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Growing Food Security: The Impact of Community Gardens on Food Security in Denver, Colorado

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GROWING FOOD SECURITY: THE IMPACT OF COMMUNITY GARDENS ON FOOD SECURITY IN DENVER, COLORADO

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ABSTRACT

Community gardens provide many benefits, including increased mental and physical health, social inclusiveness and cohesiveness, and an increased connection between individuals and their environment. In some U.S. cities gardens additionally increase community and individual food security by providing fresh food to those who struggle to feed themselves and their families. This study examined the potential for community gardens to increase food security in Denver, and is one of the first studies of its kind in this location. Specifically, I investigated who participates in community gardening and why they participate, whether community gardens are accessible, and whether gardens have the potential to improve individual and community food security. To do this, I gathered behavioral, perceptional, and demographic data from surveys (n=203) and semi-structured interviews (n=14 interviewees). I also used a variance-to-mean ratio, kernel density estimation, and walksheds to analyze the spatial distribution, accessibility, and demographic representativeness of community gardeners compared to residents surrounding gardens. Despite the national and local importance of the issue of food security and hunger reduction, gardeners in my study spoke more about mental and physical health, and social benefits of gardening. Based on their survey responses, I classified fourteen respondents as food insecure, which suggests that many gardeners in Denver are food secure. Additionally, I found that community gardeners are somewhat

demographically representative of nearby residents, and the community gardens are accessible to those who currently use them. Results from this study can advise Denver's Sustainable Food Policy Council in their suggestions to the city to institutionally assist in food insecurity and hunger reduction efforts.

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CHAPTER ONE: INTRODUCTION

The persistence of hunger and food insecurity in the face of the most productive global food systems of all time presents the U.S. with a paradox. While the current globalized food system efficiently yields mass quantities of produce, it is an inflexible system where millions of people go hungry and experience food insecurity each year (Alkon and Agyeman 2011; FAO, IFAD, and WFP 2015). In part, as a response to the lack of resilience and flexibility in the global food system, the local food system – all components of food grown in urban areas, or on a small scale – has experienced an increased numbers of participants (Allen 1999; McWilliams 2009). Local systems decrease the distance between producer and consumer, increase accessibility of fresh and healthy food, and can reduce the cost of food (Meenar and Hoover 2012).

One aspect of local food systems are community gardens. For the purpose of this research, the term *community garden*, refers to urban gardens that yield food and are created and maintained by local community members. In order to alleviate or eliminate hunger and food insecurity, there must be an appropriate and diverse system in place that makes desired food available and affordable. Existing research suggests that community gardens in the U.S. have the potential to enhance the quality of life of all participants. Subsequently, community gardens can result in a more resilient and food secure city through the direct integration of food production and food consumption (Armstrong

2000; Hansen 2008; Draper and Freedman 2010; Corrigan 2011; Meenar and Hoover 2012; Drake 2014).

To better understand the relationship between community gardens and community food security (CFS) in Denver, the goal of this research is to examine community gardens as an alternative to global food systems. Therefore, this study analyzes community gardens through a CFS framework. There are various definitions of food security, but the generally-accepted definition from the Food and Agriculture Organization (FAO) takes into account food availability, food access, and the ways in which food is used (Cummins and Macintyre 2002; Lang and Rayner 2002; McCullum et al. 2005; FAO[1] 2006; USDA 2009). For the purpose of this research I define food security as *having continuous access to affordable, healthy, culturally-appropriate, and desired food without the need to resort to coping strategies*[2]. My definition is rooted in a combination of the FAO and Anderson and Cook's (1999) definitions that do not assume that all people want healthy food, but as long as they can access and afford it, then they have the option to consume it.

In order to understand how community gardens and food security in Denver are related, my first research question asks: *Why do individuals participate in community gardening in Denver?* This question allows me to better understand the driving motivations behind participation in community gardens, and how community gardeners benefit from their participation. One benefit of community gardening is an increase in

[1] The FAO's definition of food security is as follows, "Ensuring that all people at all times have both physical and economic access to the basic food that they need" (2006, 1).

[2] Coping strategies are any strategy a family or individual uses to minimize hunger. They may include borrowing money, obtaining food from friends or family, or reducing the number of meals.

food security. With the first research question I contextualize my second research question: *How do community gardens in Denver affect food security?*

Typically, individuals who have inadequate access to food and experience food insecurity in urban environments are located in neighborhoods of predominately low income or in predominately non-white households (Eisenhauer 2001; Raja, Ma, and Yadav 2008). Therefore, living in a low income neighborhood or a predominately non-white neighborhood may translate to less access to food than middle or upper income neighborhoods, or predominately white neighborhoods (Powell et al. 2007). In order to analyze whether community gardens actually serve populations that are at greater risk for food insecurity, my third research question asks: *How do the socioeconomic status and demographic profile of gardeners compare to that of residents in neighborhoods around the garden?*

Having access to food is just as important as having healthy, culturally-appropriate, and desired food. For households that lack accessible food, the availability of alternative sources of food – from community gardens, for example – could be critically important to maintaining a stable level of food security. Therefore, my fourth and final research question (*How does garden location affect accessibility to the garden?*) incorporates accessibility as a component to food security. Without access, hunger relief would be impossible.

The following chapters will discuss the design, implementation, and results of my study. I will first present a review of relevant definitions and literature. Then, I will outline the mixed methods I used to collect qualitative and quantitative data, as well as

the methods to analyze data. Next, I present the results of data collection pertinent to each research question and the relevance of my results. I conclude with a discussion on how my results fit into previous work on food security and community gardening, and the avenues that future research should explore.

CHAPTER TWO: LITERATURE REVIEW

The following chapter covers appropriate literature related to this study. I begin with a background on the rise of the present industrial agricultural schema that dominates global food production. I then present a brief history of community gardens in the U.S. beginning in the late nineteenth century. A historical context of community gardens in the U.S. is necessary to understand the various roles that community gardens have held in urban areas. Next, I discuss documented benefits of and underlying motivations for participating in community gardens. I then present pertinent literature regarding challenges and barriers to garden participation, some of which discourage inclusivity. Following, I include literature on using CFS versus hunger relief as a metric for addressing inadequacies in food systems. Finally, I conclude with a discussion on the gaps and limitations of present literature regarding community gardens and food security.

Industrial Agriculture & Equity

Civilizations originally relied upon subsistence agriculture where people grew just enough on which to survive. Farming was labor-intensive and the tools were simple (Padgitt et al. 2000). Increases in mechanization allowed farmers to harvest larger fields, which then allowed farmers to sell their produce to communities further from their farm to increase their profits (Dimitri, Effland, and Conklin 2005). As time progressed, farms transitioned from subsistence to industrial, commercial farms.

The evolution of industrial agriculture in the twentieth century was partially facilitated by the Green Revolution. The Green Revolution was a period of time between the 1950s and 1970s characterized primarily by genetic modification of crops, but also by revolutions in irrigation, mechanization, and chemical use in agriculture (Khush 2001; Dimitri, Effland, and Conklin 2005). These revolutions provided nations the ability to massively increase their agricultural output, but decreased the number of individuals involved in farming. To illustrate, between 1900 and 2000, the number of farms in the U.S. decreased by 63 percent while the amount of acreage under production increased by 67 percent (Dimitri, Effland, and Conklin 2005).

Despite gains in output, as early as the 1970s researchers saw negative social impacts from the Green Revolution (Falcon 1970; Skorov 1973). At the very least, the Green Revolution and the industrialization of agriculture did not contribute to poverty reduction or hunger reduction (Das 2002). Advanced technologies were only available to wealthy farmers and did little to alleviate poverty for farmers in the U.S. who were struggling prior to the Green Revolution (Skorov 1973). Changes in land management and food production resulted in a decrease in "control over and access to the most essential elements of life," because farm control transitioned from local, small-scale farmers to corporate farms (Barker 2007, 9). The corporate and global transition resulted in further increasing the distance between food producers and consumer (Heynen, Kurtz, and Trauger 2012).

The transition to globalized and industrial food systems negatively impacted many people, but especially the poor and marginalized. Government subsidies enforce an

overproduction of crops, like corn and soy, making them cheaper and more monetarily accessible for lower-income families (Heynen, Kurtz, and Trauger 2012). However, the food found on the shelves of supermarket aisles is often high-calorie, but low in nutrients (Heynen, Kurtz, and Trauger 2012). High calorie, low nutrient, low cost foods are often all low income residents can afford, institutionalizing a poor diet among low income people (Kumanyika, Whitt-Glover, and Gary 2007). Fresh food is generally more expensive than processed food, so affluent and disadvantaged populations unequally consume fresh produce. The global food system does not recognize individuals' right to food, and uneven distribution of fresh, quality food is a social injustice linked to food insecurity. As a result, to help address health and social concerns associated with global food, people are increasingly interested in local, alternative food systems (Allen 2008).

In order for a food system to be fair, it must be equitable and equally accessible by all (Hesterman 2011). Local food systems can be equally as unjust as global food systems, but when local food system players are intentional about the goals and equitability of food, then local food has great potential to be just and to increase food security (Bellows, Brown, and Smit 2003; Allen 2010). Just food systems must incorporate local community members' desires. Therefore, just food systems must be community-based food systems, as long as the players in the community are diverse and represent the desires of many people (Born and Purcell 2006; Anderson 2008).

Brief History of Community Gardens in the United States

Community gardens are one component of local food systems that directly involve community members. The form of community gardens that are currently popular in the U.S. are around thirty years old. However, community gardens have existed in some form in the U.S. since the late 1800s. In this section I briefly outline the history of community gardens within the U.S. I rely heavily on Laura Lawson's extensive research on the changing purpose of gardens over time as a reaction to varying circumstance. In particular, Lawson's (2005) *City Bountiful: A Century of Community Gardening in America* serves as the most comprehensive and guiding authority to this topic.

Around the turn of the nineteenth century, civic and beautification projects began to appear in cities (Lawson 2005). During this period, city officials and organizations established allotment gardens as a response to a public concern for food security that was associated with economic depression in 1893 (Lawson 2005; Birky 2009). The public perceived allotment gardens as a form of charity that helped the poor, destitute, and undesirable inner-city residents by providing them a source of income and nutrition. Contrarily, civic groups saw allotment gardens as a way to beautify the city and develop vacant lots, which they believed to be an eyesore (Lawson 2005). Following the time of allotment gardens were three garden phases between 1917 and 1945: the national urban garden campaign during World War I (WWI), Depression-era gardens, and the victory gardens of World War II (WWII).

Gardening in the first phase, came about due to a national food crisis during WWI (Lawson 2005). In 1917 the federal government created the National War Garden

Commission (NWGC), which encouraged individuals to either participate in growing a garden, or to donate materials for war garden associations (Lawson 2005; Hayden-Smith 2007). The NWGC and its partner program the United States School Garden Army encouraged both adults and children to garden in any available and suitable land including vacant lots, backyards, and playgrounds. The gardens the national government encouraged were directed at everyone - not just the unemployed (Lawson 2005). The theme of the first garden phase was national involvement and management of urban gardens in order to provide wartime relief. In turn, a sense of national pride associated with gardening awakened within the public.

Throughout the second garden phase, city officials again targeted community gardens at the unemployed. The 1930s coincided with the Great Depression, where many individuals lost their jobs and families struggled to feed themselves. Local groups originally formed gardens as relief programs because gardening provided extra food. Later, they gained state and federal support – although not as much as the war gardens during WWI (Lawson 2005). Not only were gardens supposed to help unemployed families have a means to feed themselves, they were also intended to prevent idleness while productively assisting in relief efforts. This type of relief was easy to implement and required relatively little funding. Gardens during the second phase were successful in boosting morale and financially supporting families (Lawson 2005).

In the mid-1930s, the New Deal decreased garden funding, which ended the national drive to garden for economic relief. A downside to the gardening effort of the 1930s was that “while gaining public recognition for nutritional, recreational, and social

benefits, [they] did very little to establish gardening as a sustained community resource," which further encouraged communities to view them as temporary features on the landscape (Lawson 2005, 169).

Perhaps the most well-known phase of urban gardening is that of the victory gardens of WWII. Following Japan's attack on Pearl Harbor, U.S. citizens were eager to assist in the war effort in any way, shape, or form. The United States Department of Agriculture (USDA) conducted a report on the quantity of food produced by small gardens and decided to encourage establishment of suburban gardens more than urban gardens, because there was more available space for gardening in the backyards of suburbanites (Lawson 2005). The USDA suggested that "unless you have at least that 1500 square foot minimum, free of shade…better join the crowd at the community gardens" in the city (Thone 1943, 186).

The government organized the National Advisory Garden Committee, which was in charge of coordinating activities between agencies and organizations that had goals to increase food production through victory gardens (Lawson 2005). For the duration of the U.S.'s participation in WWII, the Victory Gardens Program produced around 40 percent of the vegetables consumed in the U.S. (Armstrong 2000). This third phase of gardening is characterized by a combination of highlighting the benefits of gardens and promoting patriotism. The victory gardens were a huge success and brought to light many personal and collective benefits of gardening. However, as the war came to a close, so did the victory garden phase. They lacked national support, and the majority of the public lacked

a purpose for continuing them. As a result, only a handful of victory gardens evolved into recreational gardening programs after the war (Lawson 2005).

Between the end of WWII and the 1970s, little community gardening activity took place. When it picked back up, community gardens took a form which would eventually evolve into the community gardens that exist today. The energy crisis of the 1970s increased food prices and resulted in a renewed interested in urban gardening through the eyes of the general public (Lawson 2005). During the 1970s, people created community garden-oriented organizations such as the American Community Garden Association, New York City Green Guerillas, Seattle P-Patch, and Boston Urban Gardeners – all of which still function and play a role in their local food landscapes (Birky 2009).

Gardening for a larger social purpose, or for economic reform, is a consistent thread that weaves the historical narrative of American community gardens together. To illustrate, the American Community Gardening Association's (established 1979) stated mission is "to build community by increasing and enhancing community gardening and greening across the United States and Canada" (ACGA 2014, 1). Researchers conduct studies on community gardens, but linking the studies together is not easy for two reasons. One, the organizational structures of community garden organizations vary considerably. Second is the locality of community gardening – the unique conditions at research locations that do not necessarily transfer to other study site locations (Lawson 2000).

What does transfer between garden locations is their impermanent status in urban landscapes. Due to their history, people tend to associate temporality with community gardens. Over time gardens were established on vacant lots that remained vacant until a more desired land use for the plot arose – in which case the community garden almost always gets slighted (Lawson 2005). Today, cities still tend to value more profitable land uses than community gardens, so residents can use vacant lots for gardening, "but eventually will be replaced as the socioeconomic conditions return to normal" (Drake and Lawson 2015, 135).

Community Gardening Benefits & Motivations for Participation

While community gardening in the U.S. originally began as a way to improve and increase local food supplies, gardening has since evolved into a strategy for addressing health, social, and economic concerns. Gardeners may be driven to participate because of these concerns, but others participate as a form of recreation. Some benefits include improved personal health and wellness, education among children, city and neighborhood beautification, promoted social processes, preserved cultural knowledge, increased food security, and platforms upon which to address other urban issues (Armstrong 2000; Lawson 2007; Alaimo et al. 2008; Teig et al. 2009; Draper and Freedman 2010). Of course, some gardeners are motivated to participate simply because they find gardening enjoyable (Hanna and Oh 2000). Draper and Freedman (2010) conducted a thorough review of scholarly literature on community gardens published between 1999 and 2010 where they found eleven primary themes in literature. I will briefly discuss five themes

relevant to this research: health, community organizing and empowerment, social capital, cultural preservation, and economic benefits.

Health

The health benefits associated with community gardening vary depending upon whether they are related to mental, spiritual, or physical health (Armstrong 2000; Ferris, Norman and Sempik 2001; Teig et al. 2009). Mentally, the act of gardening, or simply being in nature, is one that researchers find meditative, relaxing, and peaceful (Maller et al. 2005; Fuller et al. 2007; Teig et al. 2009). I will discuss social health is more in the Community Organizing and Empowerment, Social Capital, and Cultural Preservation sections.

In terms of physical health, those who grow their own food are more likely to eat it, which means that growing food in a community garden encourages the consumption of fresh produce and thus promotes healthier eating, better access to food, increased physical activity, and reduced obesity (Wakefield et al. 2007; Alaimo et al. 2008; Teig et al. 2009; Draper and Freedman 2010; Castro, Samuels, Harman 2013).

Many gardens in the U.S. are either situated in school playgrounds, or are designed to encourage youth education and healthier living. Researchers found school gardens in Idaho (McAleese and Rankin 2007), Flint, Michigan (Alaimo 2008), California (Morris, Briggs, and Zidenberg-Cherr 2000), Texas (Lineberger and Zajicek 2000), and Canada (Dyment and Bell 2007) increased fruit and vegetable consumption in children. The school gardens also improved kids' attitude towards vegetables, increased

potential for physical activity, and increased vitamin and fiber intake among students who participated.

While community gardens are beneficial to young children, they also promote health among minorities and the elderly. Armstrong (2000) surveyed community gardens in upstate New York to analyze health promotion and community development. She found that community gardens increased social networks between people in lower income and minority neighborhoods, and that physical and mental health were popular motivations for participating in community gardens. Austin, Johnston, and Smith (2006) found that community gardens located in senior centers statistically improved social and emotional health of gardeners. In particular, community garden plots provide seniors with a space that is their own and allows for an easier transition to a lifestyle within a retirement center (Armstrong 2000). Living in a senior center, residents lacked private space, so community gardens were a valuable outlet for them.

Community Organizing and Empowerment

Community gardens are social spaces that can be the catalyst for community organizing amongst participants. Speer and Hughey (1995) conceptualize empowerment as community organizations' ability to "reward or punish community targets, control what gets talked about in public debate, and shape how residents and public officials think about their community" (732). Community gardeners can transform space within their neighborhood according to their own interests, while also becoming "decision-making activists" (Ghose and Pettygrove 2014, 1098). The creation of garden programs is a good way to engage community members and helps address other social issues such as

drug trafficking, blighted/vacant lots, and crime (Glover 2004; Saldivar-Tanaka and Krasny 2004; Henderson and Hartsfield 2009; Krasny and Tidball 2009; Ohmer et al. 2009; Teig et al. 2009). I will outline three studies that highlight community activism within the context of community gardening (Armstrong 2000; Staeheli, Mitchell, and Gibson 2002; Saldivar-Tanaka and Krasny 2004).

Armstrong (2000) found that community gardens located in low income areas were four times as likely as gardens in more affluent areas "to lead to other issues in the neighborhood being addressed" (324). Additionally, she found that gardeners engaged politically and successfully organized to keep a local supermarket in their area.

Staeheli, Mitchell, and Gibson (2002) interviewed community gardeners in New York City (NYC) who took action in the mid 1990's when then-mayor Rudolph Giuliani and NYC's Department of Housing Preservation and Development decided that the city needed to provide affordable housing in vacant lots. However, many of the "vacant lots" were not truly vacant, but actually contained community gardens. The researchers frame the conflict as the right to open space (particularly in low income areas that lack open spaces) versus the right to property. NYC community gardeners and other activists who sided with the gardeners successfully mobilized through "protests, parades, community festivals, and agitation at city council meetings, property auctions, and even mayoral press conferences" to preserve 500 gardens in NYC (Staeheli, Mitchell, and Gibson 2002, 201).

In this final example, Saldivar-Tanaka and Krasny (2004) studied Latino community gardens in New York to understand how Latino gardeners view the role of

gardens in community development. Garden members went to rallies and sit-ins to help protect threatened gardens from commercial development. The researchers found that garden members actually view gardens "more as social and cultural gathering places than as agricultural production sites" (Saldivar-Tanaka and Krasny 2004, 407). Community development for Latino gardens also played a role in empowering gardeners to become more active in their community in ways they were not prior to gardening.

Social Capital

Individuals may participate in community gardening for the social or community aspect. Rather than simply gardening in one's backyard, community gardening allows individuals to get to know their neighbors, meet new people, and be part of a group (Teig et al. 2009). Social processes such as collective efficacy, social trust, and reciprocity contribute to increased social capital[3] in community gardens (Teig et al. 2009; Comstock et al. 2010). Increased social capital has the dual benefit of increasing health because collective efficacy and social cohesion amongst people promotes health (Teig et al. 2009). Even the act of community members joining together and governing themselves for the sake of producing a successful functioning garden produces gardeners as neoliberal subjects (Drake 2014). Two-thirds of the research articles that Draper and

[3] Bourdieu (1986) defines social capital as "the aggregate of actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition—or in other words, to membership in a group—which provides each of its members with the backing of collectively-owned capital, a 'credential' which entitles them to credit, in the various senses of the word" (248-249), as quoted in Glover (2004, 145).

Freedman (2010) reviewed mentioned social actions that facilitate community gardens development.

Troy Glover previously conducted research on social capital amongst community gardeners in the U.S. In a 2004 case study, he found a community garden to be a source of social capital as well as a consequence of social capital (Glover 2004). The garden he studied produced group cohesion. As a leisurely activity, community gardening builds valuable social capital (Glover and Parry 2005). Through their participation, gardeners reap the reward of developed and maintained social relationships with other gardeners (Glover, Shinew, and Parry 2007). Finally, Martin et al. (2004) found that there is a positive correlation between social capital and household food security. If at least one member of a family participates in an organization that builds social capital, then the household is more likely to experience increased food security than they would be otherwise.

Cultural Preservation

Another benefit to participation in a community garden is the preservation, expression, or affirmation of culture. For example, Latino gardeners Saldivar-Tanaka and Krasny (2004) studied, plant crops that are native to their country of origin, or the geographic area from which they culturally originate. Additionally, Armstrong (2000) found that gardeners in rural upstate New York gardened to make culturally-relevant food accessible to them. In Los Angeles, Laura Lawson (2007) also found community gardens reflected the cultures of those who tended the gardens. The ability to grow desired food

allows citizens to access culturally-appropriate food in ways they would not be able to otherwise (Wakefield et al. 2007).

Economic Benefits

One of the more tangible benefits associated with community gardens is financial savings to both gardeners and the cities that house community gardens. Based on their data, Saldivar-Tanaka and Krasny (2004) estimated that a five to ten dollar investment in plants for a ten by twenty foot garden plot has the potential to provide profits of $500-$700 for fruits and vegetables. Similarly, Hanna and Oh (2000) found that most gardeners in Philadelphia spend less than ten dollars on their garden plots.

Ferris, Norman and Sempik (2001) coined certain community gardens in the San Francisco Bay area as entrepreneurial gardens based on their economic profitability to gardeners. The entrepreneurial gardens in their study help alleviate poverty for participants. Low income households cited participation in a community garden as a way to have access to food (Armstrong 2000).

Michelle Corrigan (2011) studied community gardens in Baltimore, Maryland in the context of food security. One of her study participants improves his food security because he can share produce with his large family. Many gardeners at one particular garden have experienced increased food security via gardening. The garden is situated in a low income area and the median income for the area around the community garden was below the national mean. Community gardening in Baltimore has therefore alleviated some food insecurity issues for those who participate in the gardening process. While

there are many benefits to community gardening, there are also some challenges associated with them.

Common Problems Faced by Community Gardens

Understanding the challenges associated with community gardens provides organizations the opportunity to be more successful in future garden establishment and development (Corrigan 2011). In this section I cover a few common community gardening challenges reported within the present body of scholarly literature. Previous researchers found that generally, in order for community gardens to be successful, they must have strong bureaucratic support, access to space, available money and resources, steady participation amongst gardeners, and a strong and willing leader to organize (Schmelzkopf 1995; Armstrong 2000; Kurtz 2001; Schmelzkopf 2002; Saldivar-Tanaka and Krasny 2004; Drake and Lawson 2015). While challenges to gardening are naturally tied to site-specific characteristics, the primary themes of community garden troubles include: sustained interest and participation by gardeners, access to necessary materials, garden funding and support, garden design and access, and secured land tenure.

It is easy for a new gardener to begin a plot with vigor and excitement without fully realizing the true extent of work involved in the gardening process that takes place through all seasons. Community gardens are based on volunteerism, so they are only successful when the volunteer members remain active and present (Denver Urban Gardens 2012).

Drake and Lawson (2015) surveyed community gardeners across North America and asked gardeners to discuss issues they had with forming and maintaining their

community gardens. In their study, gardeners cited declining volunteerism and participation as the number one problem they encountered in community gardening – which supports previous findings by Milburn and Vail (2010). However, lack of gardening interest is more often associated with smaller garden organizations than larger ones due to a combination of garden politics, disagreements, and poor leadership (Drake and Lawson 2015).

A second feature of successful community gardens is access to appropriate and necessary materials, including uncontaminated soil and water. Urban soils may contain toxins or heavy metals that threaten the health of plants (Pickett et al. 2001). For that reason, it is often necessary to bring in outside soil and compost in order to successfully grow uncontaminated produce (Emerson n.d.). Access to water is also vital for a community garden to survive. In Drake and Lawson's study, surveyed community gardeners said their top challenge in gardening is getting water to their garden site (Drake and Lawson 2015).

