (2011-2013) covering three gardening seasons. The summary findings indicate that over 90% of Vermont EMGs had a fruit and/or vegetable garden over two consecutive years during that period, and over 85% of these had 'Private Home Gardens.' Less than 6% gardened in 'Community Gardens' while the rest grew fruits and vegetables in other types of gardens for example, in Community Supported Agriculture (CSA). The most cited reasons for not having a garden among those (less than 10% of EMGS) who did not garden during the study period, were lack of gardening space and time. Health and travel were also mentioned as deterring Vermont EMGs from actively gardening, although these reasons were not ranked as high in importance.

Vermont EMGs gardeners are distributed evenly across the state, and their distribution mirrors closely the distribution of the general population, with the exception of Essex County which had no Master Gardeners or Interns participating in the study. This finding is shown in Figure 4 and suggests that county residents statewide have relatively similar access to an EMG gardener. Addison, Washington and Windham Counties are especially fortunate in having resident gardening EMGs in greater proportion to the general population, at least based on the EMGs who participated in the study. The concentration of Master Gardeners around urban areas is consistent with

previous studies (Extension Master Gardener, 2010). Vermont is a rural state with a few centers of population. Chittenden County is home to Burlington the largest urban center in the State. Washington County is home to Montpelier, the State Capital. Other important urban centers include St. Albans and Rutland. With a rapidly urbanizing world, where 60% of the world's is expected to be living in urban areas by the year 2050, a figure well surpassed in the United States which currently has over 80% of residents living in urban areas (United Nations, 2014), the implications for gardening are significant. Rural states like Vermont are reasonably resourced with land and water. However, the complementary resources including quality plants and gardening supplies may not be easily accessible to residents that dwell farthest from the population centers, even if these are rural towns.

Additionally, it can be hypothesized as rural-urban migration continues on this current trajectory, the isolation of remote rural dwellers from knowledgeable gardeners such as Vermont EMGs may worsen making it difficult for them to learn the skills that are often communicated through neighborly relations and community gardens. In Vermont, the rural elderly are particularly vulnerable and would likely miss out on the much needed socio-psychological and physical benefits (Rodiek, 2002; Hawkins et al., 2013) that gardening affords.

The challenges for urban gardening are somewhat different. With high population densities, land for gardening comes often at premium, and those who rent or live in apartments often have very limited space in which to garden. Soil contamination requires that gardeners have the know-how in urban settings to mitigate risk of contamination

which can be done through soil rehabilitation, appropriate plant selection (Kachenko and Singh, 2006; Atkinson and Kim, 2015; Laramee and Waterman, 2015).

This study examined the role socio-demographic characteristics play in the choices that Vermont EMGs make and how they affect their decisions to garden and where they choose to buy garden plants and supplies.

5.1. Socio-Demographic Characteristics

Vermont EMGs are not atypical when compared to Master Gardeners around the country. By age, 41% are in their 50s, and in over 65% of the households, females are the gardening decision-makers and also do most of the gardening work. Studies show that most Master Gardeners nationwide are female (Takle et al., 2016), and the gendered division of labor at the household level (Becker, 1965) may still be at work allocating most of the gardening work to females.

With respect to education, over 70% of the EMG garden decision-makers had completed college and the largest cohort (of over 35%) had completed graduate or professional education. Household income showed a similar trend to education, with close to 90% of Vermont EMG households having incomes $25,000 and above. This might explain partly why so few garden in community gardens, since higher income is associated with homeownership, which in turn increases the opportunity for having a 'Private Home Garden.' Studies show that most 'Community Gardeners' lack private space in which to garden (Armstrong, 2000).

These statistics taken together lead one to conclude that the choices and decisions that Vermont EMGs and for a similar profile of gardener, the role of socio-demographics

may be modified or limited, compared to what it might be for a different profile of gardener.

