Setting the Table: Towards Greater Food Security in Lowell, Massachusetts, evaluates the barriers Lowell residents face in obtaining food and recommends actions that might be taken to further food security in the city. This report was created for the Lowell Food Security Coalition, a collaboration of forty community organizations, formed to help residents become more self-reliant and food-secure. Once the center of the textile industry, attracting workers from all over the world, Lowell today is still recovering from the departure of that and other industries. As some Lowell residents struggle to make ends meet, they can face the added challenge of finding food that is nutritious and culturally appropriate, in this city of immigrants.

Setting the Table proposes strengthening Lowell's food system through community resource centers, backyard gardens (including some as large as whole blocks), rooftop gardens, public orchards, community fish farms, dealing with soil contamination, recycling waste, healthy corner stores, and changes to zoning.

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The Conway School is the only institution of its kind in North America. Its focus is sustainable landscape planning and design. Each year, through its accredited, ten-month graduate program students from diverse backgrounds are immersed in a range of real-world design projects, ranging in scale from residences to regions. Graduates go on to play significant professional roles in various aspects of landscape planning and design.
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Setting the Table

Towards Greater Food Security in Lowell, Massachusetts

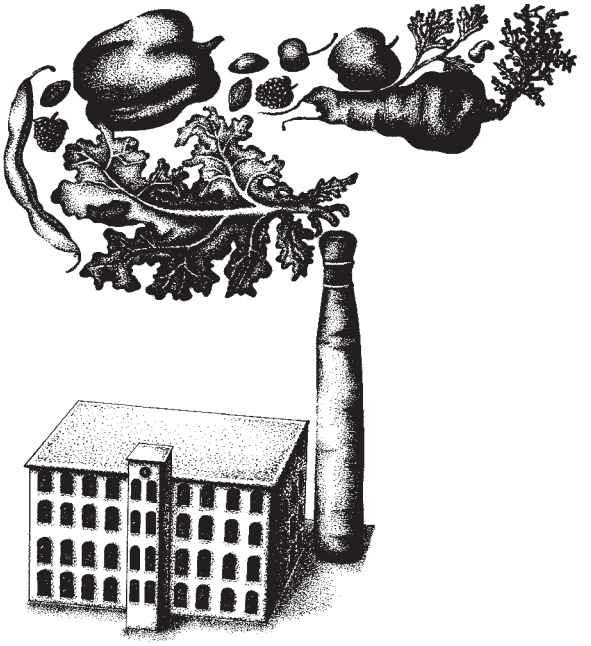
Prepared for the Lowell Food Security Coalition

Amy Nyman | Sierra McCartney | Beth Schermerhorn

The Conway School | Winter 2013

"The real work of planet-saving will be small, humble, and humbling, and (insofar as it involves love), pleasing and rewarding. Its jobs will be too many to count, too many to report, too many to be publicly noticed or rewarded, too small to make anyone rich or famous."

Wendell Berry



Setting the Table

Towards Greater Food Security in Lowell, Massachusetts

Prepared for the Lowell Food Security Coalition

Amy Nyman | Sierra McCartney | Beth Schermerhorn

The Conway School | Winter 2013

We would like to thank the Lowell Food Security Coalition for the inspiring work they are doing to improve food security in Lowell, the Cambodian Support Group for sharing their touching stories, the Garden Coordinator Group for showing us this community's potential, and our faculty for guiding us every step of the way.

Contents

Executive Summary

High unemployment and low incomes have meant that many Lowell residents have had difficulty buying enough food for themselves and their families. Immigrant and refugee status, and associated language barriers, also affect many residents' ability to find jobs and become food secure.

The Lowell Food Security Coalition (LFSC), formed to help residents of Lowell become more self-reliant and food secure, and sought the assistance of a team from the Conway School to conduct a study evaluating the barriers residents face in accessing food and recommending additional actions the LFSC might take to further food security in the city.

For the purpose of this study, the elements of food security are stability, affordability, proximity, choice, and preparation. Using GIS, survey, and government data and information gathered from stakeholder meetings and interviews with individuals and organizations in the city, the report identifies numerous barriers to food access. Many residents in Lowell live below the federal poverty level—as many as 64 percent in one section of The Acre. These residents can't afford to purchase food and rely on government assistance and food pantries, which may be affected by cuts in state and federal government budgets. The location of food markets gives good physical access to many residents, except those living in a USDA-designated food desert. Although bus routes provide access to many food markets, few residents use buses to shop for food. Emergency food providers, community gardens, and the farmers market are located in the center of the city where there is a large concentration of low-income residents, but residents in other neighborhoods have poor access to these resources.

Looking beyond the conditions within the city, Lowell's food system should be understood as part of a larger regional and global food system. Industrial farms are dependent on fossil fuels for pesticides and fertilizers. Distribution of food across many miles and many stages of food processing uses large amounts of energy. This system is fragile and could be compromised by a diminished fossil fuel supply. If energy costs rise, food costs will also rise, creating further challenges to the food insecure populations of Lowell.

A food system operates through the functions of production, processing, distribution, education, and waste cycling. These functions are the framework used for the recommendations in this report, which attempt to build on the strengths of the organizations, programs, and community relationships already in place in Lowell. These recommendations include community food resource centers within each neighborhood, backyard gardens, rooftop gardens, public orchards, community fish farms, safe gardening in areas with potentially contaminated soils, waste cycling, an expanded food hub, healthy corner stores, and revised zoning.

"An economy genuinely local and neighborly offers to localities a measure of security that they cannot derive from a national or a global economy controlled by people who, by principle, have no local commitment."

Wendell Berry

I. Lowell's Food Story

Mansfield moved to Lowell as a single dad with challenging health issues. Looking for an activity to do with his two sons, he found a community garden at the Rotary Club Park and signed up, even though he did not have experience growing food. At the garden, Mansfield and his boys found a community of gardeners who learned together.

Mansfield after a day in the garden.

The gardening experience has changed how Mansfield's family eats, and how they think about food. It also improved Mansfield's health, and reduced his need for medications. The change in Mansfield's family's life was created by having access to a space in which to grow food and access to educational resources, which the Rotary Club Park Community Garden provided.

The Rotary Club Park Community Garden was started by Mill City Grows, an organization in Lowell focused on urban food production. Mill City Grows is just one organization in Lowell strengthening the community's health and well-being, and increasing food security within the city (Slater).

The Lowell Food Security Coalition

The Lowell Food Security Coalition (LFSC) is a forty-member alliance of organizations, like Mill City Grows, committed to addressing food insecurity within the city.

Through gardening, Mansfield and his two sons have grown closer as a family. (Photos courtesy: Mill City Grows)

The organizations came together in 2009 after the United Teen Equality Center (UTEC) received a USDA Community Food Project Planning Grant to plan a commercial kitchen incubator that would increase residents' access to local food, provide training, and create space for new businesses and new jobs for teens. UTEC reached out to other non-profit organizations, city departments, universities, businesses, and individuals to assess how the kitchen could address issues of food security and education in Lowell. This group became the LFSC.

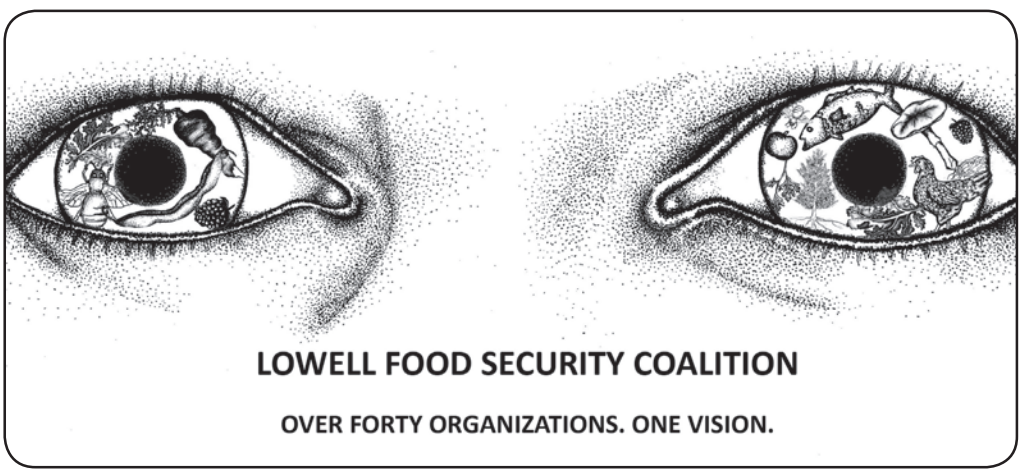
Linda King of the city's Department of Planning and Development suggested that the LFSC become a part of Lowell's Ten-Year Plan to End Hunger and Homelessness. To formally establish and launch the Coalition, the LFSC obtained planning and implementation funding from Third Sector New

England, allowing the LFSC to conduct a two-year, broad-based community food assessment, which was completed in December of 2012. The assessment included surveying 430 Lowell residents and fifty local business owners, conducting thirteen focus groups with over 150 participants, and interviewing ten emergency food providers (Camp and Sisson). With the food assessment completed, the LFSC is now creating a strategic plan to guide their efforts to reduce food insecurity in Lowell.

This document contributes to the LFSC's information-gathering efforts by further exploring the stability of Lowell's food system and residents' ability to afford food, physically obtain food, choose the foods they desire, and prepare foods. The analyses of physical characteristics of Lowell are based on Geographic Information Systems (GIS) data, the *Lowell Community Food Assessment*, government data, and information gathered from stakeholder meetings and interviews with individuals and organizations in the city.

The recommendations in this plan were informed by the analyses and focus on the main components of a food system, including production, processing, distribution, education, and waste cycling. The recommendations provide examples of programs that have been successful in communities with conditions similar to Lowell's and provide models for Lowell initiatives, suggest actions as first steps to implementation, and build on the strengths of organizations, programs, and community relationships already in place in Lowell.

Recommended are community food resource centers within each neighborhood, backyard gardens, rooftop gardens, public orchards, community fish farms, soil contamination and safe gardening, waste cycling, an expanded food hub, healthy corner stores, and revised zoning. At the heart of each recommendation lies the goal of building on Lowell's current successes and improving more residents' lives, such as Mansfield's, while simultaneously increasing food security within the city.



The Lowell Food Security Coalition brings organizations in the city together to address the needs of Lowell residents. The LFSC is seeking to act through a unified vision to bring a more just, stable, and secure food system to Lowell.

History & Ethnicity

The roots of Lowell's food insecurity lie in its history. The fertile land at the confluence of the Merrimack and Concord Rivers drew to the area European settlers with dreams of farming the land. As the land was settled, a small agricultural town emerged.

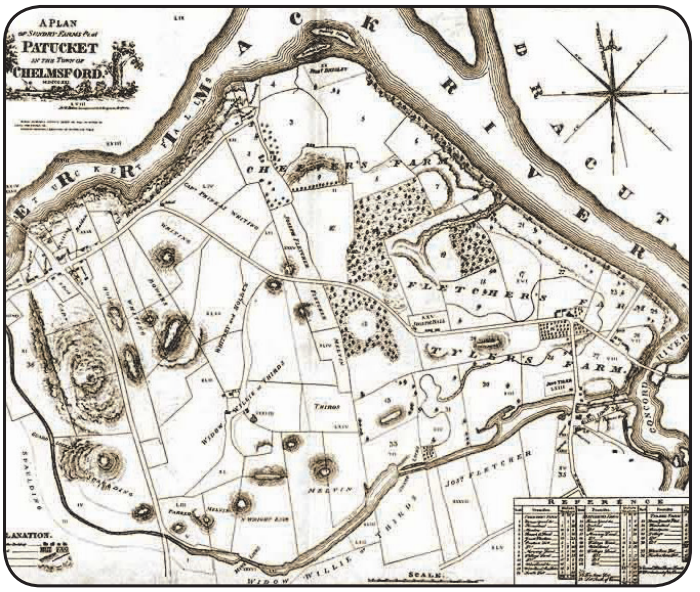
At the start of the Industrial Revolution in the early 1800s, the construction of ten textile mills powered by the Merrimack River transformed the small town into a booming city. The newly invented power loom allowed Lowell to dominate the market for fabric, creating over 10,000 jobs and bringing economic success to the city.

As nearby cities learned from Lowell's success and built textile mills, Lowell faced competition. A surplus of fabric on the market decreased the mills' profits, leading them to cut workers' wages and bring immigrants to Lowell for cheap labor. Large numbers of Irish, French Canadian, Greek, Portuguese, and other immigrant populations facing hardships in their home countries, came to Lowell to work in the mills, creating cultural richness within the city.

Industrial competition increased and in the mid 1950s, Lowell's mills shut down one by one, leaving thousands of workers without jobs. The loss of the leading industry within the city caused great economic stress, and the city has not recovered.

Today Lowell is a densely populated city that is ethnically diverse and struggling economically. It continues to be a refuge city for people who have escaped hardships, such as starvation and violence in other countries, and 22 percent of Lowell's population is foreign-born, which is twice the national average (Lotspeich, et al., 4).

The city has large Asian, Hispanic, Portuguese, and African populations. Ethnicities vary throughout the neighborhoods, creating cultural diversity within each neighborhood. The higher-income neighborhoods of Belvidere and Pawtucketville have the largest percentage of whites, but no one ethnic group dominates the lower-income neighborhoods of Downtown, The Acre, and Back Central. Many residents, of all cultural backgrounds, live below the federal poverty threshold, leaving large portions of Lowell's population facing food insecurity.

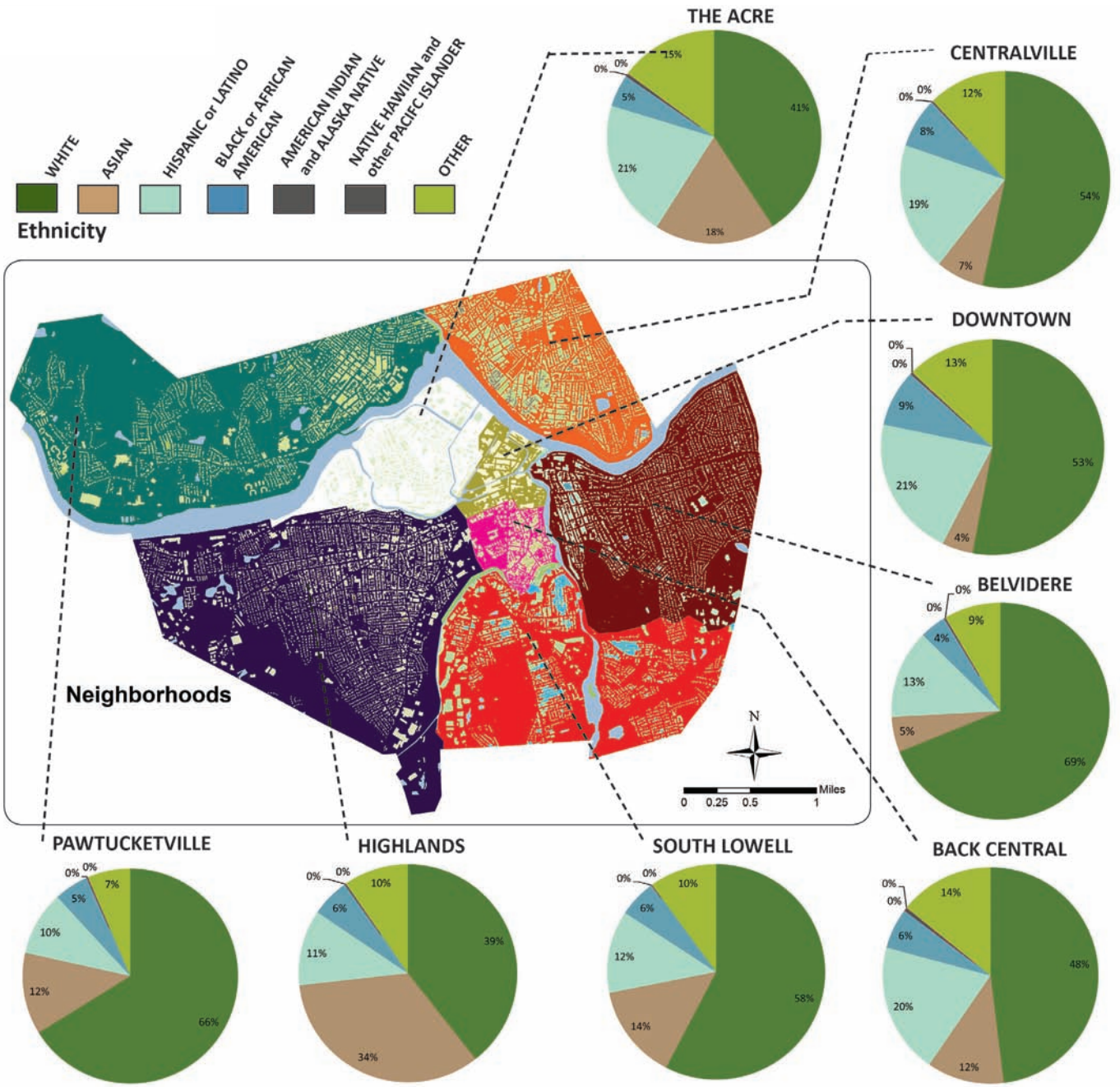


1821 - The Merrimack River's power drew industrial entrepreneurs to the small agricultural town, transforming the town into Lowell, one of the country's first industrial cities. (Map reproduction courtesy of the University of Massachusetts, Lowell.)

1876 - By the late 1800s, Lowell had become a booming industrial city supported by ten Merrimack River-powered textile mills. (Map reproduction courtesy of the Norman B. Leventhal Map center at the Boston Public Library.)

Refugees seek a better life in Lowell.

Around the world hardships, such as violence and starvation, are part of many peoples' daily lives. Lowell is a place they seek refuge. The main countries immigrants and refugees are fleeing to Lowell from are Colombia, Brazil, the Dominican Republic, Portugal, various African countries, India, Vietnam, Thailand, Laos, and Cambodia.

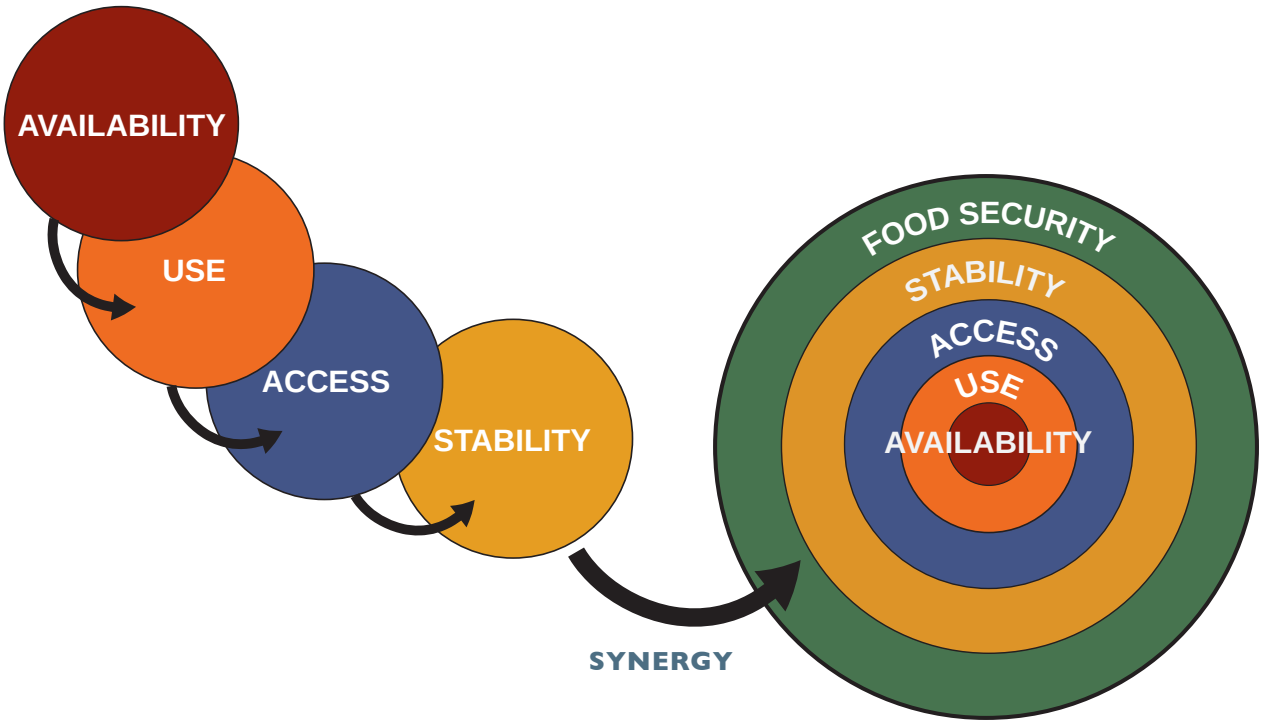


This map of Lowell shows the ethnicities of its eight main neighborhoods. Each pie chart represents one neighborhood, and shows the percentage of different ethnicities within the neighborhood. Ethnicities are spatially diversified throughout the neighborhoods, although some ethnic groups have larger concentrations in certain areas. For example, there are higher concentrations of whites in Pawtucketville and Belvidere, which are higher-income neighborhoods.

