The Growing Experience: Environmental and Dietary Effects of Urban Agriculture at the Carmelitos Housing Project, North Long Beach

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Abstract

Our study was done to quantify the environmental and social effects of The Growing Experience Urban Farm in North Long Beach. For the environmental effects, we first determined methods by which The Growing Experience could increase their rainwater harvesting to offset their water use and found that out of an average 1,460 gallons of rainfall only 385 gallons are currently collected from farm roofs, although a change in practices could increase the efficiency. The carbon sequestration and amount of criteria pollutants offset by the farm was then calculated using the USDA I-Tree software, where our most significant finding was the reduction of PM10. Finally we looked at the amount of food miles reduced by the Growing Experience as compared to a supermarket. After choosing an orange as the fruit of comparison, our food mile calculations found that the average supermarket orange travels 421.37 km from source to store and releases 96.345 gCO_2/kg, whereas the Growing Experience oranges is virtually 0 since it is grown on site.

We found through creating a timeline that the Growing Experience came early on in the green movement in Long Beach. By visiting local supermarkets, we created a box similar to that of The Growing Experience's and discovered the Growing Experience offers organic food more affordably. Through the surveys, we looked at a variety of factors and found that residents that do not use the farmer's market are most adversely affected by lack of nutrition.

Table of Contents

List of Figures

List of Tables

1. Introduction

The Growing Experience is an urban farm and community garden located within the Carmelitos Housing Development in North Long Beach (Eisenberg & Parsons, 2013). Carmelitos was a military housing community that was converted into affordable housing (J. Blackwell-Trotter, personal communication, January 26, 2013). Managed by the Housing Authority of the County of Los Angeles, the 7-acre site that is The Growing Experience was overgrown with weeds and was once an empty lot popular for dumping trash and disposing of drug paraphernalia ("The Growing Experience"). In an effort to clean it up, the Housing Authority established a farm and community garden in 1996 ("The Growing Experience").

The Carmelitos Housing Project is located in a food desert, which is an area with a high ratio of fast food restaurants to supermarkets (Eisenberg, Parsons, & Brian, 2013). The immediate 90805 zip code has 17 fast food restaurants compared to 5 supermarkets ("Google Maps," 2013) To provide the Carmelitos residents and the local area with affordable and nutritious fresh food, three programs have been implemented by the Growing Experience: a weekly Farmers' Market, individual garden plots, and Community Supported Agriculture (CSA) subscriptions (J. Blackwell-Trotter, personal communication, January 26, 2013). The CSA program, with about 80 subscribers and an extensive waiting list, is the most developed of the three programs, and thus the focus of this research project. For $17 per box, subscribers receive a box of fruits and vegetables from the farm weekly, bi-weekly, or monthly (J. Blackwell-Trotter, personal communication, January 26, 2013). The farm makes a conscious effort to include ethnically-appropriate crops targeted to the population of the housing project, which is 32% Latino and 56% African-American ("Resident Characteristic Report," 2011).

In consultation with our client, the Housing Authority of the County of Los Angeles, our team quantified the local impact of the CSA program in four ways. First, our team helped quantify the sustainable practices that The Growing Experience already employs, which included rainwater capture, carbon sequestration, and filtering of air pollutants by the trees on the farm. With the data we gathered, we will allow the farm to include environmental impact information in their grant applications. Second, our team traveled to local grocery stores in the Long Beach area to record prices of fruits and vegetables in an attempt to recreate CSA boxes for price comparisons to The Growing Experience. Thirdly, our team calculated the effect of the CSA program on "food miles," the distance food is transported from production to consumption. And lastly, our team assessed the social effects of the farm and the CSA program by assessing diet, food security, and food system involvement, of CSA subscribers and Carmelitos residents. Through these assessments, we hope to provide our client further data to use in guiding its growth and to include in grant proposals.

1.1. Food Systems

In the late 1800's, people migrated from rural to urban areas because of the Industrial Revolution. The formation of dense cities increased the land value of urban areas, making large scale agriculture economically impractical within city bounds (M. Kahn, personal communication, February 25, 2013). Over time, small local farmers were driven out of business because of the unprofitable nature of their practice (Hill, 2008). Agriculture then became predominantly commercialized, delocalized, and distribution-based.

Within economically disadvantaged and minority urban areas, a lack of entitlements, weak retail climate, low-wage labor, and physical infrastructure contribute to the abundance of fast food restaurants and limited availability of supermarkets (Corrigan, 2011). According to Sen (1981), the lack of food entitlement has created an uneven distribution of food and therefore food insecurity in poorer populations. According to Kwate (2008), population characteristics, concentrated poverty, economic characteristics (weak retail environment and low-wage labor), and physical infrastructure, are factors that lead to fast food density. In conjunction, these factors create food systems that promote food insecurity through the abundance of unhealthful foods and the decreased availability of healthful foods.

1.2. Food Insecurity: Causes and Dietary Effects

Low food security is characterized by "reduced quantity, variety, or desirability of diet," without reduced food intake. Very low food security is characterized by disrupted eating patterns or reduced food intake. Both are labeled food insecurity (Nord & Coleman-Jensen, 2013). The food insecure are low-income families' or households. Their diets are low in nutritional value and are greatly affected by their surroundings (Casey, Szeto, Lensing, Bogle, & Weber, 2001). Many of these families live in urban areas of commercialized food systems that can further be characterized as food deserts, areas deficient in nutritious food and abundant in fast food restaurants due to uneven food distribution (Corrigan, 2011). As a result of the food system and finances, urban low-income families suffer from food insecurity and have an increased chance of health risks associated with fast food and limited access to healthier alternatives.

Those who suffer from food insecurity often cannot afford healthy foods (Golan, Stewart, Kuchler, & Dong, 2008). From 1960 to today, it is estimated that the allocation of income spent on food has decreased from 30 percent to 10 percent as a result of other financial obligations, such as housing, medical care, and child care (Golan et al., 2008). Consequently, low-income families are more strained to afford healthy diets and have a higher chance of buying cheaper unhealthy food instead. One study showed that low-income groups' diets lacked fruits and vegetables and contained more meat, fat, and sugar when compared to higher income groups (Block, Scribner, & DeSalvo, 2004).

Urban agriculture serves to reduce food insecurity because it allows low-income households to grow their own fruits and vegetables and in turn, improve their diets and health (Armar-Klemesu). In addition, the locality of urban agriculture eliminates the obstacle of having to travel to the nearest supermarket, which could be miles away, especially in an urban setting.

1.3. Effects on Aggregate Food Costs

Since low-income groups living in food deserts lack nearby healthy food sources, transportation is needed to obtain healthy foods. In a study by Tsang et al. (2011) walking to healthy food sources was considered, but in the end limited because returning home while carrying food supplies proved to be too physically taxing. In a study by Nayga and Weinberg (1999) low-income families had to travel up to three miles to reach food sources. Traveling this distance both to and from a food source via foot is not viable because of physical and time constraints. According to Dibsdall et al. (2003), low-income groups used cars, taxis, and buses as modes of transportation to and from food sources. However, income directly affects the mode of

transportation chosen because each requires varying funds. Cars incur gas costs and taxis and buses require fares.

Urban agriculture may not necessarily reduce transportation costs because consumers may still have to travel to relatively far locations within the city to obtain the grown food. However, by eliminating middlemen, the cost of produce is driven down because fees from imports and the energy required to maintain the fruits and vegetables are not incurred (Armar-Klemesu). More importantly, should consumers take up urban agriculture or community gardening themselves, they can produce their own nutritious food which can save as much as 20 percent of income (Luc J. A. Mougeot, 2000). In addition to urban agriculture, consumers can also participate in CSA to offset costs. A study done by Conner (2003) compared organic produce prices between CSA and local stores and demonstrated that consumers spent less when involved in a CSA.

1.4. Urban Agriculture and Community Gardens

Historically, urban agriculture and community gardens supplemented food supplies during economic depressions. Urban agriculture is farmland in an urban setting, while community gardens are a single piece of land, either collectively tended by the community or consisting of individual plots owned by community members (Firth, Maye, & Pearson, 2011). Community gardens originated in England in the early 1800's as a source of food for displaced rural workers. In the United States, during the 1890's and again in the 1930's, community gardens arose on urban vacant lots, providing the poor with food and work during economic depression (Irvine, Johnson, & Peters, 1999). Victory Gardens were cultivated in urban areas in response to food shortages during World War II. These gardens alleviated government responsibility of food distribution to the poor and supplemented nearly 40% of the nation's produce (Armstrong, 2000). The number of gardens diminished after the war, but in the 1970's, a resurgence of community gardens occurred in response to urban blight (Saldivar-Tanaka & Krasny, 2004). Today, urban agriculture and community gardens are growing as a grassroots response to food insecurity (Lyson, 2004).

Urban agriculture and community gardens are also recognized for benefits besides food production. Both have been shown to improve social connectedness, foster community development, mitigate environmental pollution, alleviate food costs and insecurity, and improve dietary habits (Carney et al., 2012; Irvine et al., 1999). These benefits encourage local residents in lower income communities to participate in urban agriculture and community garden programs. People are also drawn to participate in gardens because of sustainability concerns, improvements to personal health, and adherence or maintenance of cultural traditions (Twiss et al., 2003).

1.5. Community Supported Agriculture (CSA)

Community Supported Agriculture (CSA) fosters the direct relationship between producer and consumer. There are two types of CSA: Shareholder CSA, in which a group hires the farmer, organizes subscribers, and makes most executive decisions, and Subscription CSA, in which the farmers organize subscribers and make most executive decisions. CSA started in the 1960's when women's neighborhood groups in Europe approached local farmers to sell food directly to consumers. In 1984, the concept of CSA reached the United States, and in 1986, CSA

projects delivered harvests in Massachusetts and New Hampshire. As of July, 2005, there were 1,144 CSA programs in the USDA database, showing an increase of over 25% every three years (Adam, 2006).

The goals of CSA are to foster a deeper connection to the land in urbanites, provide food for the disadvantaged, and encourage sustainability in food consumption (Adam, 2006). According to Cox et al. (2008), CSA creates a connection between people and the environment by bringing people closer to areas of food production. A study by Goland (2002) showed that people are brought to the farm as some CSAs require members to work on the field or to pick up CSA boxes from the farm. CSA also reduces costs by establishing a direct relationship between producer and consumer, reducing transportation costs, and eliminating the need for packaging and advertising. According to Cooley and Lass (1998), CSA members save money on equivalent amounts of produce purchased from supermarkets. Lastly, Brown and Miller (2008) report that CSA members are often provided with sustainable and organic food.

CSA subscribers are motivated to join by the increased access to fresh, organic, and higher quality food, the wish to support local farmers and communities, and the convenience (Cox et al., 2008; Goland, 2002; Perez, Allen, & Brown, 2003). Loyalty of subscribers is attributed to the wish to be environmentally and ecologically friendly, to support local community and farmers, and healthier lifestyle gained from CSA (Cox et al., 2008; Goland, 2002; Perez et al., 2003). However, according to Perez (2003) and Cox (2008) there is a high turnover rate of subscribers, between 50 - 60% each year, caused by lack of choice, too much food given and wasted, and failure to meet consumer expectations.

1.6. Effects on Diet and Food Preference

For both children and adults, involvement in a community garden or urban agriculture is associated with higher consumption of fruits and vegetables. One study found that frequency of adult vegetable intake of "several times a day" increased 4.7 times from 18.2% before community garden involvement to 84.8% after community garden involvement and that children's vegetable intake of "several times a day" was 24.0% before garden involvement and 64.0% after involvement (Carney et al., 2012). One study showed that urban farmers generally eat more vegetables than non-urban farmers of the same and higher wealth classes (Armar-Klemesu). Urban agriculture is associated with higher nutritional status and can be a result of more stable access to healthful food (Armar-Klemesu).