Gardening materials are of little use if a garden organization lacks funding. Money allows for both the preparation of a garden location, as well as the provision of garden facilities, like plant boxes or a tool shed. Unfortunately, garden costs can be fairly steep. For example, DUG estimates that the average cost to build a community garden in Denver is $20,000 – which may be much more than a neighborhood can donate (Denver Urban Gardens 2010). For this reason, support from outside organizations and institutions is often necessary for garden survival. A staggering 1 percent of garden organizations in the U.S. do not partner with outside organizations (Drake and Lawson 2015). Supporting

organizations may be nongovernmental organizations, churches, nonprofits, schools, or local governments. Even if a partnership is obtained, the relationship between the garden and partnering organization is not always healthy (Milburn and Vail 2010). Often, the services are first offered free of charge. However, after a period of time, the outside organizations may begin requesting payments with the threat of service termination (Saldivar-Tanaka and Krasny 2004).

Even if a garden has support and funding, the design, placement, and accessibility of the garden can ensure its success, or doom it to failure. Community gardens that are centrally located within neighborhoods encounter greater success (Denver Urban Gardens 2010). A central location makes it easier for members to access their garden from their home. According to Emerson, "a garden located within walking distance of its gardeners will receive more activity" (Emerson n.d., 12). Successful gardens are easy to access by walking.

Perhaps the most pervasive barrier to community garden success is that of the right to open space. The city and city planners decide who has a right to what areas within a city. In places with healthy community gardening organizations, local government supports community gardens by providing them open space within the city, providing leases for land parcels, or willfully dedicating certain areas to urban gardening (Hess and Winner 2007; Drake and Lawson 2014). As noted by Denver Urban Gardens (2012), "[w]hen community gardens are pitted against other important land uses, such as an affordable housing project, a health clinic, or a soccer field, they often do not fare

well" (23). A lack of support in a community can easily kill a community garden organization.

Community Food Security

Defining food security is a difficult task. Food security can describe whether a country, state, community, household, or individual has enough access to food in order to meet the assigned dietary requirements (whether they eat as many calories as they burn). However, food security generally represents a community-based framework that is focused on the prevention of hunger through the availability of accessible and affordable food (Gottlieb and Fisher 1996).

Food accessibility takes into account how far one must travel to get food, how safe the environment is for accessing food, and whether it is possible to get to food using different modes of transportation. In general, services, goods, or gardens that are closer to gardeners' homes and are better connected via infrastructure, influence mode of travel (Saelens, Sallis, and Frank 2003).

One indicator of accessibility is walkability. Walkability – how friendly an area is for walking – takes into account three primary principles: physical access, place, and proximity (Larvey and Hill 2014). The term "physical access" encompasses the physical inhibitors and assistors like sidewalks, hills, fences, etc. Features like sidewalk presence, sidewalk width, lighting, or safety, influence the way that individuals perceive and interact with the built environment (Larvey and Hill 2014). Place, the second principle, takes into account the services and locations that can be accessed by walking. Finally, proximity is the distance that must be traveled to reach a desired destination. If someone

can reach their destination, then they have access. However, if the destination is ten miles away, it is unlikely that walking would be the chosen mode of transportation and the individual would only be able to have access if he/she had a vehicle or public transit options (Larvey and Hill 2014).

Walking to access food in within food deserts is difficult. There are various definitions of a food desert. Hendrickson, Smith and Eikenberry (2006) define food deserts as "urban areas with 10 or fewer stores and no stores with more than 20 employees" (372). Contrarily, Cummins and Macintyre (2002) define them as "poor urban areas, where residents cannot buy affordable, healthy food" (436) – a definition which takes into account food affordability in a particular area. The definition used by Lang and Rayner (2002) is even simpler: an area that lacks food stores. Finally, the USDA's definition that they use in their Food Access Atlas qualifies food deserts as "area[s] in the United States with limited access to affordable and nutritious food, particularly such an area composed of predominantly lower income neighborhoods and communities" (USDA 2009, 1). A community that qualifies as a food desert by the USDA's standards is low income (although not necessarily in poverty) and has little access to food. Communities in food deserts may either have very little access to food, or are only serviced by fast food chains or convenience stores that have a limited quantity of food products (Raja, Ma, and Yadav 2008). Destinations within a food desert are more likely to be inaccessible than food destinations that are not. As such, an analysis of access to food and income of families in the form of identifying and mapping food deserts, reveals where communities struggle most with food and food security.

Accurately measuring food security is difficult. Households with limited financial resources are more likely to struggle with food insecurity than households that are more affluent, but using income or poverty to assess security is an inaccurate way to assess food security. For example, many households that are not in poverty are still food insecure (Rose 1999). Measures of poverty do not incorporate access to food or the price of food. Even the USDA relies on self-reported data in their food security survey assessment.

Because measuring food security is difficult, rather than create policies that allow for alternative agricultural economies, policymakers tend to put more effort into programs that alleviate hunger including charities and volunteerism (Allen 1999). Such policies and actions often do not improve food security, because people must be able to obtain enough nutrition from their diet without the assistance of non-emergency sources in order to be truly food secure (Meenar and Hoover 2012).

Contrary to their originally-intended purpose, hunger relief efforts like food banks tend to serve chronic cases of hunger rather than providing short-term help to individuals and families. People who use food pantries generally have trouble feeding their family and lack enough resources to consistently have access to food (Daponte et al. 1998; Nord et al. 2009). Food pantries are adequate anti-hunger strategies, but may not help increase food security for those who use them.

Anti-hunger movements and community food security (CFS) movements differ in both theory and methodology (Table 2.1). Anti-hunger movements seek to immediately address hunger, using whatever appropriate and available means are necessary. Those

who participate in CFS movements take a longer-term approach, address underlying economic, social, and environmental determinates to hunger, and develop comprehensive strategies to involve the broader community in effective programs and policies that are location-specific (Winne, Joseph, and Fisher 1997).

Table 2.1: Comparison of various aspects of both anti-hunger concepts and community food security concepts. Adopted from Winne, Joseph, and Fisher (1997).

	Anti-Hunger	**Community Food Security**
Model	Treatment, Social Welfare	Prevention, Community Development
Unit of Analysis	Individual/Household	Community
Time Frame	Short Term	Long Term
Goals	Reduce societal costs, Individual Health, Social Equity,	Build Community Resources "Healthy Cities," Individual Empowerment
Conduit System	Emergency Food, Federal Food Programs	Marketplace, Self-Production, Local/Regional Food
Actors	USDA, HHS, Social Services Agencies, Charitable Institutions	Community Organizations, Multi-Sector Partnerships
Agriculture Relationship	Commodities	Support Local Agriculture
Policy	Sustain Food Resources	Community Planning

Communities are beginning to recognize the danger of relying on anti-hunger programs that receive federal assistance because the programs lack predictable funding, and in no way address food accessibility (Bellows and Hamm 2002). As a result, food security activists promote greater self-reliance and have begun to rethink food production and consumption patterns. CFS strategists tend to lean more towards "autonomous" food

security that would phase out emergency hunger response mechanisms (Bellows and Hamm 2002).

CFS approaches are necessary for cities and nations to adequately address an inherent right to food. As agriculture industrialized, the distance between producers and consumers widened – and thus access to local food decreased (Allen 1999). In food deserts where (most often low income) populations have reduced fresh food options, community gardening is a viable option as a CFS approach because CFS prioritizes "the needs of low income people" (Allen 1999, 117). McCullum et al. (2004) discussed evidence-based strategies for communities to utilize to reduce food insecurity. Within their research they cite community gardens as catalysts for institutionalized policy changes that adequately address CFS.

Gaps & Limitations in the Current Literature

Although community gardens have existed in the United States for over a century, geographers, sociologists, and biologists have historically neglected them in terms of research and study (Teig et al. 2009; Draper and Freedman 2010; Matteson and Langellotto 2010; Beilin and Hunter 2011; Reeves et al. 2014). The base of scientific evidence for community gardens is limited because it was not until the past few years that scientists thought to connect community gardens to urban ecosystems and to city landscapes (Beilin and Hunter 2011). Corrigan (2011) analyzed prior research on community gardens in published journals between 1985 and 2011 and found a lack of studies that directly relate community gardening to individual and community food

security. Such a topic is vital to future research as the U.S. attempts to increase food security and reduce hunger.

Specifically in Denver, previous researchers investigated social relationships, collective efficacy, and health in relation to the act of community gardening (Teig et al. 2009; Comstock et al. 2010; Hale et al. 2011; and Litt et al. 2011). My research differentiates itself by maintaining a focus on food security. While there were similar studies in Philadelphia (Meenar and Hoover 2012), Saskatchewan (Hansen 2008), and Cleveland (Grewal and Grewal 2011), to the best of my knowledge, there has not been a systematic study of food security and accessibility in the context of community gardens in Denver. Additionally, I am currently unaware of any study in Denver which compares the demographic and economic profile of gardeners in Denver to the demographic profiles of residents in neighborhoods surrounding community gardens.

CHAPTER THREE: DATA, METHODS & ANALYSES

Through the use of mixed methods and spatial analyses, I provide information regarding the alleviation of food insecurity through community gardening to better address the issue of hunger in an urban environment. This chapter includes information on the location where my study took place, the type of data collected through my methods, and sampling strategy to recruit study participants. I then detail information about my two data collection methods: survey questionnaire, and semi-structured interviews. Following, I present the methods of analyses I utilized to draw conclusions from the data I collected. I conclude with the spatial analysis methods.

Study Area

My study site is Denver, Colorado, the capital of Colorado. Denver is a rapidly growing city. The U.S. Census Bureau estimated that the population of Denver grew by approximately 50,000 new people within only three years (U.S. Census Bureau 2013). As of 2013, Denver's population was 649,495 (U.S. Census Bureau 2013). The population of Denver is majority white, and the median household income (based on aggregated estimates between 2009 and 2013) is $50,313 (U.S. Census Bureau 2013) (Table 3.1).

Table 3.1: Demographic composition of the City and County of Denver in 2010 (U.S. Census Bureau 2015).

Race/Ethnicity	Percent of Denver Population
White	52.2
Hispanic or Latino[4]	31.8
Black or African American	10.2
Asian	3.4
American Indian and Alaska Native	1.4
Native Hawaiian/Other Pacific Islander	0.1

Although Denver is predominantly white, it is a re-emerging destination for foreign-born populations, and therefore has a growing number of immigrants and, to a lesser extent, refugees (Singer 2004). As of 2014, the Denver Office of Community Support reported that almost 100,000 individuals live in Denver who were born outside of the U.S. (Denver Office of Community Support 2014). Foreign-born populations arrive from a variety of places, but the largest group comes from Mexico, while increasingly more individuals are arriving from Eastern Asia (Figure 3.1).

[4] I follow the Office of Management and Budget's definition of "Hispanic or Latino" which is used by the U.S. Census Bureau, and is as follows: "'Hispanic or Latino' refers to a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race" (Humes, Jones, and Ramirez, 2).

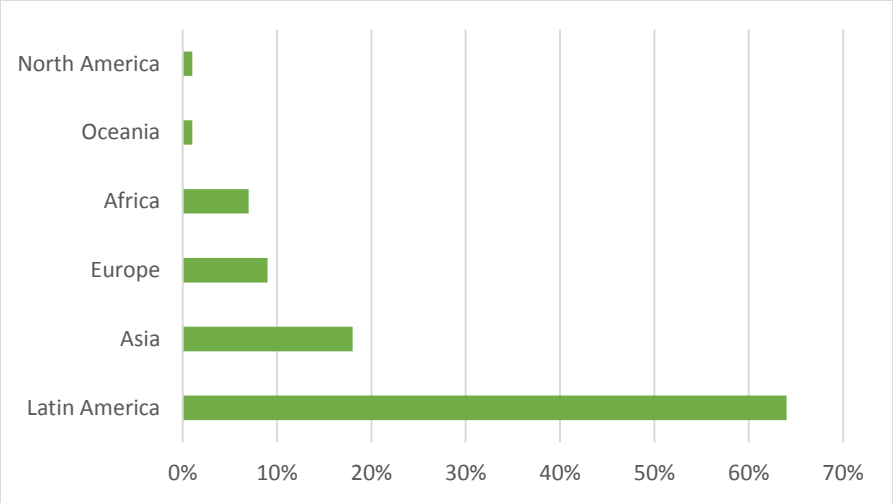

Figure 3.1: The percent of Denver's foreign-born populations by area of origin. Data from U.S. Census Bureau American Community Survey.

Refugees and immigrants are the two broad categories of foreign-born individuals. Non-refugee immigrants "are individuals who were not born in the U.S. and come to reside permanently or temporarily and who do not arrive via the refugee process" (Denver Office of Community Support 2014, 6). A refugee "is a person who has left their country of origin and is unable or unwilling to return" due to fear of persecution for race, religion, social group, or any other reason (Denver Office of Community Support 2014, 7). As of 2013, almost 2200 refugees resettled throughout the state of Colorado; the majority were placed in the Denver-metro area (Colorado Office of Economic Security 2012). Figure 3.2 shows the primary areas of origin for refugees who, as of 2012, had been resettled throughout Colorado.

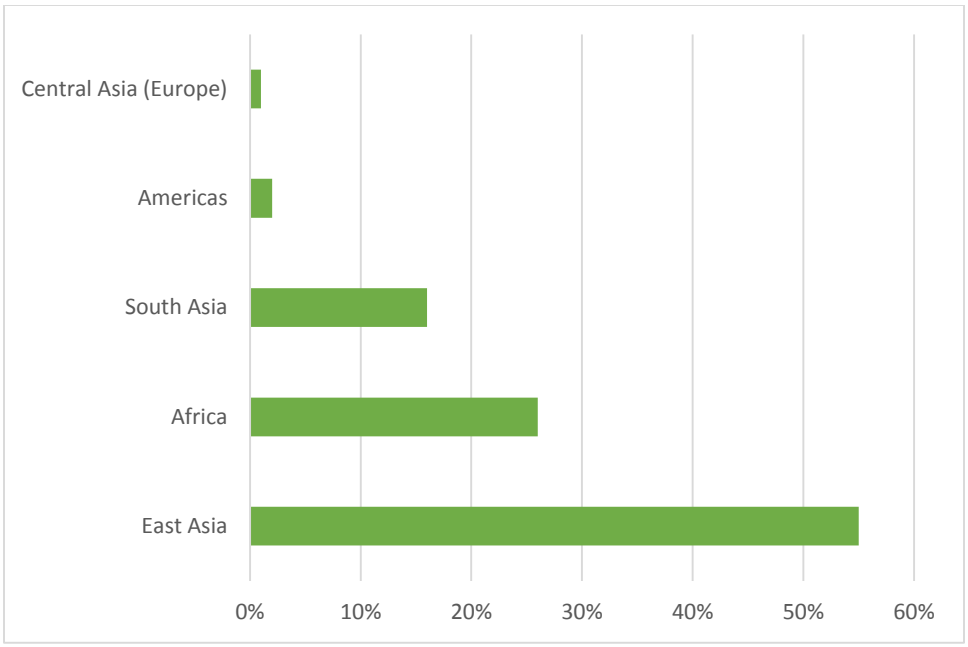

Figure 3.2: The percent of resettled refugees throughout the state of Colorado based on their primary areas of origin. Based upon data from 2012 (Colorado Office of Economic Security 2012).

There are populations in Denver that struggle with hunger. Estimates from the American Community Survey from the U.S. Census indicate that between 2009 and 2013 19 percent of Denver citizens were living in poverty (U.S. Census Bureau 2015). Individuals who struggle to achieve an adequate income often struggle to provide fresh and affordable food to themselves and their families and are food insecure (Coleman-Jensen, Gregory, and Rabbitt 2015).

Some Denver residents are food insecure because they live within a food desert. Based on the USDA's definition of a food desert[5], there are areas of Denver that are classified as a desert (USDA 2015) (Figure 3.3). Thirteen of the gardens who had members participate in my study (either as a survey respondent or an interviewee) are in,

[5] Discussed in Chapter Two.

or within a quarter mile, of food deserts in Denver. Figure 3.3 shows the location of USDA-defined food deserts in Denver, the location of community gardens in Denver, and the location of Denver in respect to the state of Colorado. Community gardens have the potential to assist populations in food deserts to increase their access to fresh and nutritious foods (Wang, Qiu, and Swallow 2014).

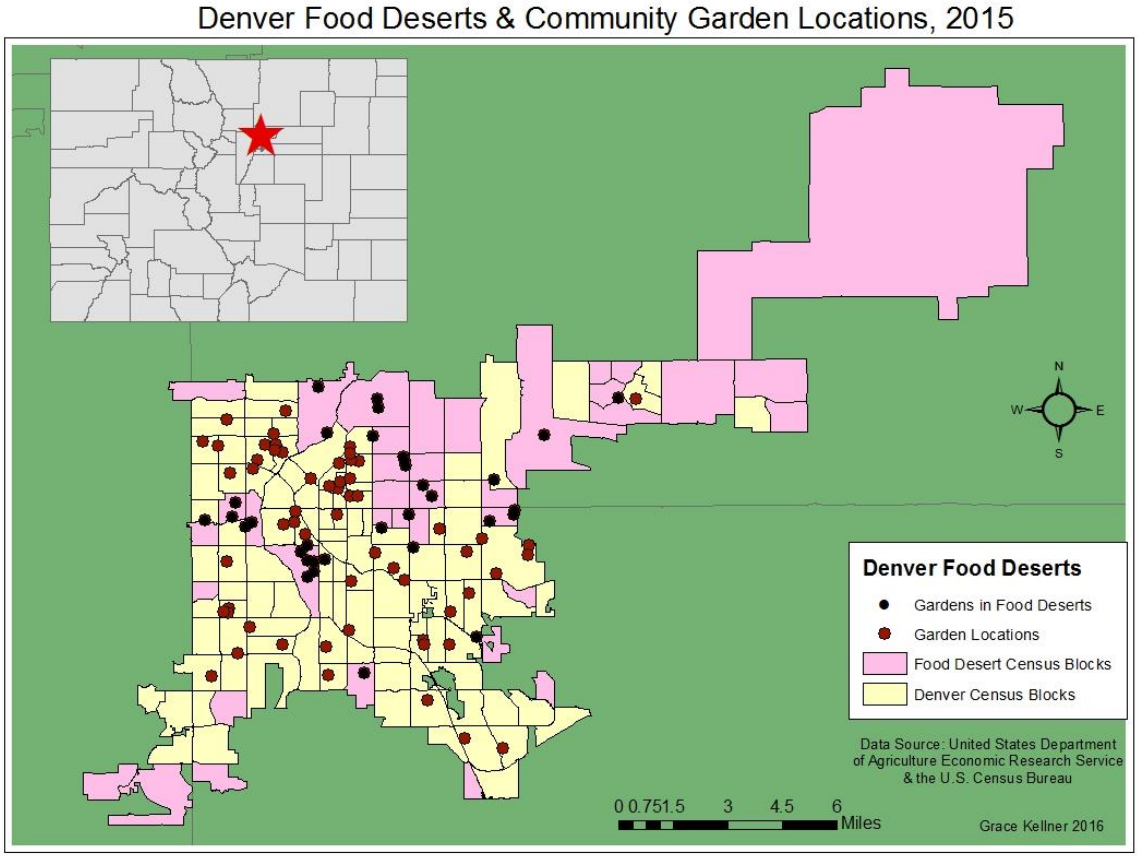

Figure 3.3: Location and distribution of community gardens in Denver that are in food desert Census blocks, as classified by the USDA.

Denver is a suitable location for a study of the role of community gardens on food security for several reasons. First, Denver has over ninety community gardens throughout the city, and there are already studies on the social and health benefits of gardens in Denver that provide contextual information for this study (Appendix A).

Second, there is currently a healthy, working relationship between the City of Denver, DUG, and the Denver Sustainable Food Policy Council. The city supports community gardens through its adoption of "urban gardens" as a permitted land use within various zoning districts as part of the city's zoning code (City and County of Denver 2014). Additionally, Denver city officials have previously helped relocate and replace community gardens that were lost to urban development (Hess and Winner 2005). Finally, in order to adequately address issues of land tenure in a city with increasingly profitable land values, DUG receives minimum ten-year leases from the land owner of sites where gardens are located. DUG also intentionally place new gardens on "institutionalized properties" to increase garden permanence (Hess and Winner 2005, 17).

Data Collected

I utilized two methods of data collection in my study: a survey questionnaire and semi-structured interviews. To answer each research question, I used a mixed-methods approach that incorporated quantitative and qualitative information from the survey answers, semi-structured interviews, and spatial analyses. As defined by Cope and Elwood (2009), mixed methods projects "weave together diverse research techniques to fill gaps, add context, envision multiple truths, play different sources of data off each other, and provide a sense of both the general and the particular" (5). Interviews allow for a greater range of perspectives, thoughts, opinions, and more detailed information than a survey can provide – thus filling gaps that could not be addressed through the use of a survey alone (Bosco and Herman 2010). A semi-structured interview process also permits interviewees to take the conversation on tangents related to interview material.

I obtained data from various sources. I received community garden-level data from DUG, Denver-specific road network data from the Denver Regional Council of Governments, block-group level demographic data from the U.S. Census Bureau, and Census tract-level data on food deserts from the USDA (Table 3.2). From the survey I collected attitudinal, behavioral, perceptional, and demographic data. I obtained attitudinal data to analyze why gardeners participate in community gardens, how they most benefit from their participation, what they like least about their garden, and how accessible they perceive their garden to be. I collected behavioral data to address garden accessibility, and gardener food security. I gathered data on gardeners' opinions as to whether they believed the majority of fellow members at their garden live in the neighborhood that surrounds the garden. The final questions of the survey collected demographic data (Appendix B, Questions 22-28).

Table 3.2: Data sources used in this study and the information obtained from each particular data source.

Data Source	Information Obtained
Denver Urban Gardens	Garden locations with attribute information about year established, whether it is a school or community garden, and whether the garden is full for the season. Garden Attribute Information included street address, Denver neighborhood, landowner, year established, number of plots (according to site plans), total square feet, percent low to moderate income, whether the garden serves refugee/immigrant communities, serves youth, serves seniors, serves homeless, serves physically/developmentally disabled, whether the garden is open to public, and if the garden is full for the season.
U.S. Census Bureau	2007-2011 American Community Survey block group information for Denver
Denver Regional Council of Governments	Street centerlines and information about Denver road networks.
Gardener surveys	Reasons for participation, contribution of participation to food security, accessibility of garden for individuals, demographic and economic profile of gardener.
Interviews with gardeners and garden leaders	General overview of the garden history, perceptions of garden leaders regarding garden contribution to food security, perceptions of leaders regarding why gardeners garden, perception of leaders on the accessibility of garden, inclusions and exclusions of certain people, goal of the garden
USDA Economic Research Service	Food desert locations within Denver based on access to available resources within one mile.
Survey	Attitudes, perceptions, behaviors, demographics
Interview	Attitudes, perceptions, behaviors, demographics

Sampling Strategy

To recruit survey participants, I contacted staff members at DUG and requested email addresses for all garden leaders within the City of Denver. I then sent emails to all garden leaders for whom I had contact information (n=89) detailing my research and requesting their help in soliciting study participants (Appendix C). I sent follow-up emails to garden leaders who did not initially respond to increase participation. Each email contained a link to the online survey and a printable version of the survey. The survey link was active between August 17, 2015 and October 31, 2015.

I used a variety of means to recruit interviewees. Of the fourteen individuals I interviewed, I requested interviews with six of them. I made this request via email after learning of particular community garden characteristics (i.e., serves low income, minorities, elderly, immigrants, refugees). Roland helped set up interviews with two other gardeners after speaking with me. Finally, four interviewees requested to speak to me, and we set up meeting times and locations following their request. Prior to each interview, I informed the interviewees about confidentiality, requested to audio record the interviews, and sent a digital form of my informed consent form that I then brought to the interview for the participant to sign (Appendix D).

I met interviewees in convenient public locations, such as coffee shops, or at the community garden with which the interviewee was associated. Each interview lasted between twenty and eighty minutes. I audio-recorded eleven interviews with interviewee consent, and took notes using a laptop during one interview.

Two interviewees were associated with a garden that is situated in a gang area of Denver (Table 3.3). I conducted two interviews with garden leaders associated with gardens that service immigrant and refugee populations (primarily from Asia and Africa), who were unable to take the survey due to language barriers. I additionally interviewed a garden leader (June[6]) of a garden which serves low income retirees. Another interview was with a garden leader (Nathaniel) of a garden that is associated with a church in Denver. Finally, I interviewed an employee (Carol) of a food pantry that receives over one ton of food from one community garden. In general, I attempted to gather the perspectives of individuals with a variety of experiences from gardens that serve different populations in Denver. Although I interviewed fourteen people, one interviewee chose not to have their information used in this study, and instead provided contextual information about food insecurity in Denver.

Table 3.3: Breakdown of twelve interviews with unique characteristics of the garden, associated with each interviewee, and information about the income level in the neighborhood around the garden and whether the garden is located in a food desert, as classified by the USDA.