What Is Food Security?

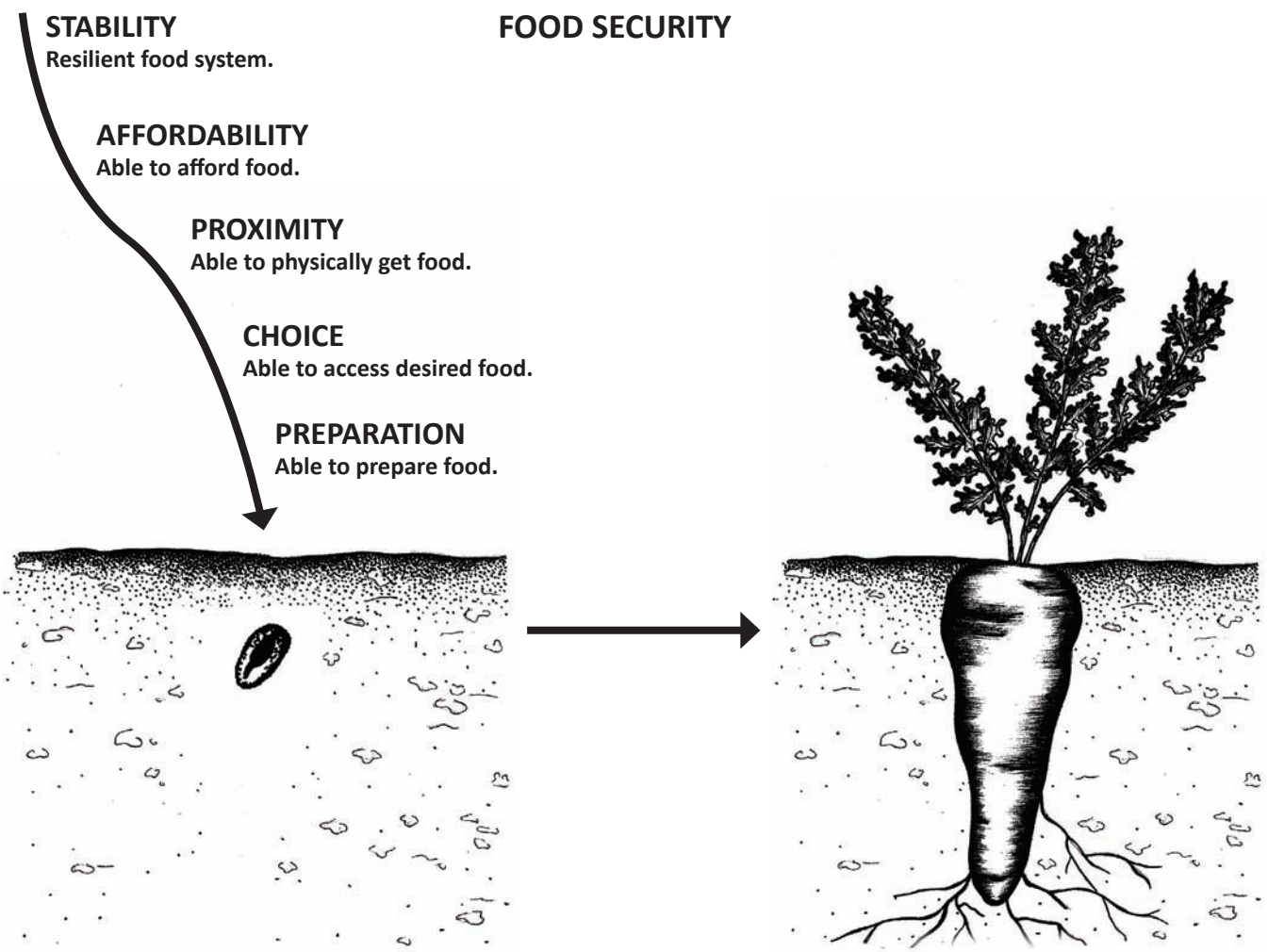
In the last twenty years there have been nearly two hundred attempts to define the complex concept of food security (Maxwell & Smith). According to the World Health Organization (WHO), the components of food security include availability, use, and access (World Health Organization). **Availability** refers to having sufficient quantities of food at all times. **Use** is being able to physically prepare food, or having the knowledge to use it, and **access** refers to the ability to easily obtain food. The Food and Agriculture Organization (FAO) of the United Nations also adds **stability**, or the sustainability of a food system over time, as a fourth element of food security (Food and Agriculture Orginzation). In addition, the USDA definition of food security includes the condition that people must be able to acquire food through socially acceptable ways, meaning they should not have to resort to accessing food through emergency food supplies, scavenging, stealing, or other coping mechanisms.

These elements of food security—access, use, availability, and stability—are interdependent, and when in place, they can reinforce each other to create a more secure system (U.S. Economic Research Service, Food Security).



Availability, use, access, and stability are components of food security that the World Health Organization and the Food and Agriculture Organization of the United Nations have identified. When all of the components are present and functioning, a more food secure system is created.

For the purpose of this document, food security includes **stability**, the resilience of Lowell's food system when faced with future shocks; **affordability**, the ability of residents to afford food; **proximity**, the ability of residents to physically get food; **choice**, the ability of residents to obtain desired food; and **preparation,** the ability of residents to physically prepare food and to know how to prepare foods. Like a seed which needs sunlight, soil, and water to grow into a mature plant, Lowell's food system needs all of these conditions to be met to grow more secure, particularly for those residents with low incomes.



Like a seed which needs sunlight, soil and water to grow into a mature plant, Lowell's food system needs stability, and its residents need to be able to afford food, physically obtain food, choose the foods they desire, and have the knowledge and physical ability to prepare food if Lowell's food system is to grow more secure.

Stability

Food systems move food from where it is grown to where it is eaten and disposed of as food waste. The system's components include production, processing, distribution, education, and waste management. **Production** is the growing of plants and the raising of animals for food. **Processing** is the preparation of food for storage or consumption. **Distribution** is the movement of food from where it is produced to where it is stored, processed, purchased, or consumed. **Education** is, broadly, the provision of information about food. **Waste management** is the process of using or disposing of the materials generated by the food system.

When a food system's components operate efficiently and sustainably, the food system is stable and contributes to food security. The currently dominant industrial food system, which Lowell is dependent on, does not operate efficiently and sustainably, increasing food insecurity in the city.

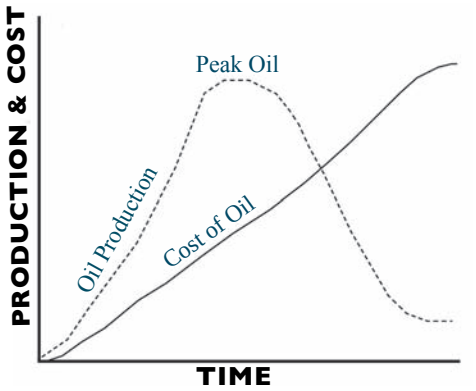
The industrial food system is energy-intensive and dependent on fossil fuels. Food travels through a long, energy-consuming process to make it from farm to plate, and as a result, a single calorie of food requires seven to ten calories of energy to produce (Ackerman).

Dependence on fossil fuels occurs from the beginning of the production phase. Industrial farms require petroleum products to fuel heavy machinery and irrigation systems. Single-crop farms lack species diversity, making them susceptible to pests and diseases, and dependent on petroleum-based pesticides. In addition, industrial farms lack nutrient cycling (see page 56), and harvest the same crop year after year, depleting the same nutrients from the soil. Nutrient losses in soil make industrial farms reliant on synthetic fertilizers, which require fossil fuels for their production.

After the production phase, food usually travels great distances before it is consumed. Trains, trucks, boats, and planes transport the food from storage facilities to packaging and processing facilities, to additional storage facilities, and finally to markets. Each stage of distribution consumes energy for transportation, and each facility that the food is taken to requires electricity for heat, light, refrigeration, and the operation of machinery. Food is then distributed through commercial markets to households where it is stored and prepared, requiring additional energy.

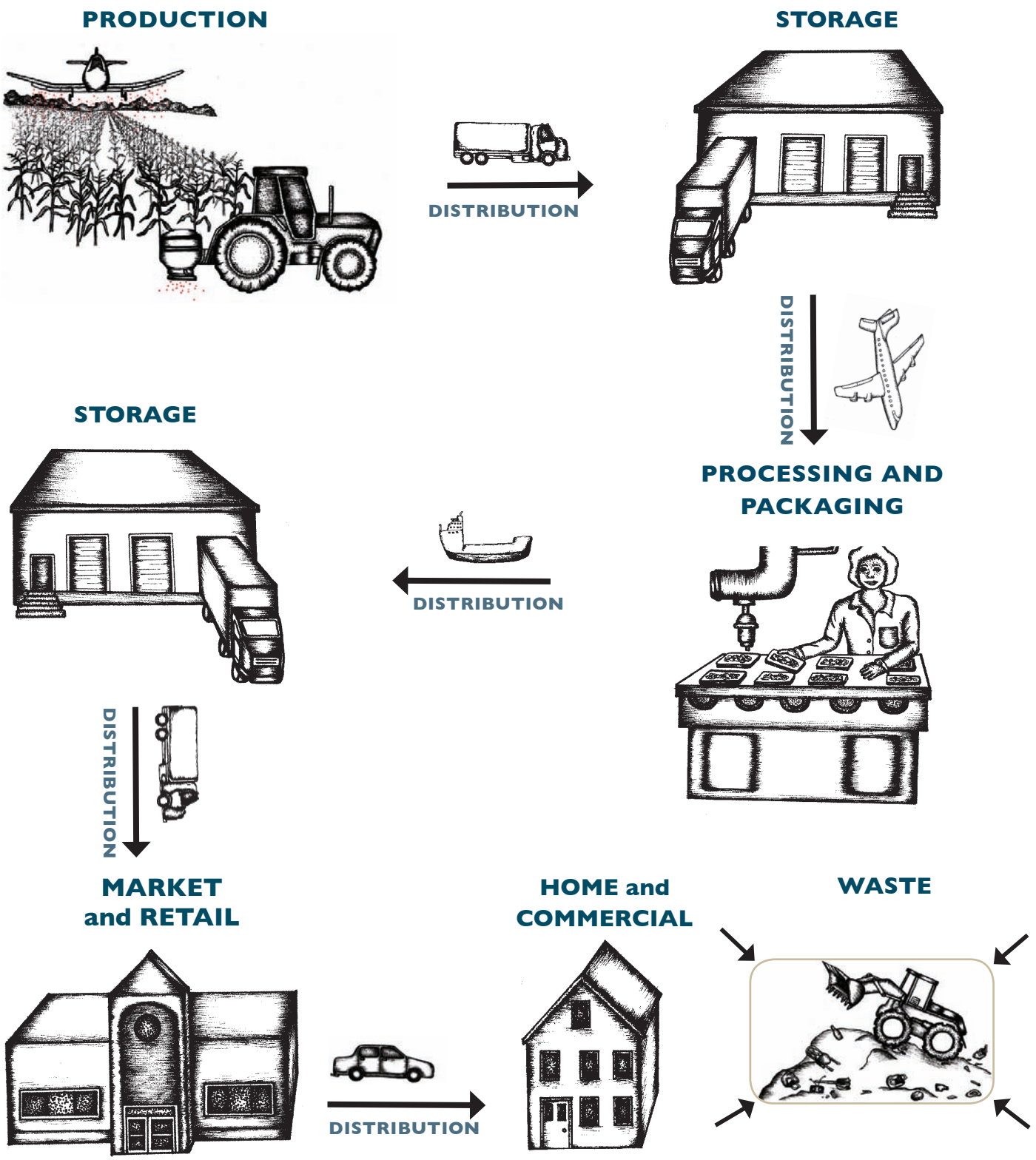
Throughout its journey, some food spoils or is discarded as waste. Most food waste is taken to landfills, consuming more energy for transportation and heavy machinery use. In the end, the food system's total energy needs make up 19 percent of the United States' total energy consumption (Ackerman).

The industrial food system's dependence on fossil fuels is a concern for the future due to potential rising costs of oil. As the supply of oil reaches a peak and diminishes, more time, money, and resources will be needed to extract it, causing the price of oil to rise. The resulting increases in the cost of food will be dramatically felt by the food insecure populations of Lowell, unless a more resilient, efficient, and sustainable food system is in place that relies less on petroleum products and more on regionally produced food.



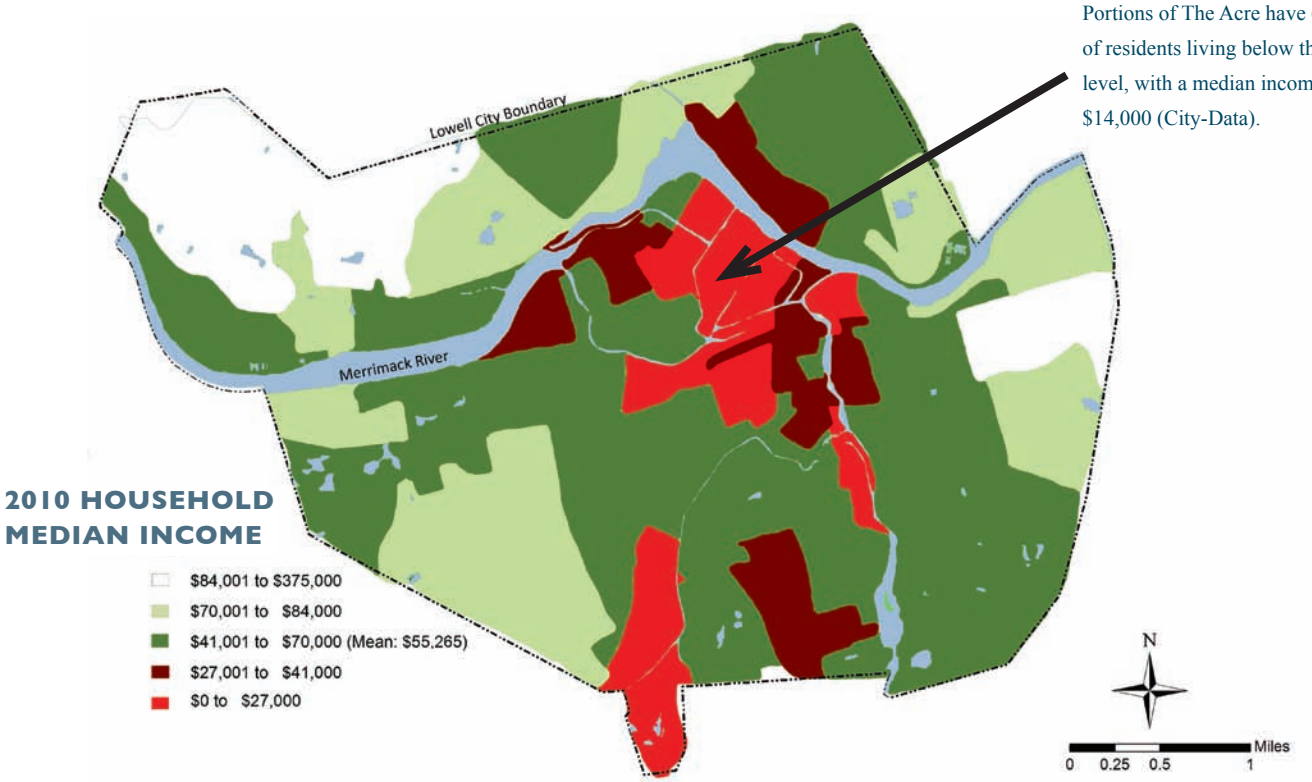
"Globalized industrialized food is not cheap: it is too costly for the Earth, for the farmers, for our health. The Earth can no longer carry the burden of groundwater mining, pesticide pollution, disappearance of species and destabilization of the climate. Farmers can no longer carry the burden of debt, which is inevitable in industrial farming with its high costs of production. It is incapable of producing safe, culturally appropriate, tasty, quality food. And it is incapable of producing enough food for all because it is wasteful of land, water and energy. Industrial agriculture uses ten times more energy than it produces. It is thus ten times less efficient."

Vandana Shiva, *Terra Madre: A Celebration of Living Economies*



The industrial food system is energy-intensive and dependent on fossil fuels. Food travels through a long, energy-consuming process to make it from farm to plate.

Affordability



In addition to having a stable food system, residents' ability to afford food affects the level of Lowell's food security. It is difficult for many people in Lowell to afford enough food to meet their individual and family needs. In Lowell, 17.5 percent of residents live below the federal poverty level (FPL), compared to 10.5 percent in Massachusetts. The federal poverty level is identified as an income of $23,050 a year for a family of four. Research shows that, on average, families need an income of about twice that level to cover basic expenses. Critics of the FPL argue that it is outdated and does not take into account typical expenses faced by low-income families (Padilla-Frausto, et al., 1).

Immigrant and refugee status, and associated language barriers, contribute to the high poverty levels in Lowell. Language barriers increase the challenges residents are faced with in finding a job where they can earn enough to secure their food needs. While there is a large proportion of immigrants and refugees living in poverty, 18 percent of people living in extreme poverty in Lowell are white (City-Data).

Surprisingly, the effects of poverty extend beyond individual families. In schools with 25 percent of the students living in poverty, all students, poor, affluent or in between, tend to do worse than students from schools in wealthy communities. Even after a family has achieved a higher income, the effects of poverty can linger. If two families have the same incomes, children from the one that became wealthy more recently might lag behind children from the other family (Bainbridge and Lasley). With 45 percent of children living in low-income families in Lowell (Addy and Wight), if no actions are taken, the cycle of poverty will most likely continue to prevent residents from meeting their food needs in the future.

Industrial Food: Inexpensive, but Costly

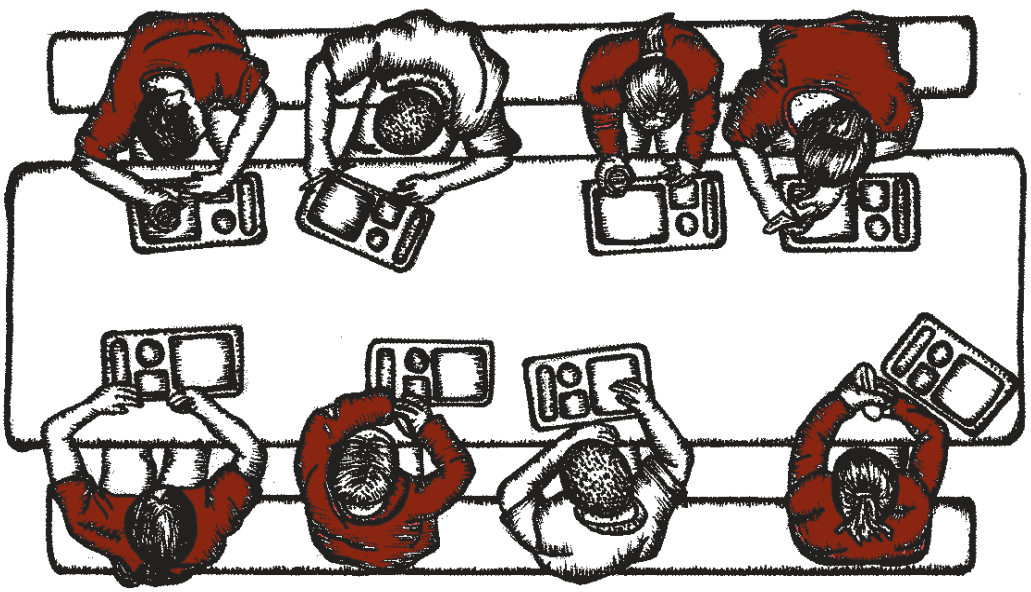
Low-income residents in Lowell buy cheap foods to stretch their food dollars, but many of these foods have low nutitional value as a result of the industrial food system, which produces vast quantities of high-yield, low-nutritional-value commodities such as wheat, soy, and corn. These foods are heavily subsidized by the U.S. government, making them cheap to grow, cheap to buy, and cheap to process into other foods in factories. As a result, processed foods are more affordable than fresh fruits and vegetables. However, subsidized processed foods entail a different set of costs. Most processed foods have high levels of unsaturated fats, preservatives, and additives, which have been linked to increased obesity, diabetes, and other food-related illnesses. While consumers find that processed foods are cheap to buy in the grocery store, these foods can increase health problems and medical bills. Low-income residents who experience health issues go into medical debt, or depend on Medicare and Medicaid to afford the medications and healthcare they need. This vicious cycle is found in Lowell and across the country.