5.2. Garden Characteristics, Plant Choices and Motivation for Gardening

Among Vermont EMGs, vegetable/herb gardens vary widely in size ranging from under 100 ft^2 to over 20,000 ft^2 and although the average size was 922 ft^2, over 50% of EMGs had gardens under 400 ft^2, with the most common size being 100-200 ft^2 (14.9%). The most popular vegetables, grown by over 70% of the EMGs over the three year period were tomatoes, herbs, salad greens, beans, cucumbers and peppers while the least favored were watermelons, parsnips and collard greens were grown by less than 20% of the EMGs. With regard to fruits and berries, blueberries, apples, raspberries and strawberries were popular in all three years, and approximately 10% of EMG gardeners who had vegetable/herb gardens did not grow any fruit or berries.

By finding out what most Vermont EMGs grow, the Master Gardener program might be able to make available key information on the key fruits and vegetables that gardeners are growing. This information could also be used to track trends of the most popular fruits and vegetables generating insights into changes in food and culture, as well as the impact of disease trends and other phenomenon such as changes in climate and resources for pollinators.

The most important motivation for gardening among Vermont EMGs is 'Having a Taste of Homegrown Fresh' produce (ratings above 4.5/5). This was the top reason cited in all three years, followed closely by 'Fun/Relaxation/Hobby' 'Food Safety' and 'Environmental Concerns' were rated about the same (between 4/5 – 4.5/5), while

'Saving Money' received moderate ratings, (between 3- 3.5/5). These results suggest that Vermont EMGs garden mostly for reasons other than saving money/food security concerns given that households of similar income, education, and age tend to garden for leisure (Wright and Wadsworth, 2014). This is one finding that perhaps illustrates the need to have several 'gardener' definitions. For example new immigrants and low income households may be more concerned about their food budget than they are of having a taste of homegrown fresh produce. Studies by Bose and Laramee (2011) and Alkon and Mares (2012) demonstrate the challenges that low income new American immigrant gardeners face in meeting their food budgetary needs while struggling to find foods that are reminiscent of their home of origin.

5.3. Gardening Expenditure, Shopping Preferences and Information Sources

Close to 80% of Vermont EMGs spend less than $250 per year on plants and gardening supplies and 'Local Garden Centers/Garden Supply Stores' are the most important sources. Vermont EMGs also favor 'local' products. This finding is consistent with the EMGs rating of 'Food Safety' and 'Environmental Concerns' as being important reasons for gardening. Studies show that conscientious/environmental shoppers tend to prefer local products (Zepeda and Deal, 2009; Yue et al., 2011). When asked the main reason they chose where to buy, 'Past Experience' was the highest rated factor, while 'Promotion and Advertising' was the least important. Other factors that were of moderate importance were 'Convenience,' 'Price,' and 'Word-of-Mouth.' This finding suggests that local retailers should strive to provide a positive shopping experience which may lead to other buyers learning about the service by word-of-mouth, similar to what

Saffley and Wohlgenant found in their 1999 study. A heavy reliance on promotion and advertising may not result in an increase in customers/sales, at least among Vermont EMGs.

Initially, 'Quality' was not included as a choice characteristic for deciding where to buy plants and gardening supplies. Analysis of the open ended question on the survey revealed that not only were some 11% of EMGs motivated by 'Quality', an even greater percentage (18.3%) was motivated by 'Local' and '(9.6%) Organic' attributes.
A clear definition of 'Quality' would need to be developed in order to meaningfully examine its impact on EMGs' choices. This finding confirms the studies from marketing that have shown 'Quality' to be an closely correlated with other variables such as price, as well as being aggregated variable whose sub-attributes need to be disaggregated in order to be accurately studied (Scitovszky, 1945; Dodds et al., 1991).

Information plays an important role in making gardening decisions. Vermont EMGs rely primarily on 'Books,' the 'Internet,' 'Extension,' 'Friends' and 'Print Articles' for gardening information. There has been an increase in the percentage relying on the 'Internet' and 'Radio,' although having a following of less than 15% experienced an uptick in users. 'Television' and 'Videos' were hardly relied upon by EMGs. The importance of 'Word-of-Mouth' is consistent with what EMGs express when asked about their shopping decisions and their choice of where to buy. This finding suggests that Vermont EMGs tend to rely on direct person-person communication for a variety of decisions. Opportunities that promote such interaction would likely be an effective way to reach this group of gardeners.

