

**The Role of Urban Agriculture in Environmental and Social Sustainability: Case Study of  
Boston**

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*A Roxbury Garden (Excerpt)*

By Amy Lowell, 1917

Mother is busy in the still-room,  
And Hannah is making gingerbread.  
Slowly, with lagging steps,  
They follow the garden-path,  
Crushing a leaf of box for its acrid smell,  
Discussing what they shall do,  
And doing nothing.  
"Stella, see that grasshopper  
Climbing up the bank!  
What a jump!  
Almost as long as my arm."  
Run, children, run.  
For the grasshopper is leaping away,  
In half-circle curves,  
Shuttlecock curves,  
Over the grasses.  
Hand in hand, the little girls call to him:  
"Grandfather, grandfather gray,  
Give me molasses, or I'll throw you away."  
The grasshopper leaps into the sunlight,  
Golden-green,  
And is gone.

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## **Introduction**

Food is at the center of many cultures, with everything from gathering around the dinner table with friends and family, to the traditional foods of one's heritage, to the customary dishes served at holidays. However, due to the modern-day abundances of processed and prepared foods in grocery stores and fast food restaurants, a large number of Americans have forgotten the art of cooking and the time-honored practice of eating a home-cooked meal at the dinner table. We are far removed from where our food comes from, and this is inflicting enormous tolls on our climate, public health, and environment. I myself grew up in a household of quick meals that required little or no cooking, most of which came in boxes with instructions of how to prepare, and much of which ironically advertised health benefits, such as "non-fat." This was the same for the majority of my friends as well. Yet in an age of seemingly overabundance, as can be seen and felt in the long aisles of suburban grocery stores, our food system is deeply threatened.

World human population is growing exponentially to reach 9 billion by 2050, and the current agricultural system will not be able to sustain it. As of 2004, approximately 800 million hectares of land were used for food production, approximating an area equivalent to Brazil, to provide enough food to feed a human population approaching 6.3 billion (FAO 2004, as cited by Despommier 2008). These land-use estimates include grazing lands for cattle, and represent nearly 85 percent of all land that can support at least a minimum level of agricultural activity (Despommier 2008). At this rate of growth, it will not be long before that last 15 percent of arable land is used up.

Large-scale factory farms have become the norm worldwide in order to achieve maximum economic efficiency, and in order to support it, millions of hectares of hardwood forest (temperate and tropical), grasslands, wetlands, estuaries, and coral reefs have been either

eliminated or severely damaged, resulting in significant loss of biodiversity and widespread disruption of ecosystem functions (Despommier 2008). One such ecosystem function is that of carbon sequestration, rendering food production, along with the massive amount of energy it takes to process, package, and ship agricultural products around the globe, a major contributor to global climate change. Furthermore, the widespread use of genetically modified crops and agrochemicals is ironically making agriculture increasingly vulnerable to disease, pests, and soil degradation. It is also decreasing the nutrient value in the produce itself. These present dire prospects, and point to a need for change in the way we grow our food.

Nearly every agricultural and food processing industry is centralized, with only a handful of corporations who own the many massive, ecologically unsound monocultures on which we grow most of our food. The vast amount of energy it takes to produce all of the inputs to industrial farms (fertilizer, pesticides, machinery), the energy used in processing and packaging, and the energy used to transport and store food are all contributing heavily to climate change. Meanwhile, in the grocery store, equitable access to fresh, healthy food has been stunted by the industrialization and centralization of the food system, as well as anti-urban biases in food retailers, leaving many communities without proper food retail and thus without food security.

Food insecurity issues have historically stemmed from inequitable or inadequate food distribution, where stockpiles of grains remain in storage in one country while large populations in other cities and countries are malnourished, or where certain neighborhoods and towns have a dearth of food retail. However, with the planet running out of arable land, fish populations diminishing, soil health weakening, and impending climate change, disparities in the food system take on new complexities. Food security will take on new meaning, and will rely on cities'

abilities to successfully develop and manage environmentally and socially sustainable local food systems.

There is a movement to grow more food in cities, where the majority of the world population lives, to reduce the environmental impacts of industrial agriculture on non-urban land while providing equitable access to affordable, fresh food across community lines. This thesis assesses urban agriculture and food retail distribution in Boston, Massachusetts, as a case study, and argues that the institutionalization of urban agriculture within the realm of urban policy will link environmental and social sustainability in an extraordinarily positive and fruitful manner.

Boston has a tumultuous history of racism and environmental injustice, and the disparities in access to affordable and healthy food still manifest themselves today. One response to this has been gardening, a form of urban agriculture that allows individuals and families to grow food for themselves and for their community. This study will look at disparities in food retail between various racial and socioeconomic demographics, and it will explore the role of community gardens, an important and widely used form of urban agriculture, in providing access to food in underserved communities.

Geographic Information Systems (GIS) software was used to map community gardens, large supermarkets, small grocery stores, specialty grocery stores, and convenience shops within the context of local socioeconomics to identify any areas of Boston that can be classified as “food insecure.” Then the numerical data from this was used to analyze significant disparities in access to food between racial and socioeconomic demographics with several remarkable and grim results, including that the top 25% communities most vulnerable to food insecurity have more community gardens than convenience stores, which may show a distinct response to a lack of affordable, healthy food. The inequitable distribution of food across Boston, the country, and

the world poses daunting problems to food security, and calls for the attention of policy makers and urban planners.

## **Chapter 1: The Story of Food**

The US food system has undergone extraordinary changes in the last century. Beginning with the Green Revolution of the 1960s, the small family farm has been abandoned in favor of the industrial monoculture, and home cooking has been replaced with easily prepared or ready-made meals. Many fruits and vegetables found in grocery stores have far less nutrients than they did fifty years ago due to the application of synthetic fertilizers and use of genetically modified crops, and the cheapest food available is often extraordinarily processed and high in fats and sugars.

The current system of industrial agriculture, sparked by the Green Revolution, is the most efficient that we know of in terms of producing the most food in the smallest area, but it has major implications for the surrounding ecosystem and for the health of those involved in production and consumption. The Green Revolution began as a publicly funded research effort aimed at applying science to the food problems of developing countries (Pawlick 2006). Started in the 1960s and named by William Gaud, head of the U.S. Agency for International Development, the Green Revolution greatly improved food production by introducing new technologies and innovations to traditional agricultural practice. New strains of corn, rice and wheat, developed over some 20 years of painstaking cross-pollination, were introduced in the third world, along with chemical fertilizers, and resulted in stunning increases in yields (Steinhart 1981). By 1967, corn production in Mexico had tripled; between 1965 and 1967, India's grain harvest grew 50 percent (Ibid).

However, it was well understood among development experts that the Green Revolution would be an expensive revolution, not least because the new, high-yield crops required more inputs than traditional varieties did (Roberts 2008). Much of the developing world's ability to

take on these new technologies was due to financial aid from the developed world. Rising yields would let poor countries generate exportable surpluses, the earnings from which could help finance schools, factories, roads, and other increments of industrial infrastructure (Roberts 2008). It would also require, however, the continual aid of wealthy countries, which did not happen in most cases, and left farmers heavily reliant on expensive seeds and agrochemicals, the majority of which were being produced by corporations in the US.

Large industrial farms have, in the process, overtaken small family farms worldwide. Small-scale, traditional family farmers have not been able to keep up with the productivity and efficiency of the factory farms and the costs of all of the inputs, and have been quite literally forced to give up their land and take up other occupations, many of them moving toward cities. In the United States alone, 105 acres of agricultural land go out of production every hour; about half of that is used for urban or suburban growth and the other half is used less intensely or actively conserved for its habitat values (USDA Policy Advisory Committee on Farm and Forest Land Protection and Land Use, 2001, as cited by Redman and Foster 2008).

This has streamlined produce growth and distribution to levels of efficiency never before experienced, and, along with processes of globalization, has allowed supermarkets worldwide to supply fresh produce year-round. However, in order to have produce be just maturing by the time it hit store shelves, it has become standard to pick most fruits and vegetables while still unripe. This premature removal from stems, trees, and soil, along with the time passed during transportation, leaves produce deficient in many of the essential nutrients, vitamins, and minerals that people need. Take, for example, changes in the potato over the last half century:

The average spud has lost 100 percent of its vitamin A, which is important for good eyesight; 57 percent of its vitamin C and iron, a key component of healthy blood; and 28 percent of its calcium, essential for building healthy bones and teeth. It also lost 50 percent of its riboflavin and 18 percent of its thiamine. Of the seven key nutrients

measured, only niacin levels have increased... The story is similar for 25 fruits and vegetables that were analyzed [in a *Globe and Mail, CTV* study<sup>1</sup>]. (Picard 2002 as cited by Pawlick 2006)

Studies showing similar results have taken place in the US and the UK over the last decade (Mayer 1997, Davis 2004, Davis 2009). Not only has our highly industrialized and centralized food system resulted in increased availability of cheap, processed, packaged foods, contributing to numerous health problems nation-wide including obesity and diabetes, but it has also decreased the nutritional value of fruits and vegetables, the healthier alternative.

This is a contributing factor in what has been called the food gap and in the creation of food deserts, both of which will be explored in Chapter 4. Inner city neighborhoods tend to have many more convenience stores, small grocery stores, and fast food restaurants, all of which offer a wealth of packaged and processed foods, but whose produce, if there is any, is of lower quality and higher prices than of suburban supermarkets. Thus inner city neighborhoods, which tend to be low-income, minority, and underserved, end up paying more for healthy foods. The more affordable and convenient options, mainly the highly processed foods, in turn cause widespread diseases like diabetes, heart disease, and obesity.

Furthermore, the first Green Revolution and subsequent agricultural practices employed today have quite literally destroyed the ecological environment in which we live and on which we survive. Agricultural runoff, which typically contains all of the fertilizers, pesticides, herbicides, and other chemicals, and is also often laden with unhealthy levels of heavy metals, as well, is generally acknowledged as the most pervasive and destructive form of water pollution, degrading virtually every freshwater aquatic environment that borders on human habitation (National Resources Inventory, USDA 1999 as cited by Despommier 2008). Crop residues and

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<sup>1</sup> Favaro, Avis. Part of a Bell Globemedia multi-media campaign called “What You Eat.” Canada: June 25, 2002-July 9, 2002.

livestock excreta, which were once recycled into nutritious compost fertilizer, have become wastes whose disposal presents a continuing problem for the farmer (Pawlick 2006).

The unsustainable nature of the food system is thus highly unlikely to be capable of providing for the future human population, projected to hit around 9 billion in the next 50 years with the majority living in cities, without some sort of food revolution. Using open space within cities, greenhouse technologies, and rooftops, a large portion of the food crops consumed by urban populations can be produced within the city, with a very small impact on the local and regional environment, while providing increased access to healthy, affordable food for a greater number of people.

## **Chapter 2: Urban Agriculture**

*There is a quiet revolution in our food system. It is not happening so much on the distant farms that still provide us with the majority of our food; it is happening in cities, neighborhoods, and towns. It has evolved out of the basic need that every person has to know their food, and to have some sense of control over its safety and security. It is a revolution that is providing poor people with an important safety net where they can grow some nourishment and income for themselves and their families. And it is providing an oasis for the human spirit where urban people can gather, preserve something of their culture through native seeds and foods, and teach their children about food and the earth. The revolution is taking place in small gardens, under railroad tracks and power lines, on rooftops, at farmers' markets, and in the most unlikely of places. It is a movement that has the potential to address a multitude of issues: economic, environmental, personal health, and cultural." --Michael Ableman, Institute of Deep Ecology, as cited in Brown (2002)*

Urban agriculture has been described as an oasis of green in a concrete-dominated urban world (Lawson 2005). It has existed since the dawn of the city itself, and continues to serve many functions in today's metropolises. Whether to ease racial and socioeconomic tensions, heal urban food deserts, overcome the unsustainability of our food system, or provide a safe and encouraging recreational environment for teens, urban agriculture has woven itself into the fabric of what makes a city healthy. There are several ways to produce food in an urban setting—some private, some public, some institutional—and innovative technological advances are developing creative solutions to enable urbanites to grow more of their own food than was ever possible.

### **Definition**

The phrase "urban agriculture" can refer to any agricultural activities, including crop cultivation, livestock, and aquaculture (fish farms) that take place in an urbanized area. Most of today's working definitions come from International Development Research Center (IRDC). In the book Cities Feeding People, published by IRDC in 1994, co-author Egziabher defined urban

agriculture “as the practice of food production within a city boundary or on the immediate periphery of a city – it includes the cultivation of crops, vegetables, herbs, fruit, flowers, orchards, parks, forestry, fuelwood, livestock, aquaculture, and bee-keeping” (Egziabher 1994).

In 1996, Jac Smit defined it as:

an industry that produces, processes and markets food and fuel, largely in response to the daily demand of consumers within a town, city or metropolis, on land and water dispersed throughout the urban and peri-urban area, applying intensive production methods, using and reusing natural resources and urban wastes, to yield a diversity of crops and livestock (Smit et al. 1996).

Four years later in a review of definitions commissioned by the same institution, Mougeot defined urban agriculture as

an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, which grows and raises, processes and distributes a diversity of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area” (Mougeot 2000).

Appendix I of Soonya Quon’s 1999 report entitled *Planning for Urban Agriculture: A Review of Tools and Strategies for Urban Planners* provides a larger list of urban agriculture definitions (Quon 1999). For this thesis, I will use Egziabher’s (1994) definition, as it is the simplest and most relevant to the analysis of the food system: urban agriculture is the practice of food production within a city boundary or on the immediate periphery of a city – it includes the cultivation of crops, vegetables, herbs, fruit, flowers, orchards, parks, forestry, fuelwood, livestock, aquaculture, and bee-keeping.

## **Literature Review**

There have been many, many studies on urban agriculture over the last decade, but most are case studies of cities in the developing world. In Sonja Brodt’s article “Farmer-Community

Connections and the Future of Ecological Agriculture in California," she and her colleagues describe a study they conducted about urban agriculture in developing countries (Brodt 2006). The paper outlines issues and topics that policy makers should address to make sure that the farming conducted in cities is sustainable, and to make sure that land is secured for the poor. A couple years earlier Erik Bryld published a study along the same vein, entitled "Potentials, problems, and policy implications for urban agriculture in developing countries" (Bryld 2003). This too described the legalization of urban agriculture as a step towards securing lands for the urban poor.

Bryld's publication was one of several publications produced at an international workshop entitled "Growing Cities Growing Food" in Havana, Cuba in October 1999. Other themes published include "Urban Agriculture and Sustainable Cities," "Urban Agriculture and Food Security, Nutrition and Health," and "Policy Options for Urban Agriculture." They focus entirely on gardens and small farms on privately owned parcels and on community plots. Most of this is subsistence farming for the families who use the plots, as opposed to farming for income or commercial farming.

Kaufman and Bailkey's (2000) study for the Lincoln Institute of Land Policy looks at urban agriculture that contributes to the food market, not to individual family subsistence. This has more of a focus on government regulation and entrepreneurship in the private sector. Pothukuchi and Kaufman (1999) also looks at government and policy, but more as an historical narrative. It follows how the food system became largely invisible in US urban society, how the development of industrial farms that relied on cheap abundant energy to produce things in one place and ship it to another resulted in the loss of small, family-owned farms around older cities. It is this process, begun by the Green Revolution of the 1960s and 1970s that caused our

agricultural system to become enormously unsustainable, and that because of which urban agriculture will soon be necessary. It will serve as the starting point for this thesis.

### **Forms**

Urban agriculture has taken many forms. The most traditional is the standard, ground level farm or garden, which is either on communal land or on private property. This can be in the form of a backyard garden, a flower garden, or a community garden, among others. Cultivating communal land, as opposed to privately-owned, has been advantageous because in dense cities, most people do not have access to their own parcel of land. There is also often a deep and positive sense of community that can thrive in a communal situation, especially with an activity enjoyed across age groups, cultures, and income level. With that comes the power in numbers and motivation that has allowed gardens in Boston to oppose development and nurture a sense of permanency.

### **Backyard Gardens**

A fundamental form of urban agriculture is the backyard garden. This was the first form of urban agriculture in modern-day cities, before vertical growth made neighborhoods of single- and multi-family homes unviable. It is the small patch of strawberries, cherry tomatoes, and raspberries, the cultivation of greens, carrots, and cucumbers for daily salads, or the carefully and tediously tended pumpkin patch. More than 82 million households in the US participate in gardening activities (Matheny 2009), and many children grow up with fond memories of the excitement and pride of growing something from a tiny seed.

Backyard gardens are typically grown for just the individual, household, family and/or friends of the people who cultivate them. They are not typically meant to be for commercial sale, and very often serve more of a recreational purpose than necessary food provision. Gardens do have a history of doing so, however, as will be explored in a later section, and they still play a critical role in access to fresh produce in many urban neighborhoods.