Dependence on Government Funding

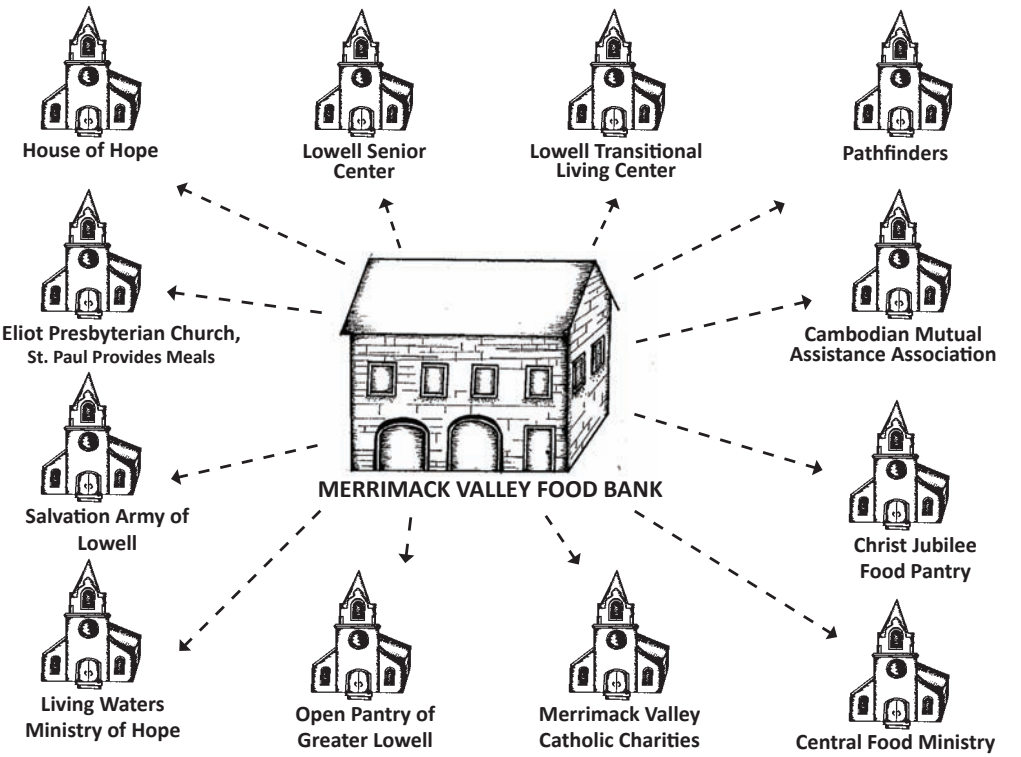
Many Lowell residents who are unable to afford food depend on emergency food providers and government assistance. If funding is reduced or cut from these programs, the city will be faced with more residents who face hunger on a daily basis.

Currently the Merrimack Valley Food Bank receives roughly $700,000 in funding each year and serves 11,000 residents (Pessia). The federal program Women Infants Children (WIC) is funded by the Food and Nutrition Service which is a part of the United States Department of Agriculture, and supports low-income women with children, from the time women are pregnant until their child turns five years old. Over 5,400 residents in Lowell receive WIC (Fullam). Residents are also assisted through food stamps, newly named the Supplemental Nutrition Assistance Program (SNAP), which provides nutritional assistance to eligible low-income individuals and families. Twenty-one percent of Lowell's households receive SNAP (American Fact Finder).

This large dependence on food assistance means cuts in funding will make it more difficult for residents to meet their food needs, and decrease Lowell's overall food security. Food security depends on reliable sources of food that will not fluctuate with changes in government funding.



Seventy-five percent of schoolchildren in Lowell are eligible for free or reduced lunch.



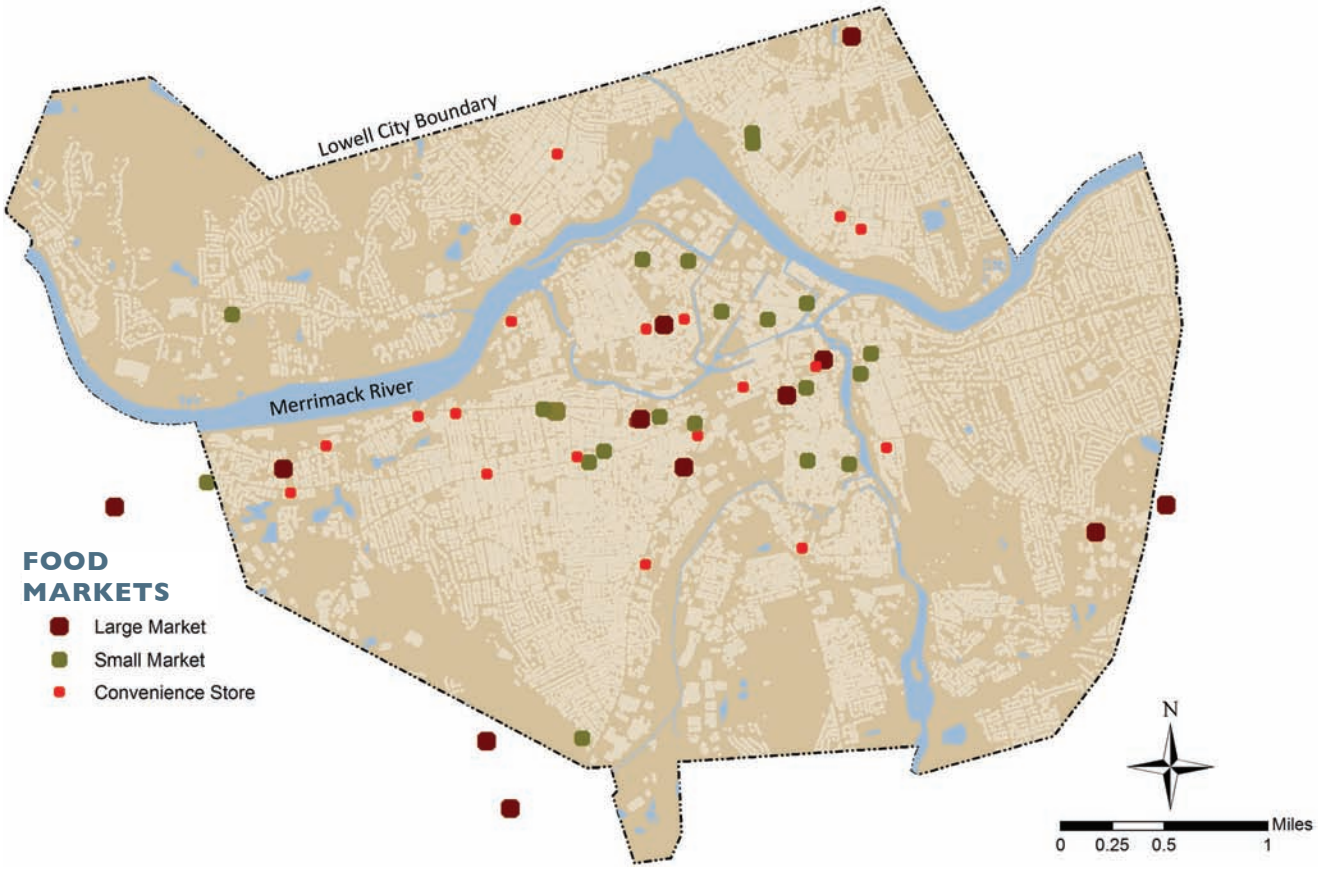
The Merrimack Valley Food Bank receives approximately $700,000 in funding each year and serves over 11,000 residents. All twelve food pantries and hot meal providers within Lowell are largely dependent on the Merrimack Valley Food Bank. The dependence on one central food bank creates insecurity within the emergency food system. If the Merrimack Valley Food Bank suffers funding cuts, where will the other providers get food to serve 11,000 residents?

When Hum Hun came to the United States in 1981, she was fleeing from the Cambodian genocide led by the Khmer Rouge. She came to Lowell hoping to find a land of opportunity, where she and her husband could raise their young daughter, but for thirty-two years Hum Hun has had difficulty finding a steady job. As a result Hum Hun has needed government assistance in order to put food on the table each night.

Her daughter Emilee now has a family and a daughter of her own. Like her mother, Emilee struggles to make ends meet. Even though she speaks English, and is willing to learn new skills, she also needs government assistance to have enough food to feed her family. Emilee spends her days babysitting, providing translation for Cambodian immigrants who need help with government forms and services, and volunteering at the Coalition for a Better Acre. Increasing food security in Lowell could break this cycle of dependency.

Hum Hun is one of many residents in Lowell struggling to put food on the table.

Proximity



In addition to the stability of Lowell's food system and residents' ability to afford food, Lowell's food security is also affected by residents' proximity to food markets and their ability to obtain food. The locations of food markets within Lowell give some residents good physical access to food, but leave other residents living a great distance from a food market.

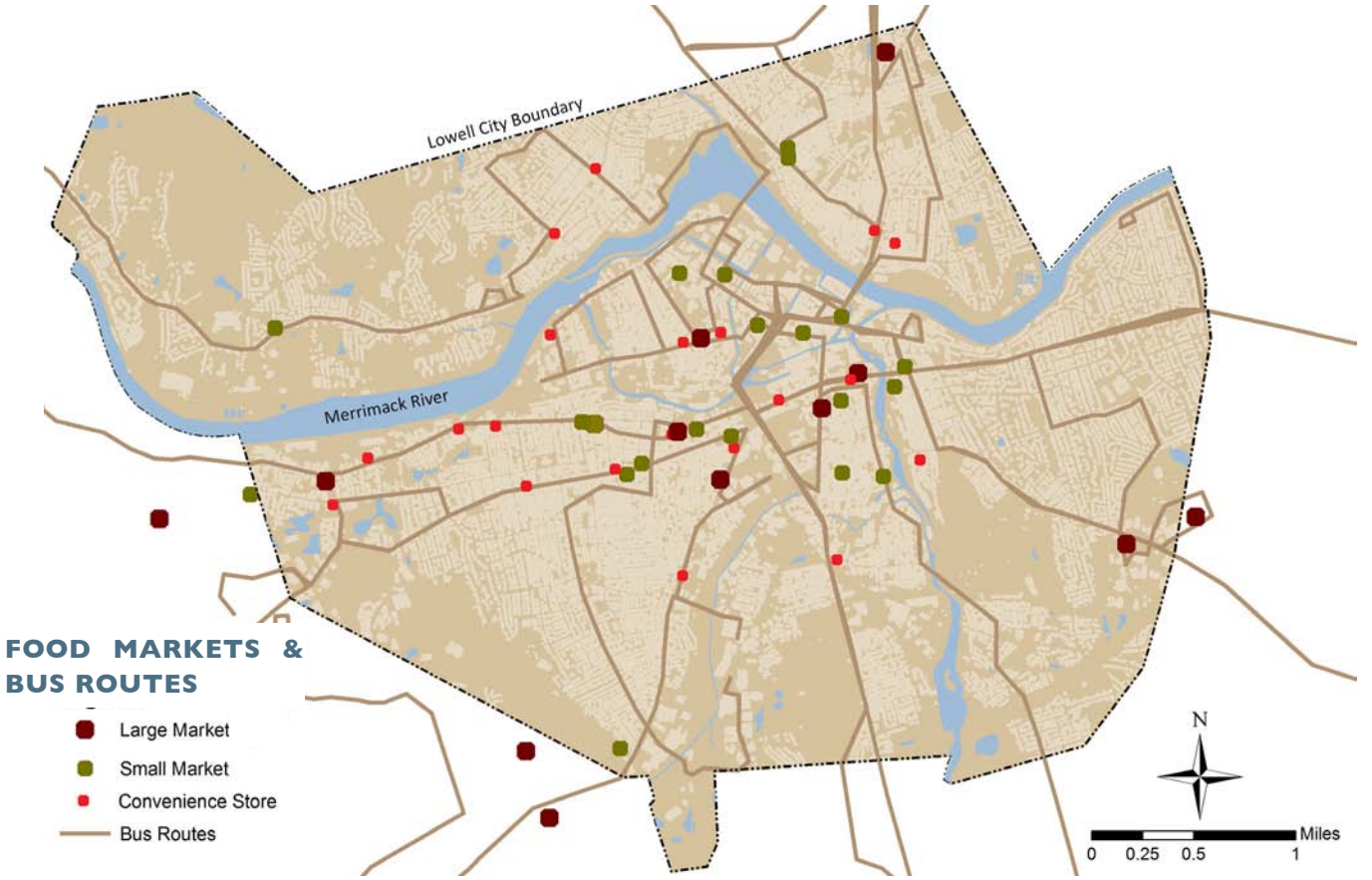
Over half of the large food markets in Lowell are located on the outskirts of the city with large gaps between them. Residents living near these large food markets on the outskirts of the city have good physical access to food, while residents living in the gaps have to travel over a mile to reach a large market.

In the midsection of the city, beyond the city center and before the outskirts, convenience stores are the only food markets available, giving midsection residents less physical access to nutritional and culturally relevant foods.

The largest number of food markets are located in the center of Lowell, giving residents living in the heart of the city the best physical access to food markets. However, the highest levels of poverty are also concentrated in the heart of the city, and even with close proximity to food markets, residents there still may not be able to afford food.

With five stores, Market Basket is the dominant large food market in the city. Others are Hannaford Supermarket, Stop & Shop Supermarket, Jay's Food Store, and large international markets such as Phnom Penh Bangkok Supermarket, Battambang Supermarket, and Khmer Angkor Market.

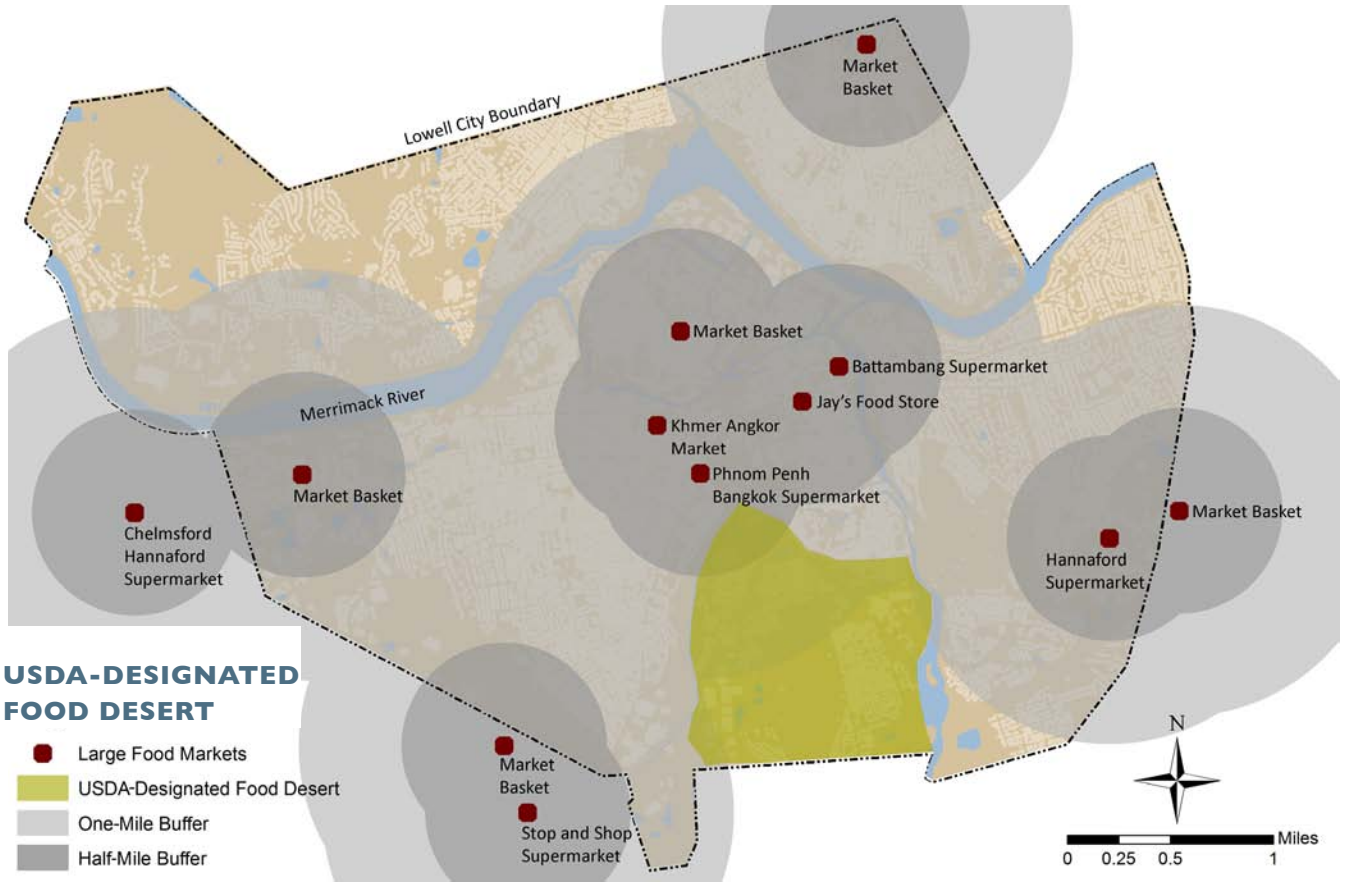
Proximity



The Lowell Regional Transit Authority (LRTA) provides public bus transportation in Lowell. LRTA buses run in all directions through the city, from a central transit hub located at Gallagher Terminal at the Kennedy Center. Most of the food markets can be reached by bus, yet according to the *Lowell Community Food Assessment*, only 2 percent of the residents surveyed use the bus system for transportation to food markets. Residents may have difficulty carrying grocery bags on the bus, perceptions that buses or bus stops are unsafe, or concerns about the time required.

Barriers within the bus system may also prevent residents from using the bus to obtain food. There are seventeen bus routes within the city and each route has a different weekly and weekend time schedule, with some routes not running on the weekend. The complex schedule and required transfers to get to a destination may make it difficult for residents to understand the system. The schedules are also only in English, creating a language barrier for the 9.8 percent of residents in Lowell who have limited English proficiency (City of Lowell, 4). In addition, most bus routes finish running by 7:00 p.m., limiting residents' use through the evening.

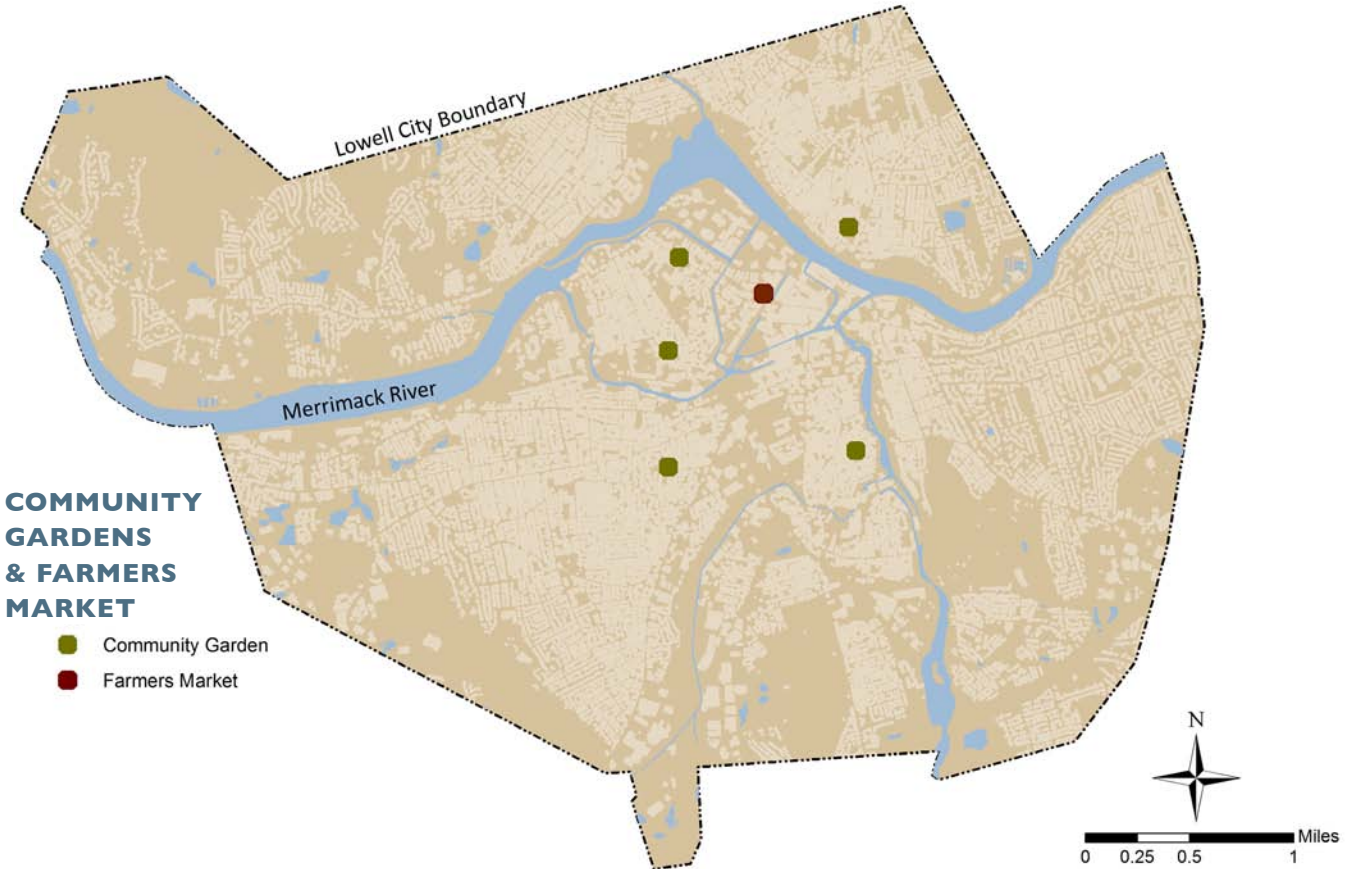
Breaking down barriers for using the public transportation system in Lowell may increase residents' physical access to food, and allow them to take advantage of the LRTA. Fares are reasonably priced, with single fares costing $1.00 and reduced fares $.50. An adult monthly pass costs $35.00 and reduced monthly fares for students, seniors, and persons with disabilities cost $20.00 (Lowell Regional Transit Authority). The LRTA is also building the state's largest public transit solar project, which is expected to supply 99.9 percent of its maintenance facility's electrical needs, and it uses buses that run on natural gas or a hybrid of electric and diesel (Lowell Regional Transit Authority), making it a sustainable option for city travel.