Interviewee	**Unique Garden Characteristics**	**Income Level Around Garden**	**In a Food Desert?**
Nathaniel	Associated with a church	Low	Yes
Ben	In a gentrifying area with race-relation struggles	Low	No

[6] All names are pseudonyms to protect the anonymity of the participants.

June	Serves low income, fixed-income, retirees, part of a housing complex	High	No
Kathy	In a gentrifying area with race-relation struggles	Low	No
Ciana	Serves immigrants and refugees, part of a housing complex	Low	Yes
Susan	Serves immigrants and refugees, part of a housing complex	Low	Yes
Roland	Associated with a food pantry	Low	No
Jenny and Meredith	On a college campus	Low	Yes
Iliana	Serves primarily non-whites	Low	Yes
Sarah	Serves primarily moderate to high income, white females	High	No
Jeff	Massive donation program in the garden	Mix of Low/Medium/High	No
Carol	Food pantry that receives donations from a community garden.	NA	Yes

Survey Questionnaire

I implemented and distributed the survey questionnaire online through Qualtrics, a survey software company that collects survey data (Qualtrics LLC 2016). Implementing

the survey online allowed me to use survey logic for certain questions. For example, the software would only present a follow-up question pending a particular response by the participant for certain questions. An online survey allowed me quick and convenient access to data and seamless conversion of the responses from the website to a spreadsheet.

Not every garden leader utilized the online survey link. June responded to my initial recruitment email and said her gardeners were primarily elderly individuals who have limited internet access and/or knowledge. She implemented the paper version of the survey and sent the results to me through the mail. Three other garden leaders indicated a paper survey would be more appropriate for their garden population. In these cases, I attended garden meetings or gatherings to hand out paper versions of the survey. After receiving the completed paper versions, I input the answers into a spreadsheet that I could upload so that the paper responses were merged with the online survey responses for easy analysis.

Semi-Structured Interviews

I supplemented survey data with in-depth interview data. The interviews followed a semi-structured order where I followed a list of prepared questions in order to guide discussion, while also allowing for a conversational style of interviewing (Appendix E). The sampling unit for interview data was community gardens because many interview questions pertained to the garden as a whole, rather than to an individual gardener. Appendix E outlines the interview questions I asked, and the research question with which each interview question was associated. Not every question was associated with a

research question. I used some questions as a way to establish contextual understanding of the garden to allow me to ask more pointed questions. For example, I asked participants questions about the history of their community garden to get information upon which to help analyze interview responses. As I encountered interviewee responses that illustrated the benefits a gardener receives from gardening, I followed-up with the interviewee about their perceptions of the greatest benefit their gardeners receive.

I asked interviewees to discuss the demographics of community gardeners that participate at their garden. Their answers were based on their experiences and perceptions of gardeners who frequent their garden. During each interview, I asked gardeners about how Denver's summer 2015 weather affected their community gardens, if at all, because Denver experienced several instances of flooding and hail that caused extensive vegetation damage in certain areas of the city.

Survey and Interview Analyses

I transcribed the audio recordings of each interview following their completion so I could more easily analyze the content of each interview. During the process of transcription, initial codes and themes began to emerge and I recorded them while transcribing. It was easy to gain familiarity with the interview content, more accurately transcribe the content, and start to mentally prepare codes for interview analysis by transcribing the interviews myself. I initially recorded codes by hand on paper copies of each interview. The process of coding was inevitably iterative in that as I conducted more interviews and gathered more information, I revisited previous interviews for additional

thematic content (Berkowitz 1997). During interviews, most interviewees said there are multiple benefits that gardeners receive from gardening. In these cases, I double-coded quotes to fit into multiple categories of benefits and motivations for community gardening.

Coding is a qualitative method whereby the researcher finds and counts themes that appear across interviews by categorizing the meaning from a large interview into one or more categories (Kvale 2007). I used codes to draw connections between and across themes that arose from the interviews and open response portions of the survey. After coding by hand I coded material in NVivo, a qualitative data analysis software package. After coding, I viewed code counts across each node and began to explore connections and patterns in order to weave the personal reflections of interviewees into a broader, and more encompassing story of community gardens in Denver.

I used codes and coded content for a variety of analyses. For one, I coded survey answers to food security questions and picked out the survey respondents who I deemed "food insecure" based on their responses. Additionally, I used respondents' answers to the benefits they receive from gardening about saving money to infer a financial impact from gardening. A positive financial impact would indicate a potential for community gardening to impact gardeners' food security. I used attitudinal data to analyze why gardeners participate in community gardens, how they most benefit from their participation, what they like least about their garden, and how accessible they perceive their garden to be. I used behavioral data to address garden accessibility, and gardener food security. One Likert-scale question about demographic representativeness of

gardeners indirectly assesses the degree to which gardeners are representative of the area in which the garden is located, or if the garden is comprised of gardeners who travel from outside the neighborhood to access the garden. I use demographic data collected in the survey to compare the gardener demographics to the demographics of residents surrounding the garden in order to see whether the gardens serve a particular populations.

Analyses of Third Party Spatial Data

I used a variety of spatial analyses in my study. First, in order to analyze the accessibility of community gardens in Denver, I created pedestrian catchments. Second, to demographically compare survey respondents to the population that theoretically lives in areas around the garden, I created a model to spatially weight demographic values within the walksheds. Finally, In order to address garden accessibility throughout Denver, I used two methods of point pattern analysis: variance-to-mean ratio, and kernel density estimation analysis. Both variance-to-mean ratios and kernel density estimation analyses address the dispersion of community gardens across Denver.

One method of spatial analysis involved the creation of a pedestrian catchment/service area (walkshed) of every garden based on a half-mile of modeled walkable area around the garden. Schlossberg and Brown (2004) suggest that pedestrian catchment areas extend no further than a half-mile, and walkable areas are heavily influenced by underlying street networks. I mapped the walksheds to visibly gauge walkability, and thus accessibility – an important aspect of food security – of each community garden. If the street network around a garden was limited, I classified that

garden as having low accessibility. I classified gardens with complete street networks surrounding all sides of the garden that extend a full half-mile as being highly accessible.

Along with creating walksheds, I quantitatively compared demographic survey responses to spatially-weighted demographics of Denver inhabitants within walksheds. Most garden walksheds intersect multiple block groups. Therefore, to best estimate the true population characteristics of the area around the garden, I calculated the percent of area that each block group comprises within the walkshed. I used weighted values to extract demographic data (gender, race, ethnicity, income) proportional to the area that the block group comprises of the walkable area (Figure 3.4). After receiving weighted demographic data from walksheds, I compared the gender, income, race, and ethnicity of gardeners to the modeled demographic data in order to analyze whether gardeners are representative of the residents who live around community gardens.

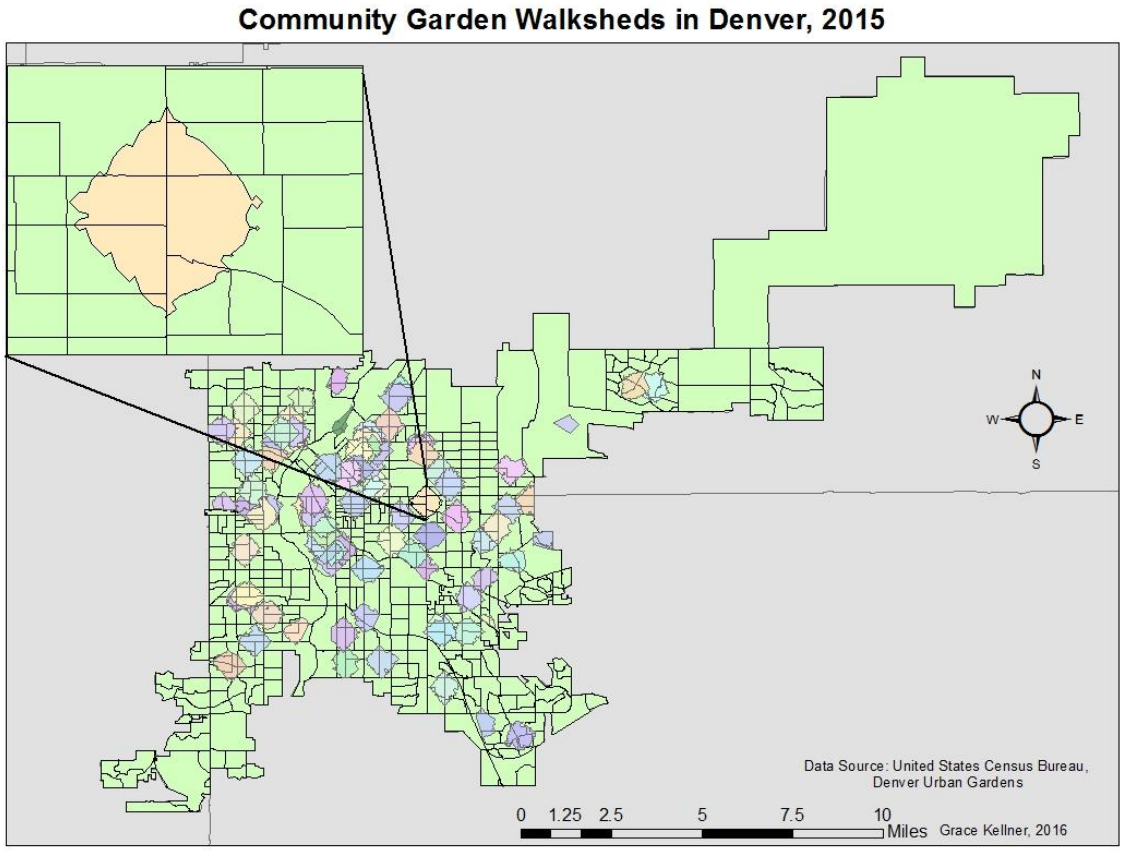

Figure 3.4: Modeled walkable areas (i.e., peach area of inset) around a community garden and the underlying block groups (green polygon) from which I proportionally extracted demographic data.

I also created maps to analyze population density, garden distribution, and the distribution of different populations in Denver by block group. To analyze the distribution of community garden locations, I utilized a quadrat analysis and then calculated the variance-to-mean ratio (VMR) of garden point locations within quadrats. When I calculated VMR, I used 3700 feet by 3700 feet squares, and I specified the extent of the area used in the calculation to be a little larger than the spatial extent of community gardens. I used 3700^2 foot squares because that resulted in squares of a medium size in comparison to the extent of the grid as a whole. Grids that are too large or too large can

incorrectly display patterns of clustering or dispersion. Using the grid, I calculated the standard deviation and mean of the counts of gardens within the squares. I then calculated variance using the standard deviation. A ratio of the variance to the mean of counts within the quadrats gives an indicator of the clustered or dispersed nature of community gardens (Krebs 2013).

A VMR of around 1.0 indicates a random dispersion patter of points, where there is no statistical clustering or dispersion happening. A VMR that is greater than 1.0 indicates a clustering pattern (Krebs 2013). The larger the VMR, the greater the degree of clustering (Greig-Smith 1952). If the VMR is only slightly larger than 1.0, there is some clustering of community gardens, but there is also a degree of randomness to their locations.

VMR results can vary greatly based on user input such as the spatial extent of the grid, and the size of the squares within the grid. If the grid squares are too small, then the VMR will indicate a dispersed pattern, while if the squares are too large, a VMR calculation will show a clustered pattern because many points would end up within one square (Krebs 2013).

I also used a kernel density estimation (KDE) analysis with a search radius of 10,000 feet to display clustering. A radius of 10,000 feet effectively displays garden clustering at a scale that allows gardens that might not be adjacent to one another to show one clustered pattern as opposed to many. KDE is a density-based point pattern analysis that transforms vector point data into a continuous surface. In a KDE, the raster cell values at the input points' locations are the greatest, and cell values decrease with

increasing distance away from input points. Cell values reach zero at the edge of the user-defined search radius (Thornton, Pearce, and Kavanagh 2011; Environmental Systems Research Institute, Inc. 2016). As a method of analyzing spatial dispersion, KDE is less subject to user input than VMR.

CHAPTER FOUR: RESULTS

Chapter four contains the results of data collected throughout my study. In total, I received 203 complete survey responses. Of the 203, twenty-two respondents from ten gardens completed the survey by hand, and the remaining 181 participants from forty gardens completed the survey online. I discarded approximately fifteen responses due to partial completion. Along with the survey, I conducted twelve interviews with fourteen people between August 2015 and January 2016.

I begin this chapter by presenting relevant results pertaining to the benefits that gardeners receive from community gardening. The next section contains results regarding community gardeners and their food security levels. In the third section, I outline the findings of community gardeners' socioeconomic characteristics. Finally, I detail the results on the accessibility of community gardens in Denver.

Community Gardening Benefits

This section contains five thematic results that pertain to survey respondents' and interviewees' self-reported benefits of community gardening. I begin with findings about what gardeners primarily indicated they receive from gardening, and then follow with benefits that non-representative populations like immigrants, refugees, and retirement home residents receive from gardening. Then, I present results about the emotional and

spiritual benefits. As I show in the final section, while community gardens have the term "community" in their name, a sense of community, or cohesiveness, amongst gardeners is not always felt, or even desired. Appendix G contains selected quotes from survey respondents that cumulatively illustrate the variety of benefits that gardeners receive from participating in community gardening.

Although most of Denver's immigrant population comes from Latin America, when I use the term "immigrant" I primarily refer to individuals from other areas of origin such as Africa or Eastern Asia. The immigrants my interviewees referred to were almost exclusively from non-Latin American areas, although the self-reported Hispanic or Latinos represented in my survey could be immigrants.

Gardeners Enjoy Growing Their Own Food

Based on survey responses, enjoyment is what gardeners most often get out of gardening (*n*=199) (Appendix G, Table 1). The number one benefit respondents cited (*n*=181) was that gardening gets them outside, and for some respondents, they had no other major opportunity to get outside during the day. Others who have a garden where they work like getting outside during the day at work to escape their workplace office, and to take a mental break. Respondents (*n*=142) who like gardening because it gets them outside also said they enjoy the physical activity that is inherent in gardening.

When given the opportunity to discuss their most important benefit from gardening, a few respondents offered no reasoning. On the other hand, many respondents listed several benefits they believe are highly important. Some of the benefits they

illuminated include: accessing organic food and consuming the food they grow because it tastes better than grocery-store purchased food (Appendix C, Table 2). Interviewees also discussed how they enjoy getting to grow their own food, although few were able to pinpoint exactly *why* getting to grow their own food was so enjoyable.

Gardening Preserves Culture

Interviewees associated with immigrant/refugee populations or elderly populations discussed cultural preservation and community gardening. According to Ciana, in the case of immigrants and refugees, the importance of being able to grow native plants is enormous:

> "*the biggest benefit is they're getting fresh produce that they can actually eat and the second part is a continuity of home. Transferring that sense of home from where they came from to here, and then just the interaction among the group itself.*"

Based on my interviews with Ciana and Susan I found that gardening is therapeutic for many immigrants and refugees. Susan said that immigrants and refugees from countries like Somalia and Sudan had previously been living:

> "*in very agrarian ways, so being able to get outdoors and play in the garden and touch the earth and have their own land was really important to their ability to integrate and their self-esteem and sense of space*."

For the immigrant and refugee populations Ciana and Susan discussed, the preservation of culture expands past just cultivating food, and reaches into their spiritual, or religious life. For example, immigrants and refugees were growing a particular variety of chrysanthemum to be used in one of their religious ceremonies (Figure 4.1). The ability to grow flowers for a religious practice that is not common in the United States is another example of the transfer of the feeling of home across the world. Susan believes it is of great importance for her gardeners to have access to the chrysanthemums for celebration, so they plant many of them, and they would either have to purchase the flowers, or use substitutes if they lacked their garden space.

Figure 4.1: Garden plots filled with chrysanthemums that are used in religious ceremonies for immigrants and refugees in Denver. Grace Kellner, 2015.

Upon analyzing the types of crops grown by gardeners as indicated in the survey, I noticed some plants and foods native to Central and South America that are not necessarily mainstream plants in the U.S. (*albahacar, caña de azucar, epazote, pepino,* and *yerbabuena*). Several of these foods came from one respondent who self-identified as "Hispano." Two other survey respondents self-identifying as Mestizo and Latino in the demographic questions of the survey, also grow some of the above-listed plants. These individuals utilize their community garden to grow plants that are native to their cultural heritage.

Self-Empowerment through Community Gardens

Survey and interview responses indicated the personal empowerment, and often, subsequent pride that gardeners receive from community gardening is a benefit. Marginalized populations (immigrant, refugee, low income, non-white, elderly, etc.) especially benefit from empowerment through gardening. Ben most clearly illuminated this sentiment in his response to my question about what he believes the greatest benefit to community gardening is for his garden members:

> "*Frankly you could say materially the food it produces, of course, but I ultimately think the empowerment (the connection with the growth process in general) … that I feel and that I see other people feel is probably the most important part of the garden. The food to me is almost secondary to the empowerment and the spiritual nature of what it means to be involved, not only with the plants, but with other people in kind of a meaningful, almost entrepreneurial capacity in the sense that you are on this larger team changing the space on an annual basis, and on a longer decade or multi-decade timeline. So, I think it's a spiritual thing. I think it's an empowering thing. Food's important of course, but what* it *does for people on an individual basis is really the most important role*."

According to Susan, a benefit of gardening is pride, and through gardening, participants also provide themselves and their families with food. As such, gardening provides a sense of self-efficiency, which can be empowering.

Even in a garden that is not struggling with food security, the ability to donate excess produce to a greater cause is a source of pride for gardeners – as Jeff explained to me. There was a strong desire among many study participants to give back to the community, and to give back to those in need. When asked to provide me with any comments or thoughts at the conclusion of the survey, one survey respondent noted that she wanted an organized way to be able to share produce with those who are less fortunate. For the gardeners who donate through a formalized donation program, there is a sense of pride that comes with the ability to contribute to a greater cause, "*so those who don't have the time or resources to garden can enjoy fresh food*." Jeff says the ability to donate to a food pantry is good for gardeners because "*it's tangible and we can go and look at where people are coming to shop, and that's what makes it so real*."

Sharing or donating excess produce is also empowering for low income and food insecure families. Members of the community desire garden produce, so gardeners feel satisfied by being able to share their excess food with friends, family, or neighbors, or to give to others who are in need. June told me:

> "*[donating], again, so empowering. It's like something really precious to offer and for their families it's something they can give back to their families*."

Not only is it empowering, but many families end up benefitting from the food that gets produced by as few as one gardener, or one family. Ciana said:

"*one plot for one apartment is really feeding more like three or four apartments of people… somewhere around 150-200 people are eating out of the garden every season.*"

Donating excess produce is not a requirement for gardening, but it is often the case that a garden produces more than what one gardener or family can realistically handle in a growing season.

The Emotional & Spiritual Side to Gardening

Some of the emotional benefits of gardening that participants mentioned include a sense of peacefulness, stress relief, and fulfillment. Many interviewees said growing food makes them feel emotionally connected to what they grow, and some used a parent-child connection to explain their feelings about their garden. Survey respondents reported that gardening helps them to relieve stress more often than they reported abstract emotional connections to their gardens. Survey respondents mentioned "stress relief" as a benefit to gardening a total of eleven times.

For the older generations of gardeners, being able to care for something is significant. They are at a point in their life where their children (if they have any) live independently. Living in an apartment that does not allow pets (which is the case for at June's complex) also restricts their ability to care for another life. For them, participating in a garden fills an emotional void in their lives. Almost a quarter of all respondents age sixty or older discussed the emotional benefits of gardening in their open responses.

Gardening, or being in nature is a source of worship for some gardeners. Nathaniel best illuminated this sentiment:

> *"Sometimes I come out here in lieu of church. They'll be in there praising and worshiping and all that stuff. I believe that you can worship God anywhere – especially out here… [I]t's peaceful… you can even meditate*."

For him, worship is an essential aspect to life, and the garden provides a space to practice meditation and connect spiritually. Nathaniel was not the only interviewee to touch on the therapeutic side of gardening. Kathy believes the greatest benefit to community gardening is a spiritual connection and the sense of being part of a larger community. At least 75 percent of her gardeners tell her about the spiritual aspect they feel while gardening:

> "*and maybe not everyone would define it as spiritual, but I think that connection to nature is what most of them are seeking you know. Getting out there and just being able to have a relationship with nature*."

Being outside and in nature is emotionally fulfilling, and makes gardeners feel more connected with the earth.

Community – Not an Inherent Aspect of Community Gardening

Although community gardens contain the term "community," not all gardens intrinsically build community. In fact, according to my survey results, some gardeners do not wish to be part of the garden community. To reduce confusion about the definition of community, when I use it apart from "community garden" I mean it to be "a feeling of belonging, or fellowship with other individuals, as a result of common interactions, shared experiences, beliefs, or goals." Interviewees most often cited (*n*=22) community building, and the sense of belonging that comes out of the process of growing and maintaining a garden with fellow community members. Table two in Appendix G shows all coded benefits that interviewees mentioned.

For the gardens associated with interviewees, community is especially valued in the gardens that serve low income neighborhoods, older populations, or immigrant and refugees. According to June:

> "*the garden just brings the community together on so many different levels. People who don't speak the same language, people who are from different faiths. It's kind of that meeting point."*

Understandably, immigrants and refugees who now live in Denver may lack the social network and support they had in their native country, so community gardens can help to build a social network that they may have lacked before. According to Karen, the community aspect of community gardening might go hand in hand with a sense of pride in the garden:

"*I think it's very fulfilling when you're able to have a garden community work day that works well. Having a group of people come together to beautify a space or to accomplish something together - like together we planted the wildflowers in that plot and now people see them and it's beautiful. We did this together.*"

Survey respondents cited a lack of community, or a lack of community participation in the garden as a challenge they experience. Based on code counts from interviewees, the community aspect is the greatest challenge to community gardening (Appendix G, Table 2). Some survey respondents also felt that the community aspect is "forced" in the garden through mandatory work hours and communal work days. However, others said they were annoyed at the lack of enthusiasm for participating in the community of the garden by other gardeners not attending the work days. One survey respondents said her biggest challenge in community gardening is:

"*Lack of proactive engagement by most gardeners in maintaining, sustaining, and improving the whole community garden beyond their plot. They come in high on the idea of gardening and participating in the community, but then that enthusiasm inevitably wanes for far too many. The community is left to be cared for and managed by the very few usual suspects. Trying to get gardeners actively involved in the community garden and the responsibilities that come with that is the Holy Grail--and the bane—of most every community garden.*"

Forty-five percent of the gardeners I interviewed struggle with the aspect of community in their garden. Comparatively, only 12 percent of survey respondents mentioned the same struggle in their community garden.

Impact of Gardening on Food Security

In the following sub-sections, I present results related to the food security of gardeners. I begin by classifying survey respondents as food secure or food insecure, and follow with challenges that respondents said they experience while gardening that decrease their ability to increase their food security through gardening. I conclude with the results from my interview with Carol, who works with a food pantry that receives community garden donations.

Food Security amongst Gardeners

Most survey respondents can afford enough food, and the kinds of food they want to eat (Appendix B, question seventeen). Based upon their responses, I classified fourteen survey respondents as food insecure, and the remaining 189 as food secure. A small number of gardeners indirectly alluded to their individual, or household food insecurity. For example, three survey respondents preserve their summer produce by either canning, freezing, or drying it so that the financial benefits of a community garden can extend past the growing season. However, the majority of survey respondents are food secure, or their household is food secure. One survey respondent felt that in her garden:

"*All of our gardeners definitely have high food security. Seems more like a hobby to most than a source of food and nutrition*."

Almost 70 percent of respondents said they financially benefit from gardening. For example, part of the incentive for June's gardeners to garden is that gardening allows them to save money. Her gardeners also achieve access to affordable organic food that they would not be able to afford without a garden, and they greatly appreciate that they can consume organically. A final category of gardeners does not save money by participating in a community garden because they are beginner gardeners, or the weather for the summer of 2015 caused them to re-plant, costing them money, and reducing their production.

Food insecure gardeners may depend on their community garden for sustenance for part, or all of, the year. They may be low income, on food assistance, or live in a food desert. Kathy's garden consists of many:

"*salt to the earth people who this is not a hobby. This is their life. It's a garden that includes people in poverty and this is a part of the way they are actually feeding themselves. It's not just to make pesto. They're there to feed themselves*."

One gardener in Kathy's garden even had a sign that suggests that he/she depends on the garden for food, particularly in the winter season (Figure 4.2).

Figure 4.2: A sign in a community gardener's plot asking that outsiders stop stealing his/her produce. The sign reads "Please whoever it is that is picking from my garden plots 34-35 stop doing it. I live on a very limited income. Each month I'm depending on this garden for part of my winter food. As I had planned on either canning or freezing most of what I raise. You are picking so much I don't have enough to eat or can or freeze. So please stop! Thank you." Grace Kellner, 2015.

Nathaniel's garden has a policy of allowing anyone to take produce from the garden as long as they contribute in some way to that garden. According to him, many of the people who use the garden are low income, food insecure, or even homeless. There

are people that "*take backpacks full of stuff*…" In addition, several survey respondents believe that although it does not contribute to food security, gardening still increases the availability of fresh and healthy food for themselves and to others who would not otherwise be able to afford it. While the gardens might not be increasing food security, they serve a role in helping individuals in various financial capacities.