Backyard gardens have particular cultural meaning for several neighborhoods in Boston, including Roxbury and Dorchester (Clark, Hauslade, and Brabander 2008). These neighborhoods have a history of being underserved by the food industry, and have often had to make up for a dearth of accessible and affordable fresh produce by growing their own. They are also home to a large population of individuals and families from agrarian areas, both within and outside of the US, and the backyard garden has served as a cultural extension of that history.

### **Community Gardens**

The most evolved and contested form of urban agriculture today, and the one that will be the main focus of this case study of Boston, is the community garden. The phrase “community garden” has been defined in many ways, including “a neighborhood garden in which individuals have their own plots yet share in the garden’s overall management,” (Lawson 2005), or just simply, “any piece of land gardened by a group of people,” (ACGA). This is different from the broader category “urban garden,” which can include other types of programs such as school gardens, relief gardens, children’s gardens, entrepreneurial job-training gardens, horticultural therapy gardens, company gardens, demonstration gardens, and more (Lawson 2005).

The definition of and use of the community garden has changed over time. From victory gardens to school gardens, some elements of these gardens have undergone dynamic changes while others have remained essentially the same. For example, although the World War I war

gardens and the 1970s community garden movement had very different contexts, many of the same justifications were used for both, such as building morale, fighting rising food prices, and improving nutrition (Lawson 2005). During the period after World War II, however, gardening was deeply frowned upon by city officials and urban planners. It was seen as too dirty for the city, despite its widespread use as a means of increasing food security, connecting with the land, and linking with one's culture. For example, urban gardens have been used by immigrants or migrants with agricultural backgrounds to stay in touch with their heritage and to transition into an urban style off the land. Crops from immigrants' particular culture or heritage that couldn't be found in grocery stores have also been grown in this manner, climate permitting.

Community gardens have a number of invisible, psychological, and spiritual effects as well, and have been shown to reduce crime through a sense of community and increased eyes on the street (Halweil 2004). A survey of over 60 community gardens in upstate New York found that having a garden in the neighborhood improved residents' attitudes towards their neighborhood, improved the maintenance of neighboring properties, reduced littering, and increased neighborhood pride (Armstrong 2000 as cited by Halweil 2004). A place away from the stress and bustle of city life, where one can reconnect with the soil, their food, and fellow gardeners, is meaningful across age groups and cultures, and serve as valuable assets for urban identity.

In some cities, however, there comes a certain danger to cultivating food in the local soil. Most American cities, especially on the east coast, were once nodes of industrial activity, which has a history of dumping tons of pollutants such as lead in to the ground, air, and water. Much of the soil is still contaminated, and the intake of chemicals and heavy metals is something most gardeners have to take great care to avoid.

## **Rooftop Gardens**

The idea of a green roof, or a roof covered in vegetation, has been rapidly gaining popularity in the last several years as a means of improving urban ecology and decreasing a building's energy use. Green roofs have been shown in several empirical studies to retain stormwater, preventing the inundation of sewage treatment centers, and lower ambient air temperature, mitigating the urban heat island effect (Collins et al. 2004; Gedge, Grant, and Jones 2006; and Bass et al. 2002). They can also provide a longer life for the roof itself, filter air pollution, and provide a layer of insulation for the building below, effectively lowering the building's energy demand. Finally, green roofs can act as community green space, enhancing the wellbeing and aesthetic pleasure found in typically green-less urban areas.

Very often, however, rooftops are planted with flora that needs very little or no maintenance, and that can be planted in light substrate, such as plants in the genus *sedum*. While this serves a very specific purpose and works very well to slow stormwater runoff, rooftops can also offer a vast expanse of space, with ample sunlight, for growing crops. With the right infrastructure, community gardens can go on top of apartment buildings, office buildings, hospitals, restaurants, hotels, etc. This would expand garden space access to places, uses, and people that would not normally have access using conventional urban garden space.

Utilizing roof space would be a completely viable solution to the problem of limited open space. It would get vegetables out of the path of air pollution from cars and buses, allow more sunlight to reach the plants than would gardens surrounded by buildings, and would open the door to allowing more city residents to cultivate their own food than would otherwise have the land to do so. Rooftop gardens would also reduce the security issues of ground-level inner-city gardens—theft and vandalism can be problematic in some areas.

The main issue with implementing roof gardens is the initial cost of installation. Depending on the type of garden desired, level of maintenance required, and materials used, it can be a number of years before the garden can pay for itself. The structure of the building is also crucial—raised beds with water and vegetation can get very heavy, so the roof needs to be able to withstand heavier loads than usual.

### **Vertical Farms and Multi-Story Greenhouses**

About a decade ago, a highly creative professor of public health had an idea. Given that the current food system is ecologically degrading, world human population is growing quickly enough to surpass the Earth's capacity to raise enough food, and most people are living in cities, Columbia University Professor Dickson Despommier designed a new commercial agricultural system that would function in and feed large urban populations. He called it the vertical farm.

The vertical farm is a multistory greenhouse. There are many designs for it, and part of one of his courses at Columbia University is making exactly that. The idea of creating a multi-story greenhouse that can be its own entity or retrofitted onto rooftops is new and barely tested, but there are already a number of cities and countries that are considering being the first to invest in a prototype, including New York City, Shanghai, and Jordan (Despommier 2008). The vertical farm would harvest a wide variety of produce in quantity enough to sustain even the largest of cities without significantly relying on resources beyond city limits (Ibid). This includes soil, fertilizer, and herbicides, which would not be necessary due to the planned use of hydroponics (growing plants in a water solution designed to have the exact level of nutrients needed for a particular crop to thrive). One vertical farm with an architectural footprint of one city block and rising up to 30 stories could provide enough nutrition (2,000 calories/day/person) to comfortably

accommodate the needs of 10,000 people employing technologies currently available (Despommier 2008). It would also provide a wealth of new city jobs.

The purpose of employing this concept in cities all over the world would be not only to implement a more ecologically benign, local agricultural system, but also to stem the conflict, unrest, and food insecurity of millions, even billions, of people as population exceeds the capacity of traditional farming to support it. Despommier believes that the vertical farm is a theoretical construct whose time has arrived, for to fail to produce them in quantity for the world at-large in the near future will surely exacerbate the race for the limited amount of remaining natural resources in an already stressed out planet, creating an intolerable social climate (Despommier 2008). This points to a need to take a critical look at social justice in discourse about urban sustainability, both on the local level and in the global realm. Efforts to make cities more in line with the actual limits of the physical environment must indeed consider the social inequities and injustices that are an integral part of providing for future generations.

Perhaps the most argued point against the use of vertical farms is that they will be too costly to build and maintain to actually be cost-effective. This is very true of the initial costs, which can easily be millions of dollars, depending on the size of the building and the necessary infrastructure. They would thus initially have to rely on government subsidies, as much of agriculture does right now, and would eventually reach an economy of scale to bring prices down.

Such intensive indoor urban agriculture would allow crops to be grown year-round, crucial to making a local urban food system in a seasonal climate like the Northeastern US a lot more viable. Despite its highly technological characteristics, it would in theory follow more closely ecological process than conventional factory farms. This is namely by safely and

efficiently recycling everything organic, turning plant waste and unsold food into energy for the building and nutrient additives for the hydroponic water, and by recycling water from human waste disposal plants, turning it back into drinking water (Despommier 2008). Bringing water, nutrients, and organic material full circle through reuse and recycling would bring a more holistic mindset to cities that, by default, dispose of most of their organic waste, grey water (water used in sinks and showers), and black water (sewage water), and thus closer to a more sustainable future for both the city, its metropolitan region, and the urban ecosystem.

### **Chapter 3: Environmental Sustainability**

Despite its potentials for greening cities and sustaining the human race, the vertical farm is a far cry from the historical and current movements to make agricultural activity as ecologically mimicking and benign as possible. This includes the present organic and permaculture movements. Permaculture is a term for “permanent agriculture,” and it entails the conscious design and maintenance of agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems—it is the harmonious integration of landscape and people providing their food, energy, shelter, and other material and non-material needs in a sustainable way (Mollison 1988).

The use of technology to try to achieve these same goals, as the vertical farm and other forms of urban agriculture do, indicates a new paradigm in the field of urban ecology. The urban ecosystem and its associated human involvement can be seen as an entity in its own right, not as a disturbance to the once-pristine environment that needs to be mitigated. The goal of this frame of thought would be to bring cities into a more holistic, efficient, and waste-less way of being, while still altering the “natural” landscape. It is to look at the unique ecosystems that actually exist in a city and try to maximize its health and the services they may provide, not to return them to the original forest or wetland on which they were built. This philosophy has been entering academic thought through many studies over the last decade (Alberti, et al. 2003; Bolund and Hunhammar 1999; Collins, et al. 2000; Marzluff 2008; Pickett 2001).

## *Urban Ecology*

One of the greatest benefits to a city that farming can bring is the improved health of local urban ecology. Urban ecology is the study of ecosystems that include humans living in cities and urbanizing landscapes (Marzluff et al. 2008, vii). It is a relatively new field that looks at cities as unique ecosystems themselves, not necessarily as a place where there was once a “pristine” ecosystem to which a city should strive to return. This places humans in the sphere of coexistence with nature, as opposed to the more traditional frame of thought that pits most human actions against it, and this is the view that this thesis will take.

Nevertheless, urban development invokes enormous, often detrimental effects on the living ecosystem it occupies, and this can significantly decrease a city’s ability to sustain itself long-term. The abundance of asphalt and the lack of green space contribute to a number of problems, including surface impermeability, which prohibits the natural filtering of water through substrate and the replenishing of the water table; urban heat island effect, which is a rise in temperature caused by the absorption of the sun’s heat into dark surfaces like streets and roofs; air pollution, caused by emissions from congested transportation and exacerbated by the urban heat island effect; and loss of biodiversity, which can disrupt the paths of migratory species, render some species extinct, or lead to a number of other consequences.

Traditional dialogue about ecology has often excluded humans and urban settings and focused mainly on the “pristine” or the original, humanless landscape. Studying cities as ecosystems themselves, however, can give us a deeper understanding of the consequences of the built-environment on local flora and fauna, including its effects on humans. As described by Davies et al (2008), several studies have looked at the influence of the extent and quality of urban green space on the provision of ecosystem services (e.g. clean air and water, climate

regulation), ecosystem resilience and biodiversity (e.g. Bolund and Hunhammar 1999; Pauleit and Duhme 2000; Gaston et al. 2005a). Vitousek et al. (1997) provides a synthesis of key major trends indicating how planet Earth is changed as a result of human action, including the 30 percent increase in carbon dioxide concentration in the atmosphere since the beginning of the Industrial Revolution and the extinction of one-quarter of the bird species on Earth (Marzluff et al. 2008).

Ensuring the health of an urban ecosystem also functions to protect and improve public health. High levels of air pollution caused by traffic congestion and higher inner-city temperatures often result in higher rates of asthma and other respiratory conditions. Immune systems can suffer from the lack of fresh air, and this places a heavy load on healthcare systems. A lack of green space also strongly correlates with degraded psychological health (Gross and Lane 2007; Arbogast et al. 2009; Castonguay and Jutras 2009).

The continual degradation of natural resources in and around an urban area can decrease the possibility of future generations being able to satisfy their own needs. The protection of water systems, air quality, and wildlife in the realm of urban ecology are thus quintessential to ensuring the sustainability of a city. The encouragement of green space, whether in the form of public parks, tree-lined streets, green roofs, or community gardens functions to enhance some of a city's ecological services. Bolund and Hunhammar (1999) included cultivated land in their seven different natural urban ecosystems. As a green space, urban farms function in a very similar manner to urban parks and forests. They increase habitat for wildlife, migratory birds, and insects. They could also provide for healthier mycorrhizal activity, as long as the garden is grown organically, which in turn has the benefit of improving production and the self-maintenance of the crops.

Increased use of urban land for agriculture would thus help mitigate many of the ecological problems associated with urban development, and should be looked at not only as beneficial to the natural environment, but also to the health of the public and the sustainability of the city as a whole. Urban agriculture's role in improving specific elements of urban ecology is outlined below. First is the water system, followed by the urban heat island effect, air pollution, soil health, biodiversity, and human psychology. The next section discusses resource recycling—the reuse of organic compost, grey water, and black water as fertilizer for farms within and on the periphery of the city.

### **Storm-water Retention and Watershed Management**

Cities are notorious for their expanses of impervious surface. Urban municipalities have had to construct elaborate sewage systems to cope with the large amounts of water rushing through the streets during a storm, so that the streets do not flood. This water poses a difficult environmental problem during intense rain events, because water treatment centers often cannot handle such large volumes of water in such short amounts of time. Efforts to reduce the burden on municipal water treatment centers by increasing pervious surface area can have highly positive effects on the water system as a whole—the city uses less tax money to clean water because less is being pushed through the treatment plants, the underlying water table is given a chance to recharge, water is naturally filtered through the soil, and water bodies are spared from having to cope with large amounts of polluted water.

Currently, urban areas employ trickle channels and sewer systems to guide runoff from rain events to bodies of water. Without impervious surfaces this water would slowly seep through the soil before reaching these bodies of water. In urban areas, however, the water moves

in large amounts straight to a receiving body of water, picking up pollutants and heat along the way. This can significantly degrade the underlying aquatic system. Water typically goes through a treatment center before releasing into the environment, but this process does not rid of all of the toxins, and during a heavy rain event, a significant amount of water may not be filtered at all.

Urban farms would increase the amount of pervious surface in a city by opening up plots of soil for percolation. Widespread use of rooftop gardens would also increase this area tremendously, and while the water retained on a green roof would not percolate directly through the soil beneath the city, it would be slowed enough as to prevent the overwhelming of water treatment plants and nearby waterways. Plants retain water that would otherwise rush through the sewer system or into a water body, preventing costly cleanups and averting damage to the surrounding aquatic system.

Boston's own Charles River has been heavily polluted from stormwater, to the point where the federal Environmental Protection Agency (EPA) called it, "the next great challenge for cleaning the Charles River," last November when announcing its new strong cleanup plans (World Fishing Network 2008). The EPA will require certain industrial, commercial and residential facilities in the area to operate under a Clean Water Act permit (Ibid). This will take pressure off of municipal water treatment centers by involving property owners themselves in the mitigation process.

### **Urban Heat Island Effect**

Many of the materials used to create the impervious surfaces in cities are dark, and they therefore absorb heat from the sun's radiation. This creates a "heat island effect," raising the

temperature of the city and exacerbating air pollution. Urban farms would greatly lower the amount of dark, impervious surface available for heating. They would also provide evapotranspiration services from the plants, which have been empirically shown to cool ambient temperatures. Economic benefits of mitigating the urban heat island effect include less of a need for interior building insulation and a decrease in need for health care services due to problems with ground level ozone (Green Roofs for Healthy Cities). Scientists at the U.S. Department of Energy's Lawrence Berkeley National Laboratory have been studying the urban heat island effect, and they estimate that using alternative surfaces, such as green roofs, to reduce the temperature of ambient air in cities by just three degrees Celsius would save up to \$6 billion per year in energy costs, nationwide (Collins 2004).

When looking at urban agriculture, however, the urban heat island effect can pose an interesting change in what can be grown. Warmer temperatures extend the growing season earlier in the spring and later into the fall, and could very well allow residents to raise an assortment of produce they otherwise wouldn't be able to. This could be particularly useful for Boston immigrants with origins in tropical climates. It could also reduce urban energy consumption by raising locally what is stored and shipped long-distance today.

## **Air Pollution**

With the congestion of people, cars, and buildings that define cities, the air is easily polluted from nearby industry and copious amounts of automobile exhaust. The decreased temperatures and increased foliage that urban farms would provide would trap air pollutants, cleaning up dirty city air. This ecological benefit translates to healthier city residents and to the economic benefits of decreased healthcare costs having to do with lung issues, like asthma,

which has become a major issue for urban children. About 70 percent of children hospitalized for asthma at the Children's Hospital Boston come from Roxbury, Dorchester, Jamaica Plain, Roslindale, and Hyde Park, and asthma hospitalization rates for Latino and Black children in 2003 were five times higher than the rate for white children (Health of Boston 2005 as cited by Sommers). These are, incidentally, as will be shown in a later chapter, the most food insecure neighborhoods of Boston as well. The high disparity of asthma rates experienced by these neighborhoods indicates deep environmental injustice as well as food insecurity, pointing to distinct manifestations of historical and systemic racism and classism.