A food desert is an area with a high concentration of low-income residents and poor physical access to large food markets. To determine food desert locations, the U.S. Department of Agriculture (USDA) uses one-kilometer-square grids (about a half-mile) to measure the distance to the nearest healthy food source, which it considers supermarkets and large food markets. In urban areas, a high number of children, elderly, low-income residents, and households without a vehicle, living in areas located farther than a mile from a food market, increases the likelihood that the area will be designated as a food desert (USDA Economic Research Service, Food Desert Locator).

In Lowell, the USDA designated a large area in the southern part of the city as a food desert. This area has a high concentration of low-income residents and in the southern portion of the designated area residents have to travel over a mile to reach a large food market. In the northern section, residents live within a half-mile of Phnom Penh Bankok Supermarket and Khmer Angkor Market, but these international markets may not meet the USDA's definition of a large food market.

Proximity



Community gardens in Lowell have been successful and they are steadily growing in number. Three community gardens have been started by Mill City Grows, one by the Lowell Alliance for Families and Neighborhoods, and one by a partnership between the Lowell Community Gardens Coalition and Lowell National Park.

Four of Lowell's five community gardens are located in the center of the city where the highest concentrations of poverty are present. While community garden leaders are focused on starting gardens in the areas of greatest need, residents living in other parts of the city have fewer opportunities to access fresh produce and learn gardening skills in a supportive environment.

The same residents who live beyond the center of the city and have greater difficulty physically accessing community gardens also have to travel a greater distance to get to the farmers market located downtown. Lowell's farmers market is supported by Community Teamwork, Inc., and is one of the few sources in the city that provides locally grown food. The farmers market is held from June to October on Fridays from 2:00 to 7:00 p.m. WIC, EBT/SNAP, and senior coupons are accepted at the market. The market is located at the JFK Plaza in front of City Hall where there are passing bus routes, but parking is limited and many residents cannot afford it.

The *Lowell Community Food Assessment* found that seniors have difficulty finding a close parking space, and as a result many of them have stopped coming to the farmers market in Lowell, preferring instead to go to a nearby town's market. Relocating the market to an area with increased parking would potentially give more residents physical access to the market.

LOWELL IN FOCUS: MILL CITY GROWS

Mill City Grows was started in 2012 to jump-start Lowell's urban agriculture movement. The organization envisions "that Lowell will be known for its innovative approach to food production and food justice, where residents are engaged actors in creating a food secure community that promotes the ability to grow, consume, and distribute healthy, locally produced food on land that is seen as a vital resource for the community and is protected for food production" (Mill City Grows). Mill City Grows' three community gardens are located in low-income neighborhoods with high ethnic diversity and a lack of easy access to healthy, affordable food. The community gardens encourage community interaction and the sharing of ideas and resources. Co-director Lydia Sisson has seen less crime in the areas where gardens have been established. She has also noticed an easing of cultural tensions as gardening makes residents feel connected and creates an openness that allows residents to learn from people they may have never talked to before.

Currently Mill City Grows is planning an urban farm and is working with Lowell's public schools to start school garden programs. The organization also believes education is an essential component of a successful urban agriculture movement, and has started a Garden Coordinator Institute to train community leaders from each community garden, and a Garden Training Program that teaches new gardeners the skills needed to be successful.

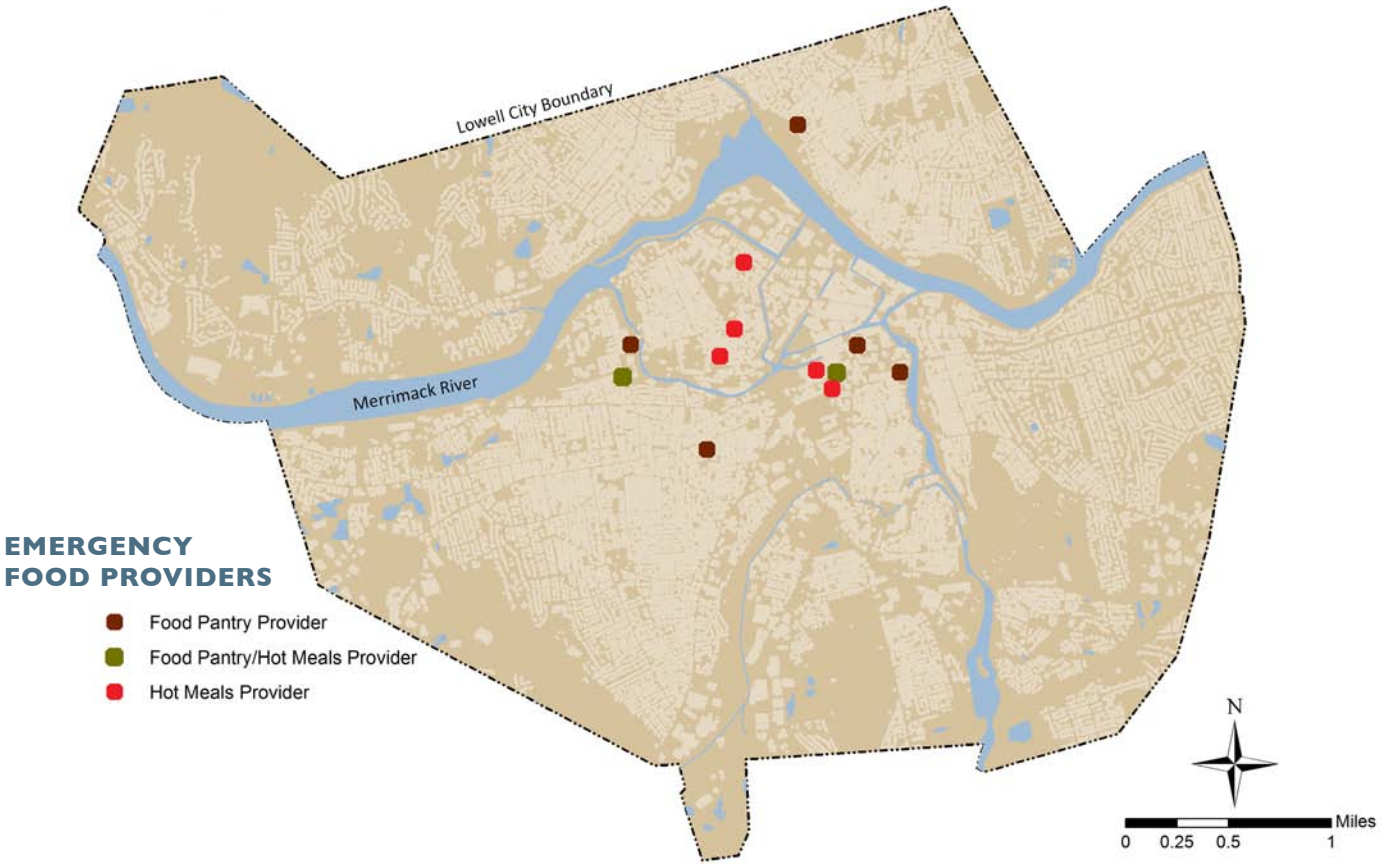
The Rotary Club Park Community Garden is one of Mill City Grows' three community gardens. (Photo courtesy of Mill City Grows)

LOWELL IN FOCUS: NEW ENTRY

New Entry was started in 1998 to work with beginning small-scale farmers who were lacking the technical, marketing, and retail resources they needed to be successful. It focuses its efforts on Lowell and Worcester "to support the vitality and sustainability of the region's agriculture, to build long-term economic self-reliance and food security among participants and their communities, and to expand access to high-quality, culturally appropriate foods in under-served areas through production of locally-grown foods" (New Entry). New Entry works with interested farmers through its Farm Business Training Course, which started in 2005 and teaches beginning farmers about all aspects of small-scale farming, from growing practices to how to run a business. New Entry then assists farmers who have completed the program to find suitable land, or it gives farmers up to a three-year lease at one of its training farms. Through technical support, continued training and education, and marketing, New Entry continues to support its farmers as they build their businesses. New Entry also runs the World PEAS Food Hub (see page 61), which gives farmers a reliable market and fair prices for their products.

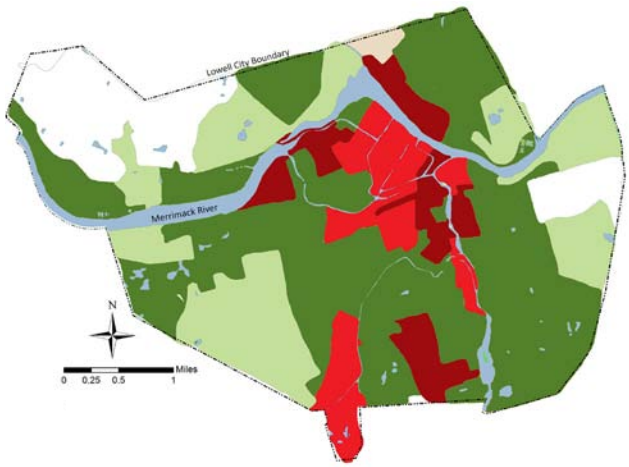
Most of New Entry's farmers who have completed its Farm Business Training Course work on farms near Lowell and Worcester. "Our work focuses primarily in the Lowell and Worcester sections of Massachusetts because of their population makeup, a strong interest in agriculture among immigrant and refugee residents, and the support of community organizations" (New Entry). New Entry has worked with U.S.-born beginning farmers and also immigrants and refugees from around the world, and has received national and international recognition.

Proximity



Emergency food providers, consisting of food pantries and hot meal providers, are centralized in the heart of the city where the highest concentrations of poverty are located. However, there is also a high concentration of low-income residents in southern Lowell who are a great distance from these providers, and they may have difficulty physically accessing these centrally located services. In addition, low-income residents live throughout the city, just not in high concentrations. These residents may also have difficulty finding transportation to reach an emergency food provider.

Many food resources in Lowell, including the emergency food providers, the farmers market, community gardens, and food markets, are located in the center of the city. Having the majority of food resources centralized in one area of the city may limit many Lowell residents' ability to access these resources.



Red represents the areas in Lowell with the highest concentrations of low-income residents. Refer to page 10 for map details.

Local Food Production

Local food producers are another potential food resource for Lowell. In the *Lowell Community Food Assessment*, Sisson and Camp point out that while there are nearly 360 farms within thirty miles of Lowell, it is difficult to find local food products in stores or restaurants, and there is just one CSA in the city. With possible diminishing supplies of oil and increased pressures on the industrial food system, Lowell could increase its food security by sourcing food from sustainable, nearby food producers.

The New England Food Vision is one of many attempts to understand how New England can produce more of its own food. It calls for the region to "build the capacity to produce up to 80 percent of clean, fair, just and accessible (good food) for all New Englanders by 2060" (New England Food Vision). As a baseline, the Food Vision project calculates different food types, including fruits, vegetables, grains, and meat, and their needed acreage using sustainable farming practices (Donahue, et al.). Applying these numbers to Lowell's current population of 106,000, the city would need 63,190 acres to produce most of its own food.

The density of Lowell's infrastructure, leaving only 4,765 acres of unpaved surfaces, make it unlikely that the city's 106,000 residents can be fed in the future with food produced entirely within its city limits. However, there is a significant amount of farmland surrounding the city.

Within thirty miles of Lowell, there are approximately 258,700 acres of farmland, stretching into New Hampshire and Maine. While other nearby towns and cities, such as Worcester and Boston, will also be reliant on some of the same farmland, it is still possible for Lowell to source large portions of its fruits, vegetables, meats, and dairy from its surrounding farms. With Lowell's cultural diets taken into consideration and the importance of foods such as rice, some foods will need to be sourced from outside of the thirty-mile radius.

Lowell's Farmland Needs

(extrapolated from the New England Good Food Vision.)

6,838 acres in vegetable production

4,414 acres in fruit and berry production

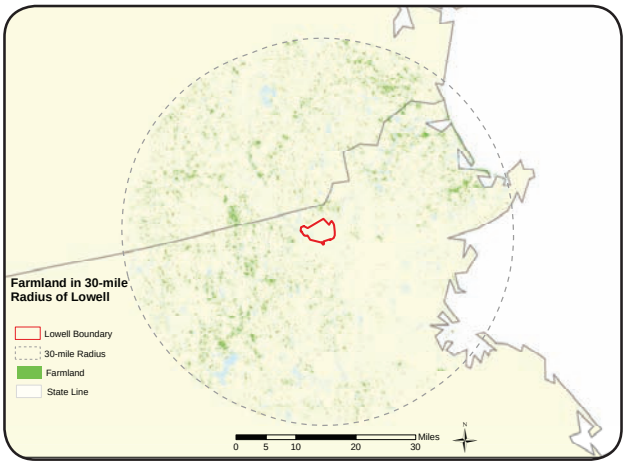
11,284 acres in grain production for human consumption

18,333 acres in grain for animal feed

22,320 acres in pasture for raising livestock

TOTAL ACRES NEEDED = **63,189**

Total unpaved surface in Lowell = **4,765** acres



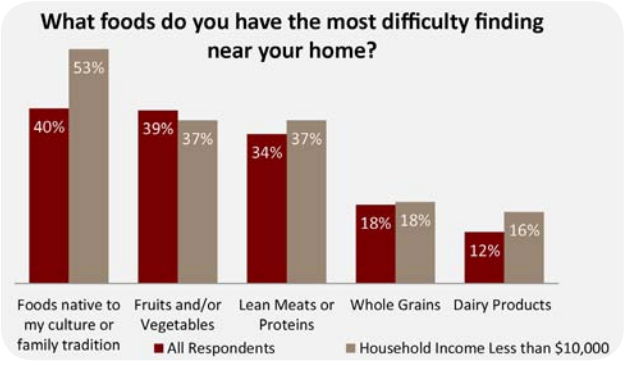
There are over 250,000 acres of farmland within a thirty-mile radius of Lowell, some in New Hampshire and Maine.

Choice

Food security depends on residents' proximity to food and their ability to afford the food, but it also depends on being able to find foods one desires.

The *Lowell Community Food Assessment* found that 40 percent of respondents have the most difficulty finding foods native to their country. When looking solely at the respondents with incomes under $10,000, the percentage increases to 53 percent. The survey indicates that large numbers of immigrants in Lowell are unable to find culturally relevant foods. Having access to culturally relevant foods is important as it connects residents to their culture and maintains a large part of their identity.

The *Lowell Community Food Assessment* also found that 39 percent of respondents have difficulty finding fruits and vegetables. For many residents, the closest food market to their home is a convenience store which carries only a few fruits and vegetables if any, and they typically cost more and have a lesser quality.



Lowell Community Food Assessment Results

Residents not only struggle to find fruits and vegetables, they especially struggle to find fresh, high-quality fruits and vegetables, and organic produce. Residents who do not have access to the farmers market, or who are unable to grow their own food, are limited to the produce available at food markets. Lowell's large food markets carry the widest selection of produce, but source most of their food from the industrial food system. The distance that food travels in the industrial food system can limit its freshness and nutrient density by the time it becomes available to Lowell residents.

Gaining access to fresh, high quality produce is also a challenge for residents who are unable to afford food, and who are dependent on emergency food providers. Food pantries and hot meal providers work hard to provide healthy meals for residents, but they are limited to the donations they receive, which consist heavily of canned and processed foods.

For many immigrants, the first trips taken to a grocery store in Lowell create a cultural shock, due to the difference in appearance from what they are accustomed to. This is especially true for immigrants who come from regions of the world where food comes from open street markets. (Market photo on the left courtesy Justin Mott.)

COMMON ETHNIC FOODS EATEN IN LOWELL

One of Lowell's biggest assets is its ethnic diversity. With each culture comes a set of foods and dishes that connect people to where they come from. Below are lists of foods common in a Southeast Asian diet and a Puerto Rican diet. While the lists do not contain all of the foods eaten by these cultures, they help demonstrate which ethnic foods are available in supermarkets or can be grown in a New England climate.

SOUTHEAST ASIAN DIET	*PUERTO RICAN DIET*
Rice	**Rice**
Fish	**Fish**
Pineapple	**Bananas**
Sorghum	**Chayote**
Mung beans	**Coconut**
Mango	**Plantains**
Coconut	**QUESO FRESCO**
Papaya	**TOMATILLO**
Longan	**GARLIC**
Lychee	**CILANTRO**
BITTER EGGPLANT	**TOMATO**
LEMONGRASS	**BEANS**
MUSTARD GREENS	**CORN**
ASIAN CELERY	**PORK**
BOY CHOY	**CHICKEN**
BITTER MELON	**BEEF**
BEEF	**ONION**
PORK	**PEPPER**

LEGEND:

Foods found in supermarkets

Foods that are not commonly found in supermarkets and cannot be grown in New England

FOODS THAT CAN BE GROWN OR MADE IN NEW ENGLAND

FOODS THAT ARE FOUND IN SUPERMARKETS AND CAN BE GROWN IN NEW ENGLAND

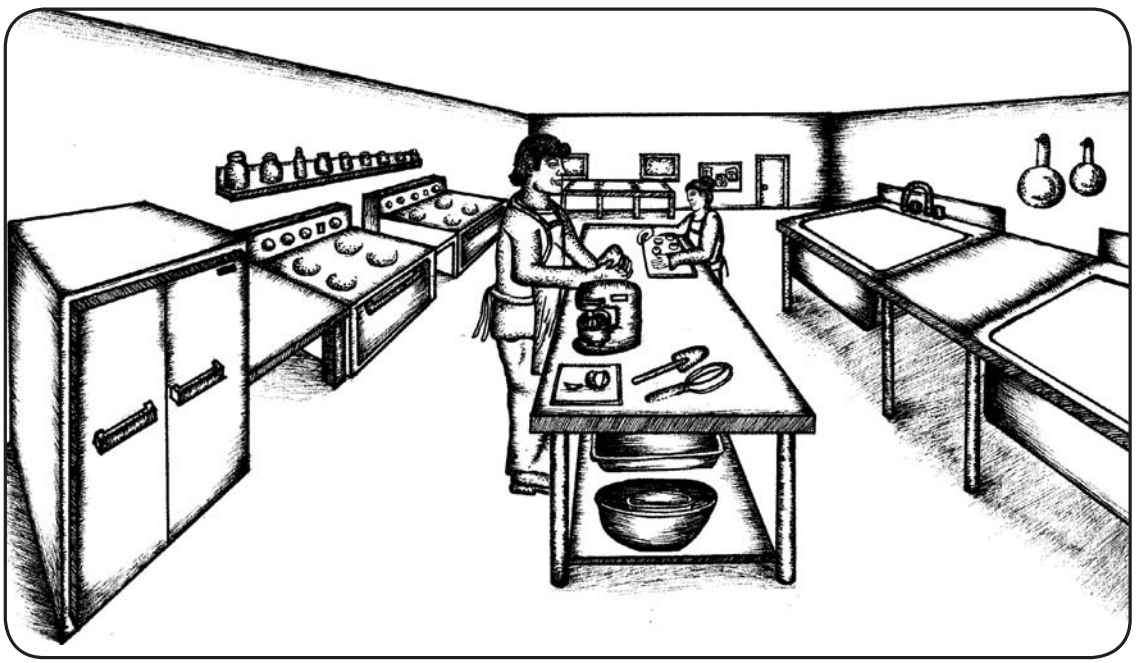
FOOD – A CRITICAL LINK TO CULTURE

For Lowell's immigrant and refugee residents, having easy access to their culture's foods means more than a familiar meal; it is a connection to their culture and a part of their identity. For many immigrants, not having access to their own foods disconnects them from the history, place, family and community that they left behind. In many countries around the world, the home revolves around the kitchen. The kitchen is the center of the home as the meal is prepared, the whole family eats together, usually in the same room in which the food was prepared, and then the kitchen turns into the equivalent of a living room as the family shares stories, jokes, and lessons. For immigrants coming from agricultural and rural regions, the entire day was once spent growing and acquiring food and water for the family. Being able to taste the foods of home helps to keep their culture and identity alive while they are far away from the places and people they love.