Respondents listed the plants they grow in their garden plot in question fourteen of the survey (Appendix H). Figure 4.3 shows the top ten plants and the number of survey respondents who grow each vegetable.

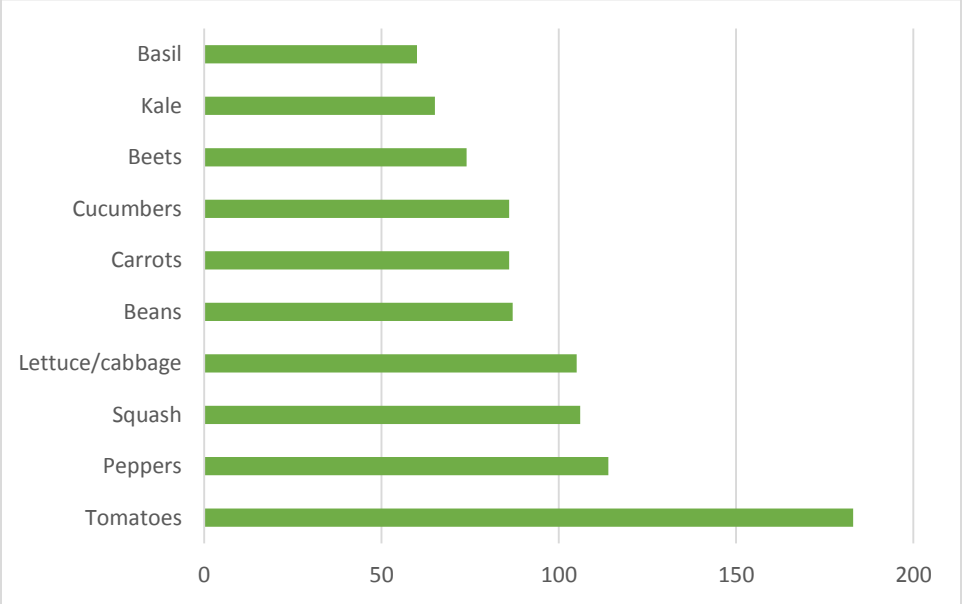

Figure 4.3: The top ten vegetables/herbs grown by community gardeners in Denver, as indicated by the number of survey responses.

Based on their responses, the predominant types of vegetables grown by community gardeners are what I classify as staple foods. In Figure 4.4 I split the plants grown into three groups: staple, boutique, and herbs. Staple foods include those that are

commonly used in meals such as tomatoes, squash, beans, peppers, lettuce, etc. Boutique plants are those that are less common, and less substantive. A final group of plants grown in community gardens that I classified based on survey responses consists of herbs. There were few gardeners, that only grew non-substantive crops (*n*=5). Two respondents did not report the plants they grow.

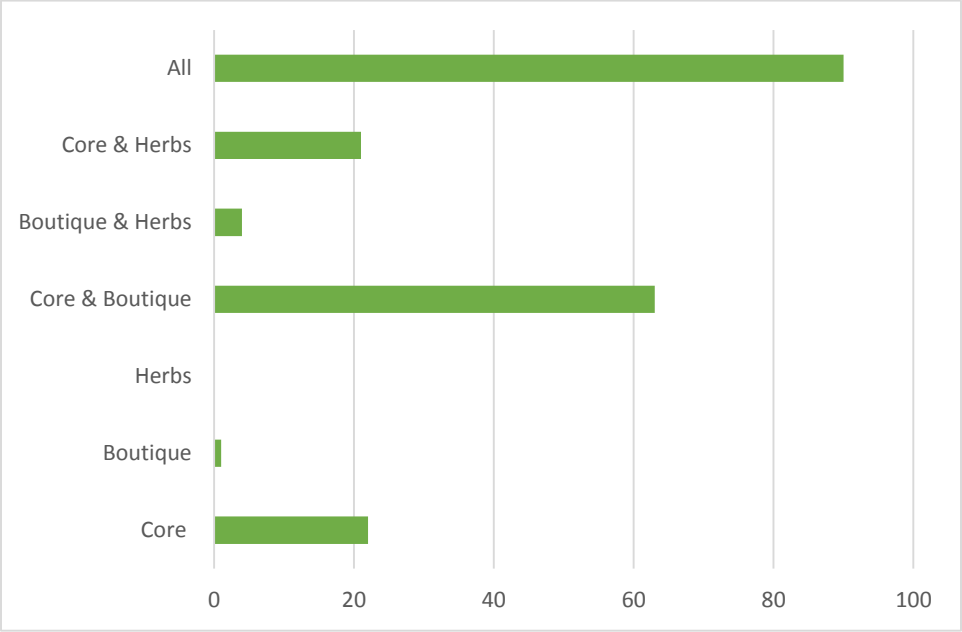

Figure 4.4: The percent of survey respondents who grow various combinations of plants in their gardens. Gardeners who grow all three categories (core products, boutique plants, and herbs) in their garden, are classified as "All."

Survey question fifteen asked gardeners to indicate the supermarkets or grocery stores they most often use to purchase their groceries (Appendix B). Most respondents shop at King Soopers, followed by Sprouts and Whole Foods (Figure 4.5). Of the thirty-nine respondents who said they shop at a different store than the ones I listed, twenty-

three of those shop at Natural Grocers. Eight other respondents said they shop at a local farmers market.

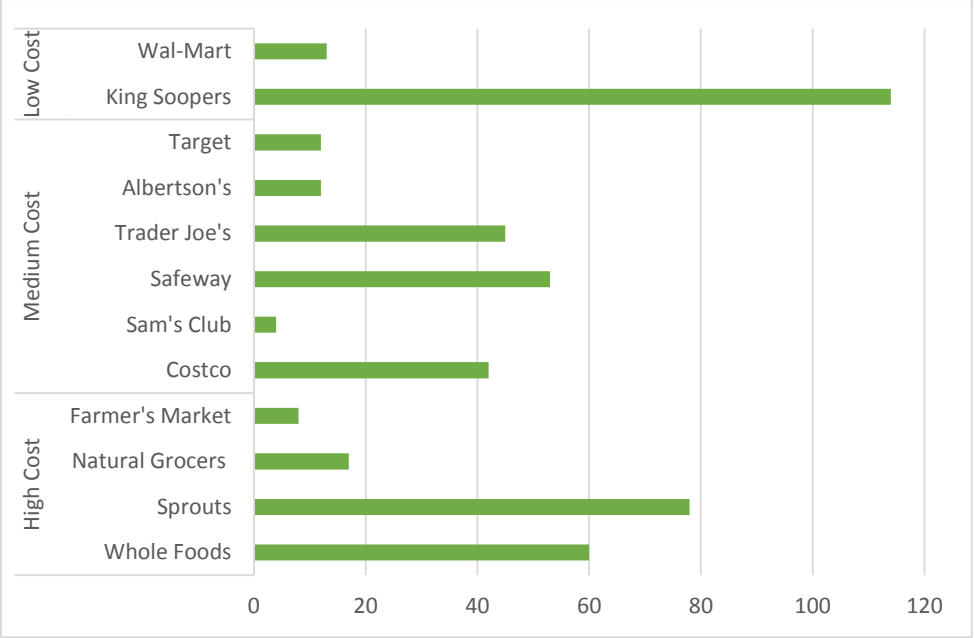

Figure 4.5: Number of survey respondents' who chose each answer option to survey question fifteen which asks them where they most often choose to purchase their food. Grocery stores are grouped by the relative cost of their products. Respondents could chose multiple answers, so the cumulative number of responses to this question exceeds the number of respondents (*n*=203).

Challenges to a Community Garden's Ability to Increase Food Security

Certain challenges to community gardening could threaten the role that community gardening serves in increasing food security to gardeners. Challenges such as bad weather, pests, and produce theft can reduce a gardeners' ability to garden for increased food security because the challenges negatively impacted produce yields.

Gardeners experience a variety of challenges in their experiences with community gardening (Appendix B, question twenty). Bad weather dominated respondents' answers

to this question. Over the summer of 2015 in Denver, there were multiple episodes of heavy rain, flooding, and hail. Interviewees said their gardeners were forced to replant their garden multiple times, and that many yields were depleted because of the rain and hail. One survey respondent said they did not save money from gardening from gardening in 2015 because of the reduced output. One garden leader documented the challenges with the weather, and shared photographs of garden plots after a summer storm with me (Figures 4.6 and 4.7).

Figure 4.6: Heavily damaged community garden plots after a hail storm in Denver during the summer of 2015. Reproduced with permission.

Figure 4.7: Recovered community garden plots after replanting following a hail storm in Denver during the summer of 2015. Reproduced with permission.

Garden theft is also an issue to gardeners, as indicated by their open response answers regarding garden challenges (Appendix G, Table 3). The following quote is an example of a food-insecure gardener who struggles with theft, and illustrates the potentially devastating effect that produce theft can have on increasing food security:

> "*People pick my veggies clean before I can pick them. I had planned on canning and freezing as much as I could since I'm on S. S. and have a limited budget each month*."

Theft is particularly an issue for gardens that lack a fence. Any time a survey respondent mentioned the absence of a fence around their community garden, they often

also mentioned produce theft. However, not everyone who discussed theft also mentioned a lack of a fence around their garden. I am unaware of which gardens lack a fence other than those mentioned by survey respondents or interviewees, so it is difficult to assess the effectiveness of fences in solving the problem of produce theft. The garden in Figure 4.8 had several signs in and around it to deter people from picking produce. All produce from this garden goes to a food pantry, so theft reduces the quantity of fresh food that can be donated to the food pantry. One survey respondent said her garden has a fence around it that is low enough for someone to jump over, and subsequently, the garden struggles with vandalism and theft. In another example, a respondent who also happens to uses food pantries to reduce hunger said that "*unwanted and unnecessary negative interaction with non-gardeners picking mine and fellow gardeners produce*" is her most formidable challenge to gardening.

Figure 4.8: Sign in a community garden meant to discourage produce theft and instead encourage anyone who needs the produce to seek help by calling the phone number.

I interviewed two gardeners who are part of a garden that intentionally lacks a fence - and subsequently, struggles with theft. In fact, of the thirty-five times survey respondents mentioned theft, thirteen of the mentions came from gardeners that come from a garden that I will refer to as Garden A. Of the thirteen respondents from Garden A, all respondents except for two mentioned vandalism and theft as a big challenge to their community gardening experience, and that their produce haul is reduced because of theft.

Unfortunately for members of fenceless gardens (such as those at Garden A), a solution to stopping theft might be more complicated than simply putting up a fence. For example, Garden A does not have a fence because a fence is a physical barrier between

the garden and the rest of the community, and the leaders believe non-gardener neighborhood residents could perceive the garden as an unwelcome or exclusive area. Garden A leaders are vehemently attempting to show community members they are the intended recipients for the benefits of the garden. In doing so, the leaders have worked to fill garden plots with local residents who live within walking distance of the garden.

There are several reasons why Garden A leaders are passionate about the locality and inclusiveness of their garden. For one, there is a public park adjacent to the garden where many neighborhood residents spend a great deal of time. Therefore, the neighborhood residents are often in close proximity to the garden. Additionally, the neighborhood struggles, with gang activity and related crime, so the community garden has the potential to reduce crime, increase safety, and increase community cohesiveness. Finally, the area is swiftly gentrifying, and historic residents are beginning to feel like outsiders in their own neighborhood. The leaders "*value and covet the diversity in the neighborhood and history of the people that have lived there for generations*," and use the garden to protect the original neighborhood residents. As one of them told me:

> "*[G]entrification means the people need to come in with respect for the community that has lived here for generations, and I think there's more of a subset of gentrifying community that realizes and shares that value and is distraught at…people getting displaced from the community.*"

Garden A has evidence of success. Residents who spend a great deal of time in the park asked, and received, their own community garden plots. In return,

"*it's like the guys in the park are a fence because they watch the garden, because obviously theft is a big issue. If they see somebody going through and picking people's plots they'll be like, 'excuse me, these are people who are gardening*.'"

While gardeners must contend with social challenges in gardening, there are also non-social challenges, such as pests. Garden pests that consume or spoil produce are also a detriment to a gardener's ability to increase his/her food security by gardening. At one low income garden, squirrels are such a problem for gardeners that there are signs around the garden asking that both gardeners and non-gardeners avoid giving food to the squirrels (Figure 4.9). Most, if not all, of the gardens that are part of Denver Urban Gardens are organic, so gardeners must handle insect pests without any form of chemicals – making controlling insect pests more difficult than if pesticides were to be used.

Figure 4.9: An English/Russian sign in a community garden informing anyone who might be in the garden not to feed the squirrels in order to deter the squirrels from eating garden produce. Grace Kellner, 2015.

To be eligible to participate in a community garden, most gardens require that members pay a fee. Although June did not say that increased food security is the primary benefit of gardeners at her garden, she said the cost of community garden participation would be a barrier to increased food security for garden participants. To address low income of gardeners, the garden leaders actually give gardeners money at the start of the season to help them cover the cost of seeds, fertilizer, and other supplies. Most gardeners simply would be unable to participate if they had to pay any sort of fee. One survey respondent echoed the thought that gardening is expensive: "*it is not inexpensive to garden with testing soil, amending soil, buying plants, controlling critters*." Many gardens in DUG's system require gardeners to pay a fee to be a member of the garden so

this situation is highly unusual, but it is an indicator of low income, and a subsequent low level of food security that is associated with gardeners there.

Produce Donations and Food Security

Of the 203 survey respondents, 108 said that they donate their excess produce in some way. In total, respondents specified that they donate about 5870 pounds of food in any given year. Ten individuals did not specify a quantity of donations because they did not have an estimate. Others were unaware of how much certain types of produce weigh, and indicated very low quantities of donation (such as two to five pounds) even if they previously said they donated half of everything they produce. According to DUG, and my research, there are also entire gardens that work to donate a large portion of their produce, or all excess produce, to a particular organization or food pantry. I am aware of twenty-five gardens that work to actively donate their produce to people in need within DUG.

Of those who donate, many gardeners (n=74) donate less than half of what they produce. Few gardeners simply do not donate any of their produce (n=24). Gardeners who do not donate generally have no extra produce to donate. For example, at June's garden, the gardeners donate when they are able, but donating is secondary to consuming the food themselves. One survey respondent said she does not donate because she does not have enough to donate, but she wants to keep learning more about gardening so that in the future she can produce enough to be able to donate.

Evidence to the importance of donations for community gardens is visible on the landscape. I found signs in two different gardens that have donation programs. The first sign (Figure 4.10) is in a community garden that is already associated with a food pantry. Produce for Pantries is a collaboration between different local food and food safety organizations in Colorado that "encourages home, school and community gardeners to plant, grow and share produce with food pantries and hunger-relief organizations in their neighborhoods" (Produce for Pantries 2016, 1). The second sign is in a community garden, which I will refer to as Garden B, which partners with a food pantry in Denver to donate all excess produce to the pantry (Figure 4.11). The sign tracks their progress through the season towards their goal of donating 3000 pounds of food to the food pantry. Both signs are indicators of the dedication of gardeners to donating their fresh produce to food pantries which help families and individuals who have low food security and are in need.

Figure 4.10: A sign from Produce for Pantries in a garden plot. Grace Kellner, 2015.

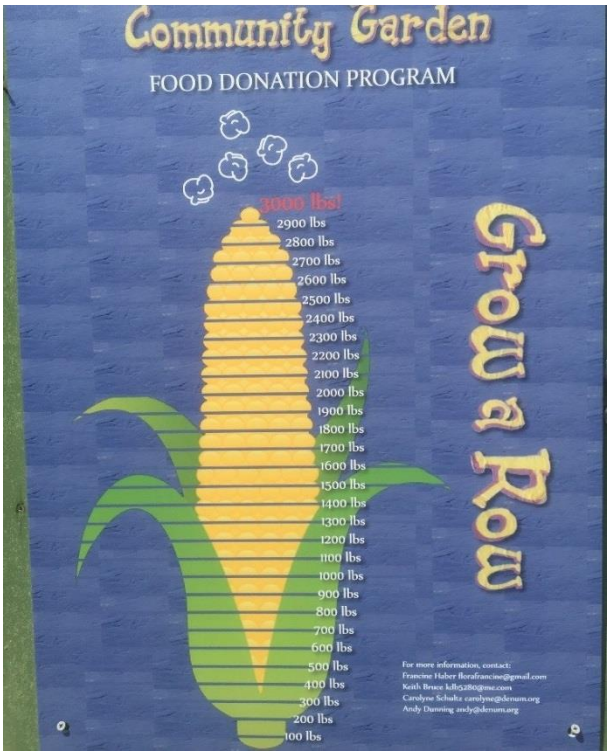

Figure 4.11: A sign in a community garden that tracks the community garden's progress toward their goal of donating 3000 pounds of produce to a food pantry through the garden's Grow-a-Row donation program. Grace Kellner, 2015.

In order to have perspectives from both gardeners who donate and food pantries that receive donations, I conducted an interview with Carol, the Community Relations Director of an organization that has a food pantry. The food pantry receives all donations from Garden B's Grow-a-Row program. Throughout the growing season of 2015, Garden B donated over 2,500 pounds of produce to the food pantry. While one ton of food seems substantial, in comparison, the food pantry receives about one ton of food throughout the course of a week. It gets food through a reclamation program that collects food from various supermarkets in Denver.

Garden B's 2,500 pounds of donations is a drop in the bucket of food required to keep the food pantry satisfying demand. From a gardener's perspective donating any amount may seem like a lot. Many interviewees discussed tending plants in a parent/child dynamic, where the gardener serves as a "parent" that cares for the garden. The donor may feel like he/she has given much more than what they actually donate. Carol says:

> "*the challenge is five pounds of produce feels like a lot – very generous from a gardener's perspective, but that serves one family. And so the magnitude of what it takes to really serve 1000 families each month with fresh produce is intense*."

Some community gardeners enjoy growing varieties of plants that cannot be found in grocery stores, or that would be too expensive to buy. When gardeners donate boutique foods to food pantries, the impact on food pantry shoppers is diminished. Carol clearly explained the issue:

> *"When someone donates kohlrabi, there is so much education that has to go into explaining what kohlrabi is and how you'd use it, especially since the best way to describe it is it tastes like a broccoli stem…most people don't eat broccoli stems. So that kind of conversation is challenging. A lot of the leafy greens (kale, Swiss chard) people don't understand it. They don't cook with spinach, so even saying "use kale like you would spinach," people aren't cooking spinach. People aren't eating spinach salads. So, there's a disconnect in that conversation*."

Based on her experience, Carol finds that boutique foods in the pantry are even insulting to some pantry shoppers. Shoppers associate boutique produce like kohlrabi with class, privilege, and the ability to choose what kinds of foods to consume. Food pantry users lack such luxury; they want tomatoes, peppers, onions, potatoes. They desire staple foods. When shoppers see boutique foods they do not know what to do with it and so those foods do not get taken home. To effectively respond to the rejection of non-staple produce, Carol said food pantry volunteers wrestle with educating families on how to prepare different varieties of fruit and vegetables.

Many of the donations to food pantries and the food that gets reclaimed from grocery stores and distributed to food pantries is cosmetically imperfect food that cannot sell in stores, or is food that is on the verge of rotting. The benefit of donated community garden produce is that it is truly fresh food. Carol believes that the ability to choose fresh, and not partially-rotted food to take home and cook is important for food pantry shoppers. Community garden produce is so fresh that it can even be eaten raw – a delicacy that often is not an option with other food pantry food that must be cooked in order to be safely consumed. Carol said the benefit of fresh community garden food addresses the dignity and respect that everyone deserves while "*honoring that everybody deserves fresh food."* One survey respondent who uses food pantries echoed Carol's sentiment and said the greatest benefit she receives through community gardening is eating the produce:

"*because I get to choose what I eat; unlike foodbank food it is fresh (not half-rotted); I worked for it and don't feel like a beggar because I'm on fixed income, and I have a sense of purpose and control of my destiny*."

Socioeconomic Status & Demographics of Garden Members

In the following sections I will present the findings for research question three: how do the socioeconomic status and demographic profile of gardeners compare to that of residents in neighborhoods around the garden? I begin by reporting the results of survey respondents' demographics, and both survey respondents' and interviewees' perceptions on demographics and diversity in their community gardens. Next, I present findings about some racial struggles within some participating gardens. I conclude with the results of a model I created that analyzes the demographic representativeness of survey respondents of the neighborhood that surrounds the garden.

Respondent Demographics & Perceptions on Garden Diversity

The survey respondents are primarily female, white, college educated, and have a median age of forty-four (Table 4.1). The ages of respondents range from eighteen to eighty-six, while the median age of respondents is forty-four. The demographic trends seen in my data are similar to the demographics of research participants from other studies of community gardens in Denver (Table 4.2). While the majority of my survey respondents have a college degree, a greater percentage of respondents in my study (81 percent) have a degree than the participants in previous studies (Table 4.2). Based upon

the homogeneity of education, I analyzed the statistics of highest level of education attainment in Colorado (Figure 4.12). My data do not deviate from the data on education presented by the National Center for Higher Education Management Systems (2000) that suggests that most individuals in Colorado that have an advanced degree are also white.

Table 4.1: Aggregated demographic information of survey respondents (*n*=203).

Demographic Information		***n***
Education Level		
	Less than a college degree	39
	College degree or higher	164
Gender		
	Male	59
	Female	144
Race		
	Caucasian/White	179
	African American/Black	6
	American Indian and Alaska Native	0
	Asian	1
	Native Hawaiian and Other Pacific Islander	1
	Other	10
	Prefer not to answer	6
Hispanic or Latino Ethnicity		
	Yes	17
	No	180
	Unsure	1
	Rather not say	5
Age		
	Median	44

Table 4.2: Self-reported demographic information of study participants from four studies that used Denver community gardeners. Journal articles by Hale et al (2011) and Teig et al. (2009) used the same pool of respondents and have the same reported demographic information.

Article	Percent White	Percent Female	Percent with College Degree or Higher	Age
Comstock et al. 2010	54	NA	53	Mean and Median: 45
Hale et al. 2011 and Teig et al. 2009	77.6	64	NA	Median: 46.8
Litt et al. 2011	57	68	56	Mean: 46

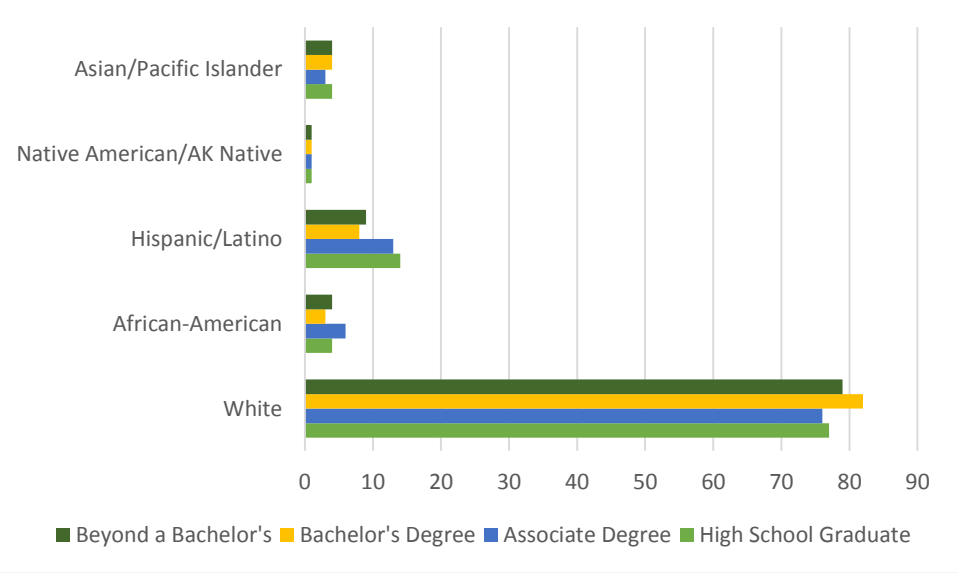

Figure 4.12: Highest level of educational attainment by race in Colorado. Adopted from National Center for Higher Education Management Systems (2000). Data sources: Western Interstate Commission for Higher Education, the National Center for Education Statistics.

Because self-reported levels of education and race were more homogeneous than heterogeneous, I compared survey respondents' self-reported level of maximum high school attainment, and self-reported race (Table 4.3). Most of the respondents who have a college degree also are white, so my results are similar to the trends of Colorado.

Table 4.3: Comparison between survey respondents' reported level of maximum educational attainment, and whether the respondent reported his/her race to be white or not. Answers "I'd rather not say" eliminated, so the total respondents in this table does not equal the sum of all survey participants (*n*=203).

	Non-White	**White**
High School Grad Maximum	1	7
Some College	4	11
Associate's Degree	3	8
Bachelor's Degree	5	62
Beyond a Bachelor's	4	89

Unlike gender, race, and education level, there is a diversity in survey respondent incomes (Figure 4.13). In fact, there is no income category that is representative of survey respondents. However, about 106 respondents (52 percent) had an income level above Denver's estimated median income which, according to the U.S. Census Bureau is around $51,800 (U.S. Census Bureau 2015). Based on the general income and number of household members of survey respondents, most respondents are likely not in poverty.