Vermont EMGs participate in community volunteer projects, both to remain current in certification, and also to fulfill the mission of the Vermont Extension Master Gardener program, which is to share information with others within the community. These volunteer opportunities may serve as an important avenue for sharing information on personal gardening issues, enhancing one's knowledge, but also gathering information that affects decisions such as where to buy plants and supplies. The Vermont EMG program planners could perhaps use this finding in marketing efforts as a benefit that might attract new members, and maybe renew interest in some on those who have become less active.

5.4. Effect of Demographic Characteristics on Gardeners Motivations and Choices

The effects of EMGs' socio-demographic characteristics on EMGs reasons for gardening as well as their preferences and choices for where to buy plants and gardening inputs were examined using regression analysis. The socio-demographic variables included Age, Education, and Gender of the gardening decision-maker and Annual Household Income.

T-tests were calculated to determine if significant differences ratings EMGs assigned to different 'Reasons for Gardening'. These results show that the means are statistically different at $p \leq 0.05$, except for 'Food Safety Concerns' and 'Environmental Concerns.' This result indicates that those groups of EMGs who consider these two factors to be very important are similar, or that these motivations are highly correlated when considered by Vermont EMGs.

Regression models testing for the impact of socio-demographic characteristics on the reasons for having a garden all have very low explanatory power, with R^2 values of 0.1 or less. This indicates that Vermont EMGs' socio-demographic characteristics do not have very strong explanatory power for their decisions to garden.

T-tests were also calculated to determine if significant differences ratings EMGs assigned to different 'Reasons for Choice of Where to Buy' gardening plants and supplies. These results) show that the mean ratings for 'Price' and 'Convenience', and those for 'Word-of-Mouth' and 'Other,' are not significantly different at $p \leq 0.01$. The category 'Other' included reasons such as 'organic' and 'local' designations. These findings suggest that EMGs who are highly concerned about price and convenience are similar. Those that select sources based on 'Word-of-Mouth' are also similar to those who are highly concerned about 'local' or 'organic' attributes of their plants and supplies.

Regression models testing for the impact of socio-demographic characteristics on the preferences for retail source for plants and supplies all have very low explanatory power, with R^2 values of less than 0.1.

The regression results for both the decision to garden and the choice of where to buy plants and supplies indicate that among Vermont EMGs, socio-demographic characteristics do not have a strong impacts. This finding is consistent with research that shows that demographic characteristics may not be as good predictors of behavior for consumers who are highly concerned with environmental issues or those who express a preference for local goods. In these cases, attitudinal, or psycho-social variables may be better predictors (Zepeda and Li, 2006; Bavorova et al., 2016).

The results of the univariate and multivariate statistical analyses revealed that socio-demographic characteristics had limited impact on the importance EMGs attached to different factors regarding their gardening choices and shopping decisions. Given the narrow socio-demographic profile of Vermont EMGs, the implication here may be that a study on different types of gardeners - perhaps Master Gardeners from other states or regions may lead to similar or different findings. These gardeners' socio-demographic profile could different by income, gardening knowledge/education, age, or gender of gardening decision-makers (given that the majority of gardening decision-makers are female) may or may not have similar impacts on gardening decisions as was found with the Vermont EMGs.

Research on different 'types' of gardeners would be needed to test this hypothesis – which then brings up the issue of a 'working definition' that is sustainable so that will allow for studies to be conducted and replicated with statistically comparable results. Essentially, there is need for 'populations' of gardeners of known characteristics to be defined so a broader set of studies can be conducted, beyond the Master Gardeners. The USDA has a definition for farmer (USDA-ERS, 2015), Master Gardeners are a well-defined population (with state and regional sub-populations). But the results of this and similar studies are not generalizable beyond the population to which they pertain. It seems an initiative such as the one undertaken Washington State University in developing the now ubiquitous Master Gardeners, might be worthwhile undertaking.