Preparation

Food security is also dependent on residents' ability to have the knowledge and physical ability to prepare foods that are available to them. There are several ways that the ability to prepare foods is limited in Lowell. The first was identified by talking with members of the LFSC and a Cambodian refugee support group: many of Lowell's immigrant and refugee populations do not know how to use a large number of the foods that are available in supermarkets. Eventually they adapt and integrate these new foods into their diets, but many often do not like the way that these foods taste. Because recipes are often only written in English, residents who do not read in English also struggle to learn how to use new foods. In addition, many residents spend their days searching for a job, waiting in government food assistance offices, or raising a family, and may not have time to prepare a full, healthy meal made from scratch. Finally, residents who are faced with limited physical ability or mobility can face many challenges in the kitchen.

Women, Infants, and Children (WIC) is part of the USDA Food and Nutrition Service and is a program working towards relieving the barriers that low-income and immigrant residents face in being able to prepare foods. The Community Teamwork, Inc.– supported WIC program provides a six-week course called Cooking Matters to WIC participants, where they learn how to cook and shop using healthy ingredients on a low budget. The class is offered at the Early Head Start Community Kitchen in Lowell. Cooking Matters was offered three times in 2012 and each course series taught eight to ten WIC participants. Participants are given fresh food, some local and organic, at each class to use at home (Fullam). They are taught a variety of recipes that are easy to cook at home, and on the final week they go to a grocery store to learn how to shop for a family of four for $10 a day (Fullam). The classes are held in the evening from 5 to 7 pm, making them accessible to parents who may be working during the day. The course is going to be offered more frequently in 2013, and organizers hope to eventually use all fresh and local ingredients, and teach the course at Lowell homeless shelters (Fullam). To provide greater access to this course for immigrant communities, translation may also need to become a part of the program in the future.



WIC's Cooking Matters class is an opportunity for low-income residents to learn how to cook healthy food on a budget.

"Food is the basic human necessity in which we invest the most energy to produce, and it unites the human race in a universal spirit of awareness, sharing, and charity."

Mark Winne, **Closing the Food Gap**

II. Recommendations

The recommendations provided in this section attempt to build on the strengths of the organizations, programs, and community relationships already in place in Lowell. If implemented, they could help improve residents' food security through greater access to fresh produce; increase residents' self-sufficiency by offering more ways they could participate in food education, production, processing, and community development; and strengthen the stability of Lowell's food system by reusing food waste and decreasing the city's reliance on the industrial food system.

Case studies offer examples of successful programs in other cities that share similar conditions to Lowell, such as high concentrations of low-income or immigrant populations, poor access to affordable fresh produce, or lack of agricultural zoning.

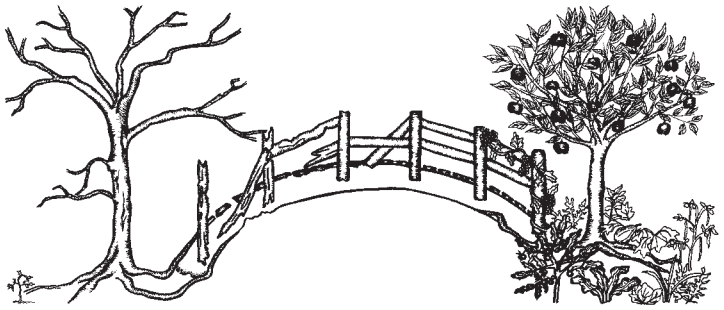
The suggested actions operate at individual, neighborhood, and citywide scales. Due to the current economic challenges found in Lowell, they include some low-tech solutions. The recommendations have been organized by the food system categories of education, production, processing, distribution, and waste cycling.

Each recommendation lists suggested action items, and some provide spatial criteria, that serve as a guide for first steps to implementation. A few general action items are relevant to most of the recommendations and are provided below.

ACTION ITEMS

- Identify the neighborhood(s) that are highest priority for pilot programs.
  - Neighborhoods with a high concentration of residents who need support services, such as low-income, single mothers, or elderly, and residents without cars,.
  - Neighborhoods with potential sites that meet recommendation requirements.
- Identify community needs through community surveys and engagement.
- Identify communication methods that are best used within each neighborhood. For example, individuals at a Cambodian immigrant support group in Lowell stated that information is best spread person-to-person through their community network.
- Identify community leaders who have established networks and trust within the community.
- Develop a team of residents, municipal, county, school, faith, community, and health leaders to serve as an advisory board.
- Identify funding that is appropriate for the recommendation being considered. Each recommendation will require some type of funding or income to establish and maintain its activities.
- Create a business plan.
- Acquire facilities or land that will meet the requirements of the recommendation being considered.
- Recruit volunteers that will support the specific activities of the recommendations.
- Design, implement and frequently evaluate the program using criteria that the advisory board finds appropriate.

(Adapted from Orange County Family Resource Centers)



BARELY MEETING BASIC NEEDS **FOOD SECURE AND RESILIENT**

Community Food Resource Centers

"Family Resource Centers re-invent how services are delivered by bringing resources into the community to families, based on their identified desires and needs. Bringing services into the community not only eliminates tangible barriers to participation such as transportation, but also demonstrates a willingness to meet parents and families 'half way'" (Orange County).

Any food system is a complex network of businesses, organizations, corporations, farmers, and consumers. Lowell is no exception. The forty organizations comprising the LFSC indicate that there is an abundance of organizations and businesses that are eager to contribute to increasing food stability. However, with so many helpful resources throughout the city, it can be hard to know who to turn to and for what. For immigrants who do not speak English, this network of organizations can be even more difficult to navigate.

The goal of a Community Food Resource Center is to bring different organizations together and place them within the neighborhoods of residents who need them. Although not primarily a food resource center, one example in Lowell of how resources can be brought together is Community Teamwork, Inc., an organization that has many department offices in the same space. This allows for increased collaboration, and creates one place where residents can go to find multiple services.

This system mimics a good garden in many ways, where any component of the garden serves multiple functions. For example, the three sisters—corn, beans and squash—support and serve each other. The corn provides the trellis for the beans, the beans add nitrogen to the soil, and the squash's broad leaves create a ground cover, holding moisture in the soil and minimizing weed growth. The three sisters' planting companionship is a small part of a larger mix of plants that may not make sense to someone who knows nothing about gardening, but makes perfect sense to farmers.

A Community Food Resource Center in each neighborhood, in a school, church, community organization, or other existing building, could potentially respond to the specific needs of that residential neighborhood. Sharing physical resources could help keep expenses low, as shown in the following case studies.

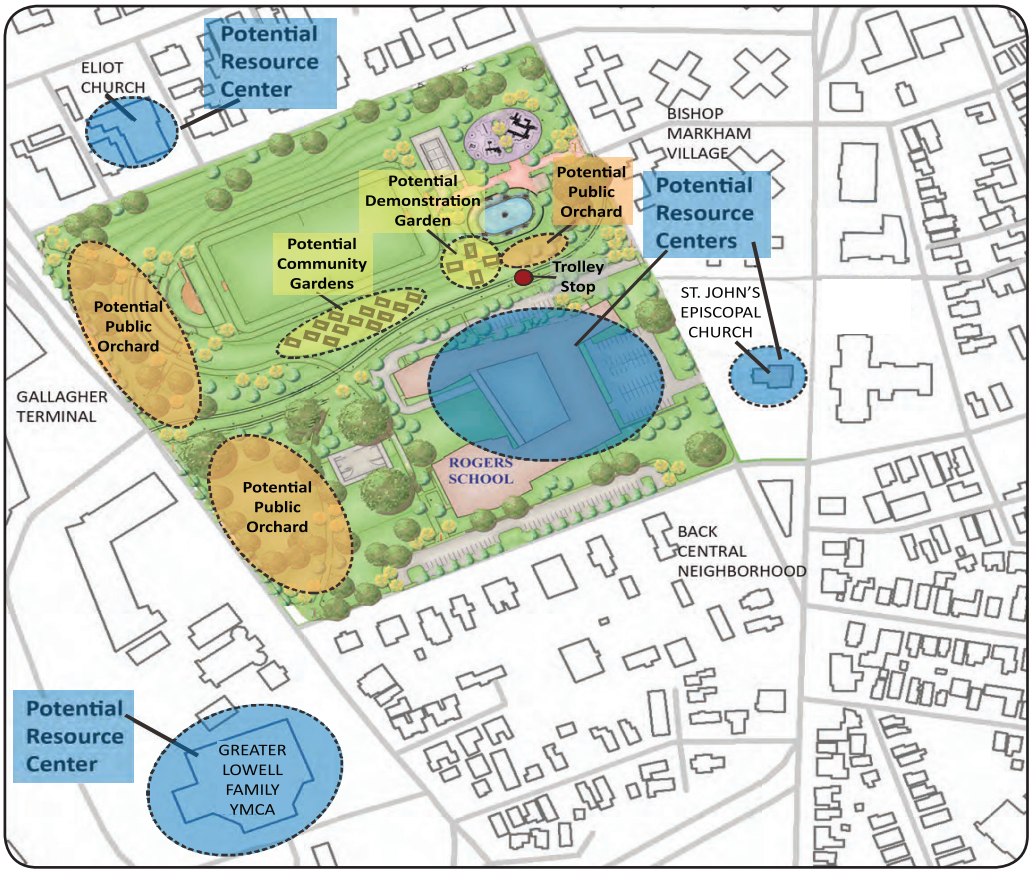
Programs such as WIC and SNAP, and organizations like the Greater Lowell Health Alliance, could have regular weekly time slots to provide residents with services such as nutrition education, help with filling out forms, translation, education about government assistance programs, community cooking classes, and support for new immigrants.

The Community Food Resource Centers could be the place to go for urban agriculture materials and supplies. Tool libraries could offer access to tools that residents can't afford, and seed libraries, like the Seed Savers Exchange and Concord Seed Lending Library, could provide a place for seeds to be stored and shared between residents each year.

The Community Food Resource Centers could be an educational center for courses on urban agriculture. Mill City Grows could have its Garden Leadership Course in each neighborhood. These and other classes could build skills, create opportunities for new relationships to be formed, and enhance the connections between growers.

A resource center could offer a community kitchen with cooking classes taught in multiple languages, an incubator for neighborhood culinary businesses, and space for neighborhood residents to do yearly canning and preserving. Classes could be offered for both adults and youth, with opportunities such as a summer garden camp where youth could participate in managing a demonstration garden and then donate the fresh, Lowell-raised food to residents who need it the most. Some resource centers could provide access to space for food storage for canned goods, or provide a location for a mobile flash freezing unit to help residents preserve surplus produce.

The Community Food Resource Centers could serve as gathering places for community and cultural events



Community Food Resource Centers could be added to proposed neighborhood developments, such as for South Common. Lowell's Back Central neighborhood has a high concentration of low-income residents, and there are several buildings such as churches and the YMCA that have an established presence in the neighborhood. Other neighborhood characteristics like the trolley stop, parking access, and high use areas such as the pool, playground, and sports fields make this a prime location for a Community Food Resource Center along with a demonstration garden and public orchard for educational purposes, and space for community gardens (image adapted from Department of Planning and Development, Sustainable Lowell 2025).

particular to that neighborhood. A neighborhood's own residents bring a deep understanding of the needs of the community as a whole, and as resource centers emerge in multiple neighborhoods, residents could collaborate with each other, learn from each other's successes and failures, and host larger events together.

Resource centers could help build community support around issues that promote sustainability, urban agriculture, and community development. Residents could attend informational meetings translated into their language about community issues at resource centers, which could allow them to become more engaged members of their community.

As a single location hosting many organizations' programs and activities, the cost to operate such a facility could be distributed, with no one organization bearing the full financial cost. Each year, the city of Lowell devotes $200,000 to a selected neighborhood for special projects. In years past, this funding has gone towards road and sidewalk improvements, or community development projects, such as starting community gardens. This money could go towards converting a facility into a Community Food Resource Center. Community development grants could also support the founding of these centers (Mees, 9).

Very few community resource centers across the U.S. currently focus on food issues, except for nutrition education. Of the many resource centers reviewed for case studies, only one food bank was found to provide

Community Food Resource Center

instruction for food production.

The case studies below present three models of successful community resource centers (sometimes called community hubs). The examples provided are a food bank, a public health and social service agency, and public schools.

Although the focus of resources centers in Lowell would be on food access, other services that support resident health and community development could be located in these centers as well, since food insecurity is affected by a wide range of factors.

The large number and variety of members in the LFSC provides a pool of creative energy, knowledge, skills, and networking power that could allow the coalition to survey community needs and find models for Community Food Resource Centers that will work effectively in each neighborhood.

CASE STUDY: COMMUNITY FOOD BANK OF SOUTHERN ARIZONA, TUCSON, AZ

Services provided at the Community Food Bank of Southern Arizona, besides emergency food provision, include:

- Nutrition education for adults and children.
- Helping fill the gaps in families' food needs where other programs end.
- Economic literacy for immigrants.
- Free legal aid for low-income residents having problems with food stamps, cash assistance, medical assistance, and Medicare and Social Security programs, provided by law students from the University of Phoenix.
- Family counseling.
- The Food Bank's Caridad Community Kitchen serves meals seven days a week to residents in need, and provides a ten-week culinary training course to prepare qualifying low-income residents for culinary careers.

The Food Bank headquarters has a teaching garden, compost bins, greenhouse, and hen house to promote and demonstrate food production methods. Staff at the Food Bank teach gardening workshops and provide seeds, compost, and starter plants to residents to help start home gardening. They also have a 2.5-acre urban farm that provides education and food production, and supports 1,120 community gardens, four farmers markets, and coordinates a gleaning program.

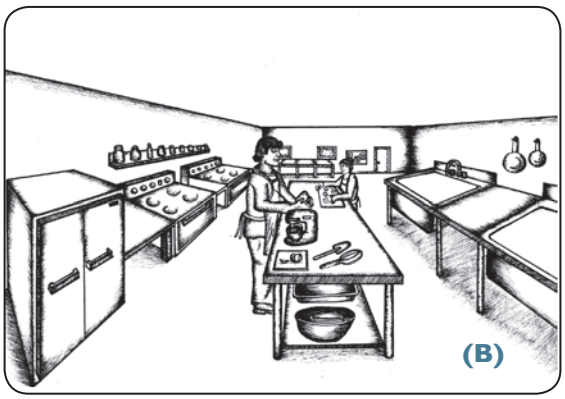
Donations, fundraising events, and foundation grants provide 77 percent of its funding, while 21 percent is from the government. An endowment grant established by the Food Bank board of directors also supports other programs that encourage community food security programs, such as the Amigos Farming Education and Resource Center, which will establish tool and seed libraries at Baja Arizona Sustainable Agriculture, and the Tucson Waldorf School that will plant an orchard and establish a community composting program.

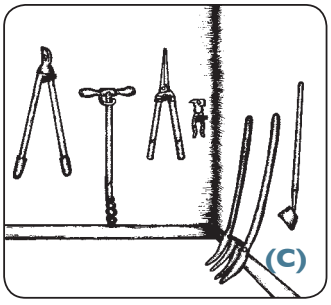
The Community Food Bank of Southern Arizona provides services that are similar to those needed by Lowell residents, and it is a very food-focused model. Currently, the Merrimac Valley Food Bank (MVFB) operates a food distribution center for member agencies and provides food support to low-income children through the Summer Lunch Program and Operation Nourish, and to homebound or disabled low-income residents through the Mobile Pantry. The MVFB provides nutrition and safe food handling education to member agencies, but does not provide services directly to the public beyond those described above. Currently, the MVFB also does not have space for demonstration gardens or a community kitchen, or equipment and space to process and store fresh produce thoughout the year. Surveys of local emergency food providers and other community organizations would need to be completed to see if those service-providers have interest in participating in establishing a community food resource center at their facility, and to see if they have appropriate space to meet the needs of the surrounding community.

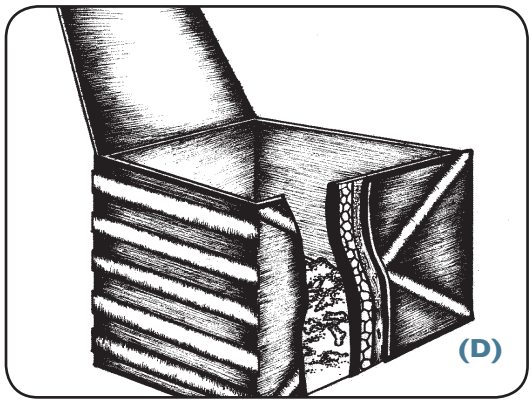
An abandoned building such as this one in the Highlands could be transformed into a vibrant center that supports food initiatives like nutrition education, cooking classes, food production and processing, access to agriculture supplies, and support for new food businesses.

AFTER

A neighborhood's Community Food Resource Center could be a community space where residents of that neighborhood have access to support services that help them learn, explore, and commune around food (a). A community kitchen could provide space for new culinary businesses, cooking classes, and rental of kitchen space and equipment (b). The resource center could offer a tool and seed library (c), gardening supplies, and neighborhood composting services (d).







Community Food Resource Centers

CASE STUDY: ORANGE COUNTY FAMILY RESOURCE CENTERS, CHAPEL HILL, NC

The Orange County Family Resource Centers (FRC) aim to become an everyday part of residents' lives, not just a resource in times of need. At their four locations in Chapel Hill, they provide a variety of services that are regularly modified based on the needs and desires of families. Centers provide for families' immediate needs, as well as assist them in establishing greater self-sufficiency. Services include:

- Nutrition and health education.
- Teen youth councils.
- Childhood immunizations and well-child exams.
- After-school, literacy, GED programs.
- Employment opportunities.
- Referrals to other agencies.

It only costs about $75,000 per year to run each center (not including staff salaries which are covered by the service-provider agencies or organizations themselves), since the centers provide the physical infrastructure in which agencies and organizations offer their services. The North Carolina Department of Health and Human Resources and Division of Social Services provide the main sources of funding to the FRCs, but grants, fundraisers, and donations provide additional financial support (Orange County Family Resource Centers).

The LFSC consists of many agencies, like the Greater Lowell Health Alliance, that have established networks in Lowell neighborhoods and could help identify existing locations for potential Community Food Resource Center sites. A variety of funding sources that are aimed at community building, sustainability, health initiatives, and nutrition education could be combined to help establish these resource centers.

CASE STUDY: CINCINNATI PUBLIC SCHOOLS, CINCINNATI, OH

In Cincinnati, public schools became hubs to support struggling and impoverished communities. Through a system that incorporates shared management of the resource centers between the schools and communities, partnerships with 150 community organizations, non-profits, city agencies, and local businesses have been established, so communities can choose the services they need. The schools are open all day and through the summer. These centers provide $2 to 4 million in services every year, but at significant savings because the schools provide the physical infrastructure. Funding comes from private foundations, public grants, and third party billing. The city, schools, and communities work together to create these centers to best reflect the needs of the communities they serve. Ongoing evaluation of the program helps determine which services to add or delete, and measures the community's satisfaction in the quality of services offered. Cincinnati's model has received national recognition for its positive effect on student achievement and strong community building initiatives.

According to Massachusetts General Law 71, Section 71, Lowell's school committee can decide too use school buildings "for such educational, recreational, social, civic, philanthropic and like purposes as it deems for the interest of the community," as long as it doesn't interfere with school activities (Massachusetts Legislature). Community Food Resource Centers could fall into any of these categories, depending on what type of resource center was established. Lowell Public Schools already have a system in place where groups can rent school facilities. Fees are based on the types of group and the type of facilities being rented, such as a kitchen or gymnasium, and includes the space and any staff such as kitchen staff and custodian. Collaboration between the LFSC and public schools could create vibrant Community Food Resource Centers in each of Lowell's neighborhoods where public schools are located (see public schools map, page 46).

"This means grassroots community building, reaching beyond the schoolhouse door to fold in health services, job resources, translation services, help navigating city bureaucracies — whatever the community identifies as its needs" (Kenning, 2011).

CRITERIA FOR COMMUNITY RESOURCE CENTERS

- Locate in neighborhoods with the greatest needs like those with low-income, single mothers, elderly, and immigrants with language needs.
- Make accessible to people of all ages and physical abilities, with barrier-free facilities and grounds.
- Locate within walking distance to residents with greatest needs, near bus or trolley stops, and with adequate parking.
- Ensure they contain shared public spaces that are available year round, in the evening and on weekends.

If a community kitchen were to be established as part of a Community Food Resource Center, it would have additional criteria such as:

- Use materials for flooring, walls, ceilings, and contact surfaces that can be wiped clean and disinfected.
- Provide adequate space for kitchen users to move. As a general rule, commercial kitchen designers allow about five square feet per person for food preparation.
- Provide spaces for storage.
- Ensure proper infrastructure needs, such as water quality and pressure.