In general, vegetation is much better than water or open spaces for filtering the air—up to 85% of air pollution in a park can be filtered out, and in a street lined with trees, up to 70% (Bernatzky 1983 as cited by Bolund and Hunhammar 1999). This indicates that foliage that is more brush-like, as the grasses and shrubberies in a park might be, or the vegetable plants in a garden are more effective in clearing the air of particles than trees. McPherson et al. (1997) found that the trees in Chicago remove around 5,500 tons of air pollutants per year, providing more than \$9 million of savings in potential costs from poor air quality (healthcare, cleanup expenses, etc.). Urban gardens could potentially save even more due to their thick foliage.

### **Soil Pollution**

A major problem of air pollution when planting a garden in the city, however, is that it contributes to soil pollution, which could threaten the safety of the produce. Roxbury and Dorchester, two Boston neighborhoods that are notorious for having higher rates of lead poisoning, also have a large percentage of Boston's community gardens and backyard gardens. The lead in the soil is likely to come from lead-based gasoline and lead-based paint (Clark,

Brabander, and Erdil 2006). These urban and underserved communities reflect the current demographics of lead poisoning in the United States in that they have the highest rates of elevated blood lead level (BLL) in children in the Boston area (Clark, Hausladen, and Brabander 2008). This, too, points to the current dire environmental justice issues in Boston, where high levels of air pollution, soil pollution, and food insecurity are synergized in a manner that makes some neighborhoods of Boston much less livable, healthy, equitable, and sustainable than others.

The use of raised-bed gardens filled with purchased soil is typically used to avoid too much exposure, or as a means of remediation, as is the use of replacement of soil and the use of chemicals or bioremediation. Clark, Hausladen, and Brabander (2008) found that the recontamination of soil in raised-bed gardens and in sites that had been excavated and replaced with compost is continually occurring due to toxins mobilized by the wind in Roxbury, a chilling find. They suggest that gardens need to be continually maintained and monitored, that simply replacing contaminated soil once will not fix the problem indefinitely. The partnership of these researchers and The Food Project, an organization that will be detailed in a later section, will ensure that these findings reach a wide audience among Boston's urban gardeners.

## **Biodiversity**

Perhaps one of the most significant mindset changes in the new urban ecological paradigm is that of the study of biodiversity. Biodiversity is crucial for the enduring survival of all living species worldwide, with diversity in food sources and prey being necessary for ensured nutrient consumption as well as population control. Ecologists are trained to look for specific species, communities, and patterns in pristine ecosystems, and have historically used that to denounce cities with all that has been lost. An important argument for green roofs, for example,

is that they would once again allow certain species of migratory birds a resting place along their flight path.

However, several studies on various scales and for various European regions and North America have shown that cities harbor more plant species than the surrounding landscape (Kühn, Brandl, and Klotz 2004). Kühn, Brandl, and Klotz (2004) compared species richness in city and non-city spaces, and found that not only naturalized alien but also native plant species richness were significantly higher in the city. This could be because of the original development of cities in biodiverse areas, or because of more varied microclimates in cities, which can in turn be due to the urban heat island effect, different elevations, wind patterns, and sun access.

Urbanization has resulted in entire landscapes that are now occupied by plant communities wholly created by humans, in which diversity may reflect social, economic, and cultural influences in addition to those recognized by traditional ecological theory (Hope et al. 2003). A classic example of this is the urban garden, in which city residents intentionally cultivate plants and crops of their particular desire, need, and culture. For example, gardeners of Chinese descent might plant bitter melon, a vegetable that has a very short shelf life and thus might be hard to find in a local grocery store. Lortie and Sperling (2008) found that urban gardens significantly enhanced local and regional plant diversity patterns.

## **Psychology**

The psychological benefits of green space, and gardens in particular, should not be undervalued in discourse on urban ecology. Green space enhances the aesthetic quality of the urban landscape, increasing overall quality of life. Gardens especially can provide a space for meditation and community gathering, and the practice of working with the land is known to be

therapeutic. Evidence for nature's direct relationship to psychological state is illustrated in a now classic study by Ulrich (1984) on short-term recovery from stress, in which he reports on the effects of a natural view on the emotional state and physical recovery of gall bladder patients (Gross and Lane 2007). Many other studies have shown green space to have enormously restorative effects on human health, psychology, as well as positive effects child morale and on healing childhood behavioral problems (Arbogast et al. 2009; Castonguay and Jutras 2009). Kaplan (1995) offers a framework for understanding attention and stress in the larger context of human-environment relationships, and Gross and Lane (2007) provides a comprehensive literature review of studies linking nature and natural settings with aspects of psychological well-being.

Research has also shown pro-environmental behavior to be positively associated with the strength of emotional connection towards the natural environment (Hinds and Sparks 2007). Gardening is a widely used example of continuing contact and commitment with the outdoor environment, as well as with the local community, helping form a local identity (Kaplan 1973; Clayton 2007). All of these reasons tend to be of little value to city municipalities, however, when dealing with land use issues, favoring uses that will maximize revenue. If psychological and social benefits of gardens and green space could be monetized, our cities would look very different.

### **Climate change mitigation**

In the United States, the majority of our food undergoes a long journey from farm, to processing plants, to distribution centers, storage warehouses, and grocery stores. As a result, our food has to travel many more miles from farm to our table, resulting in increasing

transportation and preservation, with the associated greenhouse gas emissions. Researchers estimated that local and regionally sourced meals entailed 4 to 17 times less petroleum consumption and 5 to 17 times less carbon dioxide emissions than a meal bought from the conventional food chain (Hora and Tick 2001 and Pirog et al 2001 as cited by Halweil 2004). According to a study that calculated the weighted total source distance of multiple ingredient food products, the primary ingredients for an eight-ounce container of strawberry yogurt—milk, strawberries, and sugar—travel more than 2,200 miles before reaching the supermarket shelf (Pirog and Benjamin 2005).

Transportation is only a fifth of the carbon footprint of food production, but when Pirog and Benjamin (2003) compared local versus conventional produce, they found that conventional produce items traveled from eight (pumpkins) to 92 (broccoli) times farther than the local produce to reach points of sale. Twenty percent of the fossil fuel used in the United States as a whole already goes toward food production (Food and Water Watch). This inefficient system uses 10 nonrenewable fossil fuel calories to produce only one food calorie, and spends a total of 10,551 quadrillion joules of energy each year, which is roughly the same amount used annually by all of France (Food and Water Watch). The emissions generated by producing, processing, transporting, and storing food are thus enormous. Furthermore, the current agricultural system is based on an abundance of cheap oil, a resource that will (or has already) peaked in supply, contributes heavily to climate change, and threatens national security. It is thus absolutely imperative that the food system change, from production to processing to plate.

### **Recycling: Completing the circle**

## **Compost**

In 1876, a German chemist named Justis von Liebig worried that Europe's rapidly expanding cities depended too heavily on one-way nutrient flows—the environmental and economic decline that results from continuously exporting produce out of the land on which is was grown, preventing those nutrients from replenishing the soil—undermining both urban and agricultural areas (Gardener 1997). To solve this problem, he invented fertilizer.

Agricultural byproducts, food waste, and sewage thus became discarded wastes instead of nutritious soil, creating two environmental hazards simultaneously—the problem of landfills, with the gases and toxic leachates produced by organic matter and anaerobic activity, and the problem of fertilizer, which poses an extra cost for farmers, alters the biogeochemical cycles of the soil, and pollutes nearby waterways and ecosystems. Landfills not only leak acid into the surrounding soil and nearby waterways, but the methane gas emitted into the atmosphere contributes heavily to climate change. Organic material forms the bulk of the growing mountains of municipal waste: 36 percent of the waste flow in many industrialized countries is food or landscaping wastes, and in developing countries, this number often gets above 66 percent (Gardener 1997).

Recycling organic matter instead, creating compost that could be returned to arable soil, would ease the pressure on these systems, and also relieve costly waste disposal facilities. If institutionalized in cities, it could provide a wealth of nutritious compost for urban agriculture. Compost is a common-sense solution to what is currently an environmental, social, and economic problem that makes up a large component of why our current agricultural system is so unsustainable. Many suggest that the same could be done with raw sewage in cities' black water—that the abundance of nutrients in human waste could also provide enhanced irrigation

water or it could add to the compost pile. Recycling organic waste would thus bring cities closer to the ideals of a holistic, closed-loop system not only by mitigating the numerous environmental effects, but also by providing an infinite source of organic, nutritious fertilizer to urban and regional farmers.

## **Greywater**

Another important resource that currently flows in a one-way direction is water. Large cities often need to pipe in water from miles and miles away—Boston gets its water from the Quabbin Reservoir on the other side of the state—and then dispose of it into the nearest water bodies after treating it. For Boston, much of this water, along with stormwater, enters the Atlantic Ocean, failing to replenish the aquifer from which it came and the water table beneath the city itself.

The evolution of wastewater reclamation, recycling and reuse has its roots in the early water and wastewater systems characteristic of the Minoan civilization in ancient Greece (Asano and Levine 1996). Several initiatives are sprouting up to reclaim grey water for irrigation, which can be dangerous unless treated. Grey water is the water that has been used in a shower, sink washing machine, etc., and so in order to reclaim it and recycle it for irrigation, usually only nontoxic and biodegradable soaps can be used. A common application of grey water recycling is to use it, not necessarily treated, as toilet water, so that it gets one more use before being flushed out to the municipal treatment center. However, there may be a lot more grey water than can be used by toilets, so with urban agriculture in mind, and with the right materials, grey water can be recycled to constitute a more sustainable urban irrigation system.

## **Chapter 4: Food Insecurity**

*“A hungry world is indeed a dangerous place. Only when our food policies begin with the hopes and dreams of the urban and rural poor will we build true food security, which will also be a huge step toward homeland security.” --Peter Mann, World Hunger Year (Winne 2008)*

Encouraging the urban production of food can serve as an enormous boost to improving public health. This is the focus of many community health studies on the subject, as a locally-sourced, healthy diet can decrease the risk of obesity, diabetes, and a number of other diseases and conditions that arise from poor consumption to fresh, healthy food. Several studies have already established that higher intakes of fruits and vegetables have been associated with a reduced risk of cardiovascular disease (Ness and Powles 1997; Knekt et al. 1994; Bazzano et al. 2002), cancer (Riboli and Norat 2003; Block, Patterson, and Subar 1992), and ischemic stroke (Bazzano et al. 2002), the three leading causes of death in the United States (Mokdad et al 2000, as cited by Alaimo et al. 2008).

There exists in most American cities a sharp disparity in access to fresh produce between socioeconomic demographics, with some living in what have been called ‘food deserts,’ or areas where very little food retail exists and where fresh produce tends to be very expensive and of poorer quality. This is a function of historic anti-urban biases, under-service to low income populations, and racism in the housing sector, which have led to some areas lacking equitable access to fresh, healthy, and culturally appropriate food.

During the 1940s and 1950s, many middle class and wealthy, white city residents moved to the suburbs, and most of the cities’ supermarkets went with them. “Middle class flight, aided in part by America’s car culture and the emergence of the interstate highway system,” left behind a “giant sucking sound in urban cores across the country” (Winne 2008). Inner cities largely

became majority minority, immigrant, and low income, and yet most of the food stores that remained were small grocers, taken up mostly by immigrants of Asian origin seeking livelihood and a better life. These inner city grocery stores tended to have higher prices, especially on fresh produce, and they still do today. The predominance of groceries with higher prices and less fresh produce in economically poor neighborhoods has been a contradiction that has plagued most inner cities in the U.S. over the last half-century.

The processes and changes that limited food access created a food gap, where, in a country of surplus, many communities were (and still are) food insecure, a condition where people regularly run out of food or simply don't know where their next meal will come from (Winne 2008). As in the case of supermarket abandonment of urban (and rural) areas, the food gap can be understood as a failure of our market economy to serve the basic human needs of those who are impoverished (Ibid). Over 35.5 million people in the United States are food insecure—more than ten percent of the national population (Boston Medical Center 2008). As part of the annual census update, the U.S. Department of Agriculture conducts a survey that determines the number of people who are food insecure (generally between 10 and 12 percent of the U.S. population) and severely food insecure (3 to 4 percent of the population, until 2006 labeled “food insecure with hunger”) (Winne 2008). It is a problem that relies on the hard work of hunger alleviation activists, food banks, soup kitchen volunteers, fundraisers, and food donators, yet the number of people who are food insecure in this country continues to expand. Non-profits and other entities are now not only fighting to keep up with the hungry, but also to begin to empower these communities with self-sustaining food security.

According to the Community Food Security Coalition, community food security is a condition in which all community residents obtain a safe, culturally acceptable, nutritionally

adequate diet through a sustainable food system that maximizes community self-reliance and social justice ([www.foodsecurity.org](http://www.foodsecurity.org)). One way to accomplish this is through the development of a local food system through urban agriculture.

Wayne Roberts of the Toronto Food Policy Council actually sees urban agriculture as the “new frontier in public health,” offering two potential health benefits: first, more fresh fruits and vegetables for urbanites, and second, the exercise involved in food (Halweil 2004, 99). Even just seeing fresh fruits and vegetables growing can excite people. There can also be beneficial changes in peoples’ attitudes toward food when they can actually see produce being grown as opposed to solely seeing the processed, sugary, fatty foods that are typically advertised and sold everywhere. A push toward food sovereignty, or a state where people have more control over where their food comes from, is critical for mitigating the food gap that has been woven into urban history.

### **Literature Review**

Much of the empirical literature collected about international food security has come from the UN Food and Agriculture Organization (FAO). *The State of Food Insecurity in the World, 2006* provides an objective and empirically studied overview of “setbacks in hunger reduction since 1990-92, the baseline period” established at the World Food Summit in 1996. FAO publications provide a solid foundation from which to analyze how the agricultural systems and food insecurity issues of specific countries, states, or cities fit into the bigger picture. While local food systems are an integral part of the greater international food system, this study focuses on the development of and need for local food security and food justice.

Food justice is a relatively new field. In two pioneering articles, Kami Pothukuchi and Jerome Kaufman (1999, 2000) have identified reasons for the low visibility of urban food systems in general and how municipal institutions could offer more comprehensive supports to urban food systems planning (Wekerle 2004). Levkoe (2006) outlines how industrial agriculture and the corporate food economy have separated people from where their food comes from, contributing to this problem. Further research delves into how some communities do not have as much access to fresh, healthy food than others (Anderson 1999, Campbell 2004, Clifton 2004, and Pothukuchi 2004). The study in this thesis will reflect this notion, comparing food access in Boston's diverse communities. Cohen (2002), Pothukuchi (2004), and Short, Guthman, and Raskin (2007) outline models for assessing community food security and provide valuable tools for analyzing individual cities and individual neighborhoods within cities. Boston Medical Center (2005) and C-SNAP (2008) study food security in Boston and provide information about hunger and food prices in Boston that is critical to this study.

### **History**

The formation of this systemic food insecurity began with the development of the suburbs. When the American soldiers came home at the end of World War II there was a surge of what we today know to be the “American Dream”—home ownership in a small, at that time racially completely white, town in the country, outside the degeneration of the city. Suburban neighborhoods like Levittown sprouted up everywhere, satisfying this post-war demand (although terribly disappointing most architects). In cities all over the U.S., “white-flight” diminished urban populations, taking many of the necessary social, political, and economic resources with it—grocery stores included.

The market was taken up again by small entrepreneurs, mostly of Asian descent and origin. This provided a source of livelihood for many people, but it also inadvertently created a negative aspect of Asian American history and experience in the location of these entrepreneurs as middle ground between the defined conflict between the white and African American populations. Furthermore, because of their location within the city, much of the stores' offerings were more expensive than in the suburbs, with less variety. Even today, small inner city grocery stores and food stands have less variety than the supermarkets of the suburbs, poorer quality produce, a higher percentage of processed foods, and are generally more expensive. Since these grocery stores were, situated in some of cities' poorest neighborhoods, they played a key role in the building of food insecurity.

The institutionalization of food insecurity worsened in the 1970s and 1980s. In 1982, Reagan cut minimum allotment for food stamps, reasoning that the private sector, including soup kitchens and the Salvation Army, would step up and fill in when people couldn't afford food (Winne 2008). While many positive things came out of this, including the start of America's Second Harvest – the Nation's Food Bank Network (now just called Feeding America), the lack of federal social programming promised to create a perpetual feedback loop that never actually solved the problem of hunger. A stronger focus on empowering communities through incentives for new groceries, health education campaigns, and more, would help cities get closer to achieving food sovereignty.