Community supported agriculture provides members with a greater variety of food and improves fruit and vegetable consumption. 74% of CSA members in Pennsylvania had increased produce variety and, 58% increased produce quantity (Brown & Miller, 2008; Oberholtzer, 2004). Another study reported that CSA shareholder participation was associated with owning a greater variety of vegetables, and eating more and fresher vegetables (Ostrom, 2007).

Involvement in community gardens, urban agriculture, and CSA leads to increased preference of eating more organic and fresher produce and to making healthier food choices overall. Interviewed gardeners from Corrigan (2011) and Hale (2011) expressed that they were not interested in purchasing grocery store produce after gardening. They felt that their own produce had better quality and integrity because they knew that their fruits and vegetables were grown organically. "As one gardener said, 'When you grow it, like you said, it's just so much better. And so you want to eat more of it" (Hale et al., 2011). CSA members are provided with sustainable and organic food (Goland, 2002), which promotes a healthy lifestyle. A study by

Ostrom (2007) reported that CSA participation led to shopping less and making healthier food choices overall. Healthier eating habits were also found in CSA members in the Central Coast of California in a study by Perez, Allen, and Brown (2003).

2. Environmental Impacts

2.1. Rainwater Harvesting

Rainwater harvesting is the process of collecting rainwater from a roof, or other surfaces, to provide an extra water source while reducing the pressure on existing water supplies. A report by Bergquist et al. (2012) lists several environmental benefits of Rainwater harvesting. Intercepting rainfall from surfaces reduces urban runoff and pollution reaching waterways through storm drains, improving water quality. Diversion of overflows from the catchment system to pervious surfaces allows rainwater to infiltrate and recharge groundwater resources, which are a major source of drinking water in California. Using rainwater for irrigation conserves drinking water supplies that are becoming increasingly limited in California. The State of California Energy Commission reports that approximately 20% of the state's energy consumption is used in the transport of water. Rainwater harvesting reduces the demand for this energy (Bergquist et al., 2012).

2.1.1. Methods

Calculations for the current rainwater storage of the 55-gallon rain barrels already in use on the farm and the potential rainwater harvesting capacity from all existing rooftops were made using methods described in "Rainwater Harvesting: System Planning" (Mechell et al., 2009). The area of roof footprint, average rainfall data for the region, and the runoff coefficient of the surface, estimates the amount of water that can be collected annually using the equation:

$$\text{Total Gallons} = \text{Catchment Area} \times \text{Annual Rainfall} \times 0.623 \times \text{Runoff Coeff.} \times \text{Safety Factor} \quad (1)$$

The rainwater harvesting equation is used to estimate the amount of water that can be collected from a surface. The catchment area is measured in square feet and average annual rainfall for the area is listed in the "Rainwater Harvesting: System Planning" manual. This is multiplied by a conversion factor of 0.623 to change feet squared to gallons. The type of roof or surface material determines the runoff coefficient. Smooth surfaces have a higher coefficient and rough, porous surfaces will have a lower coefficient. The safety factor takes into account evaporation or small leakage in the system.

The surface areas were measured during one of our site visits and 30-year historical average rainfall data for the area was obtained from the "Rainwater Harvesting: System Planning" manual. A recommended safety factor of 0.85 has been included in the equation to account for overestimation of the collection system due to small leaks and evaporation. The total amount of water the farm uses is unknown because the water use for the housing development, all irrigation systems as well as the farm's water use is connected to a single meter. Because of this, a system to supplement all of the needed water on the farm cannot be suggested. The roof areas are not very large and most likely would not provide enough water to sustain the farm even if all runoff could be captured. Recommendations for improving rainwater capture are based on the capture

efficiency model for large cisterns developed by Geosyntec Consultants (2009) and available space for installation.

2.1.2. Results

The Growing experience currently has seven 55-gallon rain barrels that collect rainwater runoff from a portion of the greenhouse roof (Figure 1). The dimensions of the roof footprint are 25ft by 9ft giving a total area of 225 ft^2. The barrels are not connected in series, so farm staff must manually remove the barrel when it is full and replace it with an empty barrel. Additionally, because barrels are manually removed, they may not be replaced as soon as they are full, failing to capture some of the rainfall from a storm. Staff reported they only fill and empty the barrels approximately once a year. The total amount of water collection under current practices is 385 gallons. The estimated runoff from this portion of this roof during an average rainfall year of 13.9 inches is 1,460 gallons.

2.1.3. Discussion

Figure 1. Red outlines show the current collection on the greenhouse roof on the left and the additional roof surface available on the green house and office on the right.

Table 1. Total area available for rainwater collection at the farm.

Length ft^2	Width ft^2	Total ft^2	**Total Greenhouse Area**
50	28	1400	**1850**
25	18	450	
			Total Office Area
62	21	1302	**1302**

Table 2. Rainwater runoff estimates using 30-year average rainfall recorded for Long Beach, CA.

Catchment Area (Ft^2)	**30-YearAvg Rainfall (in)**	**Conversion Factor**	**Runoff Coefficient**	**Safety Factor**	**Total Gallons**
Area currently collected on green house.					
225	12.9	0.623	0.95	0.85	**1,460**
Total areas of the green house and office.					
1850	12.9	0.623	0.95	0.085	**12,005**
1300	12.9	0.623	0.75	0.085	**6,660**

The existing roof surfaces of the main office and greenhouse are not currently collecting water (Figure 1). The collection area for the entire greenhouse is 1,850 ft^2 and the office is 1,300 ft^2. Table 1 shows the total area available for rainwater collection. These areas were used to estimate the amount of annual rainfall runoff from the surfaces in Table 2. The Growing Experience could collect over 12 times more water if all surfaces were collected. However, converting all the roof areas into catchment areas may be too costly for The Growing Experience at the moment, a more practical recommendation to increase rainwater harvested on site will be discussed in a later section.

2.2. Carbon Sequestration / Air Pollutant Filtering

Despite the improvement of air quality after the enactment of the Clean Air Act in the 1970s, urban populations are still affected by air pollution (Greenstone, 2004). Urban farms reduce air pollution through the presence of trees, shrubs, flowers, and ornamental plants, which aid in the removal of air pollutants by absorbing odors and pollutants through foliage and curbing erosion by blocking wind (Deelstra & Girardet, 2000). Mougeot (2005) and McPhearson (1983) estimated that larger trees in urban areas remove 60 to 70 percent more air pollution than smaller trees. We wanted to quantify these types of environmental benefits for The Growing Experience to provide them with a more accurate assessment of how beneficial their farm is to the environment.

2.2.1. Methods

To quantify environmental functions and values of the Carmelitos urban farm, we used i-Tree, a "state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools" ("i-Tree Eco. i-tree Software Suite v5.0. (n.d.)," 2013). Estimates of tree cover, criteria pollutant removal, carbon storage, carbon sequestration, oxygen production, and structural values were obtained by using field data along with local hourly air pollution and meteorological data from the Long Beach Airport weather station, the nearest station to Carmelitos.

An ESRI ArcGIS shapefile of the boundary of the 3.18-acre project area was created and 10 sample plots were randomly generated using the Google Maps Plots Generator function (Figure 5). Each sample plot had a circular area of 0.05 acres with a radius of 26'4'' covering 15.75% of the study area.

Figure 2. Ten randomly generated plot centers within Carmelitos urban farm (Google Earth 2011).

Within each plot, data was collected using paper forms (Appendix F). Data collection included land use, ground and tree cover, individual tree attributes of species, stem diameter, height, crown width, crown canopy missing and dieback, and distance and direction to the northwest corner of The Growing Experience's office building. The land use for the entire farm was recorded as agriculture; field data collectors estimated ground and tree cover and crown canopy missing and dieback in percentages; tree species were recorded at least at the genus level; stem diameter, height and crown width were measured using a tape measure; distance and direction to the building were estimated using plot center coordinates and Google Maps.

Air pollution removal is estimated based on calculated hourly tree-canopy resistance for ozone, sulfur and nitrogen dioxides based on big-leaf and multi-layer canopy deposition models ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013). Carbon monoxide and particulate matter removal is calculated by vegetation removal rates based on average measured values from the literature ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013), which were adjusted for the leaf phenology and leaf area of Carmelitos vegetation. The economic value of air pollution removal was calculated based on local incidence of adverse health effects and national median externality costs estimated by the U.S. Environmental Protection Agency. Carbon storage estimates were dependent on the measured biomass for each tree. The measurements were then used as variables in equations from the literature ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013). Annual carbon sequestration was estimated based on the average diameter growth of specified tree species, diameter class, and tree condition. Oxygen production was estimated based on the amount of carbon sequestered. Net oxygen release (kg/yr) = net carbon sequestration (kg/yr)*(32/12) ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013). Structural values, the costs of having to replace a tree with a similar tree, were determined by the Council of Tree and Landscape Appraisers who estimated values by using tree species, diameter, condition, and location information ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013).

2.2.2. Results

Total ecosystem services including pollution removal, carbon storage, and carbon sequestration was approximately $700 per year ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013).

Table 3. List of ecosystem services and estimated associated values if applicable ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013).

Urban Farm Function	Environmental Value	Economic Value
Tree cover	13.5%	N/A
Pollution removal	See Figure 6	$421/yr
Carbon storage	3,000 kg	$214
Carbon sequestration	800 kg/yr	$62/yr
Oxygen production	2,200 kg/yr	N/A
Structural values	N/A	$55,800

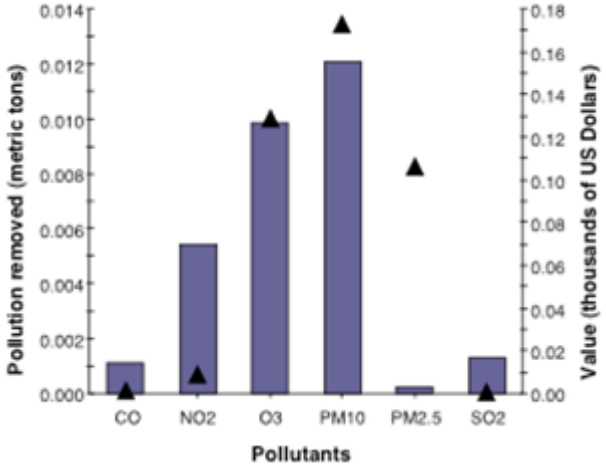

Figure 3. Pollution removal (bars) and associated economic values (point) for trees in Carmelitos Urban Farm ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013).

Although the numeric values of air pollutant removal are relatively low, as shown in Figure 6, it is important to note that even the removal of small amounts of criteria pollutants offers the greatest economic value added to the Carmelitos urban farm.

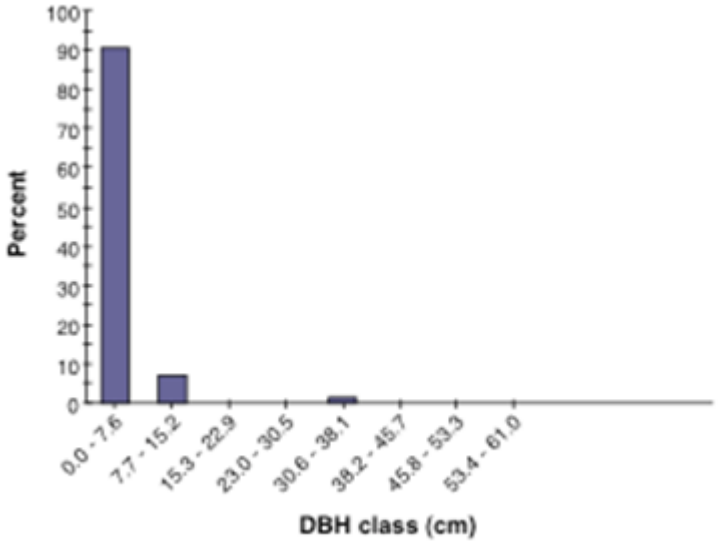

Figure 4. Percent of tree population by diameter class (DBH=stem diameter at 1.37 meter) ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013).