ACTION ITEMS

- Hire a Programming Coordinator who could oversee the development of a Community Food Resource Center and organize food, nutrition, gardening and assistance information.
- Identify Lowell neighborhoods that have a high concentration of food insecure individuals such as low-income and elderly residents, and single mothers, for a pilot Community Food Resource Center.
- Collaborate with organizations such as the Coalition for a Better Acre to understand what is already happening in the identified community, and collaborate with existing programs.
- Identify best communication strategies for each ethnic group and use those methods to disseminate information.
- Conduct a listening campaign to engage the community and better understand their specific needs.
- Assemble a programming committee composed of interested community leaders.
- Identify facilities within the neighborhood that fulfill the spatial requirements of a resource center, based on the identified needs of the community. For example, sunny outdoor space is needed for a demonstration garden, a community kitchen requires an existing kitchen that can be certified as a commercial kitchen or space to build a commercial kitchen, and health clinics need an exam room.
- Create Memorandum of Understanding with organizations (such as the YWCA of Lowell, churches, or community agencies) to use their facility as a pilot for a Community Food Resource Center.
- Estimate expenses for start-up and conduct a fundraising campaign to get the pilot project started.
- Develop and distribute promotional and educational materials in English, and translated into Spanish, Portuguese, and Khmer as appropriate for neighborhoods in which a resource center will be located.
- Work with UMass Lowell business students and the Lowell Small Business Program to develop a business plan for the Community Food Resource Center and small businesses that may sprout from resource center activities, like value-added food products.
- Coordinate with programs like Mill City Grows, WIC, SNAP, public schools, housing, health centers, senior centers, UMass law students, and community groups to coordinate classes and services.
- Partner with groups, such as the United Teen Equity Center, for expertise in community kitchen planning, design, maintenance, and understanding regulatory measures for food handling safety.
- Partner with groups, such as the United Teen Equity Center, for expertise in developing grassroots support.
- Establish a demonstration garden, community garden and public orchard on the resource center site if space is available, or in a nearby park.
- Participate in local, state and federal initiatives that support local farms, urban agriculture, market-based regulations, business development and funding for community-based agricultural development.
- Facilitate meetings to educate community members about urban agriculture issues.

Backyard Gardens - Individual and Neighborhood Block

Backyard gardens have the potential to provide fresh, nutrient-dense, culturally relevant foods for households, while also building community within neighborhood blocks.

Most of Lowell is densely built with little open space. Forty-five percent of the city is covered with impervious surfaces, which could be an obstacle to increasing food production. However, turning small, residential, under-utilized backyards within Lowell into productive gardens has potential to increase food production.

As some Lowell residents already have found, backyards can provide viable growing spaces for increasing food production. Lawns are the most obvious candidates for using residential spaces for gardens, but nontraditional growing spaces in backyards can also be transformed into gardens using innovative growing techniques. Raised beds can be built on top of paved surfaces, such as an unused portion of a driveway, and vertically built planter boxes and trellises allow food to be grown on vertical south-facing structures, such as the side of a house. Ingenuity with small space gardening will maximize food production in backyards.

Benefits of Backyard Gardens

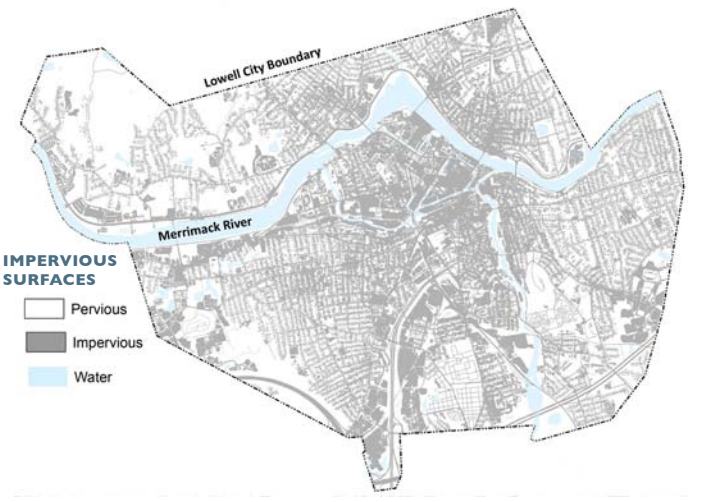
Backyard gardening can not only increase food production in Lowell, it can also give residents better access to food, making it affordable and easy to obtain, as it is directly out the back door. Residents could also grow culturally relevant foods and fresh, nutrient-dense foods, giving them access to more of the foods they desire.

Like community gardens, individual and collaborative backyard gardens can strengthen community ties, create a sense of neighborhood pride, and create an environment for increased skill sharing. Backyard gardening can be done in an individual backyard, or taken to a larger scale and done collectively on all of or part of a neighborhood block. The appropriate scale of residential gardening depends on the site and the interests of the neighborhood, and may change over time.

Advantages of Collective Gardening

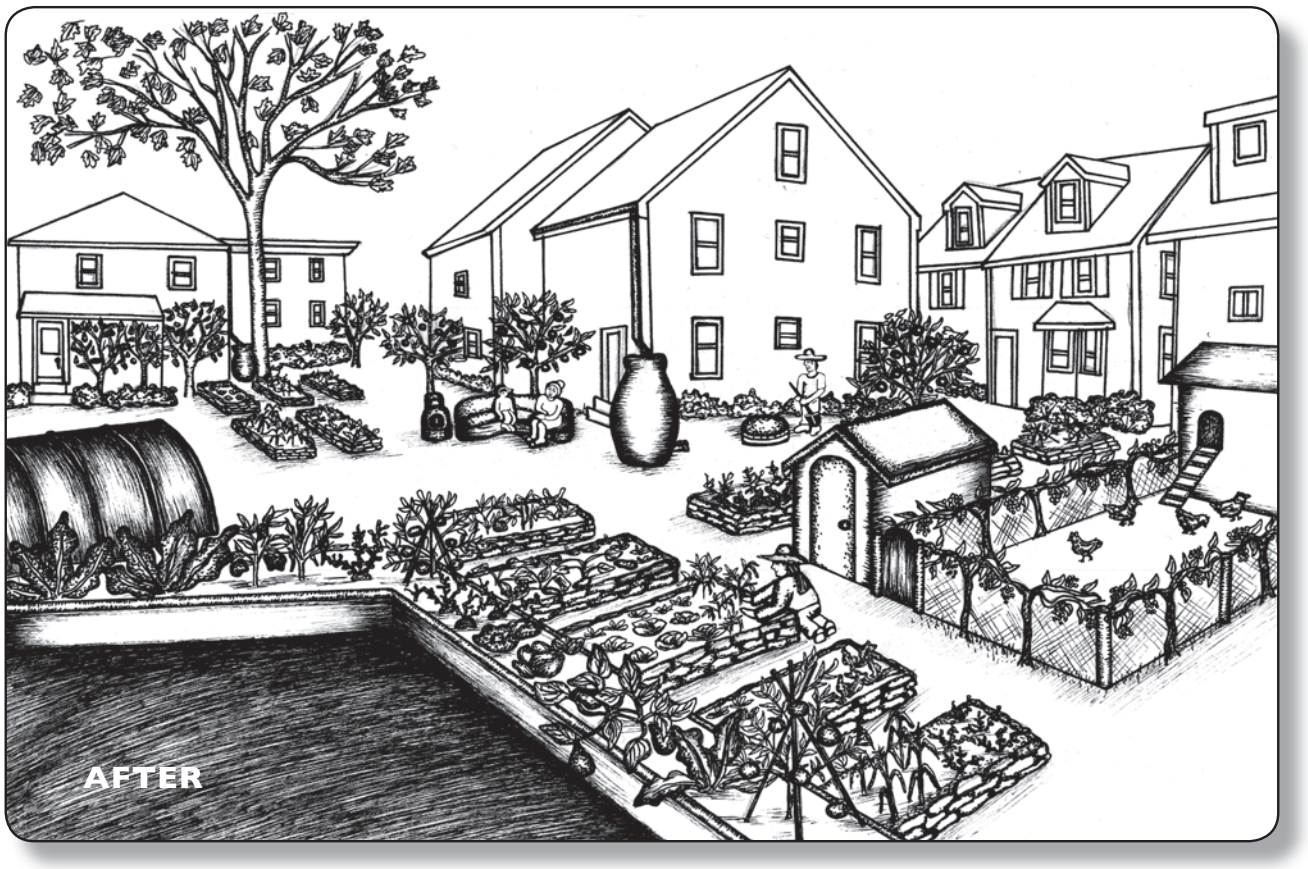
Building up backyard gardens to a larger neighborhood block scale has advantages. Some residents interested in starting a garden do not have space on their property, even with innovative growing techniques, to grow food, while other residents may have more space than they need to start a garden, or they may have a growing space, but are not interested in gardening. Forming connections between neighbors could enable more residents to meet their growing space needs. One resident, for example, who does not have gardening space may grow food on a neighbor's property and give that neighbor a portion of their harvest in exchange for using their land.

Joining individuals' garden spaces, and making collaborative decisions about shared garden use, may also increase gardeners' yield by allowing gardeners to coordinate with each other to grow specific crops with appropriate growing conditions. One resident, for example, may have a backyard that is cooler and shaded part of the day, and their next-door neighbor may have a backyard that receives full sunlight. Instead of having each resident try to grow spinach and corn on their individual properties, they can increase their harvest by



Forty-five percent of the city is covered with impervious surfaces, such as asphalt and concrete, posing a challenge for finding open space to use for food production.

If neighbors within a city block took down their fences, large expanses of land could become available for gardening. Neighbors could share resources, tools, materials, harvests, and grow foods that are healthier, more nutrient-dense, and culturally appropriate.



gardening collaboratively and growing spinach on the property that is shaded part of the day, and growing corn on the property that receives full sunlight.

Collaborative backyard gardening may start out with just two neighbors sharing a space, and then grow gradually over time. Or it may start out with an entire neighborhood block deciding that they want to remove their fences and turn their small, compartmentalized spaces into a large continuous garden space. The more residents participate in the neighborhood block backyard garden, the greater number of resources that can be pooled, lowering each gardener's cost. Tools can be shared and stored in one tool shed, and soil and seeds can be purchased in bulk at a reduced cost. Gardening and food preparation skills can also be shared. Creating gathering areas within the garden encourages skill sharing and builds a sense of community, which in a shared space is crucial to the garden's success.

Components of a Backyard Garden

The garden's productivity also depends on having functioning components which increase its productivity and reduce waste, creating environmental benefits. Rainwater catchment tanks collect and store runoff from

rooftops to provide water for the garden. Collecting rainwater lowers resident's water bills and has additional benefits (see page 36). Season-extension structures, like hoophouses and cold frames, can increase gardeners' yields by extending the growing season, and they can be built inexpensively. A hoophouse made with boards, PVC pipe, rebar, and UV-resistant greenhouse plastic can be built for $225, or less if the materials are salvaged (New Community Project).

Waste cycling using composting methods, such as bokashi fermentation (see page 59), break down food and yard waste, turning it into nutrient-rich soil for the garden, increasing productivity. Raised beds protect plants from potential urban soil contamination and can be built with long-lasting, recycled materials (see page 54). Small livestock, such as chickens and rabbits, increase gardens' edible yield and perform valuable services such as weeding and fertilizing. Fruit trees increase gardens' edible yield further and provide additional benefits such as reducing stormwater runoff.

Backyard gardens increase residents' access to food and increase self-sufficiency. They also create an opportunity for residents to increase their income by growing cash crops such as mushrooms, eggs, or honey. With the rise of backyard gardens, micro-enterprise opportunities can be created, giving residents the opportunity to earn additional income building components of the gardens such as season-extension structures or water catchment tanks.

CASE STUDY: THE URBAN HOMESTEAD, PASADENA, CA

Thirty yards from the intersection of two roaring freeways in Pasadena, California, sits a productive backyard farm (Urban Homestead). The Dervaes family started their backyard farm in 1985, and today it is known as the Urban Homestead. The farm is located on a small, urban, 66-by-132-foot lot, leaving just one tenth of an acre for growing space. Despite the limited space, the farm produces over 6,000 pounds of organic food annually. This is enough food for each of the four family members to obtain 90 percent of their vegetarian diet from the garden. The family only consumes 60 percent of their harvest, allowing them to sell the rest of the produce for profit. Thirty percent of their harvest gets sold to local establishments and individuals through a CSA. The family also cuts farm costs by using 10 percent of the harvest for animal feed. The Urban Homestead has allowed the Dervaes family to lower their environmental impact, increase their health with a diet of fresh organic produce, and save money. Because they grow their own food they also only spend about $2 dollars a day on food for each family member.

(Photo Courtesy: The Urban Homestead.)

Lowell residents could similarly benefit from backyard gardens. Growing conditions in the northeast U.S. will not give Lowell residents the same yields as California, but there are methods for extending the northeast's growing season using structures such as cold-frames and hoophouses. The Urban Homestead provides inspiration for what can be accomplished with small, under-utilized spaces in Lowell's neighborhoods.

ACTION ITEMS FOR INDIVIDUAL BACKYARD GARDENS

- Have interested residents become part of a community garden in Lowell, such as one started by Mill City Grows, where they can build skills and confidence in a resource-filled environment before gardening on their own.

- Create a support network of gardeners who can help each other build gardening skills and help new gardeners get started.
  - Identify skilled gardeners in Lowell, such as Lowell Master Gardeners, who are interested in offering gardening support and training to residents. Trained and experience-rich residents can then pass their acquired skills on to other residents.
  - Encourage organizations focused on urban food production, such as Mill City Grows, to expand their programs to support backyard gardeners by offering them individual guidance, group training courses and workshops.

- Inspire residents to start backyard gardens.
  - Promote backyard gardens by teaming up with a local newspaper, such as the Lowell Sun, to cover stories on Lowell residents' backyard gardens and how they have impacted their lives.
  - Create posters with pictures of before and after transformations of Lowell residents' backyards, and place them at well traveled spaces, such as food pantries and community centers.

ACTION ITEMS FOR NEIGHBORHOOD BLOCK GARDENS

- Create a pilot project on a neighborhood block that has:
  - High visibility and is located near a school, park, grocery store, or food pantry in Lowell where residents are likely to walk to.
  - A collective cultural background, or existing community network among residents.
  - A sizable shared space that receives at least 6-8 hours of sunlight during the day.
  - At least two reliable sources of water, in addition to planned rainwater catchment tanks.

- Evaluate residents' interest in creating a collective gardening space.

- Identify an organization focused on urban food production, such as Mill City Grows, to carry out the pilot project, including:
  - Hold garden leadership classes, similar to Mill City Grows' garden leadership class, for residents of the neighborhood block.
  - Hold workshops for the residents on skills such as building season-extension structures, composting, and building ferrocement water catchment tanks.
  - Promote the project by holding a neighborhood block party once the garden is underway and inviting residents from surrounding neighborhood blocks.

- Select members of the LFSC or other organizations to create an evaluation of the successes and weaknesses of the pilot project. Determine if participating residents feel supported, if they have easy access to garden resources, and if their gardens are productive in the way they want them to be. Also determine where participating residents' needs are not being met and where the program can be strengthened.

- Identify residents in the neighborhood block who could share the leadership and practical skills they have learned with the next interested neighborhood block.

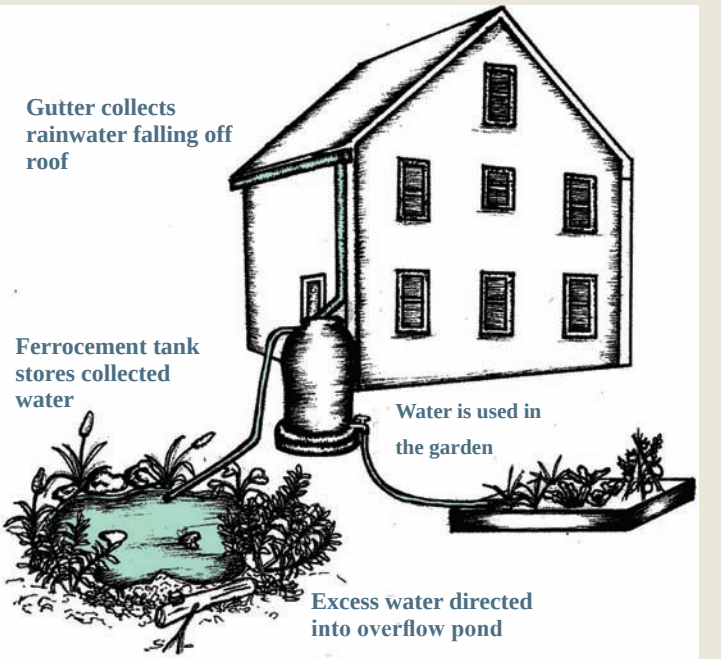
- Evaluate methods to cheaply and effectively use vertical space to increase production in small growing spaces, such as fences, trellises, hugelkulture, and hanging pots.

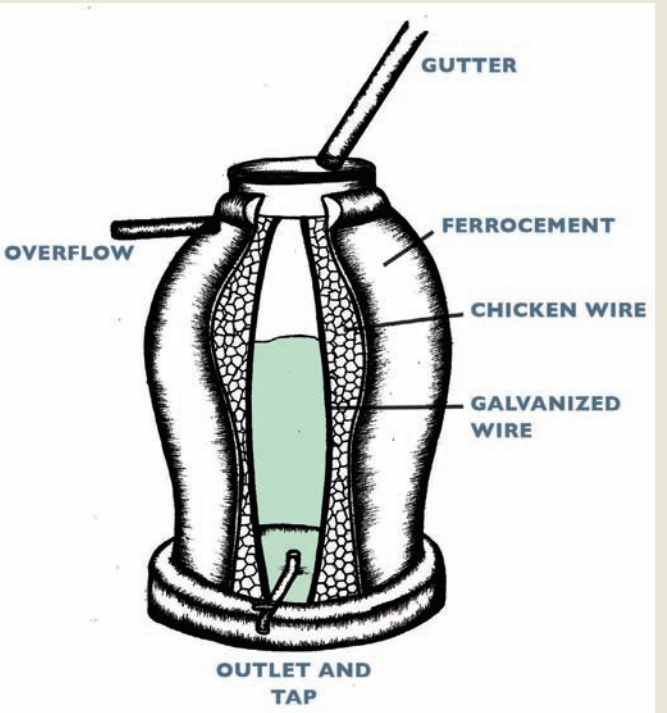
BENEFITS OF HARVESTING RAINWATER

Collecting rainwater off Lowell's rooftops can benefit urban agriculture. Harvesting rainwater to use in gardens can reduce the use of city water for watering plants and lower residents' water bills.

Although the city has an ample supply of water from the Merrimack River, reducing the volume of water treated for water used in gardens will benefit the city. Collecting rainwater will also decrease the amount of rainwater runoff flowing into the city's stormwater system. Lowell is a densely built city with extensive impervious surfaces, and it faces the challenge of handling water runoff during heavy rains. Most of the water is directed into the combined sewer overflow system, and if the system can't handle the flow, sewage is released into the Merrimack and Concord River, causing harmful environmental impacts.

Storing water can also benefit Lowell by creating water security in the city. With a changing climate and an increase of extreme weather events, stored water provides a backup when there is a supply shortage caused by a dry spell, or an electrical power outage caused by a storm or technical mishap.





A complete guide to building ferrocement water catchment tanks is provided by Art Ludwig in *Water Storage* (2007).

FERROCEMENT WATER CATCHMENT TANKS

Ferrocement is one of many materials used to make water catchment tanks, but its advantages make it well-suited for use in Lowell. A ferrocement water catchment tank consists of a steel framework covered with a sand-cement plaster. It is almost as strong and durable as cement, but uses only a fraction of the materials, making it cost-effective. The materials needed to construct an 800-gallon water catchment tank cost as little as $150. This is a small investment for the large storage capacity they provide (Ludwig, 97).

Ferrocement water catchment tanks typically range in size from 250 gallons to 30,000 gallons and can be built in a wide range of shapes. The size of the tank needed is determined by calculating the amount of rainwater roof runoff on the building, as well as the amount of water needed in the garden (Ludwig, 95). Minimal masonry skills are needed to build the tanks, giving do-it-yourself Lowell residents the ability to make their own. They also create a small business opportunity for residents who become skilled at their construction, and want a rewarding job lowering human impact on the environment.

Rooftop Gardens

Lowell could grow a portion of its food on its abundant rooftops.

Green roofs provide growing areas on otherwise unused space. In recent years, businesses and organizations have began to grow food on rooftops as food costs rise and as more people desire to grow some of their own food in urban areas.

There are many benefits to green roofs, including stormwater management, moderation of the heat island effect, improved air quality, local job creation, energy efficiency, noise reduction, improved health, aesthetics, and well-being (Green Roof Benefits). Whether an existing roof can be converted to a green roof will depend on each individual rooftop, its ability to hold the weight of soil and plants, how accessible it is for renovation and maintenance, and how the new roof would be used.