### **Food Deserts**

The existence of food deserts has only recently been realized in academic and public consciousness. The term "food deserts" was coined by a working group for the Low Income

Project Team of the Nutrition Task Force (Beaumont et al. 1995 as cited by Cummins and Macintyre 1999). Food deserts have been defined as “populated areas with little or no food retail provision” (Cummins and Macintyre 1999), “areas where no food retail outlets exist, or those that do exist are of unacceptable quality” (Guy and David 2004), “places where the transportation constraints of carless residents combine with a dearth of supermarkets to force residents to pay inflated prices for inferior and unhealthy foods at small supermarkets and convenience stores” (Short, Guthman, and Raskin 2007), and “places with too few choices of healthy and affordable food, and are often oversaturated with unhealthy food outlets such as fast-food joints” (Winne 2008).

People who live in or near food deserts tend to be poorer and have fewer healthy food options, which in turn contributes to their high overweight/obesity rates and diet-related illnesses such as diabetes (Winne 2008). Furthermore, since many low-income urban neighborhoods lack large supermarkets, which tend to offer lower prices and a wider selection, families who receive food stamp benefits and rely on small stores for their grocery needs are likely to suffer the greatest shortfalls when attempting to purchase a nutritious diet (C-SNAP 2008).

### **Demographics**

The question of who is food insecure has been the subject of many public health studies over the last couple of decades. In 2001, more than 31 million people (11.3 percent of the population) lived below the poverty line in the US, meaning that if they were a family of four, they earned less than \$17,960 each year (Brown 2002). People who are living in poverty are likely also to experience food insecurity: children, inner-city residents, single parent female-headed households, people of color, people living with disabilities, the elderly, and farm workers

(Ibid). The pressure to feed families falls unequally on women, as they are far more likely to carry the responsibility of feeding children than are men.

The Institute for Food and Development Policy reports that since 1970, 34 out of 50 supermarkets in Boston have closed (IFDP, undated, as cited by Raja, Ma, and Yadav 2008). Grocery stores over this period typically closed in majority minority and low-income neighborhoods, and this still manifests itself today in Boston. Half of all black neighborhoods in the United States are reported to be without full-service grocery stores and supermarkets (NBEJN, undated, as cited by Raja, Ma, and Yadav 2008). This thesis will look at how such disparities appear locally within the city of Boston.

### **Components of a Local, Accessible Food System**

Besides grocery stores, cities have other options for locally grown and distributed food sources. Food banks have become the center of our current system of battling hunger, and serve as warehouses for all of an area's donated and purchased food reserves. They supply food to food pantries, soup kitchens, and other outlets for free food distribution. Farmers' markets and Community Supported Agriculture (CSA) can bring fresh, sustainable produce to areas that lack access to it otherwise, and can also be a means for urban farmers to sell their products and earn an income. This section outlines the promises and problems of these components of the urban food system.

#### **Food Banks**

Food banks are large warehouses of surplus and donated produce and non-perishable food items that are distributed in a number of ways, including through food pantries and soup

kitchens. They have been the most active and widespread infrastructural means of battling hunger in the US, and rely entirely on donors and a handful of very hard-working individuals. While food banks have been enormously effective in getting food to the hungry, they have been experiencing a seemingly hopeless problem – the more food provided, the higher demand goes. In general, food banks feed more and more people every year, and are still virtually entirely reliant on food donations and federal funding.

Massive supermarket distribution centers and grocery stores have historically been enormously supportive resources for food banks. However, this has been changing, as manufacturers and distribution centers have tried to cut costs, as outlined by Winne (2008):

While food banks will do virtually anything to appease donors, the reverse is certainly not true... Increased efficiencies to reduce costs and in turn to satisfy stockholders have been accomplished through technology, consolidation, mergers and acquisitions, and simply moving or outsourcing to other regions or countries. Food banks in New Mexico, for instance, used to receive regular shipments of slightly dented cans, nonperishable food past code date, and other edible but nonsalable products. Not anymore. Major food manufacturers and wholesalers have found a secondary market in Mexico, which gives them a few pennies for each can of a product that can be sold in a country with lower safety standards. (Winne 2008)

This puts food banks in a sort of catch-22. On the one hand, lobbying against this sort of abandonment might lead to more government regulation and a more permanent assurance of American surplus food, but if such an endeavor failed at all, it would potentially turn big companies off from giving to food banks. The risk of offense could actually be detrimental:

Food banks will be unable to curry favor (receive money and food) if they offend corporations; the corporate leaders on food bank boards are not going to demand that state legislatures and Congress increase their taxes so that government will have more resources with which to tackle hunger. (Winne 2008)

It is ironic that our nation's system of feeding the hungry relies on the enormous centralized food distribution system and the corporations that process a good amount of the unhealthy products

that fill our shelves, the very developments that have led to such a dire food gap. However, the two are permanently entwined.

Tyson, one of the country's biggest industrial food corporations, even sponsored *The Almanac of Hunger and Poverty in America 2007*, the comprehensive publication on the state of hunger and poverty in the US by America's Second Harvest—The Nation's Food Bank Network. The company's logo is consequentially large on both the report and on the America's Second Harvest website. This is a corporation that has been under major fire in the last several years for accusations of environmental regulation violation, abusive livestock abuse, mislabeling antibiotic use, and racism.

Nevertheless, food banks and similar charities have helped many communities around the U.S. overcome hunger, a valiant effort that has empowered families and individuals to pursue other things besides their next meal. However, one of the reasons why they are encountering this problem of perpetually increasing demand is that they do not engage in ending hunger institutionally. They are not geared for helping communities achieve food sovereignty, self-sufficiency, or independence, only in feeding the present hungry.

The food bank that feeds the city of Boston is called the Greater Boston Food Bank. It also takes care of all of Eastern Massachusetts, including Cape Cod. With a full-time staff of just 60 people, the Greater Boston Food Bank distributed a total of 25,335,363 million pounds of food in fiscal year 2006 (*The Almanac of Hunger and Poverty in Massachusetts 2007*). More than half of that was donated. Only a little over two million pounds of food were fresh produce, however, underscoring how small the percentage is of fresh produce in comparison to other foods that reach the country's poorest populations.

## **Farmers Markets**

Farmers' markets are considered by many to be the cornerstone in a sustainable local and regional food system. At farmers' markets, producers can sell directly to consumers, giving consumers the freshest of the season's produce and producers a direct profit that doesn't go through wholesalers and retailers. They can liven up public spaces and play host to a number of community events and celebrations. Community members interact more at farmers' markets than in grocery stores, and they work to build a more holistic community unity in terms of environment, social fabric, economy, and education.

Gillespie et al. (2007) looked at how farmers' markets join together and support seemingly separate social and economic building blocks—the local resource bases and skills of producers, the needs and preferences of local households, and the development goals of communities, which emerge through four interrelated processes:

(1) making local food products and producers regularly visible in public settings, (2) encouraging and enabling producer enterprise diversification, (3) incubating small businesses, and (4) creating environments where market transactions and nonmarket social interactions are joined. Not all of these processes are present to the same degree in every farmers' market, but when they are, potential synergies abound. (Gillespie et al. 2007)

That last line, "but when they are, potential synergies abound," encompasses the snowball effect a farmers' market can have on certain communities, bringing people together in a positive fashion, celebratory of local pride.

Farmers' markets started popping up in the 1970s, the first cities to have them including Los Angeles, Santa Fe, New York City, and Hartford (Winne 2008). From as few as 100 in the 1960s, U.S. farmers' markets increased to 1,755 by 1994 when the USDA assembled its first national farmers' market directory, and then to more than 3,700 by 2006 (Hinrichs 2007).

Farmers' markets are a creative solution to the problem of food deserts, providing an abundance

of the area's freshest produce and many organic options in neighborhoods without access to high quality groceries. Many farmers' markets now accept food stamps as well, to get away from the stigma of being for the elite population, created because for many years, and still in most places today, this is the only population that can afford the premium usually placed on local organic food. The ability to use food stamps at farmers' markets can even serve to relieve pressure on food banks.

After years of pushing by local food activists, the USDA created a national Farmers' Market Nutrition Program (FMNP) under the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), that allowed WIC participants to use special FMNP coupons at farmers' markets. The first experiment with this was in 1986:

Massachusetts commissioner of agriculture Gus Shumacher and his associate Hugh Joseph had used several thousand dollars of state funding to give coupons to participants of the federally funded WIC Program. These coupons could be redeemed only at approved farmers' markets. The experiment had gone exceptionally well. Almost 70 percent of the coupons had been redeemed, a user survey found that the WIC participants had started eating more produce, and the farmers were very pleased with the additional income. (Winne 2008, 152)

Hartford did it the following year. By 1989, at least ten states had piloted some version of this program (Ibid). The FMNP was finally established by Congress in 1992, to provide fresh, unprepared, locally grown fruits and vegetables to WIC participants and to expand the awareness, use of and sales at farmers' markets (USDA FNS). In 2006, 2.5 million WIC participants received farmers' market benefits (Ibid).

Many farmers' markets also accept EBT under the USDA Supplemental Nutrition Assistance Program (SNAP), and are now experimenting with having wireless EBT machines at the farmers markets. This would allow everyone who qualifies to use food stamps more convenience when shopping at the farmers' market. Allowing buyers to use food stamps opened

farmers' markets to a population in dire need of affordable access to fresh produce. It also gives more business to the farmers themselves. In 2007, coupons redeemed through the FMNP alone resulted in over \$20 million in revenue to farmers (USDA FNS).

### **Community Supported Agriculture (CSA)**

Community supported agriculture (CSA) emerged in North America in the late 1980s, and is considered by some to be the reincarnation of the cooperatives of the 1960s. CSAs connect farms or a collection of farms directly with consumers in a different way than do farmers' markets. The buyers pay an annual fee, and in exchange receive periodic (usually weekly) boxes of the farms' freshest produce, whatever is in season. This also serves the purpose of insuring the small local farmer of a season's income, despite the ups and downs of the year's harvest itself. Customers, too, risk investment in a bad season, and this is one of the gambles of joining a CSA, but it in turn connects consumers with the reality of agriculture's vulnerability to poor weather conditions. It is estimated that upwards of two thousand CSAs now operate across the United States and Canada today (Winne 2008, 137).

There are several admirable examples of urban CSAs in the US that do more than just provide consumers with local fresh produce. Just Food, a non-profit in New York City, uses CSAs as a resource to do a number of things, including improving community health, acquainting new immigrants with what local produce is grown in the area, and revitalizing the home-cooked meal. Just Food has a CSA paired with cooking classes for the vegetable of the month to get good fresh healthy food to the low income while teaching them to change their eating habits (Winne 2008, 144). They have been working hard to bring CSAs to the city that would be affordable for neighborhoods with less financial means. As of 2006, Just Food had

organized more than 40 CSAs serving 10,000 participants in all five New York City boroughs (Ibid). Boston has several CSAs, but not quite on the same scale as those directed by Just Food. Nevertheless, CSAs provide a popular means of attaining local organic produce in the Boston metropolitan area.

## **Chapter 5: Boston Case Study**

The immense environmental, social, and economic value of a sustainable local food system is clear. In order for cities to actively work to improve their own food system, comprehensive studies of what already exists need to be undertaken. This is a case study of Boston, Massachusetts, modeled on previous studies of food access (Moore and Deiz Roux 2006, Raja, Ma, and Yadav 2008), but with the addition of the community garden as a representative of the potential of urban agriculture to provide underserved communities with food that is ecologically beneficial and socially healing. The hypothesis is that community gardens serve a definitive role in response to food deserts in Boston Proper by bridging the gaps in food accessibility between racial and socioeconomic demographics. The first section tells the story of a man who played a critical role in building Boston's largest community garden, Jim Clark.

### **The Clark-Cooper Community Garden**

Jim Clark came to Mattapan in 1969, and worked as an employment counselor in Jamaica Plain before getting hired by the MBTA. He was the first African American to work for the MBTA, and they hired him to reach out into the black community when they were required to in order to get federal funding to rebuild the Orange Line. They gave him a beautiful office and a good paycheck, but didn't let him hire anyone for two years, until his previous contacts from his work as employment counselor serendipitously came to work in the favor of the MBTA. Well-known in the community, Clark was able to hire 3,000 people for the MBTA, mostly from Boston's large minority population.

His motivation to improve the quality of life for his friends, neighbors, and fellow community members extended into what would become the largest community garden in Boston. Named after him and his fellow advocate, the Clark-Cooper Community Gardens began with 19 families on the grounds of the Boston State Hospital, which already had garden space for the patients. Demand for space grew and grew, and eventually, when more than 80 people were all trying to garden, Clark approached the staff at the Boston State Hospital, got a meeting space, and became president for life of the Community Garden Club. By the 1980s, they had 500 families on 22 acres, and the Club became incorporated. They began to collect funds, which allowed the garden administration to deal with infrastructure like irrigation and fences.

In the late 1980s the Boston State Hospital finally shut its doors, putting the land back on the market. Clark was appointed to the Citizen Advisory Committee to oversee the land, which was a key position that allowed him to advocate for the garden's wishes. The garden had the best location for development, overlooking the American Legion Highway, and Governor King "wanted [them] out of here, on the other side of the property," (Clark, personal interview). Since Clark already had the connections, he was nominated to deal with state representatives, the city council, and the governor, and this is one of the main reasons why Clark-Cooper Community Garden has lasted this long.

In order to save the garden from development, Clark insisted that everyone who registers for a plot must be a registered voter. He was able to use this large constituency to empower his community through enormous strength in numbers when dealing with elected officials. For example, when Governor Edward King wanted to move the gardens across the property, despite a soil test that rendered the land as toxic with lead, Clark organized a massive protest, calling on all of the families and neighbors who gardened there. It was such a success, with over 5,000

people, many of whom had voted for him, along with a slew of TV cameras and reporters, that Governor King didn't even have space to land his helicopter, and abandoned his plans.

The next conflict was with the new owners of the land, the Massachusetts Audubon Society, a renowned environmental conservation and education organization. They wanted to restore the land back to its original states of wetlands and other biomes, and much of this land was the land currently being cultivated by local residents. After a lot of negotiation, the Clark-Cooper Community Garden had to cut its land in half—it went from serving 500 families to less than 300 families, and it had to divide the plots into smaller sizes. In return, however, Clark stipulated that Mass Audubon Society would install bathrooms, underground piping, faucets, a garden designer, a gazebo, and free office space for life. When UMass began to build a laboratory on the property, Clark made sure they hired people of color from the community and gave the gardeners free access to the training center so that they could house large meetings and events.

When asked about the plot size reduction, Clark replied that some would say it affected their ability to provide for their families. Food prices were going up around that time, as they were when the garden first began and as they are today. He says that everyone he works with now has been freezing their produce and “making sure they take care of their family before giving some away—it’s a recycle of what happened 30 years ago,” (Jim Clark, personal interview).

They are now the largest community garden in the area, and produce an equivalent of \$500,000 worth of food every year. Only about \$200-300 of that is sold at a farmers’ market in Mattapan, the proceeds of which go back into maintaining the gardens. They have raised beds for handicapped gardeners, educational plots with Mass Audubon, and gardening workshops.

The gardens provide not only a source of food for family and friends. In the words of Jim Clark, they're everything:

*The garden club is more than just gardening to people, it's everything. Place to go, place to come during the summer, to sit, from the projects—there are a lot of people living in the projects, and there aren't many places to go [there] except for a stairway. You can't sit on a stairway and get air. Here, you can come here in the garden, work your body, and sit here along the perimeter, and think you are any place in the world, including where you came from—North Carolina, South Carolina, Georgia, Alabama, West Indies, Brazil, Argentina, Canada—you can pretend, in that spot, overlooking the American Legion Highway—looks like a country road anyway—that you could be anywhere in the world.*

*So it's recreation, it's educational, it's healthy, it's family—it's real family oriented—it's everything. Gardening is about ten percent of what you get out of it. People don't even know. It's like a church, it's like family—it is a family—everyone gets along pretty well. We have garden activities like dances, we have garden family cookouts every year...it's hard to explain. People retire, they come out in the morning and they go home when it gets dark. They go home when the mosquitoes bite them so much they gotta get out of the garden. (Jim Clark, personal interview)*

Jim Clark's story isn't rare. Most gardens around the country began informally and then had to fight for their right to stay. Today, even with the growing, ceaseless movement for a sustainable, local food system, community gardens still battle constantly against issues of land tenure and property rights.

Low-income neighborhoods and communities that are majority minority and/or immigrant are often without the same access to large grocery stores and produce markets that more affluent areas have, contributing to community health disparities. While community gardens serve many roles in these neighborhoods, an important one is that they provide a source of inexpensive, healthy fresh produce that would not be available otherwise. They serve populations that want to supplement their income with food they can raise on their own, that have little access to psychologically beneficial green space, and that may have migrated or immigrated from rural areas in which they traditionally grew their own food. Urban agriculture

in developed cities can thus be a strong tool for mitigating the disparities between socio-economic communities' access to fresh, healthy food.