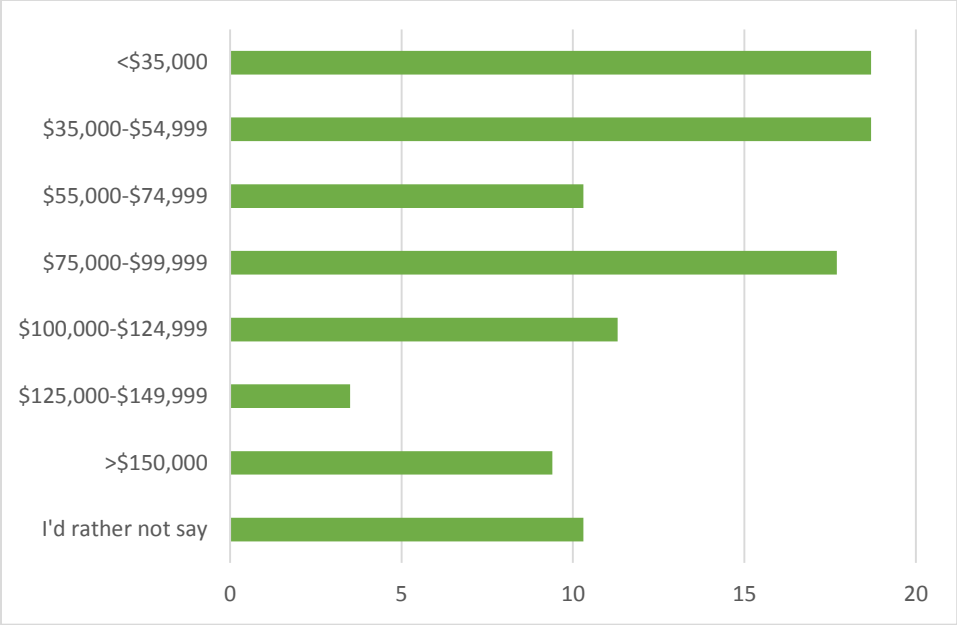

Figure 4.13: The percent of respondents by income block, or who chose to not indicate their household's income.

Income alone does not provide a clear picture of poverty – especially in these results where I group households with incomes below $35,000 into one category. Including household size in an evaluation of income diversity illustrates the influence of income (Table 4.4). The lowest three income blocks in the survey contain answers from respondents who are most likely of lower, or lower-middle class. Nineteen (51 percent) respondents who indicated that their household's income is less than $35,000 live by themselves and do not have to support anyone else. Eight (21 percent) respondents with an income of $35,000-$54,999 have households of three or more people. Although thirty-eight respondents are in the lowest income level provided in the survey, when taking into account household size, few of them would be classified as being in poverty, according to the U.S. Census Bureau's methods of poverty calculation which take into account income and household size (Institute for Research on Poverty 2014).

Table 4.4: Cross tabulation of the observed frequency of survey respondent's income by the number of individuals in their household. Income level is in the thousands of dollars.

	What is your yearly household income after taxes are removed?							
Household Size	<$35	$35-$54	$55-$74	$75-$99	$100-$124	>$125	Rather Not Say	Total
Just Me	19	13	6	2	0	1	3	**44**
Two	11	17	10	23	18	15	12	**106**
Three	3	5	1	4	2	4	1	**20**
Four or More	4	3	4	7	3	6	3	**30**
Total	**37**	**38**	**21**	**36**	**23**	**26**	**19**	**200**

Several respondents called their gardens "diverse" and said they either appreciate or enjoy the diversity of cultures within their garden. One respondent said she receives "*home remedies and natural weed killers*" from other members of her garden. Another gets different gardening tips from members of different cultures. Opposite of diversity, gardeners discussed the homogeneity and general whiteness of members of their garden: "*It just seems like a bunch of privileged white people who are wealthy enough to devote a lot of their time to a garden…"*

The gardens that serve immigrants and refugees are more racially diverse than other gardens. Ciana's garden consists *only* of immigrants and refugees who are primarily

from Bhutan and Burma. Susan said her garden consists of gardeners who are primarily from Burma and Nepal. There are also some gardeners from Russia, China, Sudan, and Somalia. However, gardens that serve immigrants, refugees, or retirees consist primarily of female gardeners. Ciana told me that in some of the immigrant and refugee households, the men in the family work and the women take care of the garden.

Excepting gardens that serve immigrants, refugees, or elderly/retired populations, interviewees reported that their associated gardens have similar demographic profiles as survey respondents. Table 4.5 breaks down interviewee garden characteristics as described by the interviewees who are associated with gardens that do not serve primarily immigrants, refugees, or the elderly. Garden 3 is located in a neighborhood that is comprised of many Latino/a families, and because the garden only accepts neighborhood residents as gardeners, the majority, if not all, gardeners, are Latino/a.

Table 4.5: Predominant demographic garden characteristics of interviewees' gardens as reported by interviewees.

Garden #	Race	Age	Gender	Income Level
1	Majority White	"older"	Majority Female	Unspecified
2	Majority White	Wide Range	Even	Not Low
3	Majority Latino/a	Unspecified	Unspecified	Unspecified
4	Majority White	Ages 30-50	Majority Female	High
5	Majority White	Wide Range	Even	High
6	Unspecified	Unspecified	Female	Medium

Interviewees were vague about income when discussing diversity in their gardeners. In general, if an interviewee indicated that the garden consisted of primarily white, non-immigrant/refugee individuals of diverse ages, then they were inclined to also speculate that most gardeners did not struggle financially. Based on interviewee responses, four of the community gardens associated with interviewees consist of majority middle/upper income gardeners. Ben speculated that 20 percent of his garden members participate partially for financial assistance, indicating that they are likely lower-income. Nathaniel's garden serves a lot of passersby who need food, but who are not gardeners. There are fewer than five people at his garden who consistently participate, and the garden functions so that the garden does not have members in the way that other gardens traditionally do.

Demographic Divides in Community Gardening

The following subsection will discuss interview results that indicated particular challenges associated with community garden participation. The first example takes place in a neighborhood that has experienced swift gentrification. As a result of gentrification, many historic residents in the neighborhood around Garden A are now sensitive to activities like gardening that take place in the neighborhood if they are comprised of primarily white individuals. The garden leaders worked to use the garden to bridge racial divides in the community in order to bring the neighborhood together. In particular, the leaders made a conscious effort to involve local, neighborhood residents who live close to the garden or who see the garden often because they spend much of their time in a park that borders the garden. Kathy said:

> "*I've seen the garden be an opportunity (and that still is only slightly tapped) in building bridges in the community and helping people to break down stereotypes and just to get to know each other as people.*"

Garden A leaders said they have been successful in achieving their goals. Their garden helps the low income neighbors of the garden by providing them with fresh produce. There is an entire plot dedicated to non-gardeners who want fresh produce. While this was a strategic move on the part of the leaders to help decrease produce theft, it was also a move designed to help decrease the perceived distance between gardeners and neighbors. The end goal is that eventually the garden will consist completely of locals and will bring the neighborhood together.

Another interviewee expressed a challenge associated with community gardening because of a historic association between agricultural activities and slavery. This interviewee is African American, and expressed a particular challenge from their[7] point of view. While some gardens have a waiting list of over fifty people, others struggle to fill their plots with participants. This interviewees' garden struggles to gain participants – in particular, male participants. There are a handful of "faithful" women who participate and tend to the garden, but men are difficult to recruit:

> "*Men, they've got that mentality about doing work outside. I don't know why they think they've gotta sit up in an office with air conditioning. Somebody's gotta get out here in the field…We have this mentality and it comes from slavery about working in the field*."

Other interviewees and survey respondents mentioned struggling to get garden participants in their garden, but this interviewee is the only study participant who linked a lack of participation with a history of enslavement associated with race.

Demographic Representativeness of Gardeners

An understanding of where gardeners live is necessary to quantitatively assess the degree of demographic representativeness of community gardeners to the demographics of residents surrounding the garden. Based on survey responses, the majority (*n*=151) of

[7] I do not reveal gender in order to protect the anonymity of the interviewees who participated in my study.

gardeners believe that their fellow gardeners reside in the neighborhood around their community garden. In fact, only eighteen (8.9 percent) respondents do not believe their fellow gardeners reside in the area that surrounds the garden. At least four respondents indicated that the garden is at their place of work, but said they think most of their fellow gardeners come from the area around the garden, so this did not affect their answers.

There were only five gardens where at least ten gardeners participated in the survey. The remaining gardens represented by at least one survey respondent had fewer than ten gardeners complete the survey. All five gardens trend slightly whiter than what the demographics around the community garden would suggest (Figure 4.14). Four of the gardens are between 10 and 20 percent whiter than the surrounding neighborhood. However, the number of respondents from these gardens is between ten and nineteen people, so the gardens have only one or two individuals that skew the demographics in comparison to the demographics of residents around the garden. In Figure 4.14 I assign arbitrary garden numbers that are not linked to the garden numbers in Table 4.5. Garden one has the greatest difference in percentage, where there is almost a 60 percent (almost eight people) difference in the percent of white individuals, but this garden is in an area undergoing gentrification. On the other hand, garden three most closely corresponds to the demographics of the surrounding neighborhood in terms of the percent of white residents.

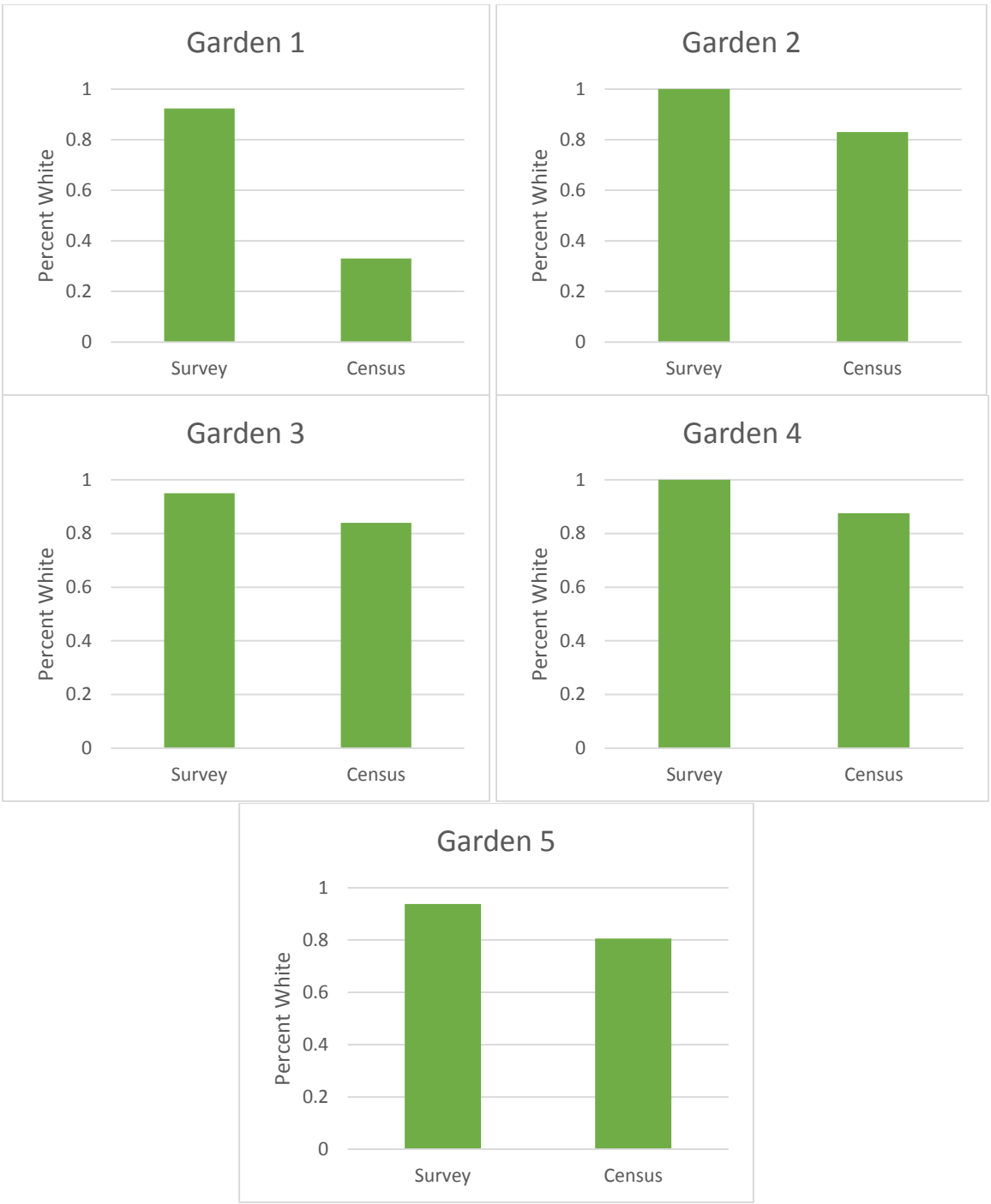

Figure 4.14: Bar graphs indicating the percent of white gardeners as shown by survey results, and the percent of white individuals who are modeled to live within a half-mile walking distance of the garden for five gardens that had a minimum of ten survey respondents.

Along with race, I compared the representativeness of the income of gardeners with the income of residents who live in the neighborhood around the garden by using a nonparametric sign test. A sign test is appropriate given both the small sample size and the non-normal distribution of the data. As seen in Table 4.6, I can reject the null hypothesis that the income of community gardeners is the same as the income of individuals who reside in the neighborhood around the community garden for garden one, three, and five.

Table 4.6: The test statistics and probability values calculated using available data and a sign test to determine whether community gardeners are statistically different from their counterparts who theoretically live in a walkable half-mile area around their community garden.

Garden	**Test Statistic (*t*)**	***n***	**Probability Value**
1	2.5	6	0.027
2	0.45	5	0.338
3	2.8	15	0.0071
4	0.33	11	0.374
5	2	16	0.032

About half (n=50) of the gardens that were operating in 2015 were full, meaning they had no available plots for new potential gardeners. To see if the gardens demographically differed from gardens that were not full, I compared the racial

demographics of all gardeners with the demographics of residents around gardens that were full during the 2015 season (Figure 4.15). I also compared the percent of residents with low, medium, and high income of households that are around community gardens with the income of households around community gardens that were full during the 2015 growing season (Figure 16). I classify low, medium, and high income as less than $35,000, $35,000-$74,999, and greater than $75,000 annual household income, respectively. Based upon the differences in the clustered columns in Figures 4.15 and 4.16, the modeled demographics for full gardens do not vary much from the modeled demographics of residents and households around all gardens. There are slightly fewer white individuals, and there are slightly fewer households with a classified low income level living in the vicinity of gardens that are full.

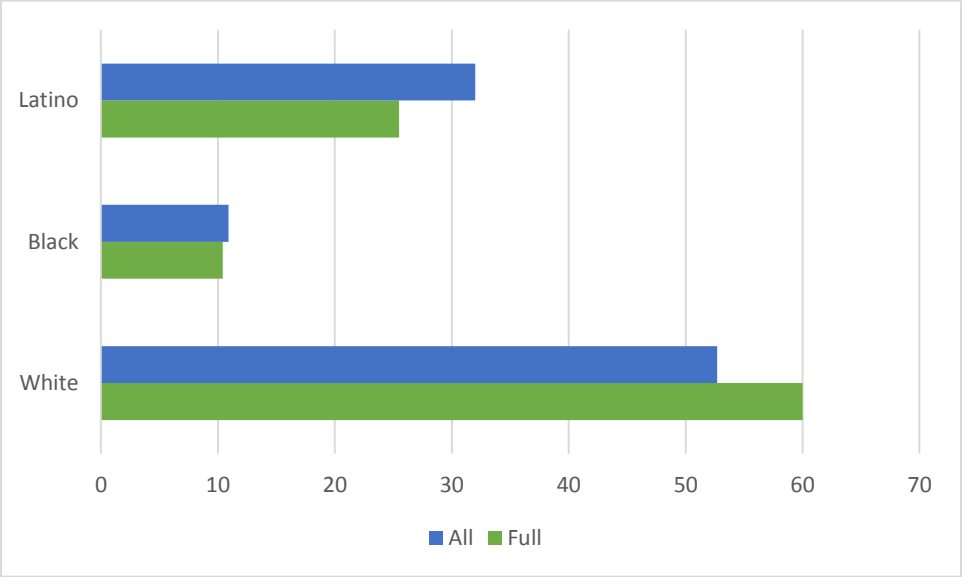

Figure 4.15: Modeled percent of residents around all community gardens in Denver who are white, black, and Latino (labeled as “All”) compared to the race of residents who theoretically reside around community gardens that were full for the duration of the 2015 growing season (labeled as “Full”).

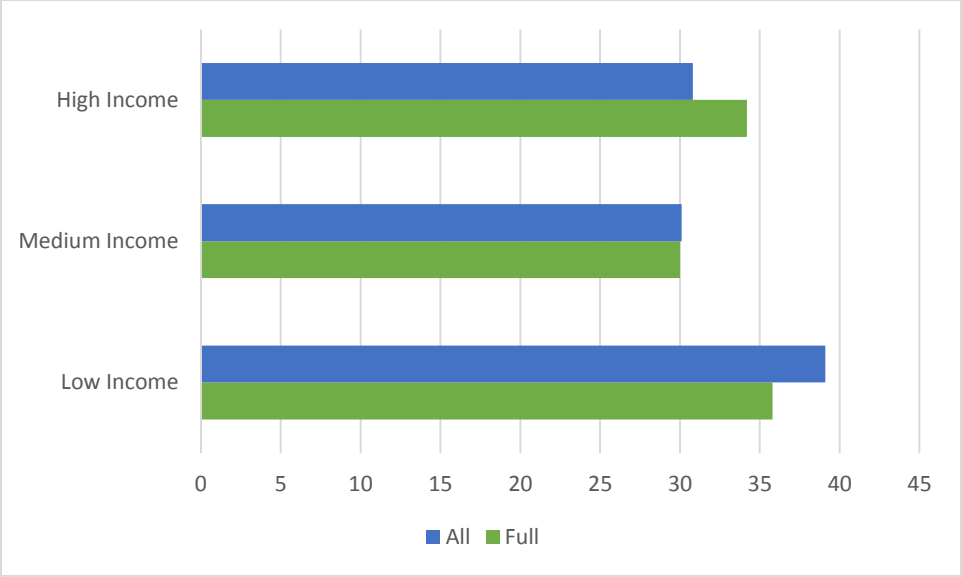

Figure 4.16: Modeled household income level classified as low, medium, or high income for households around all community gardens in Denver (labeled as "All") compared to the percent of households with high, medium, and low income that theoretically reside around community gardens that were full for the duration of the 2015 growing season (labeled as "Full").

Perceptions & Behaviors Pertaining to Garden Accessibility

The following section presents survey and interview results that pertain to the behaviors and perceptions of study participants in terms of garden accessibility. I first present the survey results regarding respondents' behaviors for travel time, travel mode, and distance traveled to access their community gardens. I then conclude with gardeners' perceptions on the accessibility of their garden.

Compared to other modes of transportation, the most popular mode of travel to access gardens is walking, although at least one respondent said she splits her time equally between driving and walking as a mode of travel. The next most popular travel mode used to access community gardens is driving (n=74). More than half (n=115) of all

survey respondents travel less than a mile to access their garden, and one to five minutes is the most common range of time that it takes them to travel to their garden. Table 4.7 shows the results of a cross tabulation between travel time and travel mode. Driving and public transportation require a longer travel time, but those who use these forms of transportation also travel greater distances. Additionally, walking is the quickest form of transportation for respondents, but those who walk travel shorter distances. Those who travel further than a mile to reach their garden generally do not walk to access their garden.

Table 4.7: Cross tabulation of the observed frequency between the length of time it takes survey respondents (*n*=203) to travel to their community garden and the mode of travel that they utilize to travel.

	How do you normally travel to and from your community garden?				
How long does it take you to travel to your community garden?	Drive	Walk	Bike	Other	**Total**
<6 minutes	24	66	8	1	**99**
6-15 minutes	40	21	9	5	**75**
>15 minutes	10	8	3	8	**29**
Total	**74**	**95**	**20**	**14**	**203**

In order to see whether there is a relationship between the time it takes a gardener to travel to his or her garden and the mode of travel, I created a contingency table. Using

the observed frequencies and calculated expected frequencies of travel methods and travel time, I calculated a Chi-square value of 49.79. The data for this calculation has eight degrees of freedom, so the probability that travel mode and travel time are random is less than 0.001. This means there is less than a 1 percent chance that travel time and travel mode are random. The relationship between travel mode and form of travel are probably more likely functions of the distance a gardener lives from his/her garden.

Regardless of travel mode, travel time, and travel distance, almost all (*n*=194) survey respondents believe the community gardens to be accessible. Only eight respondents felt that their garden is not easy to access. Many interviewees' gardens are also easy to access. Three interviewees are part of gardens that are associated with apartment complexes. The gardens on apartment property are highly accessible, and are all accessed by walking because the gardens are within a no more than a mile of gardener residences.

One garden moved locations prior to the 2015 growing season. There were some distinct pros and cons expressed by study participants regarding the move. According to the members of this garden, some people enjoy the new location because it is now more accessible for them, and others now have to travel further to access the garden. While the garden lost a few members in the move, the new location has greater visibility because it is in a location that where there is a great deal of foot traffic.

Accessibility, and in particular, the mode of transportation that members use to access gardens, impacts a gardener's experience. Sarah said it is more difficult to access a garden regularly and to maintain energy for gardening if gardeners are not within walking

distance. Jeff lives within a half-mile of his garden, and he said it takes him about ten minutes to walk to it. Many others from his garden live either across the street, or just down the street from the garden. He estimates between 75 and 80 percent of gardeners live within a mile of his garden. Although he lives within an easy walking distance, if he knows he will have to go or return from the garden with tools or produce, he tends to drive, rather than walk, to his garden.

Accessibility extends beyond location. One survey respondent primarily walks to their community garden because there is limited parking in the area where the garden is located. This limitation results in more local participation because it discourages non-local residents from gardening at this garden, because they might incur difficulty with parking. In gardens where this is the case, it would be most convenient to walk or ride a bike as opposed to driving to access the garden. Accessibility also encompasses time. Some gardens close at certain times – regardless of daylight hours. Designated open or close times make it difficult for members to use the garden to its full potential. Only two survey respondents expressed a closing time as a challenge to gardening, so this is not a widespread barrier to accessibility.

Some survey respondents would not have access to a garden if they were not community gardeners. About half of them do not have a garden at their home because they do not have a yard (Figure 4.17). Therefore, these gardeners would be unable to get the health and emotional benefits of community gardening if they did not have access to a community garden plot. Seventy-three (36 percent) of the respondents do have a yard but do not use it to garden. Some respondents indicated that they do not garden at home

because their yard is covered in shade and the conditions are not suitable to having a garden at home.

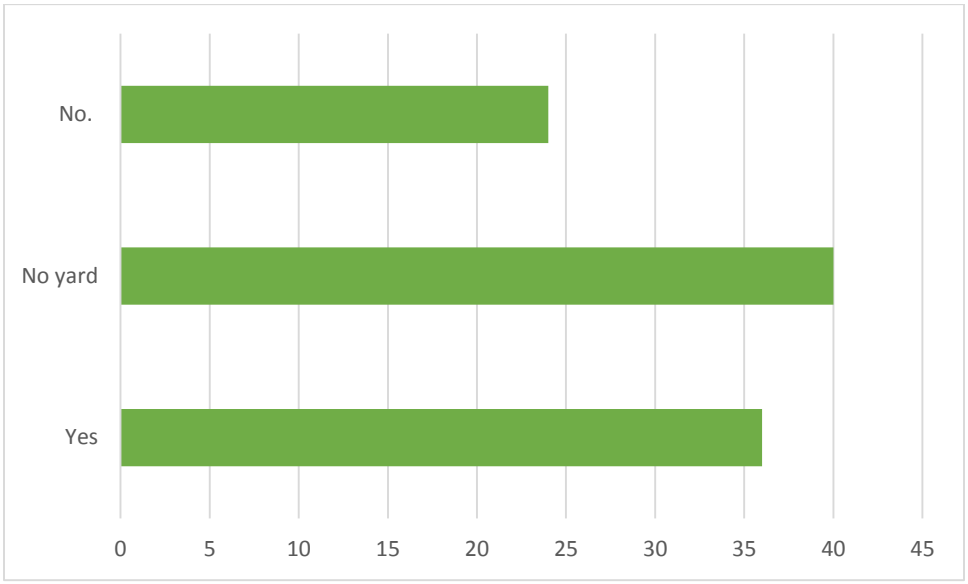

Figure 4.17: The percent of survey respondents who either also have a garden at their home, do not have a garden at their home, or do not have a garden at home because they lack a yard where they could garden.