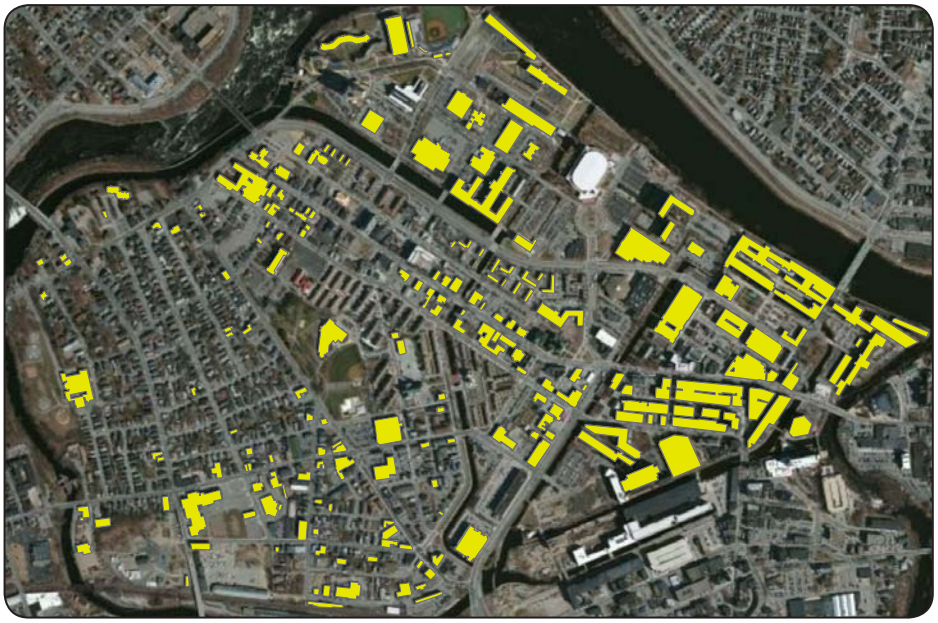
There are three types of green roofs: intensive, extensive, and hydroponic. Extensive green roofs, which eventually can be self-managing, have less soil depth, limited plant variety, and require little human interaction. They can grow edible plants that have a shallow root system and require little maintenance, such as culinary herbs.

Intensive green roofs require more maintenance, can support a deeper soil depth with greater plant variety, and can tolerate heavy and daily human use. Intensive rooftops can support an urban farm or a community garden, with many people on the rooftop daily (*Guide to Green Roof Construction and Rooftop Gardens*).

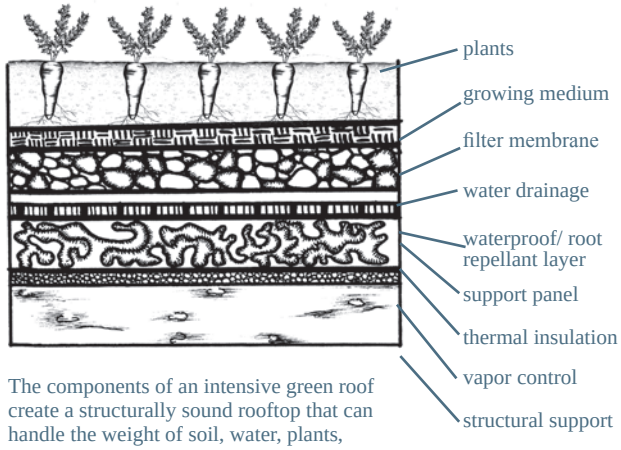
Hydroponic rooftop gardens involve building greenhouses equipped with a hydroponics system. A hydroponic system grows plants without soil. These systems have been developed in part to grow food in areas that have poor or contaminated soils.

The major components of a green roof are structural support from the existing building, a vapor control layer, thermal insulation, a support panel, a waterproof and root-repellant membrane, and insulation that will separate and protect the building from water, soil and plants. In addition to these components are drainage and filter layers for water, the growing medium, and the plants grown on the rooftop.

There are currently two predominant models for growing food on rooftops: using greenhouses with or without hydroponic systems, like BrightFarms (see page 38), or



The buildings in yellow highlight possible flat rooftops in downtown Lowell and The Acre neighborhood. The combined rooftops amount to 100 acres that could be evaluated for green roof establishment.



The components of an intensive green roof create a structurally sound rooftop that can handle the weight of soil, water, plants, equipment, and people. (Image adapted from Green Roofs for Healthy Cities.)

using a soil growing medium, like the New York City urban farm, Brooklyn Grange (see next page). These two techniques can be used individually or combined within the same greenhouse.

To evaluate whether a building could support any kind of green roof, a structural engineer must test the structural load-bearing integrity and capacity of the building. The building must be evaluated for handling the weight of all the green roof layers, plant weight at maturity, and the weight of a fully saturated growing medium and drainage layers (Tolderlund, 15). The load-bearing capacity also determines the growing medium type and depth, replacement and repair strategies, and plant selection (15). A roof that can support an urban farm using an intensive roof needs to be able to hold at least 9 inches of growing medium (69 lb./sq. ft. of dry weight and 105 lb./sq. ft. of saturated weight), and have a maximum slope of 1:12 (Green Roof Systems).

A building must also be evaluated for its ability to withstand the weight of equipment, water, people, and materials used during the installation and in the day-to-day use of the green roof (Tolderlund, 17).

Costs will vary depending on what modifications need to be made in order for the roof to meet its user needs and be structurally sound, but green roof infrastructure usually costs between $20-30 per square foot (Schantz). Because of the benefits of green rooftops—reducing energy costs, extending life span of rooftops by two to four times, providing valuable green space for occupants, and generating income from growing food— additional up-front costs are often negated through the life span of the roof.

CASE STUDY: BRIGHTFARMS, PA & NJ

BrightFarms "designs, finances, builds, and operates greenhouse farms at or near supermarkets, cutting time, distance, and cost from the produce supply chain." BrightFarms has partnered with McCaffrey's supermarket in Pennsylvania and New Jersey and Superfresh in Pennsylvania to provide fresh, local, and organic produce grown on grocery store rooftops. The participating grocery stores allow BrightFarms to renovate their roof to make it structurally sound, build hydroponic greenhouses on top and start growing vegetables. Grocery stores make no investment in any of this infrastructure; the only commitment they make is to purchase the food produced. BrightFarms also sells to other local vendors. A 56,000-square-foot operation in Yardley, PA, produces 500,000 pounds of food in one year. BrightFarms commits to hiring local farmers to run operations. These operations conserve water by cycling it through the hydroponics systems, reduce greenhouse gases, provide jobs for people in the community, and increase the availability of fresh produce at affordable prices. While BrightFarms may or may not come to the Lowell area, their operations, albeit in a slightly different climate zone, suggest that large amounts of food could be grown on structurally sound rooftops in Lowell (BrightFarms).

(Photos Courtesy: BrightFarms)

Possibilities for Lowell's Rooftops

Green roofs and rooftop farms in Lowell could potentially lead to new job and training opportunities for low-income residents, create additional space for recreation, and result in cheaper food due to reduced transportation costs. Rooftop farms could open up more growing space within the city limits. These urban farms could sell their harvest at the farmers market, to local restaurants and stores, through a CSA program, or to the World PEAS Food Hub, or could be developed into community gardens where residents have individual plots to grow a portion of their own food. Rooftop farms could also be gathering spaces for community events and workshops, where residents can snack on sugar peas and cherry tomatoes while watching the sunset over the city's skyline. Rooftop farms have the potential to turn apartment renters into farm volunteers, community gardeners, and CSA members. Store and restaurant owners could become the primary customers of a farm on their rooftop, buying produce to stock their shelves or integrate into a nightly dinner special from the farm just a few floors above.

Fruits and vegetables are not the only food that can be raised on a rooftop. If a rooftop is not suitable for intensive green roof renovations, it may be a desirable space for rooftop beekeeping or a small rooftop chicken pasture, which would not need as much structural support from the building. Indeed, other unique pervious spaces can be utilized throughout the city. Vertical walls, parking lots, and other under-utilized spaces can be developed into spaces that produce food and add beauty.

While many of Lowell's residential rooftops might not support a green roof, some of Lowell's grocery stores, institutional buildings, old mill factories, and downtown storefront buildings might. The map (page 37) highlights where some of the flat rooftops are in downtown Lowell and in The Acre neighborhood. These rooftops could be assessed by a structural engineer to determine if the building could support a rooftop farm.

CASE STUDY: BROOKLYN GRANGE, NEW YORK CITY, NY

Brooklyn Grange's 2.5–acre rooftop farm was created in 2010 as a model fiscally sustainable urban farm. In two short years, it has become the largest rooftop soil farm in the U.S. The farm is located on two separate rooftops, one on top of the Acumen Capital Partners building with a ten-year lease, and the other on the Brooklyn Navy Yard rooftop with a twenty-year lease. The project began with volunteer labor from friends and family as they worked with structural engineers to prepare the roof to handle the weight of soil, water, plants, and people. Both green roof systems provide a water and root barrier to protect the roof and drainage plates to move and store water. Brooklyn Grange uses Rooflite, a special green roof soil blend made by Skyland in Pennsylvania, composed of compost and organic lightweight porous stones. These stones break down over time and provide trace minerals to the soil for plants to absorb.

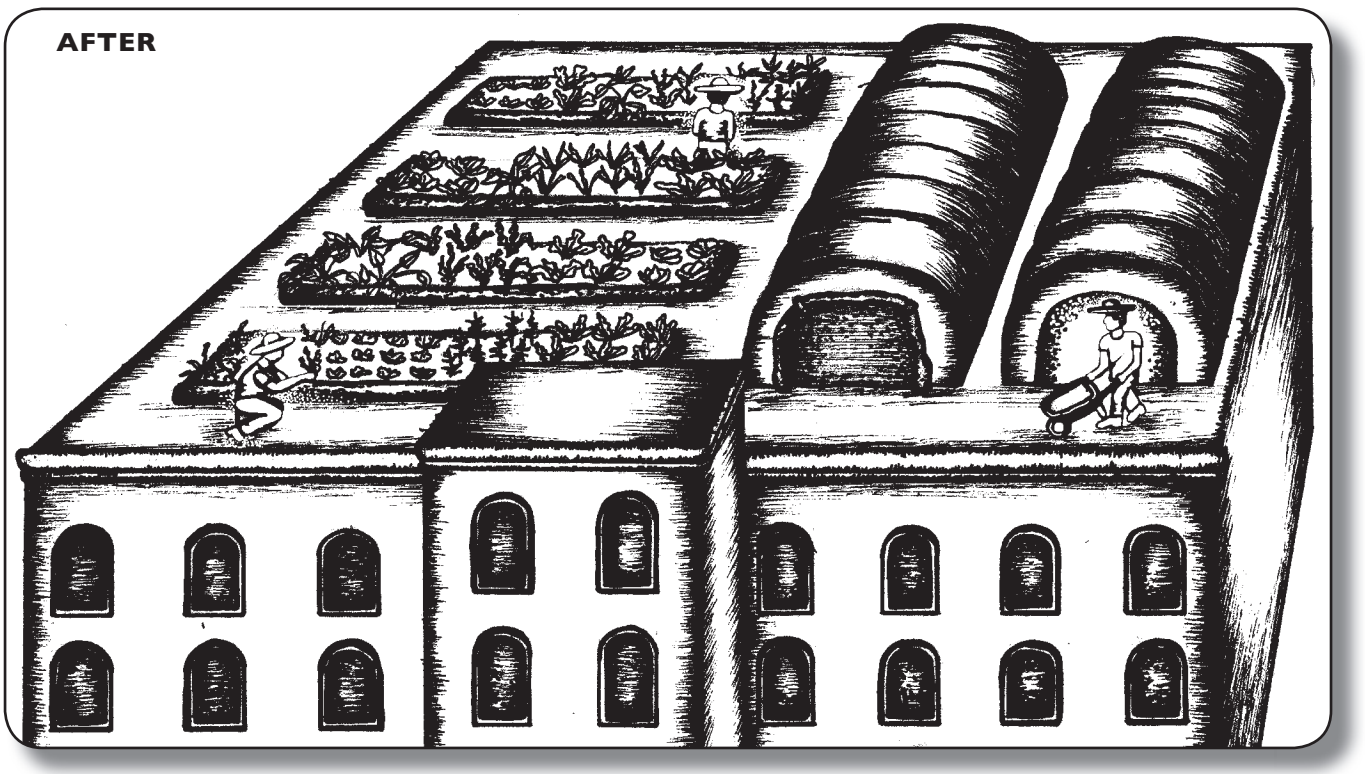
Brooklyn Grange sells its products to local stores and restaurants, has a forty-member CSA, and is a vendor at several NYC markets. The Brooklyn Navy Yard roof hosts thirty hives in a remote, controlled environment and is a training site for a beekeeping apprenticeship program. The apiary has a program that breeds and sells NYC queen bees to city beekeepers, creating a unique NYC queen bee that can thrive in this special urban environment. Brooklyn Grange also does rooftop farm consultation. Their services run at $250 per hour and include advice in design, installation, maintenance, and business management (Schantz). Brooklyn Grange also hosts a variety of educational programs for youth and adults (Brooklyn Grange).

(Photo Courtesy: Brooklyn Grange)

Rooftop Gardens

(Photo Courtesy: Lowell Historic National Park)

An old mill building with a large, flat roof could be transformed into a rooftop farm that has the potential to grow hundreds of pounds of food through several growing methods. Rooftop farms can be commercial farms that sell to corner stores, restaurants, or institutions, or they can be community gardens for people who occupy the building.



ACTION ITEMS

- With a structural engineer, identify and assess flat rooftops for intensive green roof conversion. These rooftops should:
  - Need minimal structural changes to meet load-bearing capacity for extensive, intensive, hydroponic, or other rooftop activities such as beekeeping.
  - Be large enough for commercial rooftop farmers to make their business profitable. Growing size areas may be smaller for other rooftop gardening activities such as community gardens.
  - Have existing access to the roof by stairs or elevator.
  - Have building owners who are willing to sign a contractual agreement that may include a long-term lease to make structural changes worthwhile.
  - Be in neighborhoods that could benefit from the jobs, food, and growing space provided.
  - Have existing access to a regular water supply on the rooftop.

- LFSC should identify an existing or create a new organization or business that will manage a prototype rooftop farm. This organization could:
  - Employ and create leadership positions for residents in the Lowell community who are low-income and interested in rooftop farming.
  - Manage the overall and day-to-day running of the farm.
  - Secure start up and on-going funding.
  - Develop business or organizational models that intersect with the use of the building below it (e.g., a rooftop that is suitable for a rooftop garden on top of an apartment building could be developed with community garden plots if apartment residents are interested).
  - Develop programming for training of employees and host workshops and community events to educate the general public.

- Rooftop farms should develop and maintain collaborative relationships with members of the LFSC to:
  - Create unique funding opportunities between multiple organizations (e.g., Mill City Grows and a rooftop farm could apply for the same grant for materials funding, such as the Community Food Projects Grant awarded by the USDA).
  - Develop collaborative programming around community needs (e.g., CTI's nutrition education program, Cooking Matters, and a rooftop farm could collaborate to provide nutrition workshops at a rooftop farm, use rooftop farm produce, or work with corner stores to provide culturally appropriate foods that cannot be grown in backyard gardens).
  - Co-host events that bring awareness and publicity to collaborating organizations. E.g., member organizations of the LFSC could co-host an event that educates the general public around all of the volunteer opportunities to grow, harvest, and purchase urban or locally grown foods.

- Evaluate the progress of each rooftop farm after one year of operations to:
  - Understand the financial results of the business.
  - Survey each farm's customers to understand product preferences, if prices are appropriate, and if delivery options are easy and convenient.
  - Develop new collaborative relationships that will further the farm's financial success and create new opportunities for Lowell organizations.

Public Orchards

"Fruit and nut trees are illegal along the streets of most cities. Their crime: producing nutritious food that can fall with a squish into the public domain."
Richard Register, Ecocity Berkeley

Planting fruit and nut trees in parks, schools, or other open spaces within neighborhoods that have the highest density of low-income residents could provide free food to residents with the greatest food insecurity. A public orchard consists of trees or shrubs that produce fruit or nuts, planted on public lands and open to anyone to harvest. Some fruit and nut trees can provide high yields of produce with infrequent maintenance, and they can produce food for decades.

The potential harvest yield of a public orchard can be calculated based on the area and density of plantings. A scenario for apple trees is shown below. Fruiting plants provide other benefits besides food production. These benefits include air filtration, water absorption, CO^2 reduction, shade, reduction of the urban heat island effect, feeling of well-being, and higher property values.

- 100 large, mature trees remove 53.1 tons of CO^2 from the atmosphere per year.
- 100 large, mature trees remove 430.3 lbs. of pollutants per year, worth about $1,280 in emission credits.
- 100 large, mature trees intercept 538,700 gallons of rainfall per year, reducing the need for stormwater controls, and providing cleaner water.

(McPherson, et al., 82)

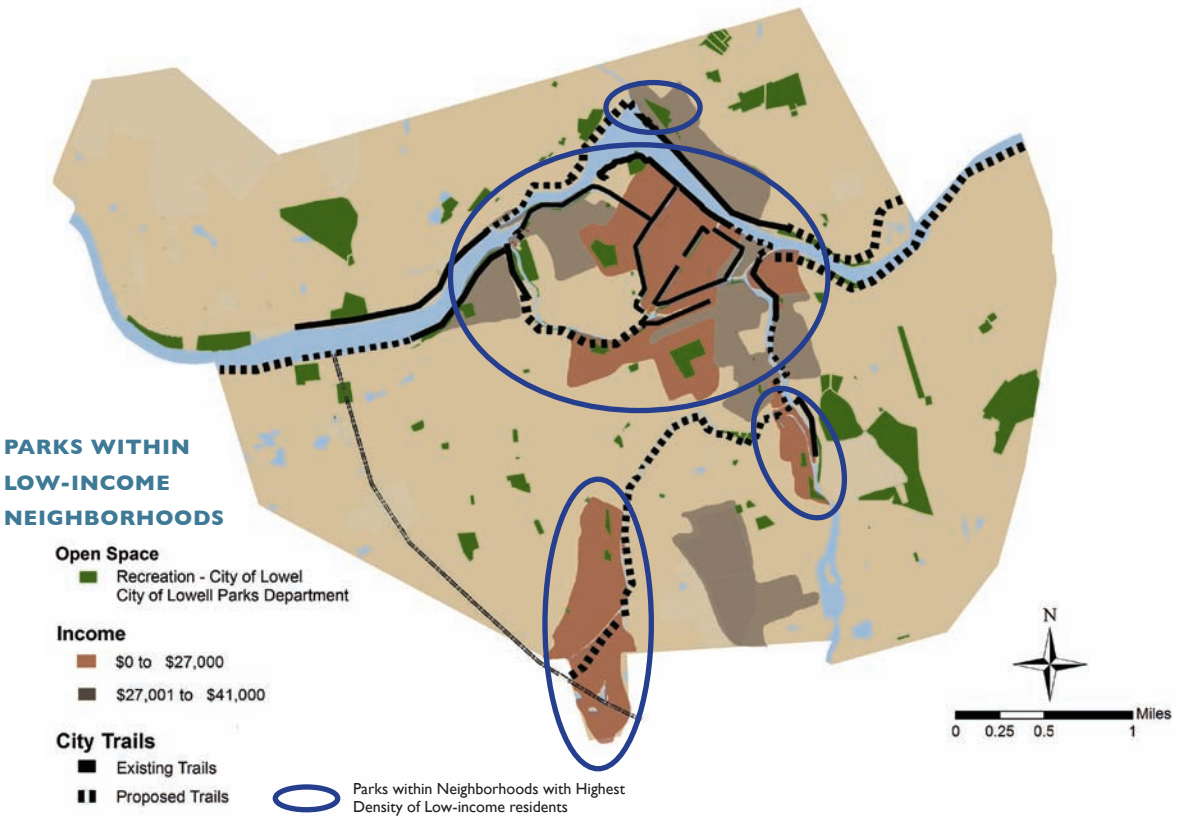
Most of Lowell's publicly owned open spaces are parks scattered throughout the city, with multiple locations in each of Lowell's neighborhoods. Nearly the entire city is within a half-mile radius of at least one park. Once cemetery, conservation, and state forest lands are subtracted from Lowell's protected open space, there are about 420 acres of public open space managed by the Lowell Parks Department. Additional open space is owned by individuals, churches, private parochial schools, local land trusts, and large institutional landholders such as UMass–Lowell.

Areas with the highest concentration of low-income residents, such as The Acre, Back Central, and South Lowell, could be prioritized for the first plantings of public orchards. The existing and proposed trails for Lowell (2012 Lowell Master Plan) are primarily located in low-income neighborhoods. The trails could create connections between parks in which public orchards are located. If space and conditions meet planting criteria, fruit tress could be planted along these trails as well.

Public orchards cannot provide complete balanced nutrition on their own, but fruits and nuts do fulfill important nutritional requirements. The USDA recommends eating half a plate of fruits and vegetables every day, but these are the very foods that people with limited incomes find too expensive to purchase. Public orchards could fill a void in the food system for Lowell residents who have limited income and are unable to purchase all their food.