There are over a hundred community gardens in Boston Proper today, and many households and individuals keep small backyard plots or plant vegetables in pots. The use of community gardens and backyard garden plots to grow food in cities has been used since the dawn of urbanization, but it has a bumpy history of vulnerability and varying legitimacy associated with its common status as a temporary land use, and it was deeply interwoven in the racial wars that divided (and still divide) the US. Boston, Massachusetts, is known notoriously as one of the most racist cities in the Northeastern U.S., and has a particularly coarse history of urban agriculture.

### ***History of Urban Agriculture in Boston, Massachusetts***

Until the Industrial Revolution, most city blocks held patches of open spaces, backyards of sorts, which residents cultivated as kitchen gardens (Warner 1987). In 1794 Thomas Pemberton described Boston as being just such a place: “Few houses are without them [garden spots] in which vegetables and flowers are raised, [and] in some fruit trees planted.” (Whitehill 1975, as cited in Warner 1987). Gardens were pushed out by city municipalities, however, in favor of firms with more financial worth. Gardens were seen as being for the poor, for rural peasants, and they were seen as too dirty for the city. Brick buildings and alleyways were more desirable for a higher-quality city image in the highly productive era of modernization.

During the economic depression of 1893-97, the US started its allotment gardening out of the desires both to feed and to control the poor (Warner 1987). The government called on owners of vacant land to let the unemployed raise food, for which it had to sacrifice a substantial

amount of tax dollars that would have gone towards relief expenditures, but it worked. This sort of “self-help” initiative became a popular target for charity and philanthropy, comparable to today’s food pantries. Eventually this changed, however, as public parks and other instances of beautification became favored over vegetable plots, and community gardens were once again pushed out of the city.

During World Wars I and II, urban agriculture made a comeback in the form of victory gardens in cities all over the country. This allowed the surplus produce of the rural US agriculture sector to be shipped to the starving populations of Europe and Russia. In Boston, even the Boston Common was plowed and farmed (although it’s original role was a grazing field for livestock, it had not been so for quite some time). The Parks Department plowed up 49 sites around the city, and the School Department undertook to give horticultural instruction to any who wished it (Warner 1987). The Fenway Victory Garden was created during World War II, and by the end of the war had a management committee, the Fenway Garden Society, that would carry on the garden after the war, when many of the other gardens would be dismantled. Though development—including proposals to establish a hospital, a school, and, on three separate occasions, an automobile parking lot—has threatened the garden from time to time, newspaper and radio publicity have combined with political support at the city and state levels to save the garden (Lawson 2005).

The Fenway Gardens, started in 1942, still exist today – with over 400 active gardeners (Warner 1987). It is one of only a handful of Boston community gardens that have survived since World War II. After the victory garden movement, today’s garden activists recall a sequence of events that they say began with public housing gardens, then shifted to the provision of community open spaces and gardens in new suburban subdivisions, and finally turned to projects

that sought neighborhood approval, construction, and maintenance for inner city open spaces (Warner 1987).

In the 1950s and 1960s, much of the white population in cities across the US left in favor of the suburbs. The government was highly supportive of this movement, known as “white flight,” and provided subsidies and other incentives to the white population to buy homes outside the city. Old buildings and neighborhoods in cities were leveled to make room for highways for suburbanites to use to commute to their jobs, and mass transportation was neglected in favor of the automobile industry. By the 1980s Boston had lost a third of its population, leaving many tracts of land and buildings abandoned, and degrading the quality of life of much of the remaining population, which was increasingly low income, African American, Hispanic, Asian, and immigrant (Winne 2008).

The destruction of low-income neighborhoods in favor of the construction of highways and of residences for middle- to high- income populations left many families disenfranchised. Large supermarkets had followed the favored demographics out of the city, leaving many inner-city neighborhoods with very few options of food retail. Racial violence and subsequent white flight continued the cycle of decline until the 1980s.

At this point, Asian Americans and immigrants, mostly of Korean and Vietnamese descent, began to fill in the void in the inner-city grocery market. Because they sold to a largely African American and Hispanic constituency, they fell in a contentious area of socioeconomic middle ground within the more visible national black/white racial conflict and dissonance. This was brought to the eye of the public with a number of tragic events, including Sa-I-Gu in Los Angeles in 1992 and the conflicts in Baltimore in the mid 1990s.

The riots of Sa-I-Gu (Korean for 4-29, in reference to April 29, the day the riots started) began as a response to the acquittal of four members of the LAPD who were being prosecuted for the case of Rodney King. Many thousands of Korean immigrants had come to LA in the last two decades seeking a better life for themselves and for their children, and many had started small grocery stores or shops in the low income areas of LA, which were predominantly minority. These stores were the target of arson and looting during the riot, and became a middle ground as a form of authority in a neighborhood that was protesting a fierce instance of white dominance.

American cities went through several decades of violence, active racism, and decline during the 1970s and 1980s. It was during this time, with increasing levels of abandoned land that was providing ample breeding grounds for gang violence and crime, that city residents saw an opportunity. Although housing abandonment, arson, urban renewal, and highways had already cleared several thousand acres of inner-city land, it took the leadership and experiences of the civil rights campaigns to transform the rubble-strewn lots into community gardens (Warner 1987). Community organizations began to take advantage of the abandoned land, resulting in, for example, the Southeast Corridor gardens of Jamaica Plains and Roxbury and the Clark-Cooper Community Gardens on the land of the old Boston State Hospital. As in other cities the most immediate opportunity for using the abandoned land in a positive way lay in gardening, turning the nearby ugly and often dangerous lots into a source of family food and personal accomplishment (Warner 1987).

There was a resurgence of the community garden in the 1970s, where it took on a broader meaning as not only a type of garden, but also as an expression of grassroots activism (Lawson 2005). This stage of urban community gardens began by people who started planting on the

abandoned lots adjacent to them without any sort of formal organization or permission (Warner 1987). Residents of Boston began to garden on the city's vacant land, which very soon became wrought with legality issues:

Already in 1970 the people living next to Cedar Square in Roxbury Highlands had taken up gardening on a vacant lot, and some years later this success carried them forward to build a "survival garden," as they called it, nearby on Linwood Street. Across Roxbury, in the Grove Hall section, Mrs. Augusta Bailey of 73 Wayne Street had for years been running an old-fashioned beautification program, but with the impoverishment of her neighborhood she had, in addition, turned to teaching nutrition to the poor families and to feeding children in a housing project. (Warner 1987)

Several other community-based projects like this sprung up around Boston and the surrounding area. With this came an enthusiastic movement to legitimize gardens as a public land use. The first formal public step toward a new politics of community gardening came with the election of Melvin H. King to the state legislature in 1972, who successfully sponsored the Massachusetts Gardening and Farm Act of 1974, legislation which stated that gardeners and farmers might use vacant public land at no cost (Warner 1987). This was still problematic in that gardeners would have no land tenure, and that most of the abandoned land was privately owned and/or polluted, but this Act was still a major step forward in the urban agriculture movement. City gardens were now seen by the government, as opposed to ignored—urban agriculture was visible, and formally accepted.

Garden activists rode on the positive momentum of the Gardening and Farm Act and pushed the city to continue to make beneficial change. In 1976, hundreds of thousands of dollars from the Community Development Block Grant funds were used to build six acres of community gardens around the city (Warner 1987). Littered with trash, junked cars and remnant foundations from demolished buildings, the sites had to be cleared and new soil introduced, so Representative King had the National Guard bring in 3,000 square yards of topsoil (Lawson 2005). Local

activist Charlotte Kahn, who played a major role in the delivery of the soil, said in a recent interview, “For me, the gardens were a symbol of the opposite of what was going on—the possibility for a better city and a real centered community, an expression of people getting along together. In opposition to what was going on in Boston at the time, as in racial violence and divisions among people, and [a] top-down approach to urban renewal, the garden was an expression of what is best in people.” (Charlotte Kahn, interview by Lawson, 1999).

Boston Urban Gardeners (BUG) was started that same year (1976) to keep finding sites, water, fencing, and soil, and to provide a means of organization and political legitimacy. A host of urgent activities carried BUG forward: deliveries of donated soil and horse manure, distribution of free seeds donated by the Department of Agriculture, and monitoring the city’s Revival Program (Warner 1987). The Boston Redevelopment Authority spent \$2,266,000 through the Open Space Management effort from 1977-1981 to clean up 178 acres of land it owned (Ibid). While these efforts were not as successful as hoped, since the contractors were unreliable and the land didn’t necessarily benefit gardeners in the end, little by little, the community gardening movement was gaining ground.

Organizations like BUG sprung up in cities all over the country around the same time. Philadelphia had the Philadelphia Green, San Francisco the San Francisco League of Urban Gardeners (SLUG), and New York the Green Guerillas. Burlington, Vermont established a large community garden that eventually became the basis for a membership organization called Gardens for All (Lawson 2005). This organization became the National Gardening Association (NGA) by the end of the 1970s, and expanded to include general gardening support in a variety of different types of gardens, including school gardens. The American Community Gardening

Association (ACGA) was also established at this time as a national organization and network of gardeners and activists.

Many of the gardens around Boston benefited greatly from these efforts, and they contributed enormously to the empowerment of disadvantaged communities. They also, however, worked to increase the value of the land, and became attractive as good places for development. This increased the vulnerability of most of the gardens around Boston, since they did not have legal entitlement to the land—only permission to use the land temporarily. Any increase in property value could lead to gentrification and the subsequent displacement of the current residents. The only gardens that were safe and permanently grounded around this time in the 1980s were the Fenway Victory Garden, the Clark-Cooper Community Gardens at the old Boston State Mental Hospital, and the Highland Park 400 Survival Garden in Roxbury, among others (Warner 1987).

The growing value of community gardens caused some discrepancy in the usual discussion of urban land use—suddenly many parcels of land that would otherwise be developed with commercial, residential, or other buildings, were arguably valuable without the growth. The conflict between using a parcel of land for an ecologically and socially beneficial park or garden and using it for something like public housing or economic development is prominent and rather tricky.

This happened in the Southwest Corridor, the name given to the land leveled to make room for I-95. Construction of I-95 was abandoned due to protest in this area, but a lot of land had already been cleared, and it became a hotly contested space as the city debated using it for public housing or for urban agriculture. Today it is a beautiful garden, but the decision involved a lot of time debating the pros and cons of using it to build more public housing instead, which

would have also added to public good. The prioritization of building new residences or offices over green space or land for cultivation ultimately detracts from the quality of life experienced by those who already occupy the space, so it is of utmost importance for city planners to take these aspects into consideration as well, and not just the financial bottom line.

### **Hunger in Boston Today**

Boston proper has an estimated population of 608,300 residents as of 2007 (Ebbert 2008). Of that, 19 percent of the population lived below the federal poverty level in 2003, and 23 percent of children and seniors live below the federal poverty line today (Boston Public Health Commission as cited by Johnson et al. 2009). Many poor families live in food deserts, and many face a “heat or eat dilemma” in which their food budget is sacrificed to keep the house warm and lights on (C-SNAP 2008).

The US Department of Agriculture (USDA) has created a Thrifty Food Plan (TFP), which “serves as a national standard for a nutritious diet at a minimal cost and is used as the basis for maximum food stamp allotments” (Carlson et al. 2007). It includes a list of groceries that are used generally and includes some used by different ethnicities, and calculates a cumulative cost, which is then used in the national Food Stamp Program. The TFP was last revised in 1999, and aims to provide a representative healthful and minimal cost meal plan that shows how a nutritious diet may be achieved with limited resources (Carlson et al. 2007). This new revision, unlike the 1999 version, includes a lot more prepared foods as opposed to items used for making dishes from scratch, reflecting how little time is given to home-cooked meals, and mealtime itself, today. USDA’s national TFP is used as a baseline standard in many food

access studies to compare the availability of generally used food products and their prices across different stores, neighborhoods, and/or regions.

In 2008, C-SNAP at Boston Medical Center and the Philadelphia Grow Project at Drexel University conducted a study on “The Real Cost of a Healthy Diet” in Boston and Philadelphia (C-SNAP 2008). They used the USDA’s TFP as the standard, looked at different sized food stores, and compared food costs and availability with Food Stamp benefit levels. This was used to evaluate how well the Food Stamp Program is working to alleviate hunger and to make policy recommendations to make the TFP and the Food Stamp Program more effective.

The findings of the study were unsettling—in Boston, the average monthly cost of the TFP was \$752, 39% higher than the maximum monthly food stamp benefit for a family of four (C-SNAP 2008). This is more than a 43% increase from only four years ago, when Boston Medical conducted a study of the Boston TFP market basket price (Boston Medical Center Department of Pediatrics 2005). Despite this drastic increase in food prices, the USDA TFP cost only increased 9% in the same span of time, to \$542.

There is a clear discrepancy between what the USDA found to be the cost of food across urban, suburban, and rural landscapes, and what Boston’s inner city, low-income neighborhoods have to pay for their groceries. The next sections describe a study of food retail locations in Boston delineated by type (convenience store, specialty store, small grocery, large supermarket) compared along side with the city’s abundance of community gardens. A study of how historic disparities still manifest themselves today in the spatial distributions of community gardens and affordable, varied, fresh groceries will show how successful Boston has been at overcoming its historic food gap, and will perhaps offer an explanation as to why Boston’s TFP is so vastly higher than the USDA’s calculations. The study hypothesizes that community gardens serve a

definitive role in response to food deserts in Boston Proper by bridging the gaps in food accessibility between racial and socioeconomic demographics.

### **Study description**

While there are many avenues for low-income families and individuals to access food when they can't afford it, including the Food Stamp Program, food pantries, and shelters, these programs are typically inadequate, trapping poor populations in a cycle of poverty (Boston Medical Center 2005, Carlson et al. 2007, C-SNAP 2008). Community gardens work to mitigate many of those disparities by increasing access to nutritious fresh produce and green space, and are thus typically most needed in low-income areas and areas with high percentages of minorities and immigrants. They have also been used to put community members back in touch with where food comes from, and make excellent tools for educating the public about nutrition. Urban agriculture can thus be a strong tool for bridging the gaps between socio-economic communities' access to fresh, healthy food, and increasing overall food accessibility in Boston.

Food accessibility is a community level indicator of community food security determined by the sum contributions of all food retail in a neighborhood (Short, Guthman, and Raskin 2007). This study is concerned with community gardens, large supermarkets, small grocery stores, specialty shops, and convenience stores in particular. Community gardens are rarely included in studies of food accessibility, so they have been highlighted here as a socially and environmentally beneficial solution to food insecurity in vulnerable city neighborhoods.

Questions considered include:

- Do the locations of Boston's community gardens and food retail outlets follow established trends for food insecurity?
- Does Boston have any food deserts, and if so, where are they?

- Who has access to community gardens?
- What are the socioeconomic demographics of the neighborhoods (census block groups used as a proxy) in which they are located?
- Where are neighborhoods with similar demographics that might benefit from a community garden?

The answers to these questions will be explored using Geographic Information Systems (GIS), a spatial mapping device, and information from the 2000 US Census.

These queries will look at the locations of the community gardens and food stores in the context of an analysis of vulnerability, to see if neighborhoods that exhibit standard aspect of food insecurity (low income, racial minority, etc.) are also the neighborhoods without ample access to grocery stores. If vulnerable neighborhoods are also without access to affordable, healthy food, the cycle of food insecurity continues. The same characteristics will be used to look at the location of community gardens—if they are located in vulnerable neighborhoods in conjunction with a dearth of groceries, they may point to a response to an ongoing need. Any neighborhoods with characteristics of vulnerability that lack the resource of community gardens can also be identified here. If, however, the gardens are located in high-end neighborhoods, they may indicate usages that are more geared toward recreation and community unity rather than a necessary means of food production.

Identifying vulnerable neighborhoods gives direct focus to policy makers when planning for aid to and new developments in specific communities, and also discerns underserved communities that need more attention. T-tests were used in conjunction with the spatial analysis to determine significant differences between the census blocks groups with and without community gardens to analyze any associations between urban agriculture, food retail, and the socioeconomic and racial composition of the neighborhoods in which they lie.