CHAPTER 6. STUDY LIMITATIONS AND CONCLUSIONS

This study was designed to characterize the choices, preferences and motivations of gardeners with a specific focus on Vermont Extension Master Gardeners (EMGs), and to determine if socio-demographic characteristics had a significant effect on some of their motivations, choices and preferences.

There were several limitations that we faced in conducting the study. The most salient one was that we needed to run online survey for several growing seasons in order to gather sufficient data for the analysis, this required. During the launching of the 2011 survey, the researcher made a technical error that led to the loss of many responses, therefore lowering the number of EMGs in the study. This demonstrates the risk inherent in running online surveys and the vigilance with which the process needs to be undertaken to avoid costly errors.

Another limitation was in the use of categorical variables where interval variables might have been just as easy to collect. For example, respondents were asked to select an age category as well as a category for educational attainment. By using categorical data, we limited the variability in that would was there in the respondents. The overall impact of this was to reduce the precision with which we could analyze the data, perhaps masking the effects on these variables on the study questions.

In conclusion, the findings show that most Vermont EMGs are very reminiscent of Master Gardeners nationwide in their demographic profile. Most garden in private home gardens with less than 20% gardening either in Community, CSAs, or other types of gardens. Vermont EMGs preferred to grow tomatoes, herbs, salad greens, beans, and

cucumbers with over 70% of them growing these in all three years. Among fruits and berries, blueberries, apples raspberries and strawberries were the favorites and were grown by over 40% of EMGs.

Then most important motivations for gardening included having a taste of homegrown fresh fruits and vegetables and fun and relaxation/hobby. Concern for food safety and the environment were important, and were likely linked to EMGs motivation to buy local plants and gardening supplies. These findings suggest that Vermont EMGs can be characterized as conscientious/environmentally concerned gardeners who being knowledgeable, are less motivated by promotion and advertising, and more by word-of-mouth and experience. Regression analysis showed that socio-demographic characteristics (age, education, household income and gender) have limited effect on the behavior of Vermont EMG fruit and vegetable gardeners, as has been shown to be the case for environmentally significant consumers of organic products (Zepeda and Li, 2006; Bavorova et al., 2016).

This study contributes to the body of work that covers gardeners, whose importance in the global food system is now recognized in the 'Global South' and ever increasingly in the 'Global North'. Research such as this is constrained by the absence of formal definitions for different types of gardeners. However, there is the potential to do similar work in other parts of the country and even internationally in places where Master Gardener programs exist. It however is limited by the fact that Master Gardeners are a specialized group of gardeners who have received training in science-based gardening, and Vermont is a unique gardening environment being mostly rural but with higher

education and income levels compared to other similar states. Vermont EMGs are therefore not likely to be representative of other gardeners, limiting the generalizability of the findings of this study. Additionally, the demographic characteristics of Vermont EMGs are atypical of the average Vermonter, with EMGs having relatively higher education and household income levels. These factors likely affect the choices, preferences and motivations of EMGs, and it may well be the case that other groups of gardeners', for example, community gardeners, of whom there were very few among Vermont EMGs, may exhibit different preferences and motivations.

As gardening continues to gain a foothold in the food system, a better understanding of gardeners and their motivations and preferences will be likely to have important implications for the sustainability of the food system at the local, regional and global levels.

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APPENDICES

Appendix 1. Survey Protocol Approval

Committees on Human Subjects Serving the University of Vermont and Fletcher Allen Health Care

RESEARCH PROTECTIONS OFFICE
245 S. Park, Suite 900
Colchester, VT 05446
Ph: 802-656-5040, F:802-656-5041
Website: http://www.uvm.edu/irb/

Protocol Exemption Certification

TO: Leonard Perry
FROM: Gale Weld, Research Review Administrator

DATE OF CERTIFICATION: 17-Mar-2011

SUBJECT: CHRBS: B11-175

Practices and Perceptions of Vermont Vegetable and Fruit Gardeners

According to federal regulations, certain types of research activities are "exempt" from formal Committee review and approval, however, University policy requires that all projects which involve human subjects be submitted to the Committee office for exemption determination.