2.2.3. Discussion

Overall, it is clear that the presence of The Growing Experience is beneficial for the environment when compared to an empty lot. The presence of trees and shrubbery helps to remove air pollutants that can be harmful to human health and to sequester atmospheric carbon. To make better sense of the benefits provided by the Carmelitos urban farm, tree benefits were compared to estimates of average municipal carbon emissions, average passenger automobile emissions, and average household emissions. Three relative comparisons include ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013):

- Carbon storage is equivalent to:
    - Annual C emissions from 2 automobiles
    - Annual C emissions from 1 single-family house
- Sulfur dioxide removal is equivalent to:
    - Annual sulfur dioxide emissions from 2 automobiles
- Particulate matter less than 10 micron (PM_{10}) removal is equivalent to:
    - Annual PM_{10} emissions from 36 automobiles
    - Annual PM_{10} emissions from 3 single-family houses

It is important to note that there are multiple factors that can alter the results of the i-Tree analysis. Our field data was collected in April 2013 and our results are representative of the urban farm characteristics that existed only during that month. Also, due to the lack of resources and time constraints, we were only able to sample 15.75% of the farm. Because our study area is strictly used for agricultural purposes, crop rotation, resting land, and vegetation harvesting should be taken into consideration as tree species and ground cover changes are capable of altering results. Additionally, the local air pollution and meteorological data was taken from the nearest weather station to The Growing Experience and not directly at The Growing Experience,

which may affect our results as well. It is recommended to take a complete inventory analysis of the study area over a long period of time to obtain exact results.

2.3. Food Miles

"Food miles" refers to the distance that food travels from its place of original production to that of final consumption, and to the total carbon emissions from food production, transportation, and importation (Paxton & Alliance, 1994). Commercial food systems have significantly separated places of production from consumption. The result is the sacrifice of food freshness, taste, and nutrition and the increase in food miles because of the increased need to transport food over long distances (Corrigan, 2011; Hill, 2008). As food miles of a certain produce increases, so does the total carbon emissions related to transportation and storage (Hill, 2008). The average distance that conventionally grown produce travels is between 1,000 to 2,000 miles (Pirog, Pelt, Enshayan, & Cook, 2001) and 80% of fossil fuels consumed by the food industry is attributed to food transport, storage, and packaging (Horrigan, Lawrence, & Walker, 2002). One study of local food production in Iowa showed that commercialized agriculture uses 4 to 17 times more fossil fuel and emits 5 to 17 times more carbon dioxide than locally-grown food (Pirog et al., 2001).

Modern food practices are highly resource consumptive; however, urban agriculture, community gardens, and CSAs are an alternative to commercial food systems, eliminating or reducing the need for transportation and distribution practices and the associated costs. Community gardens and urban agriculture reduce transportation and distribution costs by localizing food production in areas of consumption and reducing the distance between producer and consumer (Armar-Klemesu; Corrigan, 2011). In CSAs, unpackaged food travels a maximum of 200 miles, typically travelling less. Therefore, waste associated with packaging and energy associated with transportation is eliminated or reduced (Kittredge, 1996).

2.3.1. Methods

We wanted to determine whether or not the CSA box conserves energy, aggregated in the form of food miles. To determine the energy being saved by participants in the CSA program, we used two methods: a calculation of Weighted Average Source Distances and a Weighted Average Emission Ratio. The Weighted Average Source Distances (WASD) is the average distance that food travels from production to consumption. The WASD equation allowed us to calculate the average amount of food miles each particular item travels from their origin to the supermarkets in Long Beach. The Weighted Average Emissions Ratios (WAER) equation takes into account the transportation method and value of imports and estimates the emissions. We visited grocery stores in long beach and recorded the location of origin and distributor information for produce that was available in the CSA box. We used this data in the WASD and WAER equations. The first equation, WASD, is presented below:

$$WASD = \frac{\sum(M(k) \times D(k))}{\sum M(k)} \qquad (2)$$

Where:

k = different locations of the production origin
M = amount consumed for each location of consumption
D = distances from the locations of production origin to point of consumption

In WASD calculations, the weight of produce consumed, M, is estimated by dividing the total national consumption by total population of the U.S. in 2010-2011. We therefore assumed that everyone in the U.S. eats the same amount of produce. D represents the distance from the locations of production to the City of Long Beach (""As The Crow Flies" Distance Calculator,").

The second equation, WAER, is seen below

$$WAER = \frac{\sum(V \times D \times E)}{\sum V} \quad (3)$$

Where:
V=value in $ of imports from each point of production
D =distance from each point of production to point of consumption
E = emissions of carbon dioxide for the particular mode of transportation

In WAER calculations, the variable V is used to give higher weight to locations of production that supply more goods to Long Beach. Yet, it is difficult to sort out the dollar value of import, export, and local production. Therefore, weight of produce from each point of production is used to calculate WAER in this project. Both Emission, E, (given in Table 5) and Distance, D, are estimated according to the mode of transportation.

Table 4. Carbon Dioxide Emissions of Different Modes of Transportation (Whitelegg, 1993).

	Rail	Water	Road	Air
Carbon Dioxide Emission (g/ton-km)	41	30	207	1,260

2.3.2. Results

Table 5. Sample WASD Calculation of Orange Consumed in Long Beach

County	Distance (**D**) (km)	Fraction of Orange from County (**F**)	Total Consumption (**M**) (kg/capita/week)	**D*F*M**
Kern	201.25	0.2957	0.51029	30.3673
Tulare	291.41	0.255	0.51029	37.9196
Fresno	360.64	0.194	0.51029	35.7021
Central Valley	853.30	0.255	0.51029	111.0353
Sum (**S**)				215.0244

WASD = **S/M**	**421.37 km**			

Source: Trading Data from USDA ERS (2010 – 2011), 2007 Census of Agriculture (USDA NASS)

Table 6. Sample WAER Calculation of Orange Consumed in Long Beach

County	Distance (**D**) (km)	Fraction of Orange from County (**F**)	Total Consumption (**M**) (kg/capita/week)	Emission (**E**) (g/ton-km)	**M*D*F*E**
Kern	247.94	0.2957	0.510292592	207	7744.396
Tulare	317.17	0.255	0.510292592	207	8543.226
Fresno	389.62	0.194	0.510292592	207	7984.222
Central Valley	924.14	0.255	0.510292592	207	24892.45
Sum (**S**)					49164.29
WAER = **S/M**	**96.345 gCO_2/kg Orange**				

Source: Trading Data from USDA ERS (2010 – 2011), 2007 Census of Agriculture (USDA NASS)

Table 7. Comparison of Food Mile of Produce from Different Types of Markets

	Long Beach Farmer's Market	Supermarkets	The Growing Experience
Orange	151.66 km	469.72 km	0 km
Lemon	239.09 km	557.10 km	0 km

Table 8 shows the comparison of food miles of oranges and lemons from different markets in Long Beach. When calculating food miles, we assumed that Long Beach gets an equal amount of produce from the locations of production.

2.3.3. Discussion

As shown in Table 6 and 7, food miles and its associated carbon dioxide emissions are 421.37 km and 96.34g CO_2/kg orange, respectively. Food miles for markets are higher than for local agriculture. One example is that for grocery stores, one-fourth of oranges sold in Long Beach came from the Central Valley, which is 853 km from Long Beach. Compare that to buying 1 kg of oranges from the Growing Experience and carbon dioxide emissions are reduced by 96.34 g. Another comparison of food miles of produce listed in Table 8 shows that produce from the Long Beach Farmer's Market has lower food miles. This suggests that farmer's markets in Long Beach and the Growing Experience can serve as suppliers of local or regional produce that reduce food miles.

3. Social Impacts

3.1. Timeline

3.1.1. Methods

Through an extensive online search, we were able to find websites and resources that provided historical information concerning community gardens and urban farms. We used websites hosted by the City of Long Beach, Long Beach Organic, Long Beach Community Garden, and others to find the dates that the gardens or farms were established. If the information was not already provided on the website, we used the email or phone number listed in order to attain the information needed. We categorized each site to leisure gardens, food farms, school gardens, and no longer operational leisure gardens. A leisure garden was designated as a garden that sells plots to community members, and the members decided what they would want to use it for. Food farms are places that specifically grow food for either CSA or to sell in local markets. A school garden is one that is maintained on school grounds or that is sponsored by a school. And the no longer operational label leisure gardens were given to gardens that are currently not operational.

3.1.2. Results

Through our research we found 14 operational leisure gardens, 6 food farms, 6 school gardens, and 4 no longer operational leisure gardens in Long Beach. From interviewing garden sponsors, we found gardens became non-operational due to expiration of the land lease. In the case of the Long Beach Community Garden, the garden was simply relocated. All of the food farms that were established in Long Beach are still operational today. There is also a large increase in the establishment of farms and gardens as time progresses, especially near 2009.

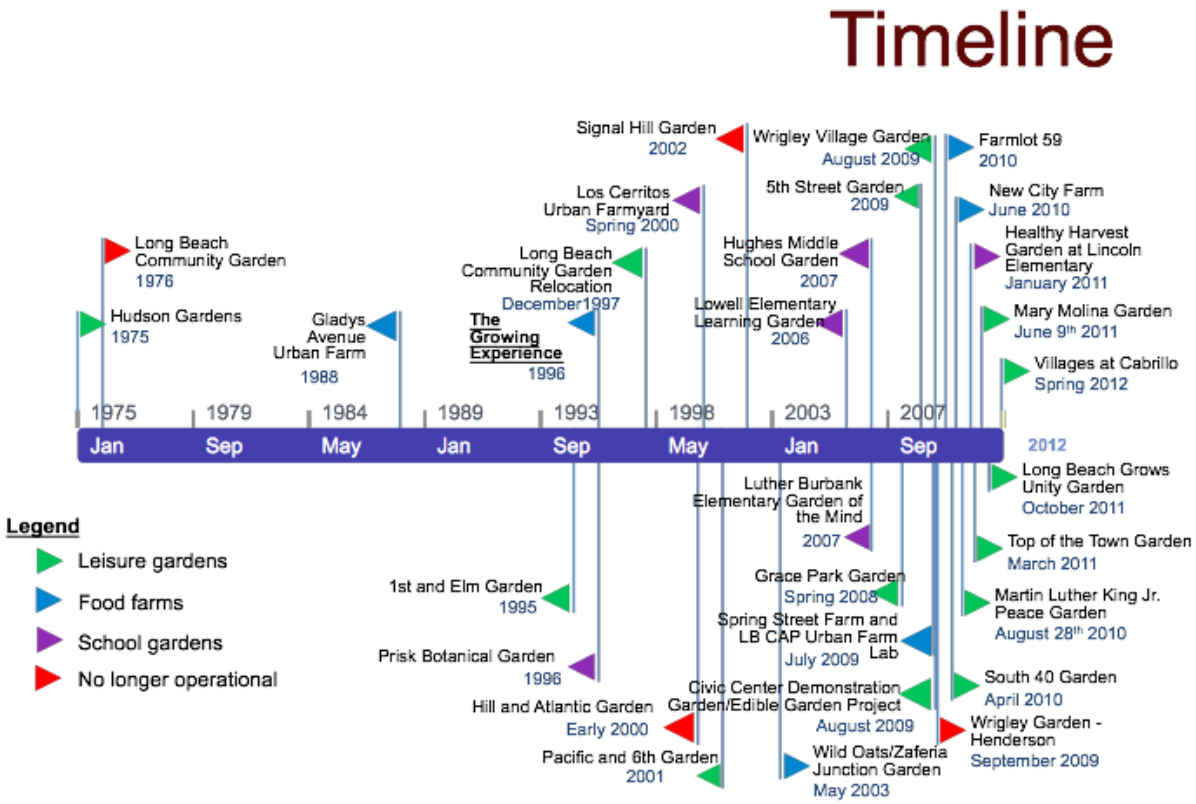

Figure 5. Timeline of Community Gardens in Long Beach

3.1.3. Discussion

The Growing Experience comes as the 5th site of urban agriculture in Long Beach and the second food farm. Although it precedes the large increase in farms and gardens, it is difficult to concretely conclude that there is a correlation between its establishment and the creation of other sites of urban agriculture. The large increase in the amount of farms after 2009 may also most likely be attributed to the passing of Senate Bill 732 that provided funding for urban greening.