## Site Description

Boston is the capitol of Massachusetts, and is the largest city in New England, with a population of just over 608,300 in 2007 (Ebbert 2008) (See Figure 1). It is also one of the oldest, as it was originally settled by English Puritan colonists in 1630. Boston was the site of several significant events during the American Revolution, including the Boston Tea Party, and holds a

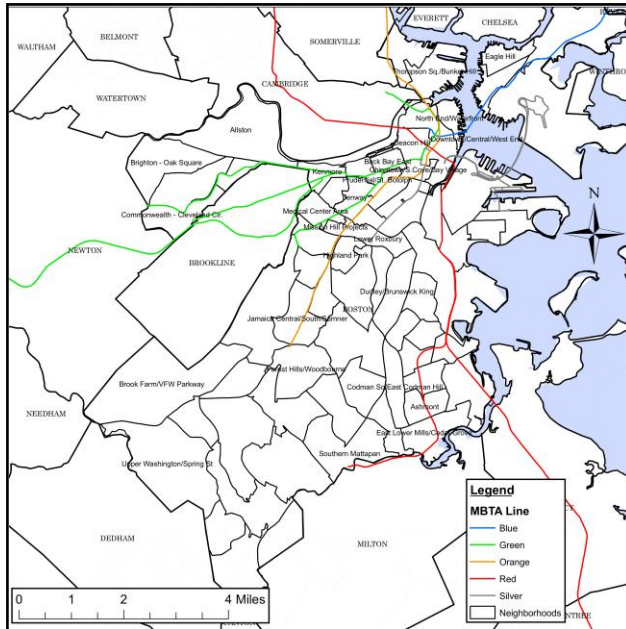


Figure 1: Boston, Massachusetts

deep significance for the country's historical memory.

Boston's elevation is approximately 19 feet above sea level. Most of it is actually built on filled-in wetlands (Boston Indicators). Annual precipitation averages 42.53 inches of rain and 42.6 inches of snow, and average temperature ranges from 29.3°F to 73.9°F ([www.city\\_data.com](http://www.city_data.com)).

## Methodology

Methods were based on the Moore and Diez Roux (2006) study entitled *Associations of Neighborhood Characteristics With the Location and Type of Food Stores* and the Raja, Ma, and Yadav (2008) study entitled *Beyond Food Deserts: Measuring and Mapping Racial Disparities in Neighborhood Food Environments*. These are both studies of the distribution of food retail using disparities between races/ethnicities as an indicator of inequality. The study analyzes food access in a similar manner, and adds urban agriculture to determine any role urban agriculture

may play in Boston's existing food system. In other words, this is a study of food access, but with the inclusion of vegetable gardens as a means of increased seasonal self-sufficiency.

The first phase of this study was to use ArcGIS and Reference USA to map all of the community gardens, food stores, and racial and socioeconomic demographics of Boston. ArcGIS is a widely used Geographic Information Systems (GIS) map-making software used by professionals and students in various fields of planning, environmental, and public health. ReferenceUSA is a private company that keeps updated databases of U.S. businesses using NAICS codes as a means of labeling (InfoUSA).

Census block groups were used as the unit of spatial analysis and as a proxy for looking at neighborhoods, as opposed to census tracts or zip codes. As Raja, Ma, and Yadav (2008) point out:

existing quantitative studies of neighborhood food environments define neighborhoods as census tracts (Moore and Diez Roux 2006; Morland, Diez Roux, and Wing 2006; Morland et al. 2002; Block, Scribner, and DeSalvo 2004) or zip codes (Lewis et al. 2005; Chung and Myers 1999), which owing to their large size...serve as a poor proxy for neighborhoods. Therefore, it is important to examine disparities in the food environment at as fine a geographic scale as feasible. (Raja, Ma, and Yadav 2008)

Here, the census block group is recommended to be a better proxy for neighborhoods than census tracts or zip codes. I also decided not to focus on only some neighborhoods within the city, as many other studies have done (Morland, Diez Roux, and Wing 2006; Short, Guthman, and Raskin 2007), so as to perform a more comprehensive study of Boston as a whole.

#### **Data sources:**

Racial and socioeconomic data came from the 2000 U.S. Census in the form of data layers from *MassGIS* page on the Massachusetts government's website (MassGIS). Boston has 541 census block groups, 81 of which contain at least one community garden.

The community garden addresses came from Boston Natural Areas Network (BNAN), an organization that “works to preserve, expand and improve urban open space through community organizing, acquisition, ownership, programming, development and management of special kinds of urban land, including community gardens, urban wilds, and greenways” ([www.bostonnatural.org](http://www.bostonnatural.org)). In order to map them, I entered the addresses into a Microsoft Excel file, and then converted it to a format that could be geocoded in ArcGIS. Many of the addresses listed were intersections or place descriptions, however, so I used Google Maps to find the nearest existing street address that would be able to be mapped. The purpose of mapping the gardens is to analyze the block groups in which they lie, so exact precision is not necessary.

While BNAN had information about community gardens, school gardens, and non-profit gardens, I decided to use only community gardens. School gardens and non-profit gardens are used differently than community gardens, which allot plots of land to individuals and/or families, and I wanted to focus on just this type of garden. Community gardens work best to analyze in terms of community food security, while school gardens and non-profits are geared more toward education.

Data about the various different types of food retail came from ReferenceUSA. ReferenceUSA is an Internet-based reference service from the Library Division of InfoUSA, and the database contains detailed information on more than 14 million U.S. businesses (InfoUSA). Information about food retailers was downloaded, and since the database includes exact addresses for each store, the lists of supermarkets, specialty stores (bakeries, dairy, ethnic), and convenience stores were able to be geocoded into ArcGIS as well. Each of these had information about the square footage of the store, so I was able to divide the supermarkets into small grocery stores and large supermarkets. Small grocery stores are 1-9,999 square feet, and large

supermarkets are over 40,000 square feet (in the city of Boston, there are no recorded grocery stores between 10,000 and 39,999 square feet).

### Analysis

The layers of census data, community gardens, and food stores were spatially joined in GIS, creating a new database attaching information about racial and socioeconomic demographics, gardens, and food stores to the specific census blocks in which they lie. This was converted into a Microsoft Excel file and used in SPSS for statistical analysis. Questions tested included:

- Number of each type of food store in Boston, and any significant differences in the top 25 percent census block groups most vulnerable to food insecurity compared to the other 75 percent
- Significant differences in race, income, citizenship, and language between the census blocks with community gardens and those without
- Significant differences in race, income, citizenship, and language between census blocks with access to have at least one convenience store, specialty store, small grocery store, large supermarket, or community garden

This information was both mapped and described numerically in tables. Having all of this information on one map serves to show various trends visually, which is an excellent tool for illustrating existing food accessibility and disparities between race and class.

### **Vulnerability Scoring**

In order to encapsulate the socioeconomic differences between census blocks and show these trends more efficiently, I developed a numerical valorization system to summarize and display selected variables in the determination of “food insecurity.” The five variables included were: percentage of households that do not speak English, percentage of households that are families with at least six members, and the percentage of residents that are low income, non-US-

citizens, and racial minority. These were chosen because the communities that are most likely to be without access to abundant, fresh, healthy food within a city are the low income, minority, and immigrant populations (Chilton 2009). Furthermore, low-income households and middle- to low-income families with many mouths to feed may find it more difficult to buy enough food on a regular basis, regardless of race or heritage, but studies have shown that immigrant families tend to have more people (McCarthy and Vernez 1997).

Each of the variables was broken down into five ranges and assigned a number one through five (Table 1). The ranges were determined using statistical quintiles within ArcGIS. The sum of the assigned numbers under each variable for each block group then determined the overall vulnerability score. For the total vulnerability measurement, the scores of the component variables were added together into one score of 1 through 25.

<b>Score</b>	<b>Percent Minority</b>	<b>Percent Low Income</b>	<b>Percent Non-Citizen</b>	<b>Percent Non-English</b>	<b>Percent Large Family</b>
<b>1</b>	0-15	0-17	0-7	0-2	0-.99
<b>2</b>	16-32	18-27	8-11	3	1-6
<b>3</b>	33-60	28-35	12-16	4-5	7-10
<b>4</b>	61-94	36-46	17-23	6-8	11-14
<b>5</b>	95-100	47-100	24-76	9-28	15-35

*Table 1: Variables and their scored ranges. Large family is defined as having six or more members.*

As can be seen in Figure 2, the Boston residents that may be at risk for food insecurity reside predominantly in the center and southeast areas of the city, with some neighborhoods in the Allston/Brighton and Eagle Hill regions in the northern corners.

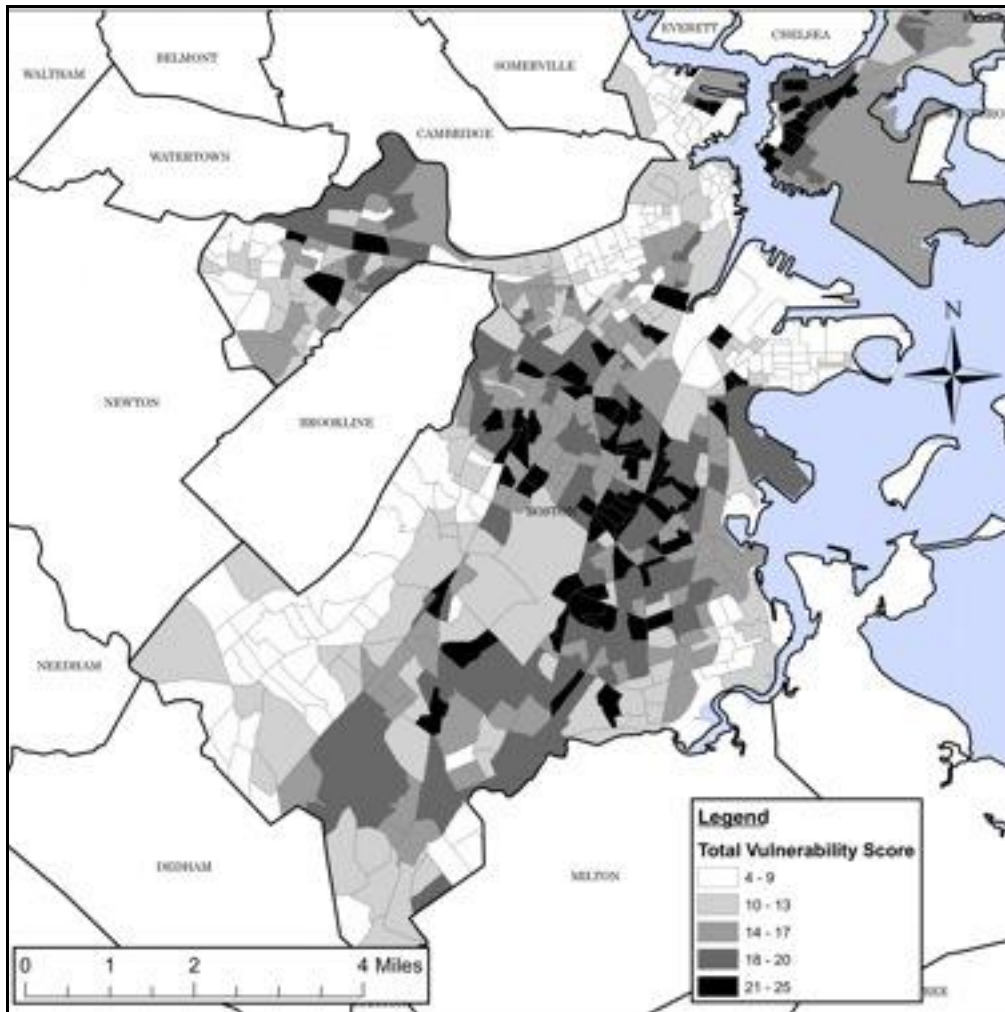


Figure 2: Total vulnerability score for Boston, Massachusetts

### Racial and Socioeconomic Demographics

Analysis of racial and socioeconomic demographics was modeled off of previous studies (Moore and Diez Roux 2006; Raja, Ma, and Yadav 2008). Census block groups where more than 60 percent of the population identified themselves as a particular race were classified as “predominantly [white, African American, Hispanic, or Asian].” The same delineation was used for classifying census block groups that were predominantly low income, medium income, or high income; citizen or non-citizen; and English-speaking or non-English speaking. This differs from the other studies—Moore and Diez Roux’s (2006) model just looked at race, and Raja, Ma,

and Yadav's (2008) model looked at race, adjusting for income, land area, and census block group population. I decided to look at race and income, but to keep them separately, as to be able to see class disparities as well as racial disparities.

The other two studies also did not look at how immigrant status may play a role in food access or use of a community garden, which I see as a potentially key factor. Almost 30 percent of Boston residents were born outside of the United States—up from 20 percent in 1990 (Lafner and Taylor). Because many immigrants come from rural areas or largely agrarian countries, they tend to have the skills and the drive to grow their own food. This was especially true before grocery stores started importing a variety of international produce, but in many cases still stands true today (Ibid). [Looking into] the Berkely Street Gardens in Boston, the impulse to plant can be strong among people with agrarian backgrounds, and the vegetables, fruits, herbs, and other plants they choose tend to reflect their homelands (Ibid). In order to look at immigrant status in this study, I analyzed the number of people per block group who identified themselves as non-US-citizen versus those who identified as citizens and households that identified themselves as non-English-speaking households versus those that identified as English-speaking.

A large part of access to fresh, healthy food is also determined by the modes of transportation available, as Raja, Ma, and Yadav (2008) pointed out. While a certain census block group may not have a large supermarket, the residents living there may have access to cars or other modes of transportation that could get them to one within a couple of miles. Shoppers with only a small number of light-weight items to buy may choose to walk or bike to a far-away supermarket, or, in the case of an urban area, can opt to use the mass transportation system or a taxi cab. Owning a car gives by far the most flexibility, because of the freedom to travel to a more distant food store in a shorter amount of time, and also because of the ability to transport

large amounts of groceries. Most people in densely populated urban areas do not own cars, however, making food shopping potentially problematic. This is why some neighborhoods in a given city can be labeled “food deserts” while others are not, even if they are only a few miles away from each other.

The modes of transportation used by Raja, Ma, and Yadav (2008) to analyze access to food were car, bike, and foot, but this does not work for the city of Boston, where many residents use the mass transportation system. While it would be possible to account for the MBTA subway and bus system, this sort of study would have been beyond the time and resources available.



There are now over a hundred community gardens within Boston Proper, each serving many individuals and families (see Figure 3). Convenience and grocery stores are scattered around the city, getting less dense toward southern Mattapan and Hyde Park in the southern end of the city. While the majority of the community gardens are spread throughout many of the high vulnerability areas, one thing that stands out is that large supermarkets are nearly absent. This points to a potential reliance on convenience stores, specialty stores, and small groceries, all of which may charge more for fresh produce than would a large supermarket—past studies have verified this, albeit not for Boston. Boston’s community gardeners have grown increasingly productive, however, and grow a substantial amount of food every year.

Boston Natural Areas Network (BNAN), a non-profit that took over Boston Urban Gardeners (BUG) and now works with most of the community gardens in the city, did a study over this past year on how much food is produced in Boston’s community gardens, and the food’s monetary value. Their results were as follows:

Boston’s community gardens collectively grow about 497,750 pounds of vegetables each growing season that are valued at \$1.3 million. That is an average value of about \$431 in fresh food each gardener can put on his or her family table. Each of Boston’s 150 Community Gardens (this includes school gardens and non-profits, which I did not include in my study) is divided into individual plots, totaling nearly 3,000 garden plots citywide. Gardeners grow what they choose for their own use, with many sharing their harvest or donating to some local food banks. (*Urban & Green*, BNAN, Winter 2009)

During this economic climate, an extra \$431 of fresh, usually organic produce is extraordinarily valuable. It could be enough to supply a family with all of the fresh produce it needs for at least five months out of the year, which would contribute enormously to their health if they were otherwise consuming mostly processed foods.

BNAN is also part of an innovative team to help the Boston refugee population begin to garden. The program is called Growing through Refugee Organizations (GRO), and involves a

partnership between BNAN and the Mutual Assistance Association (MAA) Coalition, the MA Office of Refugees, the Food Project and the City of Boston Department of Neighborhood Development (*Urban & Green*, BNAN, Winter 2009). Many of the refugees arriving in Boston come from agrarian backgrounds, and would benefit from the satisfaction and food security that stems from cultivating one's own food. The refugees targeted include Haitian, Vietnamese, Congolese, Somali, Sudanese, Liberian and Sierra Leonean populations, among others (*Urban & Green*, BNAN, Winter 2009).

Community gardeners can also get free seeds and compost from BNAN. They offer workshops, including traditional ones on basic gardening technique, as well as highly innovative ones, like the rooftop gardening workshop that will be offered in June of this year. BNAN stands as a terrific example not only of a gardening organization that is extraordinarily active in its community, but also as one that embraces its position in an urban landscape, helping longtime gardeners work within the unique and often difficult characteristics of a city.

Another renowned organization that does this is the Food Project, a not-for-profit organization based in Roxbury. The Food Project was responsible for 7 new farmers' markets in the Boston metropolitan area, and they were all authorized to participate in the Farmers' Market Pilot program for 2008 (USDA FNS). They have also started a program to construct raised gardening beds for current and new gardeners (Clark, Hausladen, and Brabander 2008).