Following such a review of your project, it has been determined that it qualifies for exemption, as indicated below, under Section 45 CFR 46.101(b) of the Federal Policy for the Protection of Human Subjects.

Exemption Number: 2
"Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior, unless: (a) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably

place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation."

It is University policy to require all research to be conducted in accordance with the Belmont Report, which sets forth ethical principles for research involving humans as subjects. A copy of this report is available on our website under Rules, Regulations, and Guidance.

Modifications may affect the original determination of exemption, therefore, you must submit any proposed project modifications which affect human subjects for review prior to implementation (i.e. surveys, questionnaires, changes to on-line interventions, etc.).

This exemption is effective for the duration of the project UNLESS modifications are made that affect the original determination of exemption.

Appendix 2. Vegetable and Fruit Gardening Survey 2013

Thank you for taking a few minutes of your day to provide us with some valuable information regarding your gardening over the last 2 years. This will help UVM Extension and your garden suppliers better provide you with the plants and supplies you want and the information you need. We will make sure we share the results of this study with you.

At the end of this survey, you may choose to enter a drawing for the following prizes: 1. "The Fruit Gardener's Bible: A Complete Guide to Growing Fruits and Nuts in the Home Garden – By Lewis Hill and Leonard Perry. 2. Free online access to Dr. Leonard Perry's Certificate Course on Garden Flowers (a $99 value, the same information as offered for 2 credits through UVM). Name and contact information will not be linked to the survey and will only be used for the drawing.

1. Did you have a fruit and/or vegetable garden in 2013?

o YES

o NO

2. Did you have a fruit and/or vegetable garden in 2012?

o YES

o NO

If you did NOT grow vegetables or fruits in either 2013 OR 2012 click here otherwise, proceed to Question #3.

3. How would you describe your garden?

o Private home garden

o Community garden

o Co-operative garden

o Other (Please specify)_____

4. If you grew fruits/vegetables in 2013, about how much did you spend on plants and supplies in 2013?

○ Less than $100

○ $101 - $250

○ $25- - $500

○ $501 - $750

○ $751 - $1,000

○ Over $1,000

5. If you grew fruits/vegetables in 2013, on a scale of 1-5 (1= Not Important, 5 = Very Important, how important were the following sources of gardening plants and supplies? (Please rate each item)

	1	**2**	**3**	**4**	**5**
Local garden center or garden supply store	○	○	○	○	○
Large chain store (e.g., Walmart, Home Depot, Lowes, etc.)	○	○	○	○	○
Other retail outlets (e.g., grocery stores, etc.)	○	○	○	○	○
Other sources (e.g., garden club sales, yard sales, etc.)	○	○	○	○	○

Please list other important sources of plants and supplies, if any _____

6. If you grew fruits/vegetables in 2013, on a scale of 1 to 5 (1 = NOT Important, 5 = MOST Important), how important were the following reasons in deciding where to buy your plants and gardening supplies? (Please rate each item.)

	1	2	3	4	5
Price	○	○	○	○	○
Convenience	○	○	○	○	○
Past experience	○	○	○	○	○
Word-of-Mouth	○	○	○	○	○
Promotion or advertisement	○	○	○	○	○
Other reasons	○	○	○	○	○

7. Please state other reasons for deciding where to buy plants and supplies_____

8. What are your main sources of information, or main influences on your gardening decisions? (Select all that are relevant.)

- ○ Books
- ○ Extension
- ○ Friends
- ○ Garden stores
- ○ Internet
- ○ Print articles
- ○ Radio
- ○ Television
- ○ Videos
- ○ Other sources

9. List other sources of information, if any _____

10. If you had a vegetable garden in 2013, what was the approximate size? (For example, a minivan covers the surface area of about 100 square feet).