3.2. CSA Box Reconstruction

Brown and Miller (2008) concluded that consumers pay less for organic produce bought in CSA programs compared with other local supermarkets. In this section, we will investigate the Growing Experience's rank in terms of price for local organic produce.

3.2.1. Methods

To estimate food costs and food miles, we visited grocery stores and one farmer's market in the Long Beach area. The farmer's market and grocery stores visited were chosen based on locality and availability of produce. For instance, there were two junior markets near the

Carmelitos Housing Project that were not included in our study because they did not have much, if any, produce. The farmer's market visited was the Long Beach Uptown Farmer's Market and the grocery stores visited included two Ralphs, two Food4Less', one Vons, a Superior, a Trader Joe's, Fresh and Easy, and a Big Saver Foods.

To account for the possible variation of produce in the CSA box, we visited the Farmer's Market and local grocery stores to record prices on two separate occasions. The first occasion took place February 21th -23rd, and the second occasion took place April 11th -14th. For each visit we recorded the price and weight of produce that was offered in the CSA box that week. Weight was recorded as the average of three different individuals of the same product, when possible. Origin and distributor or brand name of the product was recorded when the data was available. In addition, both the prices and weights of organic and non-organic produce were recorded. When a product of the CSA box was not available in the Farmer's Market or grocery store, similar, substitutable products were used instead. Different derivatives of the same kind of product and packaged or bagged produce were also recorded.

The first trial product list included: avocados, celery, chard, tangerines, kale, lemons, limes, mustard greens, oranges, oyster mushrooms (often substituted with portobello mushrooms), and parsley. The second trial product list included: artichokes, swiss chard, red beets, lettuce, broccoli, green onions, and kale. Collection of origin data during our second trial was limited to a list applicable and accessible for the food miles equations.

3.2.2. Results

We reconstructed the CSA box for each grocery store so that they would be comparable. To reconstruct the box, we first looked at the weight of each product within the box. We then took that weight and multiplied it to the unit price of the same or similar items from each grocery store. We used organic prices from grocery stores when possible, and prices for conventional food when not possible. If a grocery store did not have that product, we took the average price from all other grocery stores to be the unit price. We then summed the price of each product for the weight in the CSA box to reach the final price of the reconstructed CSA box.

We found that all grocery stores could not have all products within the reconstructed box as organic. Also, a few items from the CSA box were not found in any other grocery store, for instance, ice cream beans.

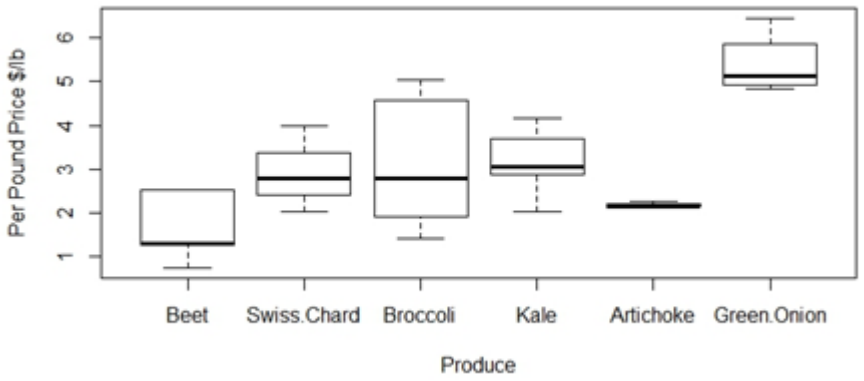

Figure 6. Boxplot of the Spring Price of Organic Produce in Long Beach

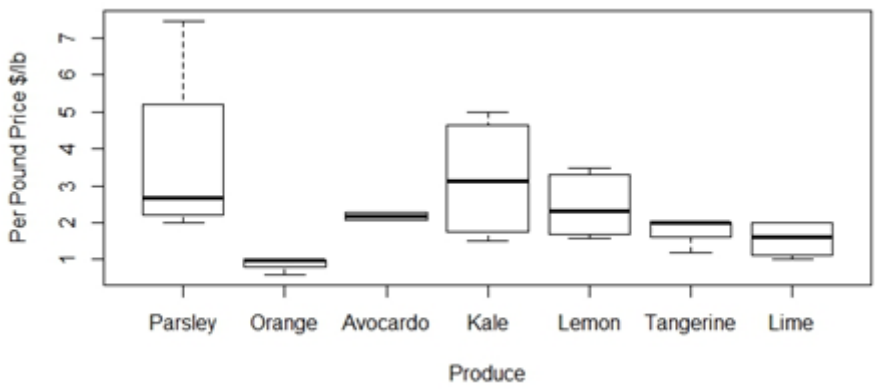

Figure 7. Boxplot of the Winter Price of Organic Produce in Long Beach

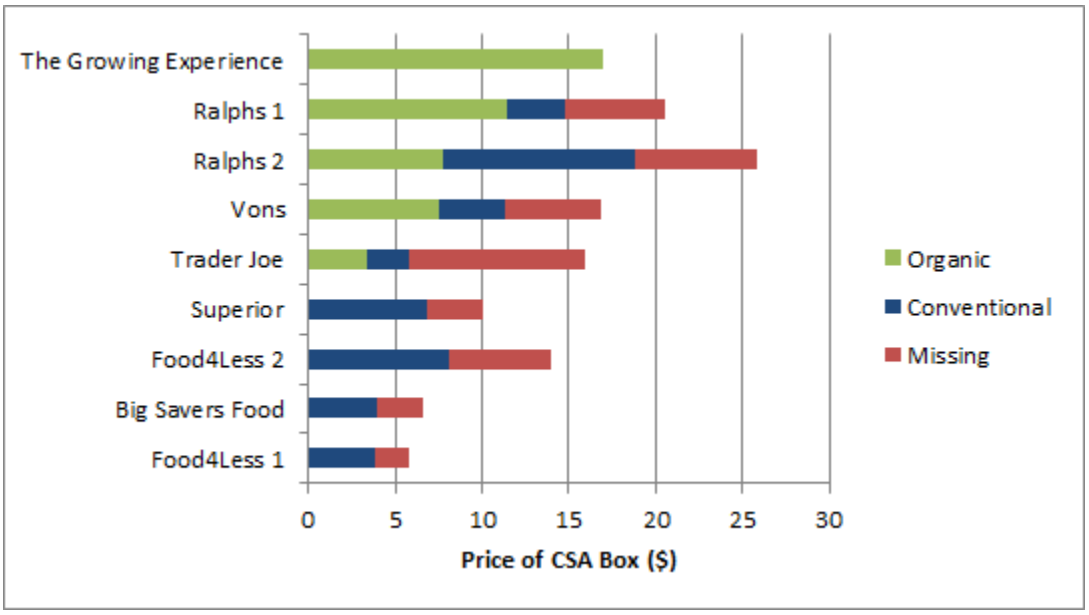

Figure 8. Price Comparison of the Winter Reconstructed CSA Box.

3.2.3. Discussion

As shown in Figure 11, the price of the CSA box and the percentage of organic produce are positively related. The CSA box from the Growing Experience is not cheaper than the majority of local supermarkets. Yet, if we take into consideration that the box from the Growing Experience is 100% organic, buying organic produce from the Growing Experience is cheaper than buying from a nearby supermarket. If more organic produce is present in the reconstructed CSA box, it would be more expensive. There are no other nearby supermarkets that offer organic produce for this low of a price. Similar to Brown and Miller's (2008) findings, this suggests that the Growing Experience influences the community by making organic food more affordable. Furthermore, in Figure 11, we are able to differentiate two types of supermarkets: (1) high price with more organic and (2) low price with no organic. Before the Growing Experience's establishment in the area, people who searched for low price grocery shopping would go to

supermarkets such as Food4Less and Superior while people who searched for quality grocery shopping would go to supermarkets such as Ralphs and Vons. With the Growing Experience's influence on lowering prices of organic produce, low income people now have a choice to pay a little bit more for organic produce. The chart above also shows that The Growing Experience has a wider variety of organic produce than the surrounding supermarkets. This suggests that the Growing Experience makes a variety of organic produce more approachable to different groups in the community.

3.3. Surveying

3.3.1. Methods

All team members participated in the administration of semi-structured interviews that addressed the impact of the urban farm on food security, fruit and vegetable consumption, food costs, and overall health. Surveys were tailored to Carmelitos residents, both CSA subscribers and non-subscribers, and to non-Carmelitos residents who were CSA subscribers. However, our category of Carmelitos residents who were also CSA subscribers yielded only one match. To compensate for this, we looked at an alternative subpopulation, Carmelitos Residents who used The Growing Experience Farmer's Market.

Surveys were conducted in person May 3rd-4th and May 10th-11th. Additional surveys were conducted over the phone the week of May 12th for individuals who did not have time to take a survey when asked in person. Recruitment for surveys was done by asking CSA subscribers as they picked up their boxes from the farm site on Fridays and Saturdays, at the weekly Farmer's Market held by The Growing Experience on the farm site, and at the Housing Project site as team members went door-to-door. Door-to-door surveys were done over the breadth of the housing project to eliminate any spatial bias between residents. We surveyed the primary grocery buyer of a household of each population. Surveys were conducted by one or two team members and took approximately 10-20 minutes. Respondents were compensated for their time with a $5 voucher to The Growing Experience Farmer's Market.

The survey primarily inquired about basic demographic characteristics so that we could control for certain traits during data analysis. These addressed: number of individuals, adult and children, living in the household, primary language spoken in the home, highest level of education attained, and participation in government food assistance programs. Surveys also addressed involvement in the local food system, asking which grocery stores or Farmers' Markets individuals shop at.

We were interested in differences in fruit and vegetable consumption habits between populations and in the types of fruit or vegetables eaten. We asked respondents to list the meals or snacks consumed in the last 24 hours and the fruits and vegetables in those meals or snacks. We showed respondents a set of cup measures and asked them to best estimate how much of each fruit and vegetable they ate. Data from the USDA Food and Nutrient Database for Dietary Studies was used to determine serving sizes.

Low-income communities often suffer from decreased access to fresh produce and they may not be able to afford food or its related costs, which includes transportation costs to and from food sources. Our surveys asked respondents which grocery store they shop from the most, the mode of transportation they used to get to that grocery store, and the level of difficulty they experienced in trying to get to that grocery store. These questions helped us understand the

hidden food costs in transportation which can cause barriers to fresh, healthy food. To figure out if the CSA boxes had a financial impact, we looked at price comparisons between local grocery stores and the CSA box. These methods helped us understand the total food costs to people.

We were also interested in whether or not the local presence of urban agriculture affected food security. The Carmelitos resident surveys addressed food security by using a validated food security four-question questionnaire designed by the USDA Economic Research Service (Bickle, Nord, Price, Hamilton, & Cook, 2000). We used the four-question form of the U.S. Adult Food Security Survey Module. Forms of this survey are used to determine household food security in the United States on a yearly basis

Finally, we wanted to ask open-ended questions to understand subscriber satisfaction or dissatisfaction, resident opinions towards CSA, and the overall social benefits associated with the Growing Experience. We took a validated question from a study by Carney et al. (2012) that asked subjects if they think the garden helped the health of their family. We modeled a question after a study by Cox et al. (2008) that asked respondents their primary reasons for participating in the CSA program. We also asked subscribers about their satisfaction with the box, and non-subscribers what would incentivize them to join The Growing Experience CSA program. Individual reasons for participation or lack thereof in The Growing Experience were documented. These open-ended questions helped us determine what people value in The Growing Experience and if the farm and CSA was meeting its original goal of providing healthy fresh food to its recipients.