### **Food Retail and Gardens**

Convenience stores and small grocery stores are the most prevalent in Boston, with 3.39 of each per 10,000 Boston residents (Table 2). These are typically the most expensive types of food retail, with poor quality produce, if any, and a wide selection of unhealthy, processed, and

packaged choices at lower prices. There are, however, more community gardens in Boston than large supermarkets and specialty food stores combined, which can indicate a number of things, including a response to a dearth of affordable, healthy food retail locations, a particularly large population of people with an agrarian history for whom this is a natural part of their culture, or a general love of Bostonians for gardening.

<b>Food Retail/Source</b>	<b>Boston Total</b>	<b>% of total</b>	<b># per 10,000 residents (2000)</b>	<b># in 25% most vulnerable block groups</b>	<b>% of total (of each type)</b>
<b>Convenience</b>	206	32.75	3.51	53	25.72
<b>Small Grocery</b>	206	32.75	3.51	79	38.35
<b>Community Garden</b>	115	18	1.96	57	49.57
<b>Specialty Store</b>	89	14	1.52	18	20.23
<b>Large Supermarkets</b>	16	2.5	0.27	2	12.5
<b>Total</b>	632	100	10.76	209	33.07

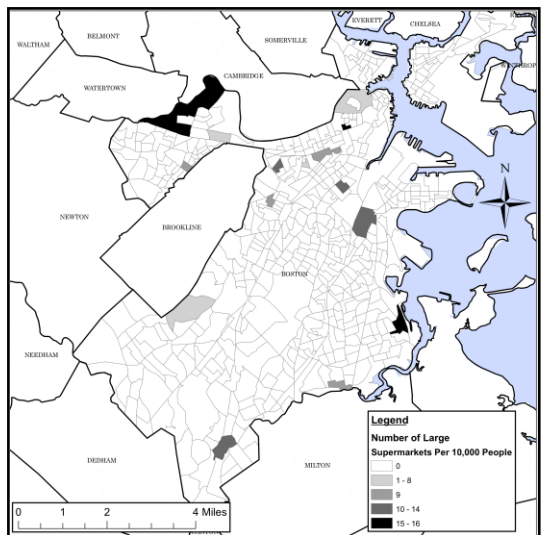
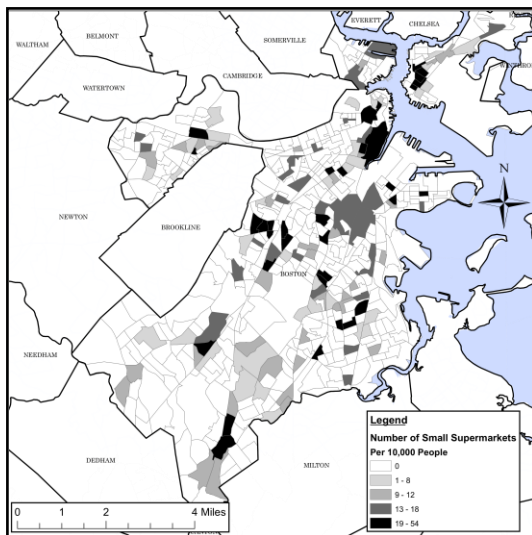
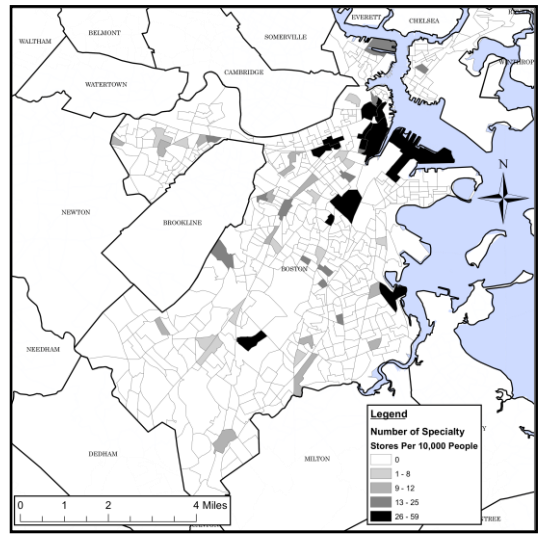
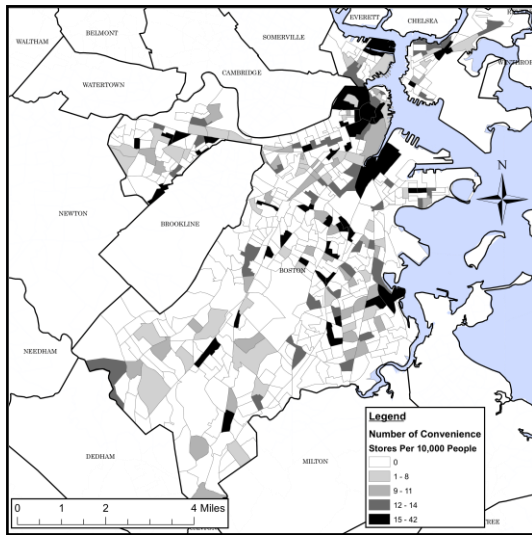
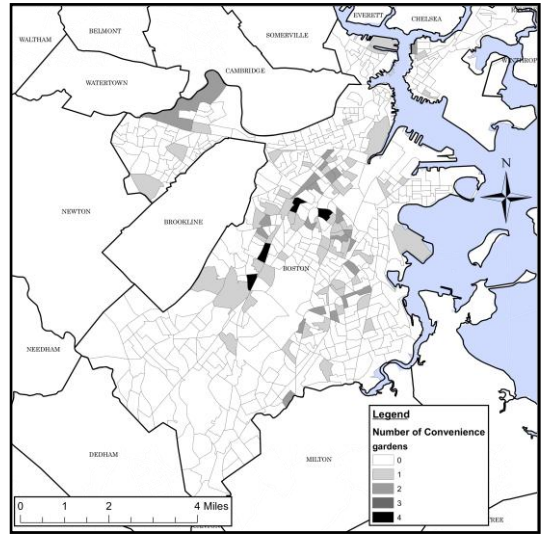
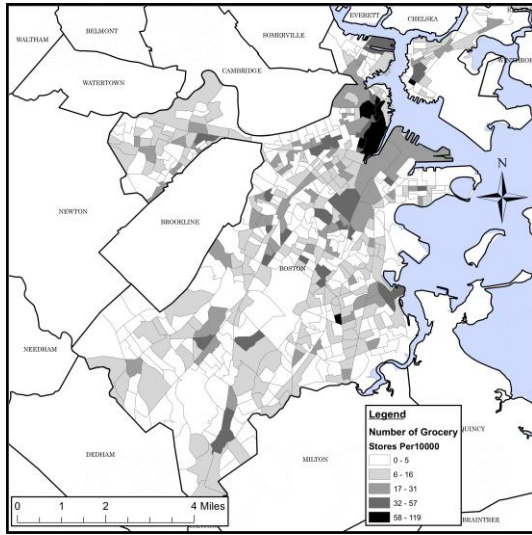
*Table 2: Food stores and community gardens in Boston, Massachusetts*

There are merely 16 large supermarkets in Boston, and only two of them are located within the top 25% most vulnerable block groups. The most vulnerable neighborhoods also have a disproportionate number of small grocery stores—nearly 40 percent of the city’s small grocery stores reside there. While small grocery stores nearly always have a produce section, it may be too expensive for many of the residents in these more vulnerable neighborhoods. The city has 33% more convenience and specialty stores than it does small and large grocery stores combined, and less than two small and large grocery stores (combined) per 10,000 people. These numbers show a lack of food retail in Boston, especially in options of places to buy affordable, healthy fresh produce.

On the other hand, about half of the city's 115 community gardens are located in that same area of high vulnerability. There are more gardens than convenience stores. Added with the number of specialty stores and this hierarchy disappears, but it is a clear indication of Boston's need for and thorough use of urban agriculture. Because of the numerous benefits that urban agriculture has for urban areas, this can be seen as a grassroots movement by Bostonians to achieve their own sense of food justice and food sovereignty.

A collection of maps showing the density of the different types of food retail shows the spatial distributions in an easily accessible, visual manner. They are placed together on the following page for ease of comparability.

*Maps of Food Retail Densities and Community Gardens in Boston, Massachusetts*



The map of general grocery store density makes food retail appear evenly distributed, but going deeper into the different types of food retail and their various implications in terms of type of food available and average prices tells a different story. The map of large supermarkets is perhaps the most striking. As established, large supermarkets most often have the most variety, freshest produce, and lowest prices out of all of the other types of grocery stores, and yet they are missing nearly entirely from the vulnerable areas of Boston. This study will go further to explore just how big the gap is in access to this sort of resource in the next section.

Specialty grocery stores are concentrated up on the northeast end of the city, the general area of Chinatown and the North End, which is Boston's "Little Italy." Many of these stores are likely to be owned by immigrants and cater toward these nationalities. Some of these stores, particularly in Chinatown, may be less expensive than other available grocery stores, providing an oasis of affordable, culturally appropriate items.

The map of the community gardens looks like a lighter version of the vulnerability map. This reemphasizes what has already been discovered and rediscovered by community members and scholars alike – that urban agriculture comes as a response to food deserts, neighborhood blights from the many vacant and dilapidated lots, and other urban woes, along with the commonly cited reasons such as a high population of residents with agrarian histories, and the beautification and sense of place that gardens can provide in a callous urban landscape. They have been used by such communities in Boston for decades.

One of the most important, invisible benefits of urban gardens is that they can provide a deeper sense of meaning for their participants than just increased food security, which is why they have lasted so long, and why the number of participants is once again on the rise. Each additional year that a community garden is active gives it more permanence and more legitimacy

in a city that has in the past strove to rid itself of such peasant activities. Each year more and more people decide to cultivate their own food in Boston, whether because of the current financial crisis, the desire to reconnect with one's culture or heritage, or a goal of lightening one's load on the environment (BNAN).

There are still many communities in Boston that lack this resource. Many of the gardens serve the Roxbury/Mission Hill, Jamaica Plain, and Dorchester, but East Boston, Mattapan, and Hyde Park, also high in vulnerability, have relatively few community gardens in comparison. This may be because there has been little demand for community gardens in those areas, because there is little open space, because the ground is contaminated, or because the residents have very few resources and little political power. These last reasons go back to my overall theme of social and environmental justice and sustainability—in cities in the U.S., neighborhoods with high minority and low income populations have been systematically and systemically disadvantaged. This study looks at one aspect of that, food access, and goes more in depth in the following sections.

GIS can show general patterns and trends, used in this study to visually portray the disparities of food access between underserved neighborhoods and more secure neighborhoods. For more detailed information, future studies can look at vacant plot location, walkability to gardens and food stores, access via different modes of transportation and the associated transport times and difficulties, or create original data by surveying residents on a much smaller scale, for example by block or street. Data on such a scale is not currently available from the US Census, so such an endeavor would be beyond the scope of this thesis, but is of the interests of this student to pursue at a later date.

## Racial and Socioeconomic Demographics

The 542 census block groups were divided into various socioeconomic labels, determined by consisting of at least 60 percent of that particular groups. This is based on Moore and Deiz Roux (2006) and Raja, Ma, and Yadav (2008). For analyzing race, block groups were divided into predominantly and not predominantly white and predominantly and not predominantly minority. “Minority” status was delineated into predominantly African American, predominantly Hispanic, and predominantly Asian. Block groups that were not predominantly anything were labeled “mixed.”

The same was done for income group – census block groups that were predominantly low income, medium income, and high income; for citizenship – block groups that were predominantly citizens and predominantly non-citizens; and for predominantly English-speaking and non-English speaking households (Table 3).

<b>Demographic</b>	<b>Predominant? Y=yes, N=no</b>	<b>Number of Block Groups</b>	<b>Percent of Block Groups</b>
<b>White</b>	Y	253	46.7
	N	289	53.3
<b>African American</b>	Y	93	17.2
	N	449	82.8
<b>Hispanic</b>	Y	7	1.3
	N	535	98.7
<b>Asian</b>	Y	3	.6
	N	539	99.4
<b>Minority</b>	Y	219	40.4
	N	323	59.6
<b>Mixed</b>	Y	70	12.9
	N	472	87.1
<b>Low Income</b>	Y	48	8.9
	N	494	91.1
<b>Middle Income</b>	Y	40	7.4
	N	502	92.6
<b>High Income</b>	Y	8	1.5
	N	534	98.5

<b>Citizen</b>	Y	527	97.2
	N	15	2.8
<b>Non-Citizen</b>	Y	2	0.4
	N	540	99.6
<b>English-Speaking</b>	Y	364	67.2
	N	178	32.8
<b>Non-English Speaking</b>	Y	36	6.6
	N	506	93.4

*Table 3: Boston census block group division by racial and socioeconomic predominance: Y indicates that the census block groups are at least 60 percent this demographic, and N indicates that they are not.*

Over 40 percent of the block groups in Boston are predominantly minority, and there are nearly six times as many block groups that are predominantly low income than there are that are high income. Only 12.9 percent of the block groups in Boston are mixed, or not predominantly anything, which shows that Boston is a city of cultural neighborhoods. Over six percent of the block groups are predominantly non-English speaking, and five percent of those are predominantly non-citizen, indicating Boston’s large immigrant population as well. While several of these demographic categories have only a small number of block groups, for example there are only two census block groups that are predominantly non-citizen, and there are only eight block groups that are predominantly high income, I will still use them in my analysis for the sake of comparison and because they still represent a large number of people.

The next analysis I did was to compare the average percentage of these demographics within the block groups that have at least one community garden, of which there are 81, and the block groups with no community garden, of which there are 461 (Table 4). Most of these results are statistically significant, indicating a definite distinction between who lives in block groups with community gardens and who does not. As expected, the trends in Boston follow the trends of food insecurity shown in other studies, as explained earlier, with only a few exceptions.

	<b>Census block groups with at least one community garden (n=81)</b>	<b>Census block groups with no community garden (n=461)</b>	<b>Significance of T-Test* (p value)</b>
<b>Avg. % White</b>	30.0	53.38	.000
<b>Avg. % Minority</b>	70.0	46.6	.000
<b>Avg. % African American</b>	35.9	22.1	.000
<b>Avg. % Hispanic</b>	20.1	12.9	.000
<b>Avg. % Asian</b>	6.11	6.84	.543
<b>Av. % English speaking</b>	60.75	67.77	.001
<b>Avg. % Non-English speaking</b>	39.25	32.23	.001
<b>Avg. % Age &lt;18</b>	24.8	18.9	.000
<b>Avg. % Age &gt;65</b>	7.46	11.42	.000
<b>Avg. % Citizen</b>	74.17	75.61	.365
<b>Avg. % Non-citizen</b>	16.8	15.0	.113
<b>Avg. % Low income</b>	36.7	32.6	.026
<b>Avg. % Med income</b>	44.73	44.64	.954
<b>Avg. % High income</b>	18.54	22.79	.015

*Table 4: Comparison of racial and socioeconomic demographics of the census block groups with community gardens and those without. \*Equal variances not assumed*

The use of a t-test here and in the following analyses highlights trends that are not immediately visible in the GIS map. The t-tests determine if the difference between the two tested groups (census block groups with at least one community garden and those without) is significant or if that difference could have just occurred by chance. It also allows a more detailed breakdown of the population’s demographics, so as to highlight trends that might be stronger than others that might not appear in a map.

Census block groups with community gardens have a substantially higher average minority population and much lower white population than the block groups that do not. There was no statistical significance within the average percentage of residences of Asian heritage, however. There was also no difference in terms of citizenship, and yet a significant difference in terms of percent of English-speaking households. Block groups with community gardens have a

lower average percentage of English-speaking households and a higher average percentage of non-English speaking households than do block groups without community gardens. This may indicate a stronger correlation between heritage and gardening than does recent immigration and gardening.

There are significant trends in household income as well, albeit not as strong as those of race and language. Because income level plays a role in a household's ability to buy enough food on a regular basis, low-income households might be more likely to participate in a community garden than high-income, food secure households. Census block groups with a higher average percentage of children are significantly more likely to have community gardens than otherwise. It also indicates that while income plays a role, race and cultural background may mean even more. This can be for a number of reasons, including institutional racisms that continue a cycle of racial oppression and domination that has been implicated in most institutions in the U.S. since the country began. It could also be because some ethnicities and classes are more likely to be of an agrarian heritage, or because of a lack of culturally appropriate produce found in grocery stores. It could also be for a reason that has to do with another foundation of food security—that of spatial disparities in food retail distribution.