_____ Square feet
(Numerical value only e.g., 100 NOT 100 square feet, if none, enter 0)

11. If you had a fruit garden in 2013, what was the approximate size?

Number of trees_____
(Numerical value only, e.g., 5 NOT "5 trees")

Number of bushes_____
(Numerical value only, e.g., 5 NOT "5 bushes")

Feet of rows_____
(Numerical value only, e.g., 5 NOT "5 ft")

If you did not have a fruit garden, enter a zero digit (0) _____
(Without the parentheses)

12. Please select all the vegetables you grew in your garden in 2013

○ Beans	○ Cabbage	○ Carrots	○ Collard greens
○ Cucumber	○ Garlic	○ Herbs	○ Kale
○ Onions	○ Parsnips	○ Peppers	○ Potatoes
○ Pumpkins	○ Radishes	○ Salad greens	○ Spinach
○ Sugar beets	○ Summer squash	○ Sweet corn	○ Tomatoes
○ Winter squash	○ Other	○ None	

13. Please list any other vegetables you grew in 2013, if any _____

14. Please select the types of fruits you planted (or had growing) in your garden in 2013.

○	Apples	○	Blueberries
○	Cherries	○	Grapes
○	Pears	○	Plums
○	Raspberries	○	Strawberries
○	None	○	Others

15. Please list other fruits you planted or had growing in 2013, if any

_____

16. If you grew fruits/vegetables in 2012, which of the following changes did you make to your garden in 2013? (A "little" is about 25% or less, "a lot" is over 25%). Please rate each item as appropriate.

	Reduced a lot	**Reduced a little**	**Same as last year (2012)**	**Increased a little**	**Increased a lot**
Space for vegetables	○	○	○	○	○
Types of vegetables	○	○	○	○	○
Space for fruits	○	○	○	○	○
Types of fruits	○	○	○	○	○
Sustainable practices (e.g., composting, pesticide use, etc.)	○	○	○	○	○

Other (please specify) _____

17. On a scale of 1-5 (1= NOT Important, 5 = VERY Important), please rate the following as the major reasons for having a garden in 2012 AND/OR 2013.

	1	2	3	4	5
Save money	○	○	○	○	○
Taste of homegrown fresh produce	○	○	○	○	○
Food safety concerns (e.g. use of chemicals)	○	○	○	○	○
Environmental concerns	○	○	○	○	○
Fun, relaxation, hobby	○	○	○	○	○
Other reasons	○	○	○	○	○

18. Please list other reasons for gardening, if any_____

19. What is the age of the gardening decision-maker in your household? (If equally shared, please indicate average age)

○	**Under 20 years**	○	**51 – 60 years**
○	**20 - 30 years**	○	61 – 7 years
○	**31 – 40 years**	○	Over 70 years
○	**41 – 50 years**		

20. What is the gender of the gardening decision-maker in your households? (Please check all that apply).

○ Male

○ Female

○ Equally shared

21. What is the highest level of education attained by the gardening decision-maker in your household (if equally shared, please check for both).

- o Less than high school
- o Some high school
- o Completed high school or equivalent
- o Some college or vocational training
- o Completed Associate or Vocational degree
- o Completed Bachelors' degree
- o Some graduate or professional degree
- o Completed graduate or professional degree

22. What is the gender of the person who does MOST of the work in your vegetable/fruit garden? (Please check all that apply).

- o Male
- o Female
- o Equally shared

23. In what ZIP Code is your home located? (Enter 5-digit ZIP Code; for example 00544)._____

24. In what ZIP Code is your garden located? (Enter 5-digit ZIP Code; for example 00544)._____

25. What is your annual pre-tax household income?

- o Less than $25,000
- o $25,001 - $50,000
- o $50,001 - $75,000
- o $75,001 - $100,000
- o Above $100,000

Thank you for completing this survey. If you would like to be entered in the raffle for our 'Thank You' gifts, please click here, otherwise click 'Done.'