3.3.2. Results

Table 8. An array of some of the surveyed demographic variables and the results from the surveys.

	CSA (n=16)	R (n=18)	R-FM (n=13)
Age	42.9	39.3	54.4
Primary Language			
English	100.0%	61.1%	69.2%
Spanish	0.0%	38.9%	30.8%
Education Level			
Elementary School	0.0%	22.2%	30.8%
High School	0.0%	61.1%	15.4%
Undergraduate College	50.0%	16.7%	53.8%
Postgraduate	50.0%	0.0%	0.0%
Government Assistance			
Yes	6.3%	50.0%	84.6%
No	93.8%	50.0%	15.4%

We initially designed our surveys for CSA subscribers, non-CSA subscriber residents, and CSA subscribers who were also residents. However, we found that there was only one resident subscribed to the CSA, so we shifted our focus to residents who use the farmers market offered by The Growing Experience and we grouped the CSA subscriber and resident with the

new group. We surveyed 16 CSA subscribers who were not residents , 18 residents (R), and 13 residents who use the farmers market (R-FM). We found that all CSA subscribers surveyed had had at least some college education or more. They were also less likely to be on government assistance. Among Carmelitos residents, we found that the R-FM surveyed were older than R and were also more likely to be on government assistance.

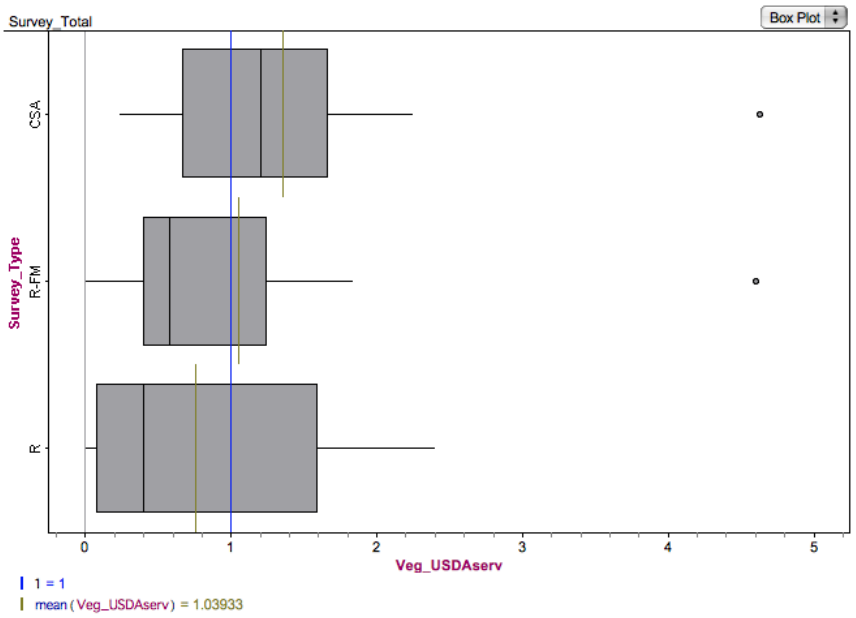

Figure 9. Boxplot of total respondent vegetable consumption for the past 24 hours, normalized to USDA recommended amount of servings.

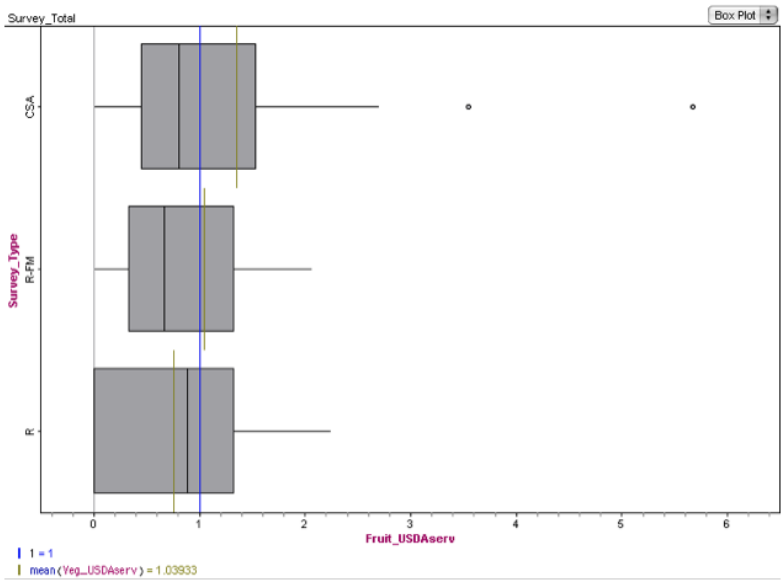

Figure 10. Boxplot of total respondent vegetable consumption for the past 24 hours, normalized to USDA recommended amount of servings.

We used a 24-hour recall to estimate respondent diets then normalized the data to the USDA recommended amount of servings, which varies with age and gender. We found that average fruit and vegetable consumption among CSA subscribers was the highest out of the three

groups, then R-FM, whose consumption fell slightly above the USDA recommended amount for both fruits and vegetables. Residents consumed the least amount of fruits and vegetables, and their group was the only average below the USDA recommended amount. However, the visible trends in consumption habits are not statistically significant because of our small sample size.

Table 9. Array of mode of transportation and respondent classification.

Survey_Total

		Transtype_Groc					Row Summary
		.	Driving	Public Transportation	Walking	Walking and Driving	
Survey_Type	CSA	0	11	0	3	2	16
	R	1	14	1	1	1	18
	R-FM	0	9	2	1	1	13
Column Summary		1	34	3	5	4	47

S1 = count ( )

Table 10. Array of difficulty in transportation and respondent classification.

Survey_Total

		Transdiff			Row Summary
		Difficult	Somewhat Difficult	Easy	
Survey_Type	CSA	0	3	13	16
	R	1	5	12	18
	R-FM	2	2	9	13
Column Summary		3	10	34	47

S1 = count ( )

Responses from our surveys regarding difficulty in reaching a grocery store and method of transportation showed little variation between groups. Table 10 shows that most respondents drove or had someone else drive them to their grocery store of choice. About the same amount of respondents walked or drove between residents and R-FM, and slightly more CSA subscribers walked. Only Carmelitos residents used public transportation to reach their grocery store of choice. Table 11 shows that most respondents found getting to their grocery store to be “easy”, and across all groups, about the same found it to be “somewhat difficult.” Carmelitos residents were also the single group that found getting to their grocery store to be “difficult.” Trends between groups are less discernible, and just as before, there is no statistical significance in our results due to our small sample size.

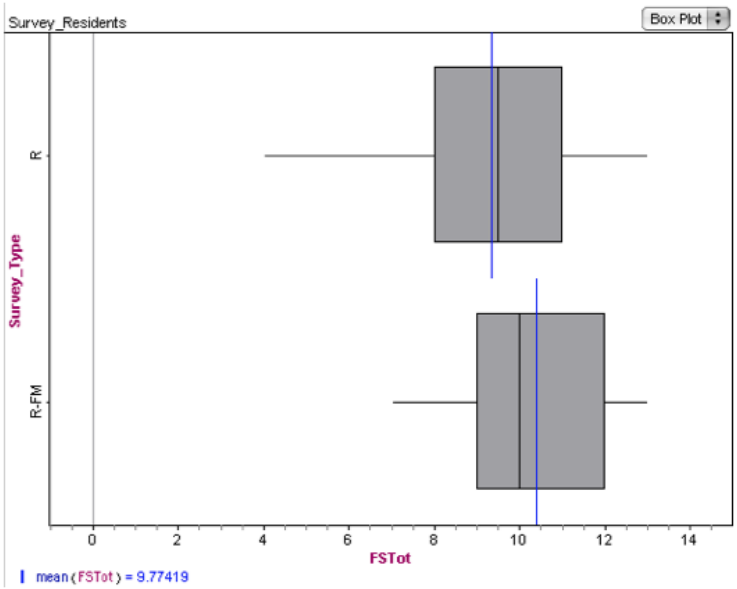

Figure 11. Boxplot of level of food security and respondent classification. Food insecurity increases to the left.

We only asked Carmelitos residents, both farmers market users and non-farmers market users, the four-question food insecurity questionnaire to assess the effects of local agriculture among local low-income residents. The difference between average food security between groups was not large, but residents who used the farmers market were more food secure while residents who did not use the Farmer's Market were more food insecure.

Qualitative questions for CSA subscribers were aimed to assess satisfaction with The Growing Experience as well as motivations for participating in the CSA. Questions for all residents aimed to assess usage of the farm, reasons for participating or not in the CSA, and suggestions to increase resident involvement. We found that residents most residents were unaware of The Growing Experience, and were therefore unable to participate in either the Farmers Market or the CSA program. We also found that residents who were aware of The Growing Experience and the CSA program most often preferred the Farmers Market because they could choose the variety and quantity of their produce, although there was one resident who was considering re-joining the CSA program because she saw that the CSA boxes had more variety than the Farmers Market. Lastly, we found that all surveyed CSA subscribers were satisfied to highly satisfied by the CSA program offered by The Growing Experience.

3.3.3. Discussion

Statistically significant conclusions cannot be drawn from our data because of our small sample size and the presence of multiple confounding variables; however, our data often supports findings from the literature. The literature states that the presence of local agriculture could ease the effects of a food desert, including food insecurity, difficulty in reaching a grocery store, and decreased fruit and vegetable consumption.

When assessing food security between residents and R-FM, we found no significant difference between the two groups. We found that R-FM were less food insecure than residents, though this may be attributed to R-FM status of government assistance. R-FM were more likely

to be on government assistance than residents, and this may have caused a shift towards increased food security in this population, unrelated to the presence of The Growing Experience.

We aimed to address the difficulty of transportation to and from a grocery store, though were overall unable to. Our data regarding difficulty of transportation shows no significant or visible trend between residents and residents who use the farmers market. CSA subscribers, overall find it easier to reach their grocery store, but this may be caused by other unaccounted for variables. Interestingly, the data shows that almost an equal amount of CSA subscribers walk to grocery stores as residents. Despite this similarity, their individual reasons are strikingly different. Most CSA subscribers who opted to walk to their grocery store did it in an effort to be healthier or more environmentally friendly, while residents who walked to their grocery store often did it out of necessity; walking was their only option. Little can be drawn from our data regarding difficulty of transportation within a food desert, however we can begin to see differences in values between CSA subscribers and residents.

We found that those involved with The Growing Experience ate more fruits and vegetables than those uninvolved. It should be noted that trends in fruit consumption are not as strong as vegetable consumption, and this may be due to the time frame of our study. This study was conducted in between harvests, just before any summer harvest that would have provided an abundant amount of fruit in the CSA box. CSA subscribers, who were mostly dependent on the CSA box for produce, consumed a lower amount of fruits. The presence of local agriculture to increase fruit and vegetable consumption is commonly cited within the literature, and we can see that within our data. Other variables affecting fruit and vegetable consumption such as motivations and values will be discussed below.

From open-ended questions, we found that CSA subscribers most valued these following themes: the atmosphere of the farm, access to organic, healthy, and seasonal food, supporting local agriculture, an increase in the amount of fruits and vegetables within the household, and being introduced to new vegetables. CSA subscribers were also overall very pleased by the knowledgeable staff and their weekly email reminders listing the contents of the box that week. From these things, it becomes apparent that CSA subscribers are more flexible with what they get from the box, they are open to new and seasonal produce, and they want to be healthy by eating more fruits and vegetables as well as having them more available in their household. Residents on the other hand, seemed to reflect very different values than CSA subscribers.