My final analysis was to compare the instance of each type of food retail and community garden in the census block groups distinguished by demographic predominance (Table 5). The types of food retail included convenience store, specialty store (dairy, bakery, etc.), small supermarket, and large supermarket. Other studies have included restaurants (Raja, Ma, and Yadav 2008), but eateries are not included in the scope of this study. This also did not include a comparison of the *number* of each of the different types of retail, just whether or not the block group had at least one. Because of the many numbers in this table, the significance values for t-

tests comparing census block groups that are predominantly the given demographic versus those that are not are bolded for quicker reference. The number not in parentheses is the mean instance of grocery store or garden for the census block groups that are predominantly the given demographic, and the number in parentheses those not predominantly the given demographic.

	<b>Has convenience</b>	<b>Has specialty</b>	<b>Has small supermarket</b>	<b>Has large supermarket</b>	<b>Has garden</b>
<b>White</b>	.33 (.29)	.09 (.10)	.31 (.19)	.03 (.02)	.07 (.22)
<i>p-value</i>	<b>.305</b>	<b>.71</b>	<b>.001</b>	<b>.604</b>	<b>.000</b>
<b>Minority</b>	.27 (.33)	.11 (.08)	.33 (.21)	.00 (.04)	.24 (.09)
<i>p-value</i>	<b>.176</b>	<b>.249</b>	<b>.002</b>	<b>.002</b>	<b>.000</b>
<b>African American</b>	.19 (.33)	.09 (.10)	.29 (.25)	.01 (.03)	.22 (.14)
<i>p-value</i>	<b>.004</b>	<b>.713</b>	<b>.429</b>	<b>.133</b>	<b>.086</b>
<b>Hispanic</b>	.43 (.30)	.14 (.10)	.71 (.25)	.00 (.03)	.29 (.15)
<i>p-value</i>	<b>.564</b>	<b>.751</b>	<b>.046</b>	<b>.000</b>	<b>.484</b>
<b>Asian</b>	.33 (.31)	.67 (.09)	1.00 (.25)	.00 (.03)	00 (.15)
<i>p-value</i>	<b>.942</b>	<b>.227</b>	<b>.000</b>	<b>.000</b>	<b>.000</b>
<b>Mixed</b>	.33 (.30)	.06 (.10)	.27 (.25)	.09 (.02)	.16 (.15)
<i>p-value</i>	<b>.673</b>	<b>.157</b>	<b>.764</b>	<b>.056</b>	<b>.851</b>
<b>Low Income</b>	.25 (.31)	.10 (.10)	.21 (.26)	.04 (.03)	.10 (.15)
<i>p-value</i>	<b>.357</b>	<b>.847</b>	<b>.401</b>	<b>.611</b>	<b>.299</b>
<b>Middle Income</b>	.25 (.31)	.05 (.10)	.28 (.25)	.00 (.03)	.13 (.15)
<i>p-value</i>	<b>.405</b>	<b>.190</b>	<b>.788</b>	<b>.000</b>	<b>.636</b>
<b>High Income</b>	.25 (.31)	.13 (.10)	.00 (.26)	.00 (.03)	.13 (.15)
<i>p-value</i>	<b>.739</b>	<b>.821</b>	<b>.000</b>	<b>.000</b>	<b>.849</b>
<b>Citizen</b>	.31 (.33)	.09 (.20)	.24 (.80)	.03 (.00)	.15 (.20)
<i>p-value</i>	<b>.830</b>	<b>.337</b>	<b>.000</b>	<b>.000</b>	<b>.637</b>
<b>Non-Citizen</b>	1.00 (.30)	.00 (.10)	1.00 (.25)	.00 (.03)	.00 (.15)
<i>p-value</i>	<b>.000</b>	<b>.000</b>	<b>.000</b>	<b>.000</b>	<b>.000</b>
<b>English</b>	.30 (.33)	.10 (.10)	.21 (.35)	.03 (.02)	.12 (.21)
<i>p-value</i>	<b>.495</b>	<b>.981</b>	<b>.001</b>	<b>.232</b>	<b>.013</b>
<b>Non-English</b>	.25 (.31)	.19 (.09)	.53 (.24)	.00 (.03)	.25 (.14)
<i>p-value</i>	<b>.433</b>	<b>.130</b>	<b>.002</b>	<b>.000</b>	<b>.158</b>

Table 5: Census block groups that are predominantly (at least 60 percent) a specific racial or socioeconomic demographic and the mean instances of types of grocery stores. Census block groups that are not predominantly that demographic are in parentheses. Significant values are **bolded**.

\*Equal variances not assumed

Predominantly white neighborhoods are far less likely to have a community garden. Predominantly minority neighborhoods are significantly more likely to have community gardens than non-predominantly minority areas, but are less likely to have any sort of supermarket, small or large. Neighborhoods of mostly Asian heritage all have small grocery stores and a large number of specialty stores, but no large grocery store, indicating a possible presence of affordable, culturally appropriate food where there otherwise would not be any.

There is an interesting difference between the predominantly citizen and predominantly non-citizen census block groups that did not appear in Table 4. Predominantly citizen neighborhoods are significantly more likely to have a large grocery store and less likely to have a small grocery store, whereas the non-citizen census block groups are significantly more likely to have convenience stores and small grocery stores, but no specialty or large grocery stores. Surprisingly, however, they are also less likely to have a community garden. This may indicate that although status as a recent immigrant may not play a role in urban gardening in Boston, many community gardeners are still of non-U.S. heritage. One might go further to say that recent immigrants most likely need time to get settled before knowing the area well enough to find a place to grow food, or would also be striving to distance themselves from their previous agrarian lifestyle by moving to the city. This would need further study.

A similar trend occurs with the English-speaking and non-English-speaking block groups. Predominantly English-speaking neighborhoods have less small grocery stores and more large grocery stores (although this second value was of statistical insignificance), while the neighborhoods that weren't predominantly English-speaking or predominantly non-English all together were very likely to have small grocery stores and no large supermarket. Once again, there is also a statistically significant difference between the predominantly English-speaking

block groups and the predominantly non-English speaking block groups in terms of community garden access.

### **Discussion**

Placed in the context of Boston's racist history, it is likely that the abundance of community gardens in vulnerable neighborhoods has been out of necessity. The fact that communities have had to come up with means of food provision since the majority of the grocery stores fled the city shows just how dire the affects of racism became. The disparities created during that time still exist today, however, revealing the incompetence of the government to ensure equitable access to basic resources.

An interesting aspect of this analysis is that most of the statistically significant differences between the block groups with community gardens and those without community gardens are based on race and class, but not necessarily citizenship. The community garden locations follow the trends of vulnerability almost exactly, besides this aspect, which shows that gardening may have to do more with income and culture rather than a more direct connection with an international agricultural background. It also indicates a closer link between gardening and a response to need as opposed to with recreation.

The existing gardens are serving a visible purpose, and they have struggled greatly to get there. Urban agriculture in Boston has had a tumultuous history, especially because most community gardens began on vacant plots, not legally owned by the gardeners. They also frequently got in the way of plans for redevelopment by the Boston municipality. There are still several neighborhoods that are clearly outside a distance of accessibility to the gardens, mostly around East/Southeast Boston and the Allston/Brighton area in the Northwest.

### **Difficulties and Opportunities for Future Research**

The use of maps is a great tool for locating such neighborhoods that may be vulnerable to food insecurity but that currently have no means of producing their own food. While this study can show spatially where the gardens are, it leaves out other important questions, such as how many people can use each one, or what the demographics of the people who actually use them are. For this, one would have to interview people at each garden. Such an in-depth study would be useful to provide a policy framework for urban agriculture in the city of Boston because of its inherent specificity.

Furthermore, the use of maps is a great visual tool for locating neighborhoods that may be vulnerable to food insecurity but that currently have no means of producing their own food. To go more in depth into next steps for such communities, one could use GIS to locate vacant parcels in these neighborhoods and determine the surrounding land uses, and then approach policy makers and the Boston zoning board for further inquiry.

This study also leaves out transportation networks, which are key to giving urban residents access to grocery stores. Most city residents do not own a car, and so food shopping is much more difficult than in the suburbs. A grocery store two miles away could easily be out of reach to a food shopper, especially one that is disabled or elderly. Several other food accessibility studies have looked at modes of transportation, but it would be interesting to see one that incorporates Boston's mass transit system (MBTA) and how, if at all, people use it for grocery shopping.

Lastly, this study omits demographics that potentially add important dimensions to food insecurity. For example, family size could play a major role in a household's ability to feed itself a balanced, healthy diet. Immigrant families especially tend to have more children,

grandparents, and other extended family members living in one household, increasing the number of mouths to feed per income-earner.

## **Chapter 6: Policy Recommendations and the Future of Urban Agriculture**

### **Urban Agricultural Policy**

There is a dire need for formal urban food policy. For far too long, organizations that represent narrowly defined business and public interest concerns—whether it be arms manufacturers, zucchini growers, or food stamp advocates—have dominated the national policy-making scene (Winne 2008). While the federal government is responsible for many aspects of the food system, including minimum food stamp allotment, municipalities have a wide variety of actions to take in favor of a more sustainable future.

First and foremost, Boston and other cities around the US should implement Food Policy Councils, which would consist of policy makers, government officials, gardeners, grocers, community health workers, members of the board of education, non-profits, restaurant owners, and urban planners. The goal of a Boston Food Policy Council would be to develop a citywide food system plan, engage underserved communities in policy decision-making and strategic planning, and develop partnerships with the State Food Policy Council (Clapp 2009).

Municipalities can also incorporate urban agriculture as a legitimate land use in their urban planning process or long-term sustainability plan, if one exists. One of the main reasons why urban agriculture has not thrived over the last century is that it was always viewed as a blight on the landscape and a temporary land use propagated by the city's poor and undesirable populations. Securing long-term land commitment for community gardens, entrepreneurial farms, and other urban agriculture ventures is imperative to ensure the horticultural, social, and economic value of the endeavor (Brown 2002).

Many cities are beginning to have green building regulations and incentives, and part of this can be building codes that allow for rooftop gardening coupled with incentives to encourage it. This could include infrastructure for raised beds or single- or multi-story greenhouses. Things like irrigation, tool storage would need to be taken into account.

City governments can also subsidize and/or provide infrastructure for urban food production, including tool banks with food growing equipment and supplies, community kitchens and other shared processing facilities, farmers' markets, community supported agriculture ventures (CSAs), funding streams, and technical service providers (Brown 2002). Institutionalized composting and making it available for urban agriculture would also provide a great resource, and many cities have either programs or non-profits that provide compost to community gardens. BNAN is one of them.

Low-interest loans and/or microfinancing could help local farmers and gardeners attain capital for initial investments in new farms, greenhouses, and gardens. Many urban gardeners are of demographics that tend to have a difficult time receiving loans, especially during our current financial crisis. Helping neighborhoods start community gardens or encouraging local entrepreneurs to build urban farms, whether on the ground, on a roof, or in a vertical farm, would give this movement the boost it needs to reach more people.

### **Sustainable Food System Policy**

City governments can also sponsor research initiatives that would establish the city's known food resources and that would help to determine neighborhoods in need of certain services. Such research might include a foodshed analysis, which would determine where food comes from in Boston, how much local food production is available to city residents, and the

capacity of the city to provide food for its citizens. It could also research the success of gardening initiatives in enhancing the local urban ecological health or test the viability of rooftop gardens. Other research might measure the distance that conventional food travels and the energy used to reach its destination on Boston, often named food-miles or food footprint, and compare it to the distance that food travels and energy used to reach the farmers' markets.

The Manhattan Borough President Scott Stringer and his office put together an enormously comprehensive framework for policy toward a sustainable local food system earlier this year (Clapp 2009). This included stemming hunger, supporting urban and regional agriculture, attaining equitable food distribution, encouraging economic development, food and nutrition education, and offers steps of actions to take toward implementation of such policy.

The following are examples of policy initiatives from this report that would be particularly pertinent to the city of Boston:

1. Lobby for more federal funding for food programs, particularly Food Stamps, National School Lunch Program, and the Emergency Food Assistance Program (TEFAP)
2. Streamline enrollment in food stamp program and expand the number of places where food stamps can be used
3. Coordinate social service programs so that clients can apply for several simultaneously, including public health insurance, childcare subsidies, and nutrition programs, and ensure that enrollment is available at soup kitchens and food pantries
4. Promote local agriculture in neighborhoods with limited access to fresh foods through new farmers' markets, food cooperatives, and CSAs (with universal EBT machine access and targeted advertising), as well as community gardens in parks, schools, and other city-owned land
5. Create a comprehensive map of the city's food distribution system, with the aim to establish the infrastructure necessary to encourage local sourcing and processing

6. Establish a wholesale farmers' market and storage facility to serve the needs of regional farmers and local buyers. In addition, identify refrigerated space for storage in neighborhoods across the city, create long-term leases for farmers' markets to create a sense of permanency as well as infrastructure needs such as electricity
7. Explore freight options that reduce reliance on vehicular traffic in conjunction with a model to reward distributors and truckers who use hybrid technology and clean fuels when they enter [Boston]
8. Develop 'food enterprise zones' in neighborhoods with food deserts, attract new food outlets by identifying potential locations and creating incentives
9. Develop a job incubator program in conjunction with an urban agriculture education program to connect job training with the food industry, such as urban food production, processing, and entrepreneurial job training
10. Encourage the consumption of healthy food in place of junk food

In the future, Boston can plan for the more revolutionary changes in food production, like the vertical farm, but there is much to do in the meantime. Boston still has food deserts, and there are underserved neighborhoods that would still benefit enormously from a community garden, or that need more community gardens than they already have. Between the growing farmers' markets, increasing demand for CSAs and other forms of local food retail, and endlessly mounting demand for community garden plots, the tireless movement for a sustainable, equitable local food system in Boston is clear, and it demands the attention of policy makers.

## **Conclusion**

*Everywhere landless people are seeking space to grow food for their families and a place to put up shelter. They find room on the wastes and fringes of cities—in vacant lots, along railroads and highways, in rough land unfit for commercial agriculture, and on the cast-offs at the outer edges of urban expansion. To control this land, which they commonly do not own or lease, the gardeners band together into informal associations that establish the lot boundaries, streets, and paths, obtain water, and often, as well, govern what becomes a squatter settlement. (Girardet 2004)*

According to the UN Development Programme, some 800 million people, or nearly 8 percent of the world's population, are now engaged in urban agriculture worldwide (Girardet 2004). Since World War II, Boston's community gardens have been prisms of the social and political localities of specific neighborhoods, and they have told a turbulent story. Most community gardens began on vacant plots, not legally owned by the gardeners, who themselves were usually poor, minority, immigrant, or a number of other demographics historically deemed undesirable by city officials. During a time when supermarkets were systematically leaving the city, gardeners knew they had a responsibility to themselves and their communities to stem the growth of food deserts and to reconnect with their own cultures.

Sometime between 1968 and 1976, city dwellers and landless suburbanites stopped waiting for public institutions to provide land for them and began, instead, to demand land and services from their municipalities (Warner 1987). Since then community activists and gardeners have been working tirelessly to increase access to cultivatable land in the city. Non-profits such as Boston Natural Areas Network have been created to streamline processes like seed acquisition, problem and dispute solving, an information database, and inter-garden networking. The Food Project is engaging all age levels in the most underserved Boston communities in food education and gardening experience. The legitimization of urban gardening in the city of Boston

has and will continue to bolster vulnerable communities against food insecurity, and as such will improve the environmental and just sustainability of the city overall.

An important step in achieving this is increasing local food sources in urban areas through local policy. Support from all levels of government, especially on the municipal level, in developing a sustainable and equitable local urban food system, not only empowers neighborhoods with a greater supply of fresh, healthy produce, but it also puts more money into sustainable agriculture around the city, feeding back into a greater availability of local food. Urban agriculture contributes great value to the expression of individual, cultural, and citywide identity, and gives many residents a sense of place as it heals and beautifies the harsh urban landscape.

Everything is connected, from the environmental degradation that is changing our climate, to public health, to the loss of the home-cooked meal. Urban municipalities, non-profits, and private institutions understand that they have a responsibility to improve the health of their residents through education about the way they eat and about consequences of unhealthy eating, such as obesity and diabetes, but without adequate access to the right foods, nothing will change. In neighborhoods where all that exists is a handful of convenience stores and where the healthiest advertised product is a box of reduced-fat, whole grain pretzels, and where any fresh produce is likely to be of low quality and more expensive, the residents are far more likely to be unhealthy themselves.

The ability to grow one's own food, and to have it be supported by the city as opposed to labeled as renegade, reconnects underserved communities with a sense of place and a sense of being. Improved mindsets about the urban landscape in which they live, paired with improved health and community harmony, can empower youth to do better in school. Local food is

infused with a deeper power of place, and is the cornerstone of a holistic place to live, work, and create.

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