Community Garden Locations & Accessibility

Community gardens are not evenly dispersed throughout Denver. This is especially the case for the "arm" of Denver that extends northeast from the main portion of the city to encompass the Denver International Airport. In this area of Denver, there are few to no homes, and thus, no community gardens.

The spatial dispersion of gardens throughout Denver could affect the accessibility of the gardens if the gardens are clustered rather than spread throughout the city evenly. To analyze the spatial dispersion, or clustering of all community gardens across Denver, I used a variance-to-mean ratio (VMR) and a kernel density estimation (KDE). Table 4.8

contains statistics that correspond to the average and variance number of community gardens per square in the square grid. A VMR that is greater than 1.0 indicates a clustering pattern (Krebs 2013). Because the VMR ratio I calculated is slightly larger than 1.0, the spatial pattern is slightly clustered, indicating that community gardens in Denver are not evenly or randomly dispersed throughout the city.

Table 4.8: The calculated mean, variance, and VMR ratio of community gardens in Denver using a grid comprised of 3700^2 foot squares.

Statistic	Value
Mean	0.348
Variance	0.488
VMR ratio	1.401

I also used a KDE to visually analyze the distribution of community gardens in Denver[8] (Figure 4.18). Based upon red raster cells, which indicate greater density, there is a visible concentration of gardens in the lower-downtown area of Denver, as well as in the neighborhoods of Five Points, Cole, Whittier, City Park West, and North Capitol Hill. There is another cluster area south of the first cluster within the neighborhoods of Baker, Speer, and West Wash Park. West of Interstate-25 there is a moderate cluster in the greater Highland neighborhood area.

[8] See Chapter Three, "Compiled Third Party Spatial Data Layers and Analyses" subsection for more information.

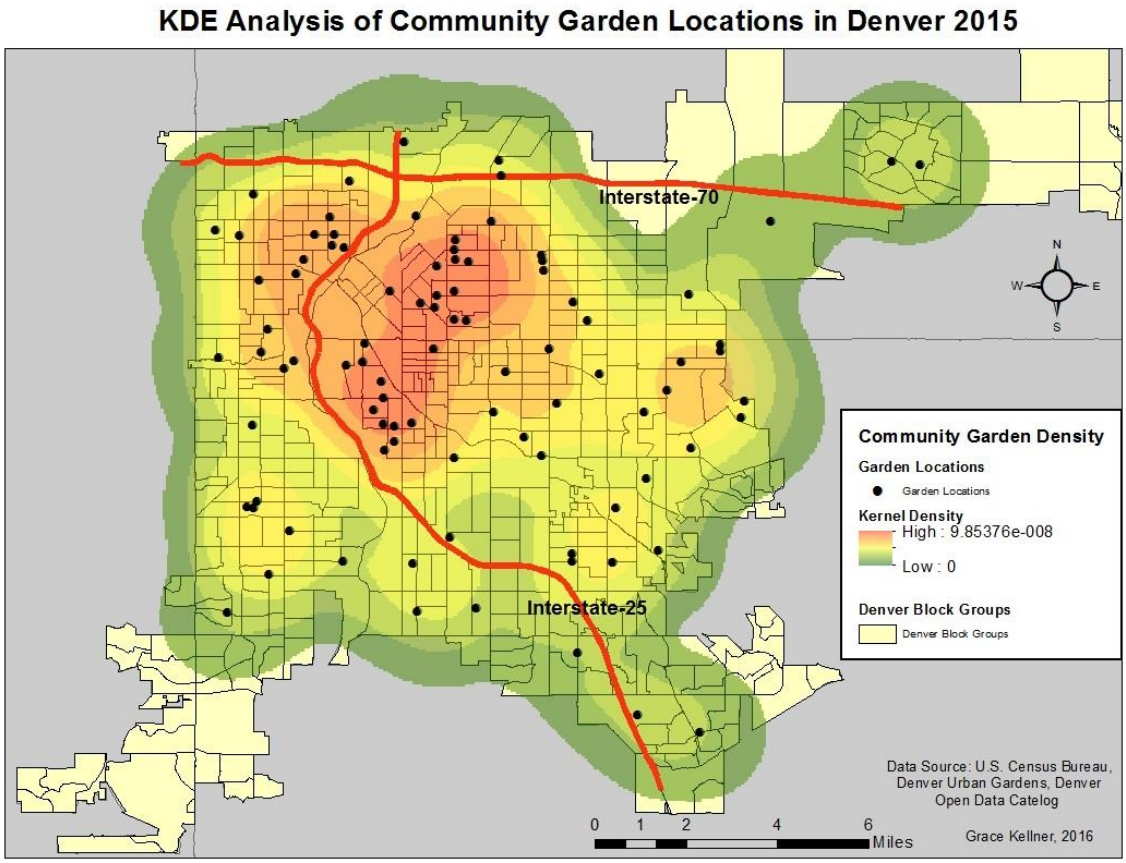

Figure 4.18: Kernel density estimation analysis of 2015 community garden locations in Denver using a 10,000-foot radius.

While the spatial distribution of community gardens is not evenly distributed across the city, neither is the density of residents. Figure 4.19 displays the population density of Denver using block group data. Based upon visual interpretation of the correspondence of both higher population density and community garden density (raster and polygons both in the orange or red category), there is slight overlap in the pattern of population density and community garden locations, but it is not a direct correlation. There are areas in the southern portion of Denver that have moderate (indicated by light green and yellow block groups) population density, but lack the density of gardens

compared to other densely populated areas. Within the Central Business District (shown as the area in the center of Denver, Figure 4.19) there is a dense population, and no gardens at all, as is seen by the red polygons, but green KDE raster layer overlaid. There is a dearth of vacant lots that could be used as community gardens in downtown Denver. The majority of gardens are in moderately-high density areas of the city that most often correspond to residential neighborhoods where empty lots, or portions of parks, may be converted into community gardens, and where there is greater availability of empty space.

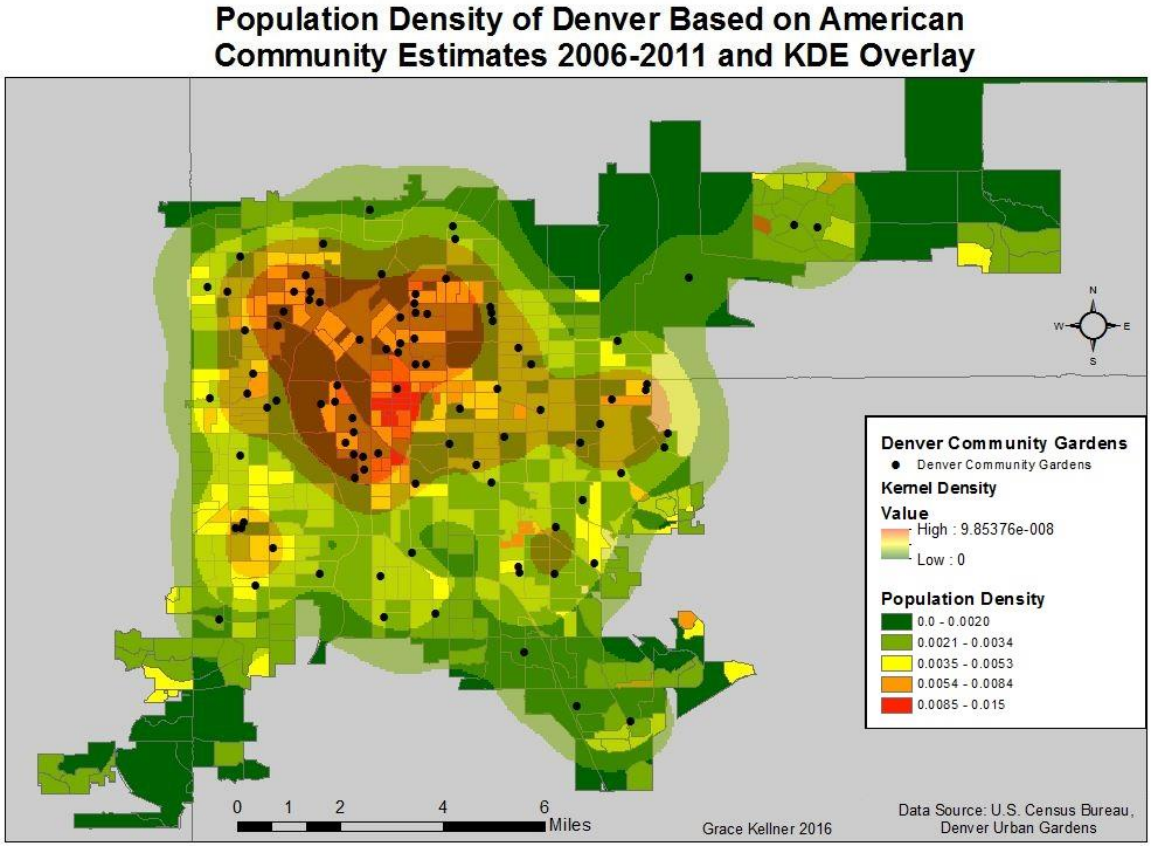

Figure 4.19: Population density of Denver based on 2006-2011 American Community Survey Estimates with community garden respondent locations and overlaid raster KDE.

I determined the degree of walkability of community gardens using a spatial analysis method of service catchment areas. Figure 4.20 is a map of my generated walksheds based upon underlying street network that model walkability in a half-mile radius around community gardens in Denver. I define good accessibility as having almost a full half-mile of walkability in 360 degrees around the community garden. Most gardens have full access – especially those with overlapping walksheds.

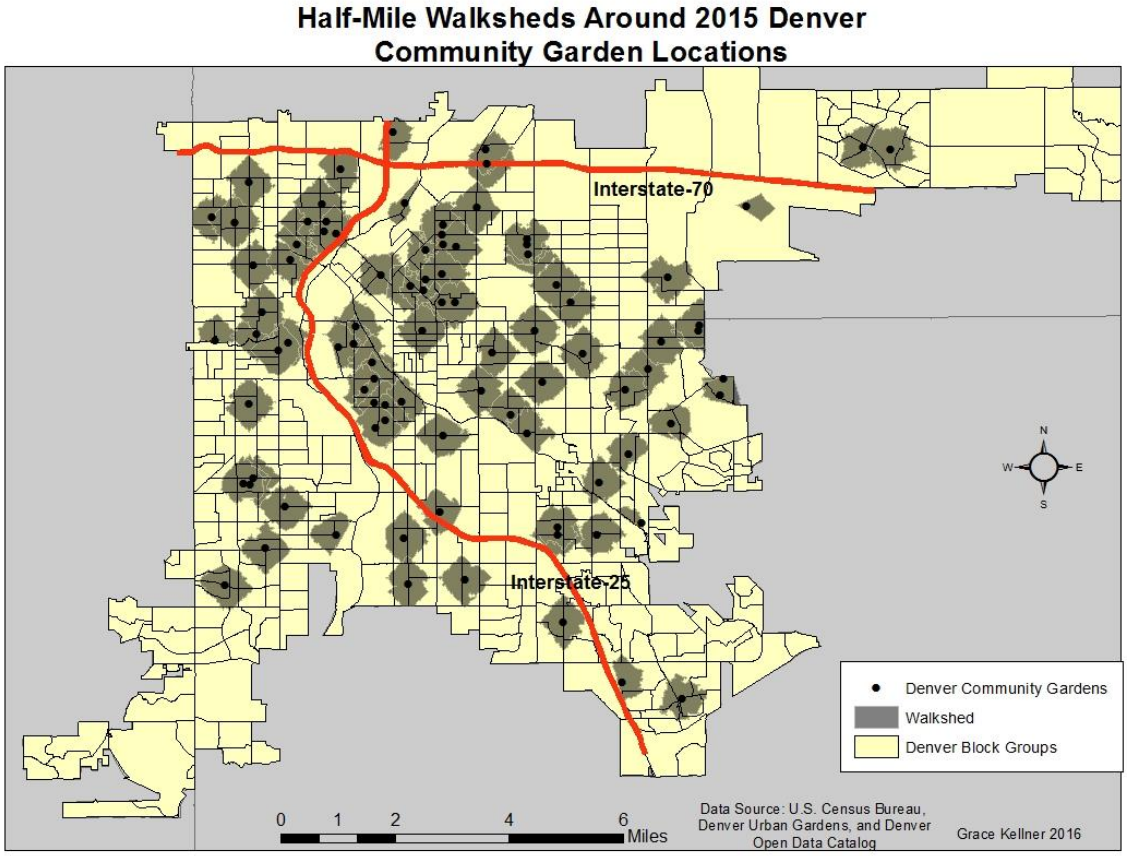

Figure 4.20: Half-mile walksheds modeled around the 2015 community garden locations in Denver.

Using this method, I classified four community gardens as not easy to access by walking, and therefore of low accessibility (Figure 4.21). I received at least one survey response from three of the gardens with low access. In Table 4.9 I report the responses of gardeners from these gardens regarding perceived garden accessibility, and the travel behaviors of the members. Survey respondents from low access gardens travel further, drive more, take longer to access their garden, and do not strongly agree that their garden is easy to get to when compared to the rest of the survey respondents (Appendix B, questions seven thru nine and sixteen).

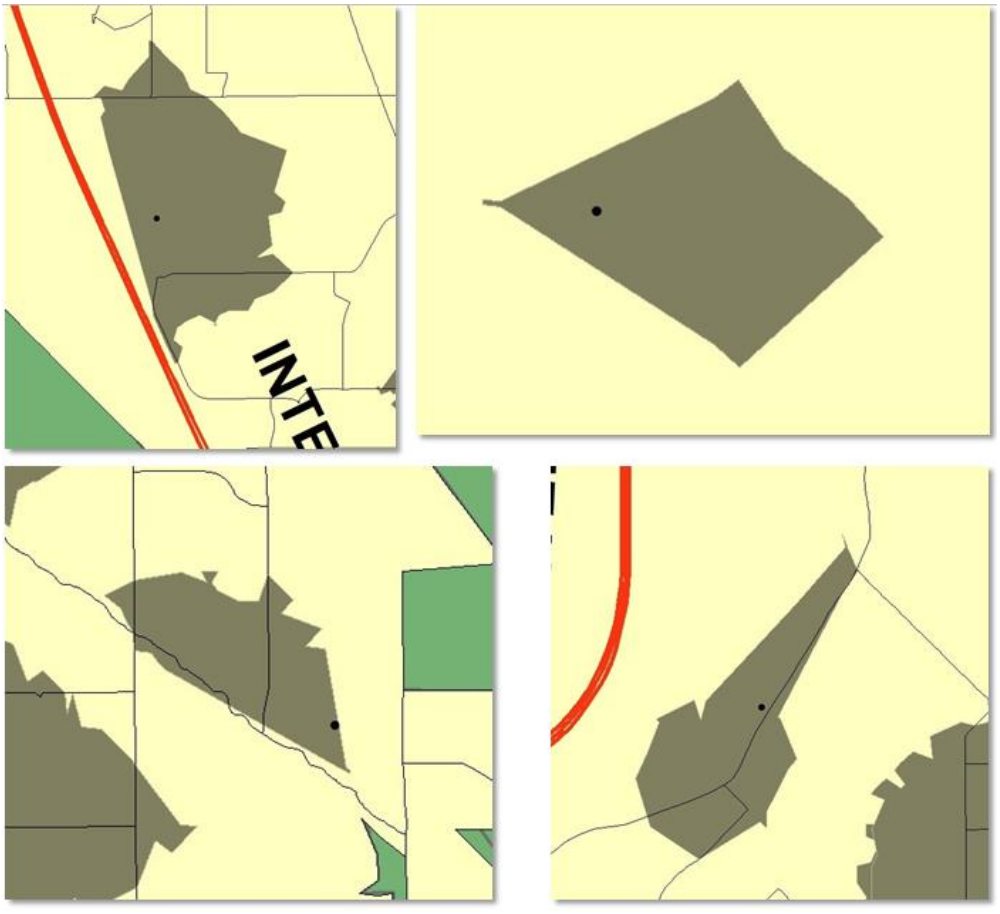

Figure 4.21: Walksheds of four community gardens in Denver that have low walkability, and low accessibility based on the underlying street network.

Table 4.9: Summary of the travel characteristics and travel perceptions of gardeners who are associated with classified "low access" gardens based upon survey responses.

Garden #	Mode of Transportation	Miles Traveled	Time Traveled	Perceived Accessibility
1	Drive	3-5 miles	6-15 minutes	Strongly Agree
2	Walk	<1 mile	<1 minutes	Agree
3	At respondents' work place. Walk from work.	From home: 3-5 miles	From home: 16-30 minutes	Strongly Agree
4	Walk	<1 mile	1-5 minutes	Agree
5	Drive	1-2 miles	16-30 minutes	Disagree
6	Drive	6-10 miles	16-30 minutes	Disagree
7	Drive	1-2 miles	1-5 minutes	Agree

CHAPTER FIVE: DISCUSSION

My research addresses aspects of food security in Denver and illuminates the role of community gardens in adequately addressing food insecurity. Four primary themes emerged. First, my data show that community gardens provide diverse benefits. One benefit is food security. Second, the majority of survey respondents in my study are food secure. However, based on anecdotal evidence I gathered via semi-structured interviews and survey responses, community gardens are still valuable components in hunger reduction for food insecure gardeners. Third, community gardens serve particular populations in Denver more than others. Finally, I found that all but four community gardens in Denver are easily accessible by walking, so location does not inhibit current gardeners from accessing gardens and potentially increasing their food security. A caveat of the following discussion is that my data are not fully representative of Denver gardeners because immigrant and refugee gardeners were unable to take the survey or participate in an interview due to language barriers. Additionally, I am only able to characterize the respondents I captured in my survey, and not those who did not participate.

Community Garden Benefits are Dynamic

Community gardens provide a vast array of benefits. They are places for sharing advice, life experiences, values, and more. Gardeners in my study garden to increase their health, relieve stress, save money, be part of their community, and to simply be outside and with nature.

One finding that emerged from my data pertains to elderly gardeners' community gardening experiences. Providing, or empowering, aging persons with a sense of control increases health because older adults with responsibility (like that which can come from tending a garden) tend to be healthier and live longer lives (Langer and Rodin 1976). Fifty-six survey respondents were at least sixty years old. Thirty of them reported that gardening is mentally beneficial and leads to increased overall wellness. Fifty-three percent of all survey respondents at least sixty years old mentioned receiving emotional benefits from gardening. Additionally, half of the survey respondents I classified as food insecure were at least sixty years old. To older respondents, the accountability and sense of empowerment that goes hand-in-hand with gardening is as beneficial as increasing food security.

Similarly to aging gardeners, the experiences of refugee and immigrant gardeners are distinct from the gardening experiences of the general population of gardeners in Denver. There are cultural and language barriers that migrants must deal with - fortunately, gardening is an activity which requires little knowledge of language, assuming that gardeners can successfully acquire a garden plot. For the immigrant and refugee gardeners in my study, garden plot acquisition is easily facilitated through the

associated housing complexes. Because language is not a barrier for many immigrant and refugees, gardeners may develop social cohesion amongst themselves (Wen Li, Hodgetts, and Ho 2010). Social cohesiveness is one aspect of gardening that benefits immigrant and refugee populations. They also have the ability to plant culturally-appropriate foods using techniques native to their country of origin that align with diets familiar to them. By planting foods native to their homeland, immigrants and refugees produce a continuation of a sense of home in a new country, and can more easily express their cultural identity (Harris, Minniss, and Somerset 2014). The physical appearance of a garden can reflect immigrant and refugees' memories because gardeners adapt their techniques to new urban spaces. For example, Bhutanese and Sudanese gardeners in both Ciana and Susan's gardens plant orange chrysanthemums[9] so they can have access to the flowers during spiritual ceremonies.

Fifty-six percent of my survey respondents said they receive health benefits via community gardening. Hunger and food insecurity are associated with detrimental health effects, and while I did not directly address health, my research builds upon the greater body of literature that examines urban health. Fresh produce is often healthy, so those who garden for the benefit of fresh food receive the added benefit of increased physical health through their diet. Finally, 73 percent of the surveyed gardeners said they benefit physically from the exercise they receive while gardening. My data supports other research on community gardening and physical health in North America[10]. Food security

[9] Figure 4.1.

[10] Armstrong 2000; Lineberger and Zajicek 2000; Ferris, Norman and Sempik 2001; Morris, Neustadter, and Zidenberg-Cherr 2001; Morris and Zidenberg-Cherr 2002; Twiss et al. 2003; Graham and Zidenberg-

is so crucial to human health and happiness that aspects of human development depend upon it (Hamelin, Habicht, and Beaudry 1999).

Very few gardeners actually indicated that they food insecurity by participating in a community garden. Furthermore, based on code counts and survey responses, no survey respondents garden *solely* to increase their food security. This result is logical based on the demographic profile of most survey respondents. My findings fit in the findings of some other researchers. Gardeners in other research do not cite food security as their top benefit to gardening (Patel 1991; Armstrong 2000; Saldivar-Tanaka and Krasney 2004; Lanier, Schumacher, and Calvert 2015).

Food Security and Hunger

The second emergent theme from my research finds that Denver community gardeners are largely food secure. This result should not lessen the importance of a community garden for gardeners who have low food security. Based on anecdotal survey and interview evidence from mine and other studies, gardens remain highly important for food insecure gardeners (Armstrong 2000; Kurtz 2001; Corrigan 2011). These individuals depend heavily upon their community garden for fresh, affordable, healthy produce, and would not have access to such food if they did not participate in the community garden. Additionally, my results suggest that community gardens in Denver

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Cherr 2005; Hermann et al. 2006; Koch, Waliczek, and Zajicek 2006; Lautenschlager and Smith 2007; McAleese and Rankin 2007; Ozer 2007; Wakefield et al. 2007; Alaimo et al. 2008; D'Abundo and Carden 2008; Heim, Stang, and Ireland 2009; Parmer et al. 2009; Robinson-O'Brien, Story, and Heim 2009; McComack et al. 2010; Hale et al. 2011; Litt et al. 2011.

have great potential to allow Denver residents to use community gardens to increase food security. The narrative of food insecurity amongst community gardeners, while not representative of all gardeners, illustrates a nuanced relationship between food security and community gardening in Denver.

A barrier to increasing food security through gardening in Denver and elsewhere is produce theft (Armstrong 2000). Unfortunately, there is no clearly effective strategy for reducing theft. As speaking with Kathy illuminated, a fence might reduce theft in her garden, but it would negatively impact the gardeners' relationship with their local neighbors. As mine and other data show, local residents may interpret a garden with a fence as a space exclusive to certain types of peoples (Kurtz 2001). This is especially the case when gardens are situated in socioeconomically diverse areas (Kurtz 2001). If community gardens are to actively engage with everyone, then non-gardeners should not perceive them as exclusive spaces (Slocum 2006).

In addition to evaluating food security of gardeners, I also evaluated food security through community garden donations to food pantries. Talking with Carol illustrated the relationship between fresh food donations and food security for food pantry users. As she told me, the only real food security indicators that organizations use are ones created by the USDA. In order to successfully quantify an increase in food security through food pantry use, Carol's clients must show increased food security based upon the USDA's measurements:

"*[O]ur clients…say that accessing a food pantry does decrease their worry and does help them get through until they receive more money and food stamps…Perhaps coming to a food pantry, getting food, and then getting signed up for food stamps might help decrease someone's food insecurity in the future…But the actual act of what we're doing isn't decreasing food insecurity*."

Individuals who use food pantries in Denver value community garden donations above reclaimed food because community garden produce is freshly picked. Carol said that community garden food provides food pantry users with a sense of dignity because the food does not have to be cooked or frozen in order to be eaten. Many food pantry users have little to no access to fresh food, so whatever quality food is in the food pantry is what they bring home to their families. Although fresh produce donations may not measurably increase food security, they positively impact the experiences of those who rely on food pantries to decrease their hunger.

Gardens Serve Particular Populations

Results from my study indicate that community gardens in Denver serve particular groups of people more than others. To illustrate, the majority of both survey respondents and interviewees were white. Alternative food movements have been historically driven primarily by white culture and white identity. The players in these movements are still primarily white individuals (Slocum 2007). However, it is imperative to differentiate that "[w]hile the ideals of healthy food, people and land are not

intrinsically white, the objectives, tendencies, strategies, the emphases and absences and the things overlooked in community food make them so" (Slocum 2007, 526). The dominance of white gardeners may discourage minorities from participating in community gardening (Meenar and Hoover 2012).

An African American interviewee in my study expressed a link between race and low levels of community gardening participation. This garden leader believes the reason for a lack of participation is a historical association with slavery and farming in the U.S. Although other interviewees and survey respondents did not mention a connection between gardening and slavery, this interviewee shares sentiments that other researchers have found. The garden coordinator at a community garden study site in Philadelphia reasoned that the legacy of slavery, racism, and a "generational gap in farming" could explain low participation (Meenar and Hoover 2012, 152). Future researchers should work to identify whether Denver residents perceive gardening to be an exclusive activity reserved for white individuals. Results from such a study could help promote greater demographic inclusiveness within community gardens.