Overall, residents who were on stricter food budgets were unwilling to participate in the CSA. Often times, residents were aware of the benefits of eating healthier by eating more fruits and vegetables, but they did not display as much motivation to be healthier as CSA subscribers. This can be because they are limited by financial and time constraints. Low-income people often work long hours with insufficient pay. One resident who at the time was trying to be healthy and had just started a vegetable diet said, “Healthier food is more expensive; it’s harder to stay within budget.” This same resident also mentioned that it is difficult for her to go out and buy fresh produce and cook it after work because she is tired from working all day. Also, in response to a question regarding the possibility of joining the CSA program, one resident said, “I might be able to buy cheaper food in grocery stores.” When we questioned farmers market users whether or not they would be interested in participating in the CSA program, most resident users responded that they are more willing to simply use the Farmers Market where they can pick and choose their own vegetables, as opposed to buying a CSA box for $17 with the possibility of getting an unknown product and letting it spoil. From here we see the most apparent difference between CSA subscribers and all residents---CSA subscribers have more flexible budgets,

meaning that they are more capable of being healthier and of choosing to eat more organic or more fruits and vegetables, while low-income residents are budget and time constrained. As such, low-income residents are not as capable of eating healthier.

A smaller difference that we noted between CSA subscribers and residents is a difference in understanding the seasonality of food. One resident showed extreme dissatisfaction with the available selection at The Growing Experience Farmers Market, and this can be attributed to an insufficient understanding of the local agriculture and its constraints to seasonal produce. Since the farm is small and local, it can only produce fruits and vegetables during their respective harvest seasons. This is in stark contrast to grocery stores that maintain a core stock of fruits and vegetables available year round by importing from different parts of the globe at different times of the year. This resident may have expected the same variety available in a grocery store, and she may have been unaware that only produce in their harvest season is available. Interestingly, we see that while residents may display some discontent with the constraints on available harvest at The Growing Experience, we also see CSA subscribers valuing the increased access to seasonal produce.

4. Recommendations

4.1. Rainwater Harvesting

The Growing Experience can increase their rainwater harvesting capacity by using one of the following recommendations. The first is the easiest and least expensive option by connecting the seven rain barrels already in use into a series (Figure 2) so all barrels fill without staff needing to manually move them.. A full barrel weighs over 450 pounds, making this an inefficient way to collect rainwater. All of the supplies are readily available from the hardware store and could be completed in a couple hours.

Figure 12. Example of rain barrels connected in series to a single downspout.

Larger cisterns could be purchased and installed off of the greenhouse and office buildings to substantially increasing the amount of water available for irrigation use (Figure 3). A local

company, Chemtainer base in Compton, CA sells ready-made food grade water storage systems eliminating expensive delivery charges.

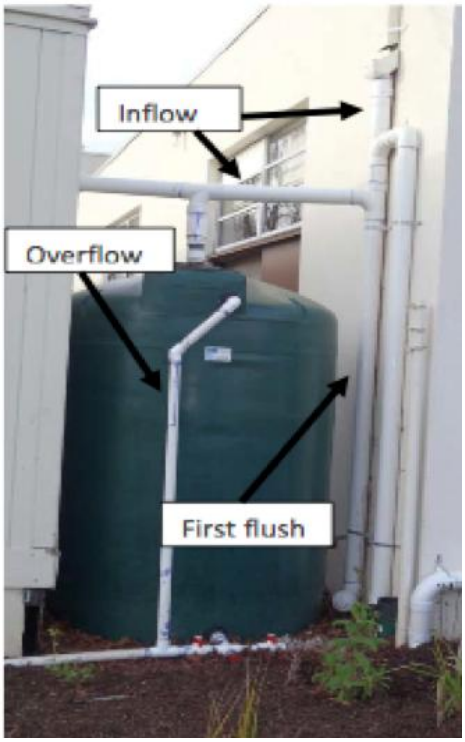

Figure 13. *800 gallon cistern.*

The cistern volume that captures the largest percentage of rainfall depends on the farm's irrigation ratio. This is calculated by dividing the area of irrigation by the area of the catchment area (Federico et al. 2009). The ratios were defined with grass area irrigation, which has a high demand of water. This can be applied to the farm as a good estimate because citrus trees and other crops also have a high water demand. The graph shown in Figure 4 can then be used to recommend a cistern volume that will collect the highest percentage of rainfall. The Growing Experience has an irrigation ratio is 10 due to the large irrigation area relative to the small area available for catchment. The top blue line estimates the percentage of rainfall captured in a given volume cistern per 1000 square feet of available catchment area. As can be seen on the graph, 500 gallons/1000sqft of roof collects approximately 75% of the rainfall on the surface. Doubling the cistern volume to 1000 gallons/1000sqft only increases efficiency by about 10% due to diminishing returns. Available space and cost of the larger system need to be considered to justify the small increase in rainwater capture.

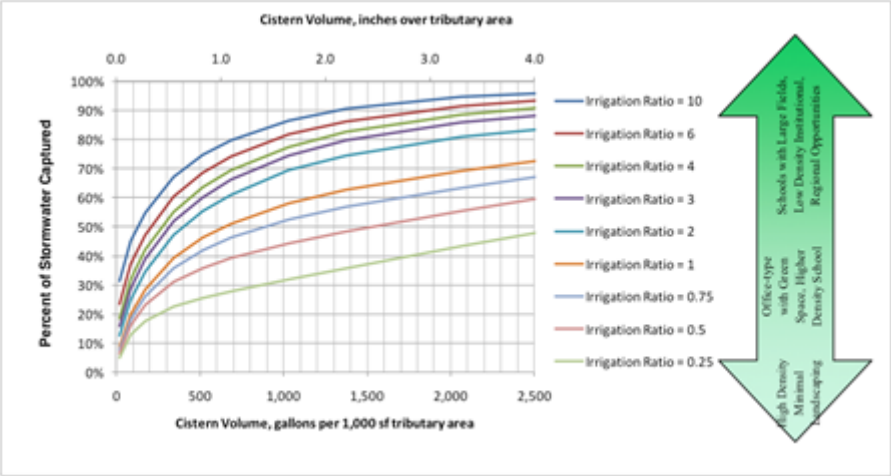

Figure 14. Large cistern rainfall capture efficiency model developed by Geosyntec Consultants (2009).

4.2. Carbon Sequestration / Air Pollutant Filtering

This data is now available to The Growing Experience for the grant writing process. Environmental benefits have now been quantified, based on actual field data, which can be used in the grant writing process to increase credibility. Additionally, this data can be utilized for operational management strategies based on the environmental and economic values of ecosystem services provided by the farm. For example, Figure 7 shows that the majority of Carmelitos' trees have a DBH of less than 8 cm. This information is useful when considering the fact that larger trees store more carbon, sequester more carbon, and remove more air pollutants, thus The Growing Experience should promote the growth of these trees to maximize ecosystem services.

Local and regional air quality can be directly or indirectly affected by urban vegetation altering the urban environment. Four main ways that urban trees affect air quality are ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013):

- Temperature reduction and other microclimate effects
- Removal of air pollutants
- Emission of volatile organic compounds (VOC) and tree maintenance emissions
- Energy effects on buildings

Given these factors, the following urban farm management strategies are recommended in Table 4.

Table 11. Urban farm management strategies to help improve air quality ("i-Tree Ecosystem Analysis: Carmelitos Urban Farm," 2013).

Strategy	Result
Increase the number of healthy trees	Increase pollution removal
Sustain existing tree cover	Maintain pollution removal levels
Maximize use of low VOC-emitting trees	Reduce ozone and carbon monoxide formation

Sustain large, healthy trees	Large trees have greatest per-tree effects
Use long-lived trees	Reduce long-term pollutant emissions from planting and removal
Use low maintenance trees	Reduce pollutants emissions from maintenance activities
Reduce fossil fuel use in maintaining vegetation	Reduce pollutant emissions
Plant trees in energy conserving locations	Reduce pollutant emissions from power plants
Plant trees to shade parked cars	Reduce vehicular VOC emissions
Supply ample water to vegetation	Enhance pollution removal and temperature reduction
Plant trees in polluted or heavily populated areas	Maximizes tree air quality benefits
Avoid pollutant-sensitive species	Improve tree health
Utilize evergreen trees for particulate matter	Year-round removal of particles

In order to fully assess the added value of having an urban farm within a highly urban area, it is recommended to do further fieldwork and research regarding the energy cost savings experienced by the community surrounding the farm. A bioswale study is also encouraged to better understand the full environmental impact of the Carmelitos urban farm. Because the urban farm surface area is approximately 100% permeable, it is recommended to quantify the amount of the stormwater that is absorbed by the farm and consequently, the associated values of water quality improvement.

4.3. Local Grocery Stores Price Comparison

The Growing Experience Farmer's Market normally sets their prices independent of prices set within the market. After collecting data on grocery store prices for both organic and conventional products, The Growing Experience, can now use this information to determine more competitive or affordable prices for produce sold at their Farmer's Market. By making prices more competitive, they would incentivize people who shop for organic food to shop at the Farmer's Market. Making prices competitive will also makes prices more affordable, by doing so, this may encourage more Carmelitos residents to shop from the Farmer's Market. It may also alleviate effects of a food desert by introducing an affordable vendor for healthy and fresh produce that is also local and by encouraging fruit and vegetable consumption.

4.4 Survey

Suggestions from the surveys are primarily focused on increasing resident involvement with the farm since CSA subscribers are overall very well pleased with The Growing Experience. One of the first and main barriers to resident involvement with the garden, is the lack of awareness. Many respondents were unaware of the garden or of the CSA program. So, a welcome packet for residents with informational brochures or flyers will help increase awareness of the farm within the housing project. From door-to-door surveying, we noted that residents were more attentive in face-to-face conversations. So, interaction with residents or simply interacting with them is one of the first steps to increasing resident involvement.

The second suggestion is for the Housing Authority to implement an after school program that is involved with the garden. Looking at a study done by Heim, Stang, and Ireland (2009), children enjoyed the fruits and vegetables they ate if they were invested in it. The study showed that children that planted their own food or prepared it enjoyed eating it too (Heim et al., 2009). If The Growing Experience were to have a similar weekly program for children to come to plant food and maintain their planted fruits and vegetables, it would help to expand the range of vegetables the children would eat. Increasing children interest in fruit and vegetable consumption is known to increase the fruit and vegetable consumption of their parents and their household. One study noted that 50% of parents surveyed admitted that they let their children make governing decisions in the grocery store (Heim et al., 2009).

The third recommendation, suggested by Carmelitos residents, is for The Growing Experience to have smaller boxes available in the CSA program. Since Carmelitos residents have very tight food budgets, smaller boxes would fit into their budget much better than a $17 box.

5. Conclusion

The Growing Experience is a great asset to the local community and represents a solution to the existence of the surrounding food desert. It is an important source of quality organic produce in an area full of fast food restaurants and chain supermarkets, and is a model for how to transform a troubled site into a thriving community garden that provides numerous benefits. Besides its obvious benefits of providing healthy produce to the community, The Growing Experience has many hidden benefits including its pollution removal capabilities, its ability to save on carbon emissions associated with buying locally grown produce, and its presence to serve as a place of recreation for the local community. Our research suggests that The Growing Experience does all these things, but needs to increase awareness within the community to increase involvement among local residents.

The most important thing our research suggests while doing this study was the importance of communication with the local residents. An overwhelming amount of people interviewed had nothing but positive things to say about the presence of the farm in the local community, but simply lacked knowledge about it. Providing more knowledge and reaching out to both new and existing residents will undoubtedly increase participation and use of the farm and its spaces. Our research also suggests that the CSA program should try and recruit more local residents from the Carmelitos housing development. The single Carmelitos resident in the CSA program (along with the other subscribers) were very pleased with its operation, but many residents simply did not know enough about it. The CSA program is a very good effector of healthy eating habits and The Growing Experience should be promoting it more to residents of the local housing development, since they are among the most likely to experience low food security, higher food cost and unhealthier dietary habits. Our research shows the CSA program provides more of a larger selection of organic produce at less cost than local grocery stores and this should be emphasized, because the CSA program could save many of these residents some money in their grocery bill.

The Growing Experience provides various environmental benefits by merely existing. Making a few relatively simple structural modifications to the buildings and the farm would immediately increase its environmental benefits in rainwater capture, pollutant removal and carbon storage shown in Table 3 and Figure 6. The CSA program represents a sizable savings in carbon emissions (food miles) and public health benefit and increased awareness of their

programs is very important to combat the effects of a food desert. Based on the feedback we collected from residents, everyone was pleased with its existence but we feel it might be beneficial to fine-tune it so more people will participate. With more communication with residents, The Growing Experience will be able to get more Carmelitos residents into the CSA program. Implementing the recommendations we have listed will help the farm improve its mission to serve the low-income residents who all agree that its existence provides them with potential dietary and lifestyle benefits.

The Growing Experience is a unique place that represents a source of community, healthy produce and environmental benefits that challenge the economic inequalities of the surrounding area. We hope to have provided useful information for The Growing Experience so it can continue to be a beacon for healthy living and connectivity in the local Long Beach community.

6. Acknowledgments

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8. Appendix

Appendix A. Resident Testimonies

Do you think the CSA program has helped the health of your family?

CSA Subscriber Themes	Quotes
Introduction of new vegetables; eat more vegetables	"Yes, because it forces our family to use the produce and we also enjoy finding new ways to eat new vegetables/fruits that we wouldn't necessarily buy"; "Yes, because the vegetables are so tasty, it increases the appetite for more vegetables. Eating organically replaces other inorganic foods that we might potentially buy"

What do you like about being part of TGE CSA program?

CSA Subscriber Themes	Quotes
Supporting TGE organization; supporting local farms; atmosphere of the farm	"I love the produce and supporting the organization"; "I like supporting local foods. I feel like I am supporting the community"; "I like coming here; it's peaceful, the air is better. People are helpful and pleasant"

Is there anything the garden can do to make its CSA program better?

CSA Subscriber Themes	Quotes
No suggestions; more community involvement; implement a no trading policy/sign; increase farm production and subscriptions	"It's great the way it is, the little extra things like honey, jam, seelings are very appreciated"; "The community can be more informed and more aware of the farm"; "It's great, I have no complaints about the program itself but I have noticed that not all boxes were the same so maybe subscribers are swapping produce with other boxes...make a "no trading" sign"; Expand land on which they're growing to expand the number of people that can sign up for CSA. Provide people with information about healthy or vegetable lifestyle"

Would you join TGE CSA program? Why or why not?

Resident Non-FM, Non-CSA Themes	Quotes
Willing to try based on selection and price; Yes for own health and health of family	"Yes: but have to see what kinds of vegetables are available. I might be able to buy cheaper food in grocery stores"; "Would be nice to eat balanced meals - it could kill a lot of hunger because I eat a lot at once so that the food will last"
Resident FM, Non-CSA Themes	**Quotes**
No, prefer to choose own variety and amount; No, CSA box quantity is too high; Yes, potential increase in fruit and vegetable consumption	"Don't want to; I prefer to pick up when I want to"; "No, because the box is too much for one person to finish. Because it is fresh, I don't want it to spoil"; "Yes. We need more fruit and vegetables. The farm is just there for us"

What would you need to be able to participate in the CSA program?

Resident Non-FM, Non-CSA Themes	Quotes

More awareness/information about the program; kid-friendly fruits and vegetables; more money; accessibility for elderly and disabled	"If they made it more public. I never knew it was there. Even though Carmelitos is a small community, not a lot of people go outside"; "If I had more money, I would"; "They need to check into delivering especially for older residents who have health issues"
Resident FM, Non-CSA Themes	**Quotes**
Better selection; diet-specific boxes; flexibility of box content	"If they had better selection, variety, and options to choose, I would participate"; "Perhaps 5 lbs. box to accommodate for people with diabetes, menu for people with different diseases"; "Be more flexible on what is in the box, for example, let subscribers pick fruits and vegetables"

Do you think the CSA program would help the health of your family? Why or why not?

Resident Non-FM, Non-CSA Themes	**Quotes**
Yes for own health and kid's health; value of TGE produce	"Yes, because of fresh fruits and vegetables…kids can eat them before school and maybe they'll do better in school"; "Yes, good nutrition, no chemicals"
Resident FM, Non-CSA Themes	**Quotes**
Yes for fresh, organic, pesticide-free food; CSA food could replace unhealthy foods; more selection and variety	"Yes, because the farm grows fruits and vegetables without pesticides. It is fresh."; "Yes, if purchased, there would be less junk food at the house and I would cook with more healthy ingredients"; "Yes, simple fact that there are a lot of good things that come out of it. I buy vegetables at TGE that I like that I wouldn't buy from the grocery store"

Appendix B. CSA Subscriber / Resident Survey

I. Preliminary Questions

Question 101: Are you the primary grocery buyer for the household?

1. Yes (skip to 201) 2. No (ask 102)

Question 102: If they are not home, when will he or she be home so that I may speak with them?

II. Demographics

Question 201: What is the primary language spoken in this home?

1. English 2. Spanish 3. Korean 4. Other:

Question 202: How many people live in the household?

Question 203: How many children live in the household?

Question 204: What is your age?

Question 205: DO NOT ASK: But please specify the gender of the respondent: 1. male 2. female

Question 206: Are you a part of the CalFresh Program, SNAP, the WIC Supplemental Nutritional Program, or EBT?

1. Yes 2. No

Question 207: What is your highest level of education?

1. Elementary or Middle School
2. High School or GED
3. Undergraduate Degree
4. Post Graduate Degree

III. Carmelitos, CSA Participation, and Local Food System Involvement

Question 305: How long have you lived at Carmelitos?

Question 306: How long have you been involved in the Growing Experience CSA program?

Question 307: Are you currently involved in the community garden program?

1. Yes 2. No

Question 308: Do you shop at a Farmer's Market?

1. Yes (ask 309) 2. No (skip to 401)

Question 309: Which ones?

1. The Growing Experience Farmers Market (ask 310)
   (for all other answers skip 310)

2. Long Beach Uptown Farmers Market at Atlantic Ave and E. 46th St.
3. Other

Question 310: How often do you use the Farmers Market offered by the Growing Experience urban farm?
1. Never 2. Less than once a month 3. Once a month 4. Weekly 5. Other

Question 311: How often do you use the CSA program offered by the Growing Experience urban farm?
1. Weekly 2. Every other week 3. Monthly 4. Other

Question 312: How fast do you use up the food in the box?

Question 313: Are you satisfied with the quantity and variety of produce given in the box?

Question 314: What do you do when you receive an unfamiliar fruit or vegetable?
(May ask probes, the aim is to have a specific answer: i.e. do you search up recipes online?)

Question 315: Why do you participate in the Growing Experience CSA Program?

IV. Grocery Shopping and Transportation
Question 401: How often do you go grocery shopping for fruits or vegetables?

Question 402: Which grocery store do you normally get your fruits/vegetables?

Ralphs	1. Long Beach Blvd and E. San Antonio Dr. 2. Cherry Ave and Carson St.
Vons	3. Atlantic Ave, in between Del Amo and E. San Antonio Dr.
Food4Less	4. Cherry Ave and Artesia Blvd 5. Cherry Ave and South St.
Big Saver Foods	6. Artesia Blvd
Superior	7. Cherry Ave and E. Market St.
Trader Joe's	8. Atlantic Ave and Carson St.
Fresh and Easy	9. Atlantic Ave
Other	10.

Question 403: Typically, how do you get to your grocery store?

Question 404: In your opinion, how difficult is it for you to get to this grocery store?

1. Easy/Not difficult 2. Somewhat difficult 3. Very difficult 4. Other

If they responded that travel was difficult, continue to question 405
Question 405: Why is it difficult?

V. Fruit and Vegetable Consumption (short explanation)

What was the last meal you ate? (breakfast, lunch, dinner)
Did you eat fruits and vegetables in that meal?
If so, can you list the fruits and vegetables that you ate in that meal? (write down best description / spelling in language)
Continue in this pattern until all major meal periods have been accounted for.

	Vegetables	Amount	Fruits	Amount
Breakfast				
Lunch				
Dinner				
Snacks				

VI. Food Security

Question 601: Which one of these statements describes the food eaten in your household in the last 12 months?

1. Enough of the kinds of food we want to eat
2. Enough but not always the kinds of food we want
3. Sometimes not enough to eat
4. Often not enough to eat
5. DK
6. Refused

Say: *Now, I am going to read to you a few statements that refer to the past year. Please tell me if they are often true, sometimes true, never true, don't know, or you may refuse to answer.*

Question 602: The first statement is "(I/We) worried whether (my/our) food would run out before (I/we) got money to buy more." Was that often true, sometimes true, or never true for (you/your household) in the last 12 months?

1. Often true 2. Sometimes true 3. Never true 4. Don't Know 5.Refused

Question 603: "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

1. Often true 2. Sometimes true 3. Never true 4. Don't Know 5.Refused

Question 604:. "(I/we) couldn't afford to eat nutritionally balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

1. Often true 2. Sometimes true 3. Never true 4. Don't Know 5.Refused

VII. Open Ended Questions

Question 701: Do you think the CSA program helped the health of your family? If yes, how?

Question 702: What do you like about being part of the Growing Experience CSA Program?

Question 703: Is there anything the garden can do to make its CSA program better?

Prompt: What would get you more involved in the urban farm?

Question 707: Is there anything else that we need to address or anything that we missed?

(If recruited at the Growing Experience Farmer's Market)

Question 708: How did you hear about this Farmer's Market and CSA?

Appendix C. CSA Subscriber / Non-Resident Survey

I. Preliminary Questions

Question 101: Are you the primary grocery buyer for the household?

1. Yes (skip to 201) 2. No (ask 102)

Question 102: If they are not home, when will he or she be home so that I may speak with them?

II. Demographics

Question 201: What is the primary language spoken in this home?

1. English 2. Spanish 3. Korean 4. Other:

Question 202: How many people live in the household?

Question 203: How many children live in the household?

Question 204: What is your age?

Question 205: DO NOT ASK: But please specify the gender of the respondent: 1. male 2. female

Question 206: Are you a part of the CalFresh Program, SNAP, the WIC Supplemental Nutritional Program, or an EBT cardholder? 1. Yes 2. No

Question 207: What is your highest level of education?

1. Elementary or Middle School
2. High School or GED
3. Undergraduate Degree
4. Post Graduate Degree

III. Carmelitos, CSA Participation, and Local Food System Involvement

Question 306: How long have you been involved the Growing Experience CSA program?

Question 307: Are you currently involved in a community garden program?

1. Yes 2. No

Question 308: Do you shop at a Farmer's Market?

1. Yes 2. No (skip to 311)

Question 309: Which ones?

1. The Growing Experience Farmers Market (go to 310)
   (for all other answers, skip to 311)
2. Long Beach Uptown Farmers Market at Atlantic Ave and E. 46th St.
3. Other

Question 310: How often do you use the Farmers Market offered by the Growing Experience Urban Farm?
1. Never 2. Less than once a month 3. Once a month 4. Weekly 5. Other

Question 311: How often do you use the CSA program offered by the Growing Experience Urban Farm?
1. Weekly 2. Every other week 3. Monthly 4. Other

Question 312: How fast do you use up the food in the box?

Question 313: Are you satisfied with the quantity and variety of produce given in the box?

Question 314: What do you do when you receive an unfamiliar fruit or vegetable?
(May ask probes, the aim is to have a specific answer: i.e. do you search up recipes online?)

Question 315: Why do you participate in the Growing Experience CSA Program?

IV. Grocery Shopping and Transportation

Question 401: How often do you go grocery shopping for fruits or vegetables?

Question 402: Which grocery store do you go to most often?