While survey respondents were primarily homogenous in terms of race, they were also homogeneous in terms of gender, as the majority were female. Previous research has noted that a garden environment can be a place for females to challenge traditional gender roles. Women can be both catalysts for garden establishment and leaders within the community gardens (Parry, Glover, and Shinew 2005). One way in which women might rework traditional gender roles is that in low income households, females get the opportunity to provide for their family nutritionally and/or financially through gardening

(Buckingham 2005). Although the gender of community gardeners represented by mine and other studies in Denver were not equally comprised of men and women, the lack of male gardeners might be a positive benefit because it empowers women (Teig et al. 2009; Comstock et al. 2010; Hale et al. 2011; Litt et al. 2011).

Education levels amongst respondents were indicated a trend towards more college-educated gardeners. Based on the data reported by the National Center for Higher Education Management Systems, the trend towards more college degrees could be a correlation between race and education, rather than gardeners and education (Table 4.3 and Figure 4.12). So, because I have a large number of white respondents and white individuals more often attend college in Colorado, perhaps this trend is more reflective of race than education. Alternatively, perhaps Denver residents who have completed higher education are more aware of local food opportunities and seek them out. Either way, the pattern of higher education among community gardeners deviates from the national average and suggests that there might be a correlation (National Center for Education Statistics 2014).

Household income was the only demographic variable where there was not one clear category that described the majority of survey respondents. For three of the five community gardens that I could statistically compare, I found that gardener income is significantly different from the income of residents surrounding the community garden. Garden members in Denver are not always comprised representative of the neighborhood's median household income. Rather, some gardens are comprised more of individuals that have greater household incomes than residents. Given the low number of

gardens that could participate in this analysis, it is difficult to draw broader conclusions from these analyses, and future studies should work to better understand the representativeness of gardeners in terms of household income. These findings deviate from the findings of previous researchers who saw urban agriculture serving those who are most in need of hunger relief and increased food security, which suggests that either those populations do not desire local food access in Denver, or they do not know it exists (Meenar and Hoover 2012).

I analyzed the demographics around community gardens that were full during the 2015 season. I compared the demographics of residents around full gardens to the demographics around all gardens (Figures 4.15 and 4.16) and found very little difference. These results suggest that a factor other than demographic profile might drive larger numbers of people to be involved in community gardening in certain areas of Denver.

Accessibility Does Not Impede Food Security

Accessibility is an essential component to food security, and based on my survey responses and spatial analyses, garden location does not negatively interfere with current gardeners' ability to garden for increased individual food security. I used the walksheds I created to analyze accessibility to also model[11] demographic representativeness of gardeners. Given that most participants in my study said they live in the neighborhood where their garden is located, greater weight can be attributed to my model that evaluates the demographic representativeness of gardeners. My model assumed that the

[11] See Chapter Four, subsection "Demographic Representativeness of Gardeners."

neighborhoods around community gardens could be constrained by walkability – an assumption my results support.

Most, but not all, survey respondents walk no more than half a mile to access their garden and believe their garden to be accessible, findings that align with the results of previous research (Blaine et al. 2010; Meenar and Hoover 2012). There were four out of ninety-one community gardens in Denver that I classified as not easy to access by walking, but there are other gardens that might not be safe for pedestrians to access. For example, walking through a quiet residential intersection is generally safer than walking on a road that crosses an interstate. There are five community garden walksheds in Denver that cross an interstate, so these five gardens that appear to be easy to access by walking, might, in reality, not reflect the modeled walkability.

My analysis of walkability was also limited to the components of accessibility and pedestrian mobility, but more factors than simply road network influence walkability (Ewing and Handy 2009). Physical features that influence walkability include sidewalk presence, sidewalk width, lighting, traffic volume, and building height influence. Future walkability analyses should take into account more than just road network to more accurately model walkability. Additionally, accessibility by other modes of transportation could also be assessed in future research to fully understand the ways in which individuals can effectively access community gardens.

While I analyzed the walkability and distribution of present community gardens, there are areas of Denver that are not served by community gardens. There are also areas that lack easy access to local or healthy food – as seen by the presence of food deserts in

the city (Figure 3.3). Of course, there could be other local food options in the areas that lack community gardens, but I did not map or study the locations of other local food options, such as urban farms or backyard gardens. Regardless, there is a demand for local food in Denver.

Although there are many other organizations and operations in Denver that provide local food, residents, and many of my study participants still desire more community gardens. In fact, around half of the community gardens in Denver are full and have a waiting list of residents who desire a plot at their neighborhood garden. There are some community gardens that are full that fall within food desert neighborhoods in Denver, which could indicate that gardeners in these areas are participate in gardening more intentionally to increase food security than gardeners in other neighborhoods. It could be useful to have an in-depth study of gardens located in food deserts to better understand if there is a difference in the garden members from these gardens so that either DUG or the DSFPC could assist in the establishment of gardens where they are might be most desired.

A barrier to accessibility that is difficult for researchers to contend with, and one that I did not address at all, is informational accessibility. An individual who desires to participate in a community garden, but does not know where gardens are, how to get on a garden waiting list, how to establish their own garden, or lacks other information pertaining to community garden involvement, has low informational access. Populations of lower income generally have lower informational access than populations or neighborhoods of higher income (Meenar and Hoover 2012). Because this is the case,

DUG and/or the DSFPC should survey communities across Denver to assess the degree to which residents desire community gardens in order to better facilitate the establishment of more gardens where they are desired.

Community gardens are one facet in the local food system, and food insecure residents may depend upon alternative players in the local system to increase their food security. Other entities such as Hunger Free Colorado or the Denver Sustainable Food Policy Council may expressly aim to increase community food security or community resilience, whereas Denver Urban Gardens does not. Although DUG does not have a strict goal of working to increase food security, their organization indirectly works to improve communities by providing them with fresh, accessible, and affordable food. While some participants garden to increase their food security, the dominant narrative of community gardening in Denver is comprised of stories of countless other benefits that improve the wellbeing of gardeners.

CHAPTER SIX: CONCLUSION

Through this study I aimed to answer the following research questions: Why do individuals participate in community gardening in Denver? How do community gardens affect food security in Denver? How do the socioeconomic status and demographic profile of gardeners compare to that of residents in neighborhoods around gardens? How does garden location affect accessibility to community gardens? Each research question played an integral role in revealing a comprehensive story of community gardens' relationship with food security in Denver.

As a topic of research, community gardens and food security in Denver were previously unstudied in an intentional and systematic manner. However, one way that DUG promotes community gardens is by saying that the gardens have "[led] to tangible, positive change in community health and food security" (DUG 2015). Based on my results, I believe DUG is correct in making this statement, although they may have been relying upon evidence that did not result from a methodical study like this one. DUG can use my results to further support community gardening as a model for healthy living.

Community gardens are dynamic, complex, and multi-dimensional features in an urban landscape. They improve economic development and address not only social issues, but also increase a community's capacity to successfully address local problems. (Meenar and Hoover 2012). For example, community gardens increase local residents'

awareness of food security issues. As residents become more aware of food insecurity and the benefits associated with community gardens, they work to change the local food system (Meenar and Hoover). My study affirms that community gardens have the potential to increase food security, and subsequently decrease hunger for those who are food insecure.

In order to overcome the range of challenges associated with community gardening that emerged from my research, garden organizers and DUG should continue to collaborate with the City of Denver and the Denver community at large. Denver is well-positioned to successfully address the challenges of gardening; the Denver Sustainable Food Policy Council (DSFPC) is working to increase Denver residents' access to food through initiatives that directly connect citizens to Denver's local foodscape. Members of the DSFPC should emphasize the potential of community gardens to address food security, social, and environmental issues in Denver.

While community food security efforts contribute to increased community food security, they are not replacements for "a nonretractable governmental safety net" that protects against insecurity (Allen 1999, 117). Policymakers in the City and County of Denver play integral roles in protecting Denver residents against food insecurity and hunger. Community food security advocates should continue to work to create effective policies that coordinate with those who desire local food, and/or community gardens. Doing so will promote the effectiveness of community gardens and increase the diversity and number of people who have the ability to increase their food security through gardening. Eliminating hunger at a local level is impossible if there are no local

initiatives that incorporate place-specific characteristics. Community gardens are just one aspect of a sustainable, productive, and just food system. Knowledge of how each facet of the local food system impacts food security must exist in order to tackle the complicated and diverse challenge of decreasing hunger and increasing food security.

Ultimately, improved food security is one of the many emotional, spiritual, social, and health-related benefits that community garden members receive. While food security is not the primary benefit for gardeners in Denver, community gardens do effectively address food insecurity concerns for a minority of participants. The community-related benefits of community gardens are equally as important to that of food security.

REFERENCES

ACGA. Growing Community across the U.S. and Canada. In ACGA [database online]. College Park, GA, 2014 Available from https://communitygarden.org/mission/ (last accessed 17 January 2016).

Alaimo, K., E. Packnett, R. Miles, and D. Kruger. 2008. Fruit and vegetable intake among urban community gardeners. *Journal of Nutrition Education and Behavior* 40:94-101.

Alkon, A. H., & Agyeman, J. 2011. Introduction: The Food Movement as Polyculture. In *Cultivating Food Justice: Race, Class, and Sustainability,* ed. Alkon, A.H., & Agyeman, J., 1-20. Cambridge: MIT Press.

Allen, P. 2010. Realizing justice in local food systems. *Cambridge Journal of Regions, Economy and Society* 3:295-308.

———2008. Mining for justice in the food system: Perceptions, practices, and possibilities. *Agriculture and Human Values* 25:157-161.

———1999. Reweaving the food security safety net: Mediating entitlement and entrepreneurship. *Agriculture and Human Values* 16:117-129.

Anderson, M. D. 2008. Rights-based food systems and the goals of food systems reform. *Agriculture and Human Values* 25:593-608.

Anderson, M., and J. Cook. 1999. Community food security: Practice in need of theory? *Agriculture and Human Values* 16:141-150.

Armstrong, D. 2000. A survey of community gardens in upstate New York: Implications for health promotion and community development. *Health & Place* 6:319-337.

Austin, E. N., Y. A. M. Johnston, and L. L. Morgan. 2006. Community gardening in a senior center: A therapeutic intervention to improve the health of older adults. *Therapeutic Recreation Journal* 40:48-56.

Barker, D. 2007. *The Rise and Predictable Fall of Globalized Industrial Agriculture.* San Francisco: International Forum on Globalization.

Beilin, R., and A. Hunter. 2014. Co-constructing the sustainable city: How indicators help us "grow" more than just food in community gardens. *Local Environment: The International Journal of Justice and Sustainability* 16:523-538.

Bellows, A. C., and M. W. Hamm. 2002. U.S. - based community food security: Influences, practice, debate. *Journal for the Study of Food and Society* 6:31-44.

Bellows, A. C., K. Brown, and J. Smit. 2003. Health benefits of urban agriculture. *Community Food* 1-8.

Berkowitz, S. 1997. Chapter 4: Analyzing Qualitative Data. In *User-Friendly Handbook for Mixed Method Evaluations*, ed. J. Frechtling and L. Sharp Westat, National Science Foundation.

Birky, J. 2009. The modern community garden movement in the United States: Its roots, its current condition and its prospects for the future. Master's thesis, University of South Florida.

Blaine, T. W., P. S. Grewal, A. Dawes, and D. Snider. 2010. Profiling community gardeners. *Journal of Extension* 48:1-12.

Born, B., and M. Purcell. 2006. Avoiding the local trap: Scale and food systems in planning research. *Journal of Planning Education and Research* 26:195.

Bosco, F. J., and T. Herman. 2010. Focus Groups as Collaborative Research Performances. In *The SAGE Handbook of Qualitative Geography*, ed. D. DeLyser, S. Herbert, S. Aitken and M. Crang, 193-207. London: SAGE Publications Ltd.

Buckingham, S. 2005. Women (re)construct the plot: The regen(d)eration of urban food growing. *Area* 37:171-179.

Castro, D., M. Samuels, and A. Harman. 2013. Growing healthy kids: A community garden-based obesity prevention program. *Journal of Preventative Medicine* 44:S193-S199.

City and County of Denver. Fresh Produce and Cottage Foods Sales Home Occupation. In City and County of Denver [database online]. Denver, 2014 Available from denverext.colostate.edu/pdf/Handout_Residential_Sales_English.pdf (last accessed 23 February 2015).

Coleman-Jensen, A., C. Gregory and M. Rabbitt. U.S. Household food security survey module: Three-stage design, with screeners. In Economic Research Service, USDA [database online]. 2012 Available from http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/survey-tools.aspx (last accessed 06 April 2015).

Colorado Office of Economic Security. 2012. *The Refugee Integration Survey and Evaluation (RISE) year five: Final report. A study of refugee integration in Colorado.* Denver: Colorado Department of Human Services.

Comstock, N., M. L. Dickinson, J. A. Marshall, M. Soobader, M. S. Turbin, M. Buchenau, and J. S. Litt. 2010. Neighborhood attachment and its correlates: Exploring neighborhood conditions, collective efficacy, and gardening. *Journal of Environmental Psychology* 30:435-442.

Cope, M., and S. Elwood. 2009. Introduction: Qualitative GIS: Forging mixed methods through representations, analytical innovations, and conceptual engagements. In *Qualitative GIS,* ed. Anonymous 1-12. London: Sage.

Corrigan, M. P. 2011. Growing what you eat: Developing community gardens in Baltimore, Maryland. *Applied Geography* 31:1232-1241.

Cummins, S., and S. Macintyre. 2002. "Food deserts" - evidence and assumption in health policy making. *BMJ* 325:436-438.

Daponte, B., G. Lewis, S. Sanders, and L. Taylor. 1998. Food pantry use among low income households in Allegheny County, Pennsylvania. *Journal of Nutrition Education* 30:50-57.

Das, R. J. 2002. The green revolution and poverty: A theoretical and empirical examination of the relation between technology and society. *Geoforum* 33:55-72.

Denver Office of Community Support. 2014. *Denver immigrant community & neighborhood assessment.* Denver: Denver Office of Community Support.

Denver Urban Gardens. 2012. Growing community gardens: A Denver Urban Gardens' best practices handbook for creating and sustaining community gardens.

———Mission and History. 2010 Available from dug.org/mission-and-history/ (last accessed 14 February 2015).

Dimitri, C., A. B. Effland, and N. C. Conklin. 2005. *The 20th century transformation of US agriculture and farm policy.* Washington, DC, USA: US Department of Agriculture, Economic Research Service.

Drake, L. 2014. Governmentality in urban food production? Following "community" from intentions to outcomes. *Urban Geography* 35:177-196.

Drake, L., and L. J. Lawson. 2015. Results of a US and Canada community garden survey: Shared challenges in garden management amid diverse geographical and organizational contexts. *Agriculture and Human Values* 32:241-254.

———2014. Validating verdancy or vacancy? The relationship of community gardens and vacant lands in the U.S. *Cities* 40:133-142.

Draper, C., and D. Freedman. 2010. Review and analysis of the benefits, purposes, and motivations associated with community gardening in the United States. *Journal of Community Practice* 18:458-492.

Dyment, J. E., and A. C. Bell. 2007. Grounds for movement: Green school grounds as sites for promoting physical activity. *Health Education Research* 23:952-962.

Eisenhauer, E. 2001. In poor health: Supermarket redlining and urban nutrition. *GeoJournal* 53:125-133.

Emerson, B. n.d. *From neglected parcels to community gardens: A handbook.* Utah: Wasatch Community Gardens.

Environmental Systems Research Institute, Inc. How kernel density works. 2016 Available from http://webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=How%20Kernel%20Density%20works (last accessed 20 February 2016).

Ewing, R., and S. Handy. 2009. Measuring the unmeasurable: Urban design qualities related to walkability. *Journal of Urban Design* 14:65-84.

Falcon, W. P. 1970. The green revolution: Generations of problems. *American Journal of Agricultural Economics* 52:698-710.

FAO, IFAD, and WFP. 2015. *The state of food insecurity in the world 2015. Meeting the 2015 international hunger targets: taking stock of uneven progress.* Rome: Food and Agriculture Organization of the United Nations.

Ferris, J., C. Norman, and J. Sempik. 2001. People, land and sustainability: Community gardens and the social dimension of sustainable development. *Social Policy and Administration* 35:559-568.

Fuller, R. A., K. N. Irvine, P. Devine-Wright, P. H. Warren, and K. J. Gaston. 2007. Psychological benefits of greenspace increase with biodiversity. *Biology Letters* 3:390-394.

Ghose, R., and M. Pettygrove. 2014. Urban Community Gardens as Spaces of Citizenship. *Antipode* 46:1092-1112.

Glover, T. D. 2004. Social capital in the lived experiences of community gardeners. *Leisure Sciences* 26:143-162.

Glover, T. D., and D. C. Parry. 2005. Building relationships, accessing resources: Mobilizing social capital in community garden contexts. *Journal of Leisure Research* 37:450-474.

Glover, T. D., K. J. Shinew, and D. C. Parry. 2007. Association, sociability, and civic culture: The democratic effect of community gardening. *Leisure Sciences* 27:75-92.

Gottlieb, R., and A. Fisher. 1996. "First Feed the Face": Environmental justice and community food security. *Antipode* 28:193-203.

Greig-Smith, P. 1952. The use of random and contiguous quadrats in the study of the structure of plant communities. *Annals of Botany* 16:193-316.

Grewal, S., and P. Grewal. 2011. Can cities become self-reliant in food? *Cities* 29:1-11.

Hale, J., C. Knapp, L. Bardwell, M. Buchenau, J. Marshall, F. Sancar, and J. S. Litt. 2011. Connecting food environments and health through the relational nature of aesthetics: Gaining insight through the community gardening experience. *Social Science & Medicine* 72:1853-1863.

Hamelin, A., J. Habicht, and M. Beaudry. 1999. Food Insecurity: Consequences for the household and broader social implications. *The Journal of Nutrition* 129:525S-528S.

Hanna, A. K., and O. Pikai. 2000. Rethinking urban poverty: A look at community gardens. *Bulletin of Science, Technology, & Society* 20:207-216.

Hansen, Y. 2008. Food and social justice in Saskatchewan: Community gardens as a local practice of food sovereignty. Master's thesis, University of Regina, UMI Dissertations Publishing.

Harris, N., F. R. Minniss, and S. Somerset. 2014. Refugees connecting with a new country through community food gardening. *International Journal of Environmental Research and Public Health* 11:9202-9216.

Hayden-Smith, R. 2007. "Soldiers of the Soil": The work of the United States School Garden Army during World War I. *Applied Environmental Education & Communication* 6:19-29.

Henderson, B. R., and K. Hartsfield. 2009. Is getting into the community garden business a good way to engage citizens in local government? *National Civic Review* 98:12-17.

Hendrickson, D., C. Smith, and N. Eikenberry. 2006. Fruit and vegetable access in four low income food deserts communities in Minnesota. *Agriculture and Human Values* 23:371-383.

Hess, D. J., and L. Winner. 2005. Case studies of community gardens and urban agriculture. Available from https://www.davidjhess.org (last accessed 28 March 2016).

Hess, D., and L. Winner. 2007. Enhancing justice and sustainability at the local level: Affordable policies for urban governments. *Local Environment* 12:379-395.

Hesterman, O. B. 2011. A Fair Food System. In *Fair food: Growing a healthy, sustainable food system for all*, 49-76. Philadelphia: Public Affairs.

Heynen, N., H. E. Kurtz, and A. Trauger. 2012. Food Justice, Hunger, and the City. *Geography Compass* 6:304-311.

Humes, K. R., N. A. Jones, and R. R. Ramirez. 2011. *Overview of race and Hispanic origin: 2010.* U.S. Census Bureau, Report Number, C2010BR-02.

Institute for Research on Poverty. How is poverty measured in the United States? [database online]. 2014 Available from https://www.irp.wisc.edu/faqs/faq2.htm#official (last accessed 05 March 2016).

Khush, G. S. 2001. Green revolution: The way forward. *Genetics* 2:815-822.

Krasny, M. E., and K. G. Tidball. 2009. Community gardens as contexts for science, stewardship, and civic action learning. *Cities and the Environment* 2:1-18.

Krebs, C. J. 2013. Chapter 6 Spatial Pattern Methods: Part two: Spatial Pattern in Animal and Plant Populations. In *Ecological Methodology*, ed. Anonymous 233-274. New York: Harper & Row.

Kumanyika, S., M. Whitt-Glover, T. Gary, T. E. Prewitt, A. Odoms-Young, J. Banks-Wallace, B. Beech, C. Hughes-Halbert, N. Karanja, K. Lancaster, and C. Samuel-Hodge. 2007. Expanding the Obesity Research Paradigm to Reach African American Communities. *Preventing Chronic Disease* 4:1-22.

Kurtz, H. E. 2001. Differentiating multiple meanings of garden and community. *Urban Geography* 22:656-670.

Kvale, S. 2007. Analyzing Interviews. In *Doing Interviews,* ed. S. Kvale, 102-120. London: SAGE Publications, Ltd.

Lang, T., and G. Rayner. Why health is the key to the future of food and farming. In UK Public Health Association [database online]. 2002 Available from https://www.iatp.org/files/Why_Health_is_the_Key_to_the_Future_of_Food_an.htm (last accessed 10 January 2015).

Langer, E., and J. Rodin. 1976. The effects of choice and enhanced personal responsibility for the aged: A field experiment in an institutional setting. *Journal of Personality and Social Psychology* 34:191-198.

Lanier, J., J. Schumacher, and K. Calvert. 2015. Cultivating community collaboration and community health through community gardens. *Journal of Community Practice* 23:492-507.

Larvey, J., and J. Hill. What is walkability? In Community Builders [database online]. 2014 Available from https://www.communitybuilders.org/walkability/ (last accessed 05 May 2015).

Lawson, L. 2007. Cultural geographies in practice: The south central farm: Dilemmas in practicing the public. *Cultural Geographies* 14:611-616.

———2005. *City Bountiful: A Century of Community Gardening in America.* London: University of California Press.

——— 2000. Urban-garden programs in the United States: Values, resources and role in community development. Master's thesis, University of California, Berkeley.

Lineberger, S. E., and J. M. Zajicek. 2000. School gardens: Can a hands-on tool affect students' attitudes and behaviors regarding fruit and vegetables? *HortTechnology* 10:593-597.

Litt, J., M. Soobader, M. S. Turbin, J. W. Hale, M. Buchenau, and J. A. Marshall. 2011. The influence of social investment, neighborhood aesthetics, and community garden participation on fruit and vegetable consumption. *American Journal of Public Health* 101:1466-1474.

Maller, C., M. Townsend, A. Pryor, P. Brown, and L. St Leger. 2005. Healthy nature healthy people: 'Contact with nature' as an upstream health promotion intervention for populations. *Health Promotion International* 21:45-54.

Matteson, K. C., and G. A. Langellotto. 2010. Determinates of inner city butterfly and bee species richness. *Urban Ecosystems* 13:333-347.

McCullum, C., E. Desjardines, V. Kraak, P. Ladipo, and H. Costello. 2005. Evidence-based strategies to build community food security. *Journal of the American Dietetic Association* 105:278-283.

McAleese, J. D., and L. L. Rankin. 2007. Garden-based nutrition education affects fruit and vegetable consumption in sixth-grade adolescents. *Journal of the American Dietetic Association* 107:662-665.

McWilliams, J. 2009. *Just Food: Where locavores get it wrong and how we can truly eat responsibly.* New York City: Little, Brown and Company.

Meenar, M., and B. Hoover. 2012. Community food security via urban agriculture: Understanding people, place, economy, and accessibility from a food justice perspective. *Journal of Agriculture, Food Systems, and Community Development* 3:143-160.

Milburn, L. S., and B. A. Vail. 2010. Sowing the seeds of success: Cultivating a future for community gardens. *Landscape Journal* 29:71-89.

Morris, J., M. Briggs, and S. Zidenberg-Cherr. 2000. School-based gardens can teach kids healthier eating habits. *California Agriculture* 54:40-46.

National Center for Higher Education Management Systems. The impact of state higher education inequality: Colorado state profile. In National Center for Higher Education Management Systems [database online]. 2000 Available from http://www.higheredinfo.org/analyses/Colorado_State_Profile.pdf (last accessed 01 April 2016).

National Center for Education Statistics. In Educational attainment [database online]. 2014 Available from https://nces.ed.gov/fastfacts/display.asp?id=27 (last accessed 18 April 2016).

Nord, M., A. Coleman-Jensen, M. Andrews, and S. Carlson. 2009. *Household food security in the United States, 2009.* USDA, Report Number, 108.

Ohmer, M. L., P. Meadowcroft, K. Freed, and E. Lewis. 2009. Community gardening and community development: Individual, social and community benefits of a community conservation program. *Journal of Community Practice* 17:377-399.

Padgitt, M., D. Newton, R. Penn, and C. Sandretto. 1998. Production practices for major crops in US agriculture, 1990-97. USDA, Statistical Bulletin Number, SB-969.

Parry, D. C., T. D. Glover, and K. J. Shinew. 2006. 'Mary, mary quite contrary, how does your garden grow?' Examining gender roles and relations in community gardens. *Leisure Studies* 24:177-192.