Ralphs	1. Long Beach Blvd and E. San Antonio Dr. 2. Cherry Ave and Carson St.
Vons	3. Atlantic Ave, in between Del Amo and E. San Antonio Dr.
Food4Less	4. Cherry Ave and Artesia Blvd 5. Cherry Ave and South St.
Big Saver Foods	6. Artesia Blvd
Superior	7. Cherry Ave and E. Market St.
Trader Joe's	8. Atlantic Ave and Carson St.
Fresh and Easy	9. Atlantic Ave
Other	10.

Question 403: Typically, how do you get to your grocery store?

Question 404: In your opinion, how difficult is it for you to get to this store?
1. Easy/Not difficult 2. Somewhat difficult 3. Very difficult 4. Other

Question 405: Why is it difficult for you?

V. Fruit and Vegetable Consumption

What was the last meal you ate?
Did you eat fruits and vegetables in that meal?
If so, can you list the fruits and vegetables that you ate in that meal?
About how much did you eat of each?

	Vegetables	Amount	Fruits	Amount
Breakfast				
Lunch				
Dinner				
Snacks				

VII. Open Ended Questions

Question 701: Do you think the CSA program helped the health of your family? If yes, how?

Question 702: What do you like about being part of the Growing Experience CSA Program?

Question 703: Is there anything the garden can do to make its CSA program better?
Prompt: what would get you more involved in the urban farm?

Question 707: Is there anything else that we need to address or anything that we missed?

Appendix D. Non-CSA Subscriber / Resident Survey

I. Preliminary Questions

Question 101: Are you the primary grocery buyer for the household?

1. Yes (skip to 201) 2. No (ask 102)

Question 102: If they are not home, when will he or she be home so that I may speak with them?

II. Demographics

Question 201: What is the primary language spoken in this home?

1. English 2. Spanish 3. Korean 4. Other:

Question 202: How many people live in the household?

Question 203: How many children live in the household?

Question 204: What is your age?

Question 205: DO NOT ASK: But please specify the gender of the respondent: 1. male 2. female

Question 206: Are you a part of the CalFresh Program, SNAP, the WIC Supplemental Nutritional Program, or an EBT cardholder? 1. Yes 2. No

Question 207: What is your highest level of education?

1. Elementary or Middle School
2. High School or GED
3. Undergraduate Degree
4. Post Graduate Degree

III. Carmelitos, CSA Participation, and Local Food System Involvement

Question 301: Are you aware of the Growing Experience Urban Farm?

1. Yes 2. No (skip to 305)

Question 302: If so, what have you heard?

Question 303: What best describes your involvement with the Growing Experience CSA program?

1. Never participated
2. Previous Participant
3. Waiting list (skip to 305)
4. Not on the waiting or subscription list, but want to use (skip to 305)

Question 304: Please briefly explain why you do not currently participate or wish to participate in the CSA program?

Question 305: How long have you lived at Carmelitos?

(skip this question if answered NO in QUESTION 301)
Question 307: Are you currently involved in the community garden program of Carmelitos?
1. Yes 2. No

Question 308: Do you shop at a Farmer's Market?
1. Yes 2. No (skip to 401)

Question 309: Which ones?
1. The Growing Experience Farmers Market (go to 310)
   (for all other answers, skip to 401)
2. Long Beach Uptown Farmers Market at Atlantic Ave and E. 46th St.
3. Other

Question 310: How often do you use the Farmers Market offered by the Growing Experience community garden?
1. Never 2. Less than once a month 3. Once a month 4. Weekly 5. Other

IV. Grocery Shopping and Transportation
Question 401: How often do you go grocery shopping for fruits or vegetables?

Question 402: Which grocery store do you go to the most often?

Ralphs	1. Long Beach Blvd and E. San Antonio Dr. 2. Cherry Ave and Carson St.
Vons	3. Atlantic Ave, in between Del Amo and E. San Antonio Dr.
Food4Less	4. Cherry Ave and Artesia Blvd 5. Cherry Ave and South St.
Big Saver Foods	6. Artesia Blvd
Superior	7. Cherry Ave and E. Market St.
Trader Joe's	8. Atlantic Ave and Carson St.
Fresh and Easy	9. Atlantic Ave
Other	10.

Question 403: Typically, how do you get to your grocery store?

Question 404: In your opinion, how difficult is it for you to get to this grocery store?
1. Easy/Not difficult 2. Somewhat difficult 3. Very difficult 4.Other

Question 405: Why is it difficult for you?
V. Fruit and Vegetable Consumption
What was the last meal you ate?
Did you eat fruits and vegetables in that meal?

If so, can you list the fruits and vegetables that you ate in that meal?
About how much did you eat of each?
Continue in this pattern until all major meal periods have been accounted for.

	Vegetables	Amount	Fruits	Amount
Breakfast				
Lunch				
Dinner				
Snacks				

VI. Food Security

Question 601: Which one of these statements describes the food eaten in your household in the last 12 months?

1. Enough of the kinds of food we want to eat
2. Enough but not always the kinds of food we want
3. Sometimes not enough to eat
4. Often not enough to eat
5. DK
6. Refused

Say: *Now, I am going to read to you a few statements that refer to the past year. Please tell me if they are often true, sometimes true, never true, don't know, or you may refuse to answer.*

Question 602: The first statement is "(I/We) worried whether (my/our) food would run out before (I/we) got money to buy more." Was that often true, sometimes true, or never true for (you/your household) in the last 12 months?

1. Often true 2. Sometimes true 3. Never true 4. Don't Know 5. Refused

Question 603: "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more."
Was that often, sometimes, or never true for (you/your household) in the last 12 months?

1. Often true 2. Sometimes true 3. Never true 4. Don't Know 5. Refused

Question 604:. "(I/we) couldn't afford to eat balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 12 months?

1. Often true 2. Sometimes true 3. Never true 4. Don't Know 5. Refused

VII. Open Ended Questions

Question 704: Would you join the Growing Experience CSA program? Why or why not?

Question 705: What would you need to be able to participate in the CSA program?

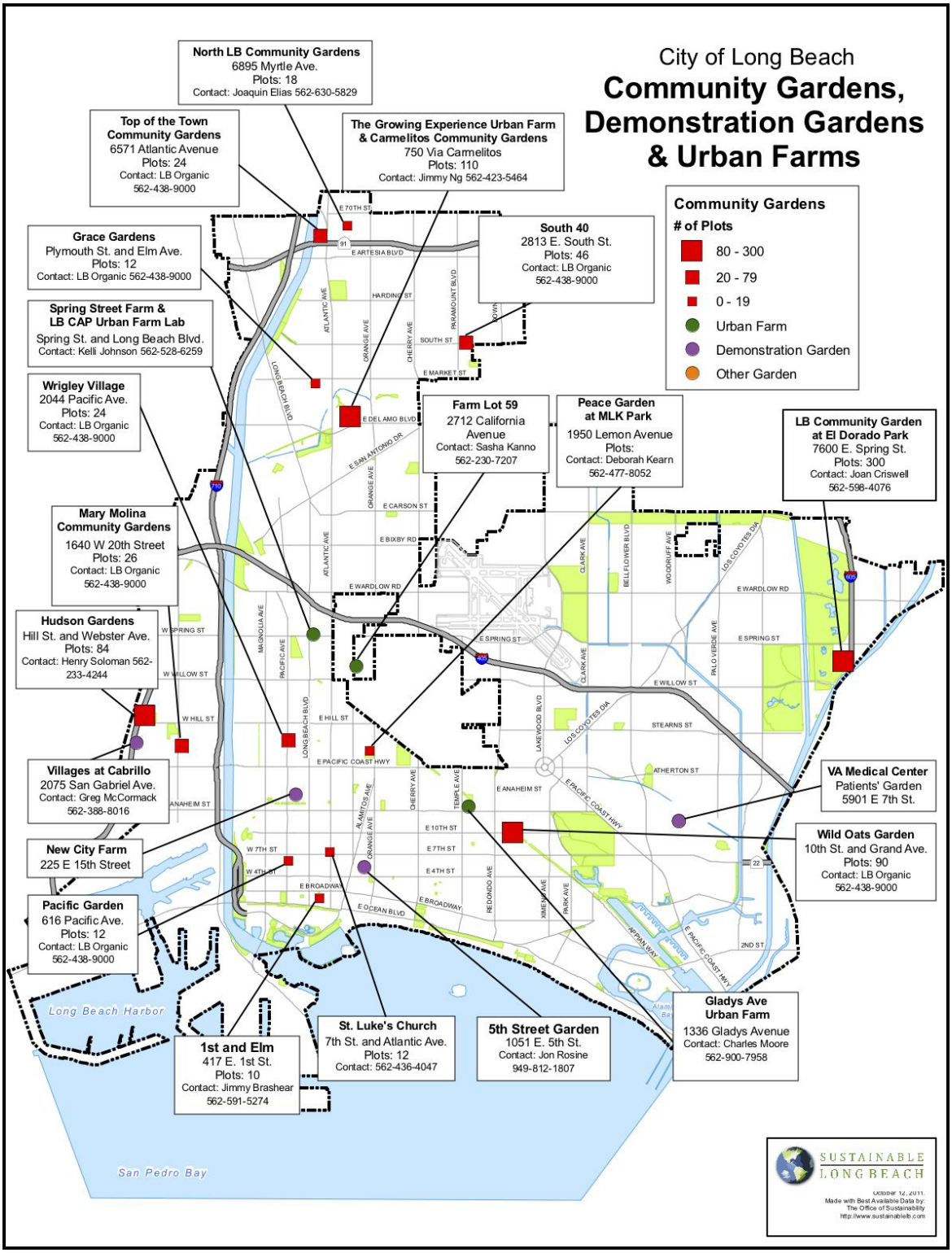
Prompt: what would get you more involved in the urban farm?

Question 706: Do you think the CSA program would help the health of your family? Why or why not?

Question 707: Is there anything else that we need to address or anything that we missed?

If recruited at the Farmer's Market
Question 708: How did you hear about this Farmer's Market?

Appendix E. Map of Long Beach Community Gardens



Appendix F. i-Tree Forms

PLOT ID=	DATE=	CREW=	GPS COOR	PHOTO ID=
			X	
			Y	

PLOT SKETCH AND NOTES FOR PLOT RELOCATION

(Note distance and direction from plot center to fixed objects; sketch fixed objects in relation to plot center)

Plot address=
Notes:

Plot contact info:
Name and Title:_____
Phone #_____

LOCATING REFERENCE OBJECTS/LANDMARKS (Identify at least 1 object)
Measure Reference Object (1) description_____
Distance to Reference Object (1)_____
Direction to Reference Object (1)_____
Measured Reference Object (2) description_____
Distance to Reference Object (2) _____
Direction to Reference Object (2)_____
Tree Measurement Point (TMP): Reference Object (1) used Y/N
Reference Object (2) used Y/N
Measurement Unit: M/E

Percent Measured_____

ACTUAL LAND USE=	PERCENT IN=	PLOT TREE COVER (%)=	SHRUB COVER (%)=	PLANTABLE SPACE (%)=
ACTUAL LAND USE=	PERCENT IN=			
ACTUAL LAND USE=	PERCENT IN=			
ACTUAL LAND USE=	PERCENT IN=			

GROUND COVER	%BLDG	%CMNT	%TAR	%ROCK	%SOIL	%DUFF/ MULCH	%HERB/ IVY	%MAIN. GRASS	%UNMAIN GRASS	%H2O

	SPECIES	HEIGHT	% AREA	% MISSING	SPECIES	HEIGHT	% AREA	% MISSING	SPECIES	HEIGHT	% AREA	% MISSING
SHRUBS												

PLOT ID=				TREE SPECIES			DBH						HEIGHT			CROWN WIDTH							TREES NEAR BUILDINGS						
TREE ID	STAT	DR	DS	LAND	USE	HT DBH	1	2	3	4	5	6	TOT	LIVE TOP	CROWN BASE	N-S	E-W	% MISS	DB	% IMP	% SHRUB	CLE	D1	S1	D2	S2	D3	S3	TREE SITE