Patel, I. C. 1991. Gardening's socioeconomic impacts. *Journal of Extension* 29:7-8.

Pickett, S. T., M. L. Cadenasso, J. M. Grove, C. H. Nilon, R. V. Pouyat, W. C. Zipperer, and R. Costanza. 2001. Urban ecological systems: Linking terrestrial ecological, physical, and socioeconomic components of metropolitan areas. *Annual Review of Ecological Systems* 32:127-157.

Powell, L., S. Slater, D. Mirtcheva, Y. Bao, and F. Chaloupka. 2007. Food store availability and neighborhood characteristics in the United States. *Preventative Medicine* 44:189-195.

Produce for Pantries. Local Food for Local Need. In Produce for Pantries [database online]. 2016 Available from https://www.produceforpantries.com (last accessed 15 February 2016).

Qualtrics LLC. In Qualtrics LLC [database online]. 2016 Available from https://www.qualtrics.com (last accessed 12 April 2016).

Raja, S., C. Ma, and P. Yadav. 2008. Beyond food deserts: Measuring and mapping racial disparities in neighborhood food environments. *Journal of Planning Education and Research* 27:469-482.

Reeves, J., Z. Cheng, J. Kovach, M. D. Kleinhenz, and P. S. Grewal. 2014. Quantifying soil health and tomato crop productivity in urban community and market gardens. *Urban Ecosystems* 17:221-238.

Rose, D. 1999. Economic determinants and dietary consequences of food insecurity in the United States. *The Journal of Nutrition* 129:517S-520S.

Saelens, B., J. Sallis, and L. Frank. 2003. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. *Annals of Behavioral Medicine* 25:80-91.

Saldivar-Tanaka, L., and M. E. Krasny. 2004. Culturing community development, neighborhood open space, and civic agriculture: The case of Latino community gardens in New York City. *Agriculture and Human Values* 21:399-412.

Schlossberg, M., and N. Brown. 2004. Comparing transit-oriented development sites by walkability indicators. *Transportation Research Record: Journal of the Transportation Research Board* 1887:34-42.

Schmelzkopf, K. 2002. Incommensurability, land use, and the right to space: Community gardens in New York City. *Urban Geography* 23:323-343.

———1995. Urban Community Gardens as Contested Space. *Geographical Review* 85:364-381.

Singer, A. 2004. *The rise of new immigrant gateways.* Washington D.C.: The Brookings Institution Center on Urban and Metropolitan Policy.

Skorov, G. 1973. The green revolution and social progress. *World Development* 1:13-21.

Slocum, R. 2007. Whiteness, space and alternative food practice. *Geoforum* 38:520-533.

———2006. Anti-racist practice and the work of community food organizations. *Antipode* 38:327-349.

Speer, P. W., and J. Hughey. 1995. Community organizing: An ecological route to empowerment and power. *American Journal of Community Psychology* 23:729-748.

Staeheli, L. A., D. Mitchell, and K. Gibson. 2002. Conflicting rights to the city in New York's community gardens. *GeoJournal* 58:197-205.

Teig, E., J. Amulya, L. Bardwell, M. Buchenau, J. A. Marshall, and J. S. Litt. 2009. Collective efficacy in Denver, Colorado: Strengthening neighborhoods and health through community gardens. *Health & Place* 15:1115.

Thone, D. F. 1943. Victory Gardens. *Science News-Letter* 43:186-188.

Twiss, J., J. Dickinson, S. Duma, T. Kleinman, H. Paulson, and L. Rilveria. 2003. Community gardens: Lessons learned from California Healthy Cities and Communities. *American Journal of Public Health* 93:1435-1438.

U.S. Census Bureau. Quick Facts. 2015 Available from census.gov/quickfacts/table/RHI105210/08031 (last accessed 01 March 2015).

———State & County Quick Facts. In United States Census Bureau [database online]. 2013 Available from quickfacts.census.gov (last accessed 21 February 2015).

USDA. Food Access Research Atlas. In USDA [database online]. 2015 Available from https://www.ers.usda.gov/data-products/food-access-research-atlas/go-to-the-atlas.aspx (last accessed 11 January 2016).

———2009. *Access to affordable and nutritious food: measuring and understanding food deserts and their consequences.* USDA.

Wakefield, S., F. Yeudall, C. Taron, J. Reynolds, and A. Skinner. 2007. Growing urban health: Community gardening in South-East Toronto. *Health Promotion International* 22:92.

Wang, H., F. Qiu, and B. Swallow. 2014. Can community gardens and farmers' markets relieve food desert problems? A study of Edmonton, Canada. *Applied Geography* 55:127-137.

Wen Li, W., D. Hodgetts, and E. Ho. 2010. Gardens, transitions and identity reconstruction among older Chinese immigrants to New Zealand. *Journal of Health Psychology* 15:786-796.

Winne, M., H. Joseph, and A. Fisher. 1997. *Community food security: A guide to concept, design and implementation.* Medford, MA: Tufts University.

APPENDIX A: Summary of Previous Research and Findings Regarding Community Gardens in Denver.

Author & Year	Topic	Methods	Findings
Teig et al. 2009.	Do community gardens promote stronger social neighborhood relationships and improved health?	Interviews with 67 individuals at 29 gardens.	Gardens serve as a place for improved social relationships in neighborhoods and also help promote other positive social dynamics within the area. Gardening has the potential to improve health both mental and physical.
Comstock et al. 2010.	How does community gardening and collective efficacy affect neighborhood attachment?	Population-based survey with 410 respondents from 45 block groups.	Length of time that one has resided in the area, home gardening, community gardening, and collective efficacy promote neighborhood attachment.
Hale et al. 2011.	How do people experience and respond to the experiences of community gardening in regards to emotions, values, and health.	67 interviews at 28 gardens	Gardeners experience nature through gardening. The act of gardening promotes improved social and physical interactions which in turn promote positive health
Litt et al. 2011.	What is the relationship between fruit and vegetable consumption and social processes and garden participation?	Population-based survey with 436 respondents from 58 block groups.	Community gardeners consumed more fruits and vegetables when compared to non-gardeners and home gardeners. Social involvement in gardening activities affects one's relationship to food.

APPENDIX B: Survey Questionnaire with Respondent Counts (*n*) for Multiple Choice Answer Options, the Associated Research Question (RQ), and the Type of Data Collected from Each Question

Survey Question	*n*	RQ	Data
2. How long have you been gardening at this community garden? A. Less than a year B. Number of years:	 57 3[12]	NA	Behavior
7. How do you normally travel to and from your community garden? A. Drive B. Public transportation (bus, light rail, etc) C. Bike D. Walk E. Other (please indicate)	 74 5 20 95 9	4	Behavior
8. Approximately how far do you travel from your home to reach your community garden? A. Less than one mile B. 1-2 miles C. 3-5 miles D. 6-10 miles E. More than 10 miles	 115 52 21 12 3	4	Behavior

[12] Represents the calculated median number of years for respondents who have been gardening at their community garden for more than one year.

9. Approximately how long does it take to travel from your home to reach this garden? A. Less than one minute B. 1-5 minutes C. 6-15 minutes D. 16-30 minutes E. 31-60 minutes F. More than 60 minutes (one hour)	 15 84 75 23 5 1	4	Behavior
10. How often do you garden at your community garden? A. Daily. B. 4-5 times a week C. 2-3 times a week D. Once a week E. Twice a month F. Less than twice a month	 19 65 84 30 4 1	4	Behavior
11. Do you have a fruit or vegetable garden at your home? A. Yes B. No, because I do not have a yard. C. No.	 73 81 49		Behavior
12. How much of the produce that you grow at your community garden do you donate? A. None. I do not have extra produce to donate B. All C. Most D. Half E. Less than half F. None	 71 6 4 22 76 24	2	Behavior
13. (*If you donate produce*) Please estimate how many pounds of produce you donate in a year.	20[13]	2	Behavior

[13] Represents the calculated median.

14. Please list the fruits and vegetables that you grow at your community garden.		2	Behavior
15. Where do you most often purchase your food (Indicate all that apply) A. Albertsons B. Target C. King Soopers D. Trader Joe's E. Safeway F. Wal-Mart G. Sam's Club H. Costco I. Sprouts J. Whole Foods K. Other (please indicate)	 12 12 114 45 53 13 4 42 78 60 39		
16. Indicate the response that best fits your opinion for each statement: 1) Community gardening is more affordable than purchasing food at a store. *A. Strongly Agree* *B. Agree* *C. Disagree* *D. Strongly Disagree* *E. Don't know* 2) Gardening allows me to get fresh produce that I could otherwise not get. *A. Strongly Agree* *B. Agree* *C. Disagree* *D. Strongly Disagree* *E. Don't know* 3) I save money by community gardening. *A. Strongly Agree* *B. Agree* *C. Disagree* *D. Strongly Disagree* *E. Don't know*	 66 98 20 5 14 54 67 68 13 1 45 95 37 6 20	 2 2 2	Perception

4) This garden is easy to get to. *A. Strongly Agree* *B. Agree* *C. Disagree* *D. Strongly Disagree* *E. Don't know* 5) Most people that garden at my community garden are people from the neighborhood around the community garden. *A. Strongly Agree* *B. Agree* *C. Disagree* *D. Strongly Disagree* *E. Don't know*	 112 82 14 4 34 69 82 14 4 34	4 3	Perception
17. Please tell me how often each statement has been true for your household in the past 12 months[14]: 1) We could not afford enough food to eat. *A. Always* *B. Often* *C. Sometimes* *D. Never* *E. Don't know* 2) We could not afford the kinds of food we wanted to eat. *A. Always* *B. Often* *C. Sometimes* *D. Never* *E. Don't know* 3) We could not afford to eat healthier meals. *A. Always* *B. Often* *C. Sometimes* *D. Never* *E. Don't know*	 3 1 16 181 2 5 9 49 138 2 3 9 37 153 1	 2	Behavior

[14] The design of these questions is based on the USDA's Food Security Survey Module (Coleman-Jensen, Gregory, and Rabbitt 2012).

18. Please check all benefits you receive from participating in community gardening. A. I get to grow my own food. B. I have more access to fresh food C. I enjoy gardening D. Improved diet/nutrition E. Increased physical activity F. Education about gardening G. I save money H. I get outside I. Increased community involvement J. I spend time with family or friends K. It adds beauty to the neighborhood L. Other (please indicate)	189 120 199 108 148 132 95 181 143 112 142 45	1 & 2	Perception
19. Out of the benefits that you listed in the previous question, which is most important to you, and why?		1 & 2	Perception
20. Please check all challenges that you have experienced (at any point) in your time at this community garden. A. Bad weather B. Too time consuming C. I feel unsafe at the garden D. It is hard to get to the garden E. There's nobody to watch my kids F. Negative experiences with other gardeners G. Other (please indicate)	160 53 9 7 3 32 86	1, 2, 4	Perception
21. What do you like least about gardening at your community garden?	2	1, 2, 4	Perception
22. In what year were you born? A. 1991-1997 (Age 18-24) B. 1990-1971 (Age 25-44) C. 1970-1951 (Age 45-64) D. 1950-1931(Age 65-84) E. <1930 (Age >85) F. Unknown	5 96 60 37 1 1	3	Demographic

23. What is your gender? A. Male B. Female C. No Answer	59 143 1	3	Demographic
24. Are you of Hispanic or Latino ethnicity? (Note: Hispanic or Latino origin is independent of race and is termed "ethnicity" by the U.S. Census Bureau) A. Yes B. No C. Unsure D. I'd rather not say	17 180 1 5	3	Demographic
25. What is your race? A. Black or African American B. White C. Asian D. Native Hawaiian or Pacific Islander E. American Indian or Alaska Native F. Other (please indicate) G. I'd rather not say	6 179 1 1 0 10 6	3	Demographic
26. What is your yearly household income before taxes are removed? A. Under $35,000 B. $35,000-$54,999 C. $55,000-$74,999 D. $75,000-$99,999 E. $100,000-$124,999 F. $125,000-$149,999 G. $150,000 or more H. I'd rather not say	38 38 21 36 23 7 19 21	3	Demographic
27. Including you, how many people currently live in your home? A. Just me B. Two C. Three D. Four E. Five F. More than five G. I'd rather not say	44 106 20 23 5 2 3	3	Demographic

28. What is the highest level of education you have completed? A. Some high school B. High school graduate/GED C. Some college, no degree D. Associate Degree E. Bachelor's degree F. Beyond undergraduate college G. I'd rather not say	 1 9 15 11 68 96 3	3	Demographic

APPENDIX C: Recruitment Script Email

Dear Garden Leader,

My name is Grace Kellner and I am a master's student at the University of Denver. I am researching community gardens in Denver as part of my thesis, and I am contacting you to ask for your permission and assistance in distributing a survey to the members of your community garden. The goal of this study is to better understand the degree that community gardening in Denver affects (or doesn't affect) food security – something that has not been researched before in Denver.

I am requesting that you **forward a brief message from me about the questionnaire, and a link to the online questionnaire** to the gardeners at your community garden. Please note that there is a Spanish option for the survey so that native speakers are not excluded.

I have attached a copy of my survey and cover letter which has a little more information about the questionnaire and confidentiality.

If you have any questions, concerns, or want to know more about this research, please contact me at gckellner@gmail.com. Additionally, **please let me know as soon as possible if you are not interested** in having your community garden participate in this research.

Thank you so much for your assistance!

Grace Kellner
Department of Geography and the Environment
University of Denver
Denver, Colorado

APPENDIX D: Informed Consent Form

Approval Date: 8/10/2015 **Valid for Use Through:** 1/29/2019

Project Title: Growing food security: The contributions of community gardens towards gardeners and food security in Denver, Colorado
Principal Investigator: Grace Kellner
Faculty Sponsor: Dr. Rebecca Powell
DU IRB Protocol #: 757235-1

You are being asked to be in a research study. This form provides you with information about the study. Please read the information below and ask questions about anything you don't understand before deciding whether or not to take part.

Invitation to Participate
You are invited to participate in a research study about community gardens and why you garden and whether your participation in community gardens improves food security for yourself or members of the community. Knowing whether community gardens improve or could potentially improve food security in Denver could help the city to fight food insecurity, and subsequently, hunger here in Denver.

If you agree to be part of the research study, you will be asked to participate in a group interview. This will take about 30 minutes to an hour.

Possible Discomfort
The researchers have taken steps to minimize the risks of this study. Even so, you may still experience some discomfort related to your participation, even when the researchers are careful to avoid them. Potential discomfort may include discussing food insecurity or hunger.

Possible Benefits
By doing this research I hope to learn about your experiences with community gardening, background about this garden, and if this garden contributes to food security, and if so, how it does. If you agree to take part in this study, there will be no direct benefit to you. However, information gathered in this study may help inform policies that the Denver Sustainable Food Policy Council suggests to the City Council which could benefit community gardens.

Confidentiality
To keep your information safe, the researcher will not attach your name to any quotes or information that you provide. The researcher will keep all data on a password-protected computer. Myself (Grace Kellner) will be the only one who has access to the audio recording (if you agree to be recorded), and after the completion of the research, I will erase the recordings.

The results from the research may be shared at a meeting. The results from the research may be in published articles. Your individual identity will be kept private when information is presented or published.

Who Will See My Research Information?
Although we will do everything we can to keep your records a secret, confidentiality cannot be guaranteed. Both the records that identify you and the consent form signed by you may be looked at by others such as federal agencies that monitor human subject research or the Human Subject Research Committee

All of these people are required to keep your identity confidential. Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

Voluntary Nature of the Study
Participating in this study is completely voluntary. Even if you decide to participate now, you may change your mind and stop at any time. You may choose not to continue with the interview at any time for any reason.

If you have questions about this research study, you may contact Grace Kellner at grace.kellner@du.edu.

If you have any concerns or complaints about how you were treated during research participation, you may contact the Chair of the Institutional Review Board for the Protection of Human Subjects, at 303-871-4015 or by emailing IRBChair@du.edu, or you may contact the Office for Research Compliance by emailing IRBAdmin@du.edu, calling 303-871-4050 or write to the University of Denver, Office of Research and Sponsored Programs, 2199 S. University Blvd., Denver, CO 80208-2121.

You should receive a copy of this form for your records. Please sign the next page if you understand and agree to the above. If you do not understand any part of the above statement, please ask the researcher any questions you have.

Agreement To Be In This Study

I have read this paper about the study or it was read to me. I understand the possible risks and benefits of this study. I know that being in this study is voluntary. If I choose to be in this study I will get a copy of this consent form.

Please initial in the appropriate boxes:

☐ I agree to be interviewed for research purposes.

☐ I agree to be audiotaped for research purposes.

Signature: _____ Date _____

Print Name: _____

By continuing with this research, you are consenting to participate in this study.

APPENDIX E: Interview Questions and Associated Research Question

Interview Question	Associated Research Question
General Background	
1. Tell me what you know about the history of the garden.	
2. How long have you been part of this garden?	
3. (*If talking to leader(s)*) How long have you been a garden leader at this garden?	NA
4. What are the goals of the garden? Have these changed over the years?	
Purposes and Motivations	
5. Why did you decide to participate in the garden?	1
6. What are the benefits that you get from participating in the garden?	1, 2
7. What are the benefits that you think other gardeners get from gardening?	1, 2
Perceptions about Gardening & Contribution to Food Security	4
8. What kinds of groups of people are generally involved in the garden?	3
9. Are the gardeners from this area/neighborhood?	3
10. Do you feel that the gardeners are representative of the residents in this area in terms of their demographics?	4
11. Do you think that many people walk to get to the garden?	2 & 4
12. What are some challenges that gardeners face while gardening?	2
13. How many gardeners at this garden would you say garden to either save money, make money, or garden to improve their access to fresh foods?	2 2
14. Do you have a formal donation program?	
15. Do many of the gardeners donate on their own to charitable projects or to family members who are in need of food?	2 2
a. If so, could you estimate how much gets donated?	
16. Was your garden impacted by the weather this summer?	
Final Thoughts	
17. Do you have any questions or comments for me? Is there anything else you would like to add about the garden?	NA

APPENDIX F: Selected Survey Responses to Survey Question 19: Of the previous benefits you selected, which is most important to you and why?

Health	I believe that when you grow your own produce, it is safer to eat, is higher in vitamin content when it is freshly picked, and the exercise of being outdoors and working is very beneficial to my health.
	Increased physical activity. I would rather be in the garden than in a gym.
Social/Community Involvement	The garden is a main source of my social life, as it is very fun and such a positive experience and stress relieving activity.
	Increased community involvement, this neighborhood is our family away from family
	Being part of my community is important to me, as I want to learn from others and believe in community
	Increased Community Involvement. This is a Fundamental root to the development of strong a community and blossoms fruit like more interactions between people, aesthetics, shared meals, and longevity. And soon an entire neighborhood is transformed.
Emotional/Spiritual Benefits	Gardening nurtures my soul.
	There is an exciting feeling of empowerment, capability and self-sufficiency about gardening and growing one's own food.
	I enjoy gardening because it is a quiet, relaxing retreat from the city, it gives me a sense of accomplishment and pride, and it provides my family with fresh, healthy, and low cost food.

Emotional/Spiritual Benefits	There are few activities that are more relaxing and grounding (literally and figuratively) than gardening.
	Growing my own food gives me a sense of accomplishment and adds to my desire to eat well.
	I like the freedom of the community garden, how I can do anything I want with my plot.
	I enjoy gardening because it is a source of stress relief and reminds me of my grandparents, who taught me to garden.
	I get to grow my own food - it gives me a sense of connectedness with the earth and with my community that I can't find anywhere else…I believe that when we understand being connected, we are better people to ourselves and each other.
Education	I get to see my children put in the time and effort that fewer and fewer children actually witness. My children are learning that it is ok to get your hands dirty.
	Learning about nature. Our culture is especially destructive and is coming into a crisis with nature. I think a major reason is because people no longer have a connection to or an understanding of nature. Because ultimately we all come from the ecosystem we are eating from. We are only as strong and healthy as the soil that creates our food.

Cost Savings	I get to grow my own fresh food and save money. I use Food Stamps, growing my own vegetables saves my family money all year long (I freeze a lot of meals and vegetables) and I have more to spend on meat and food products.
	I get delicious vegetables at a low price!
	I have access to high quality food that I could not easily afford if I didn't grow it.
Environmental Benefits	I like being self-sufficient and not supporting factory industrial farming.
	While I am fortunate enough to be able to buy year-round almost exclusively organic produce, I find growing my own food (obviously not enough to live on year round) humbling and rewarding. I am challenged and rewarded every season, and in my small way, participate in protecting the planet and helping to feed a few people and educate some about the importance of small scale sustainable food production.
	To grow my own food - so I know exactly where it came from, no chemicals were used
	I get to grow my own food. I know exactly what methods are being used to grow the food. Gardening offers organic produce at low costs.
Beautification	Adding beauty to the neighborhood because the neighborhood is gentrifying.
Being Outside	Living in an apartment complex I do not have a yard, but the community garden allows me to spend time outside and take care of my plants, which I really like doing

Giving Back	I suppose if I have to choose ONE, it would be providing food for those who need it the most.
Everything	I can't separate the benefits; the whole experience is a convergence of all of them, growing excellent produce without any harmful chemicals, being outdoors in a beautiful place, working with friends and neighbors, and on top of all that, the knowledge that we're doing something bigger, donating food.

APPENDIX G: Tables of Coded Answers to Multiple Choice Survey Questions and Interview Questions

Table 1: Survey codes of the motivations and benefits for gardening and the percent of people who mentioned each benefit for the question "Of the benefits that you listed in the previous question, which is most important to you, and why?" Some respondents indicated many benefits, while others mentioned one, so the sum of *n* does not equal the number of survey respondents (203).

Code Description	***n***
Grow own food	51
Enjoyment	48
Fresh Food	34
Outside	31
Mental Health	27
Education	26
Friends & Family	23
Community	19
Organic	18
Physical Health	16
Healthy Food	14
Save Money	14
Tastes Better	13
Donating - Giving Back	12
Friends & Family	9
Environmentally-Friendly	9
Empowerment	7
Everything is important	6
Sharing	6
Pride	5
Beautification	4
Cultural Preservation	2
Cook Food Grown	1

Table 2: Interview codes of the motivations and benefits to community gardening and the frequency counts of the codes as well as the number of interviewees who mentioned the benefit.

Code	*n* (# interviewees)
Community	22 (9)
Cultural Preservation	18 (5)
Mental Health	17 (7)
Fresh Food	13 (9)
Education	13 (2)
Save Money	8 (5)
Beautification	7 (10)
Healthy Food	7 (6)
Safety Increase	7 (3)
Sense of Ownership	6 (5)
Organic	6 (4)
Empowerment	6 (3)
Outside	4 (2)
Pride	3 (2)
Cooking	2 (2)
Enjoyment	2 (2)
Friends & Family	2 (2)
Grow Own Food	2 (2)
Physical Health	2 (2)
Sharing Food	1 (1)

Table 3: Codes counts of the challenges experienced while community gardening and the frequency count of the codes in response to the open-answer question "What do you like least about community gardening?" Some respondents indicated many benefits, while others mentioned one, so the sum of *n* does not equal the number of survey respondents (*n*=203).

Code	***n***
Theft	35
Weeds	32
Time-Consuming	28
Soil	28
Lack of Participation	24
Lack of Accessibility	20
Bad Weather	16
Pests	15
Interpersonal Conflict	15
Water	14
Trespassing	10
Lack of Community	10
Racial Conflict	9
Rules	9
No Fence	6
Feel Unsafe	2
Growing Season	1

APPENDIX H: All Plants Grown by Survey Respondents within their Community Garden, in Order of Popularity amongst Respondents

Tomatoes
Peppers
Squash (general)
Lettuce/cabbage
Beans
Carrots
Cucumbers
Beets
Kale
Basil
Eggplant
Onions
Peas
Zucchini
Chard
Herbs (not specifically listed)
Strawberries
Radish
Broccoli
Garlic
Pumpkin
Watermelon/Melons
Cauliflower
Spinach
Tomatillos
Potatoes
Corn
Flowers
Arugula
Cilantro
Chives
Collard greens/Greens
Dill
Jalapenos
Mint
Rhubarb
Leeks
Raspberries
Swiss chard
Kohlrabi
Sage
Turnip
Okra
Oregano
Asparagus
Thyme
Celery
Parsley
Bok choy
Chiles
Blackberries
Brussel sprouts
Shallots
Artichoke
Ground cherry
Mustard greens
Apples
Cantaloupe
Epazote
Plums
Grapes
Parsnip
Nasturtium
Rosemary
Horseradish
Fennel
Rutabaga
Sorrel
Shiso
Amaranth
"Berries"
Albahacar
Borage
Calendula
Caña de azucar
Catnip
Cherries
Chrysanthemum
Coriander
Curry
Echnacia
Edamame
Hops
Komatsuna
Mibuna
Paps
Peaches
Pears
Pepino
Savory
Yerbabuena
Pak choy
Lovage
Roses
Tarragon
Quinoa
Marigold
Cosmos
Radicchio
Ginger
Marjoram
Elderberries
Blueberries