Planting Coverage Scenario (360 apple trees/acre): (360 trees/acre is considered a medium density planting per USDA)	5%	20%	50%
Acres of urban public park land in Lowell	420	420	420
Total number of acres planted with food trees	21	84	210
Number of trees to plant per acre	360	360	360
Total number of trees planted	7,560	30,240	75,600
Fruit yield potential (pounds/year)	300,005	1,200,020	3,000,050

The potential yield of fruit from an orchard planted at medium density according to the percent of park planted with dwarf apple trees (Clark, 33).



Parks within neighborhoods with the highest density of low-income residents can be identified when the median income map is superimposed on top of the open and protected space map. These parks could be planted with fruit and nut trees, to make free food available to these residents. The existing and proposed trails for Lowell (from the 2012 Lowell Master Plan) are primarily located in low-income neighborhoods. The trails could be used to connect public orchards in these neighborhoods.

There are several options for managing publicly owned orchards. The Lowell Park and Recreation Department, which already maintains landscaped public spaces, could also maintain some edible public landscapes because similar skills are required. Parks departments manage fruit trees at Kilbourn Park Orchard in Chicago and parks in Portland, Oregon, with the help of volunteers.

Alternatively, community organizations could train volunteers to maintain the edible landscapes. Certified arborists or trained staff could teach volunteers the proper way to plant, transplant, water, mulch, and prune trees. The non-profit organization Trees New York runs a Citizen Pruner tree care course in New York City. Graduates can legally prune New York City street trees. This is a vital service where tree maintenance is needed but, funding is limited. The Citizen Pruner course has trained over 11,000 graduates. The course costs $100, but scholarships are available. Certification lasts five years and renewal exams are free of charge. The city's parks department provides tools on volunteer workdays.

Lowell residents could also be encouraged to increase publicly available edible landscapes on their privately owned land. These additional fruiting trees and shrubs do not necessarily need to be maintained by home-owners of the property. Home-owners may be willing to participate in harvest programs, while some gardeners do not have the space they desire for growing food. Fruit tree advocates could collect information from landowners, gardeners, and harvesting volunteers who want to participate, and then match owners with gardeners. The available land could then be planted and maintained by those with the time and interest to do so,

and home-owners could have the option to share in the harvest. Community organizations could provide the organization and communication structure required to make these programs work.

As Darkin Nordahl suggests in *Public Produce: The New Urban Agriculture*, another way to support public harvesting is for the city to create ordinances that place incentives or requirements on commercial developments, to plant a percentage of landscaped grounds with edibles that could be harvested by the public. Required maintenance could be completed by professional landscape crews that already manage the commercial landscapes. Chemical pesticides, insecticides, and fertilizers could be restricted, which would, as an added benefit, reduce environmental impacts on water quality and soil.

Public orchard projects elsewhere are funded with money from a variety of sources including tree trusts or endowments, memorial tree funds, donations from businesses and individuals, adopt-a-tree programs, and public and private grants. Under Massachusetts General Laws (M.G.L.), Chapter 87, all public trees that are not planted in either the public highway or in parks are in the charge of a city or town's Tree Warden (§ 260-5, Charter). Orchard planning, planting, and maintenance on these lands should be conducted in collaboration with Lowell's Tree Warden, Department of Highways, and Parks Department, respectively.

M.G.L. Chapter 8, section 7, does not specify whether or not fruit and nut trees are considered shade trees, but does state that "cities and towns may appropriate money for the purpose of acquiring and planting shade trees." Lowell could include fruit and nut trees in their approved planting list of public shade trees to help establish public orchards.

Under § 214-8B of the Lowell Charter, no person may cut a tree, or pick the leaves or fruit of trees and plants on public land. If public orchards are planted, residents trained to help with maintenance, and the public encouraged to harvest fruit and nuts, zoning will need to be changed to accommodate these activities.

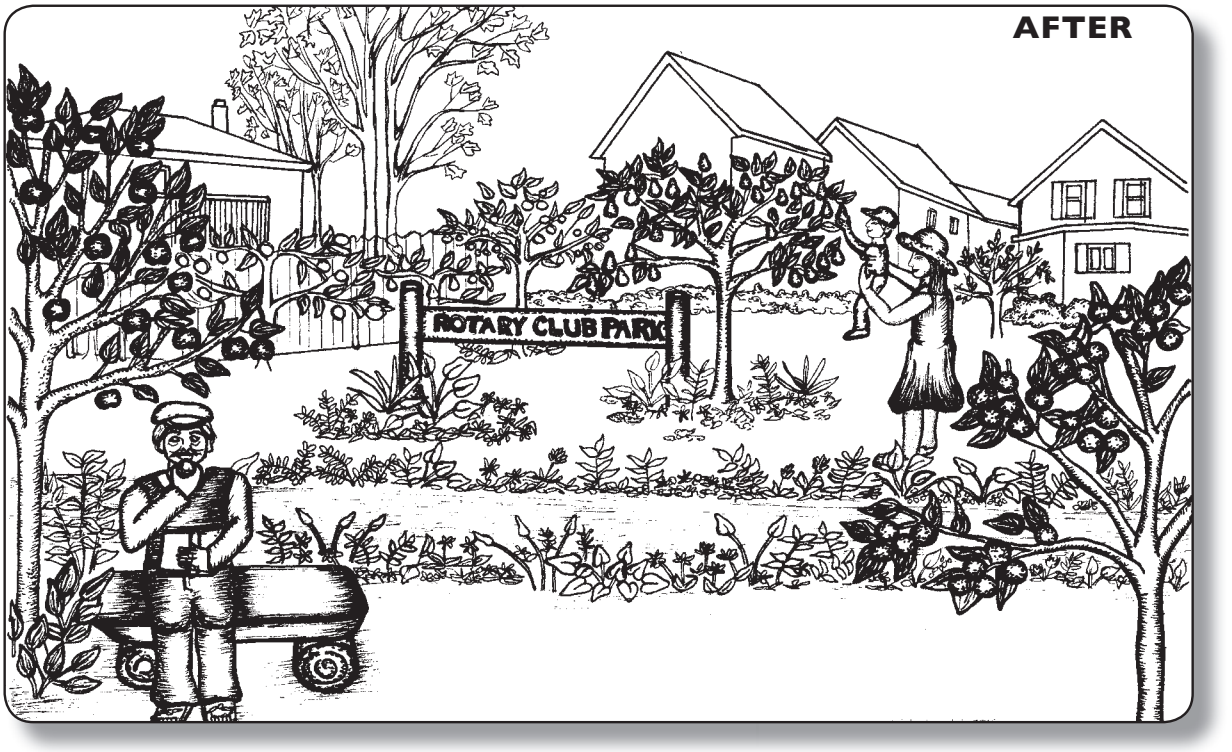
CASE STUDY: PHILADELPHIA ORCHARD PROJECT AND LIFECYCLES FRUIT TREE PROJECT, VICTORIA, BC

The Philadelphia Orchard Project (POP) is dedicated to intensive planting of food-producing trees, shrubs, and vines throughout that city, but especially in vacant lots, community gardens, and schoolyards. Its goal is "to plant orchards in the city of Philadelphia that grow healthy food, green spaces and community food security." POP's aims to make sure there is local food within a half-mile of all low-income residents. It relies on volunteers in these neighborhoods to participate in education and planting efforts. POP provides the trees, plants, and education, but leaves the harvesting to the community. Community organizations own the orchards, take care of them, harvest the fruit and decide how to distribute the produce. By the end of 2012, POP had planted thirty-two orchards in Philadelphia with 518 trees and 1,019 berry bushes and vines. Because produce is harvested by various community groups, yields have not been documented.

This program has worked because it builds on well-established community groups that already have strong connections in low-income neighborhoods. These community groups are able to reach more residents, build a volunteer workforce, and create pride in and commitment to community projects (Philadelphia Orchard Project).

The LifeCycles Fruit Tree Project in Victoria, British Columbia, provides an example of how much fruit can be harvested from urban orchards. Volunteers harvested 39,000 pounds of fruit and redistributed it among the community, food banks, and volunteers in 2011 (LifeCycles Project).

The Rotary Park in Lowell could be planted with fruit and nut trees which could provide food for nearby residents, enhance the ecological sustainability and diversity within parks, and provide an aesthetically pleasing environment which could encourage more recreational use.



Schoolyards are other publicly owned lands that could potentially be planted as public orchards. With twenty-five public schools in Lowell, many Lowell children and families could have access to this free food.

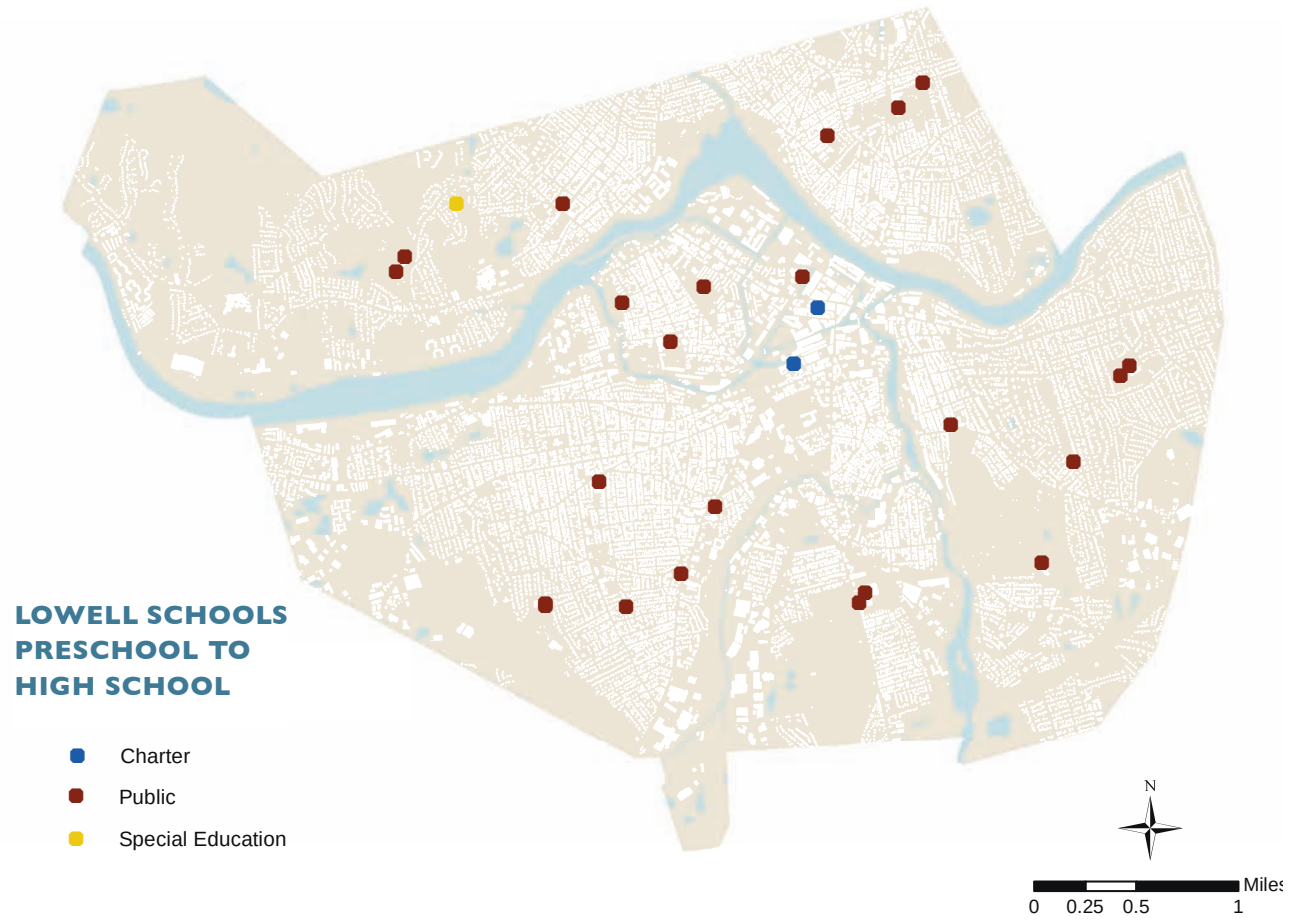
Planted in schoolyards, orchards and gardens can also be used to support curriculum in the language arts, science and math. Perhaps the first documented U.S. school garden was in 1891, at the George Putnam School in Roxbury, Massachusetts, and the USDA estimates there were as many as 75,000 school gardens by 1906 (Hayden-Smith). There have not been many school gardens in Lowell for a while now, but Mill City Grows is starting its first school garden at the Wang and Pawtucketville Memorial Schools this year.

Adding or improving green space surrounding schools has emotional and developmental benefits for students as well. Edible landscapes could be integrated into a playspace for even greater benefits. Located near play activities, exploring and working in the garden and orchard could become a regular part of students' outdoor free time, enhancing their learning.

Grants, private contributions, fundraisers, and donations are usual funding sources for planting school gardens. Student families and community organizations often help with maintenance.

No matter what city sites are chosen for planting public orchards, water, sun and good soil are necessary to have happy fruit trees. Trees should be chosen based on their

Public Orchards



Public schools are located in every neighborhood in Lowell, so many residents could access fruit if public orchards were planted on public school land.

hardiness, disease and pest resistance, and toleration of urban conditions, drought, and temperature changes. Urban conditions such as limited space, soil compaction, salt spray, and pollutants can significantly stress trees. Climate-change-related drought and high temperatures will increase urban tree stress. Monitoring for pests and disease, carrying out good sanitation of the orchard, and proper pruning will also help.

Organic maintenance does not require chemicals that would potentially leave pesticide residue on fruit and contaminate soil and waterways, but it does require attention to practices that enhance natural systems that reduce the need for chemical intervention, such as choosing sites with adequate sun, pest management and good site cleanup. Planting varieties that are disease-resistant can reduce or eliminate the need to manage disease outbreaks, such as apple scab, with organic or chemical spraying (Ellis et al, 428).

Some research indicates that fruit trees generally do not take up soil contaminants, and particularly do not

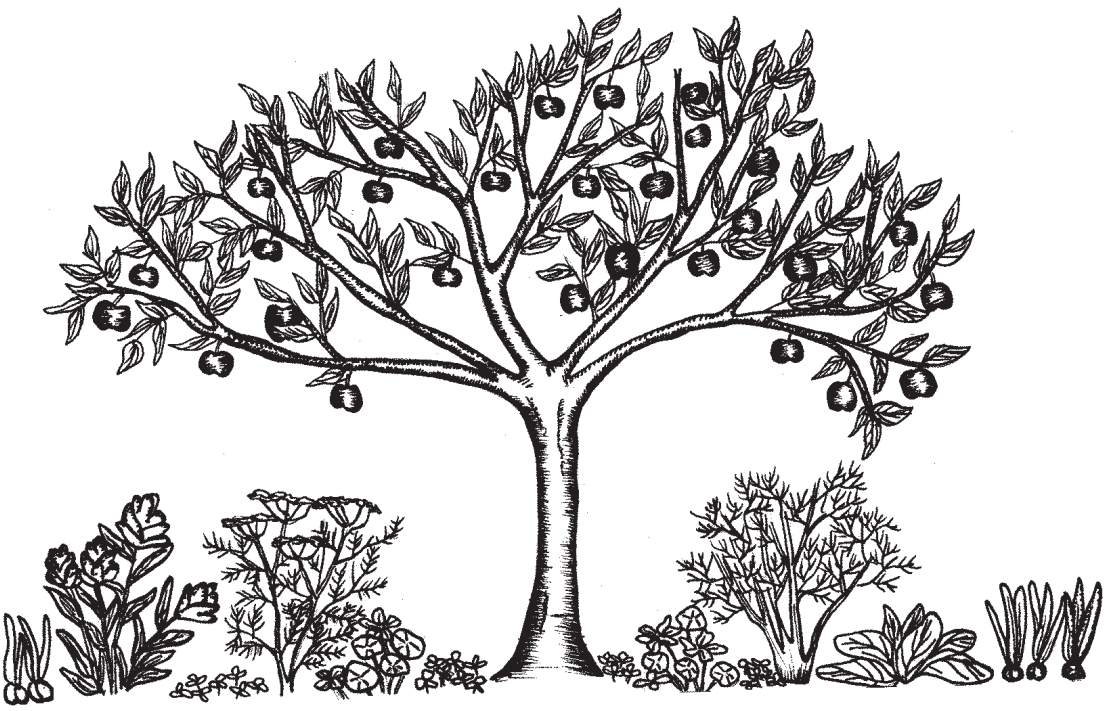
RESEARCH ON NATURE AND CHILDREN:

- "The value of active exploration and intimate encounters with a natural landscape is crucial to mental and physical health, especially for children." (Rubenstein)
- "Children with views of, and contact with nature score higher on tests of concentration and self-discipline. The greener, the better the score." (Wells, 775-795, Taylor, et al.)
- "Children who play regularly in natural environments show more advanced motor fitness, including coordination, balance, and agility." (Grahn, 145, et al., Fjortoft and Sageie)

assimilate them into their fruit (Pierzynski 484; Pinamonti, et al. 1411; Cataldo 157), and it is generally considered safe to grow fruit crops in soil with lead up to 1,000 ppm. Keeping the soil pH between 6.0-6.5 with high organic mulches also helps make contaminants less bioavailable to plants. Parks and open space that have never been developed do not have the same contamination concerns as developed land, since these sites are farther from buildings that were painted with lead paint and from industrial activities. Still, soil of potential orchard sites should be tested. Paul Locke, Director of Response & Remediation at the MA Department of Environmental Protection, can provide information about potential soil contamination and best management practices to follow for growing fruit trees.

A climate-food-species matrix for temperate climates can suggest which woody food-producing species are suitable for Lowell's urban sites. It includes information on drought and cold hardiness and edibility for species commonly used in urban forestry in temperate regions of the U.S. and Europe, as well as many species that could be considered for urban use. A sample can be found at urbanfoodforestry.org/Climate-Food-Species-Matrix.pdf.

An urban food forest is a well-planned orchard and garden with many layers of vegetation, mimicking a natural forest system, which is capable of producing its own food and recycling its own waste. A public urban food forest could provide a variety of foods beyond fruits and nuts. A plant guild is a combination of plants that provides benefits to all the plants within the guild. For example, cover crops help retain soil moisture, provide mulch, attract beneficial insects, deter pests, kill root parasites, and provide nutrients. Permaculture guilds provide suggestions of plants that create these beneficial partnerships: spring bulbs (allium and daffodils), nitrogen-fixers (clover and legumes), cover crops (nasturtium and lavender), and dynamic accumulators (comfrey and globe artichoke) work together to form a healthy plant community.



Spring bulbs, such as iris, help control grass keeping it out of the root zone of the tree.

Nitrogen fixers, such as clover, make nitrogen available for the tree.

Cover crops, such as nasturtiums, hold moisture in the soil and create a living mulch.

Dynamic accumulators, such as comfrey and globe artichoke, take up nutrients from deep in the soil, and make them available to the tree.

Spatial criteria for siting most fruit and nut trees:

Ideal locations:

- Receive at least 6-8 hours of sunlight per day.
- Are near a reliable water source.
- Have well-draining soils that are slightly acidic (6.0-6.5)
- Are likely to have few contaminants, such as parks and land that has never been developed.
- Have adequate ventilation and protection from cold pockets and strong winds.
- Are within a micro-climate that provides added warmth and protection, such as southern courtyards or south-facing walls. In parks, a northeast-facing slope provides protection from prevailing southwest winds.

Orchard planners should:

- Avoid areas that have compacted soil, confined space for roots, extreme heat, drought conditions, or high levels of salt spray such as in the middle of a parking lot.
- Place orchards where fruit and nuts will be visible and can be harvested easily, such as near schools, along trails, near bus and trolley stops, and near spectator seating in parks.
- Place orchards where trees can be easily accessed for maintenance.
- Place orchards so fallen fruit or nuts do not create a hazard in areas with high pedestrian traffic; such as entrances to buildings and hospital walkways.

ACTION ITEMS

- Partner with the Northern Middlesex Council of Governments to prioritize where public orchards could be beneficial, and collaborate in securing funding, outreach, and implementation of orchards.
- Work with Lowell Parks and Recreation and Tree Warden to identify public spaces that have the greatest potential for plant success, and public interest and develop strategies for integrating edible trees and shrubs into public spaces. (Refer to criteria for siting trees.)
- Work with local tree experts to develop regular workshops about all aspects of orchard care and maintenance.
- Create a public orchard inventory of all edible trees and shrubs throughout the city that can be a public resource for the entire community.
  - Translate into Khmer, Spanish, Portuguese, and Arabic.
  - Create signs that indicate when a tree is harvestable and suggest harvest quantities per person.
  - Create a code of ethics around harvesting quantities and ways to enforce.
- Choose the best species of trees, shrubs, and vines for the space.
  - Weigh the advantages and disadvantages of planting for low, medium or high yields for each planting site.
  - Calculate potential harvest.
- Develop a Lowell Harvest Festival in a public orchard that features taste-testing, workshops, demonstrations, and activities related to all aspects of urban agriculture.
- Work with neighborhood Community Food Resource Centers and Lowell Parks and Recreation to coordinate management and public outreach plans for each public orchard.

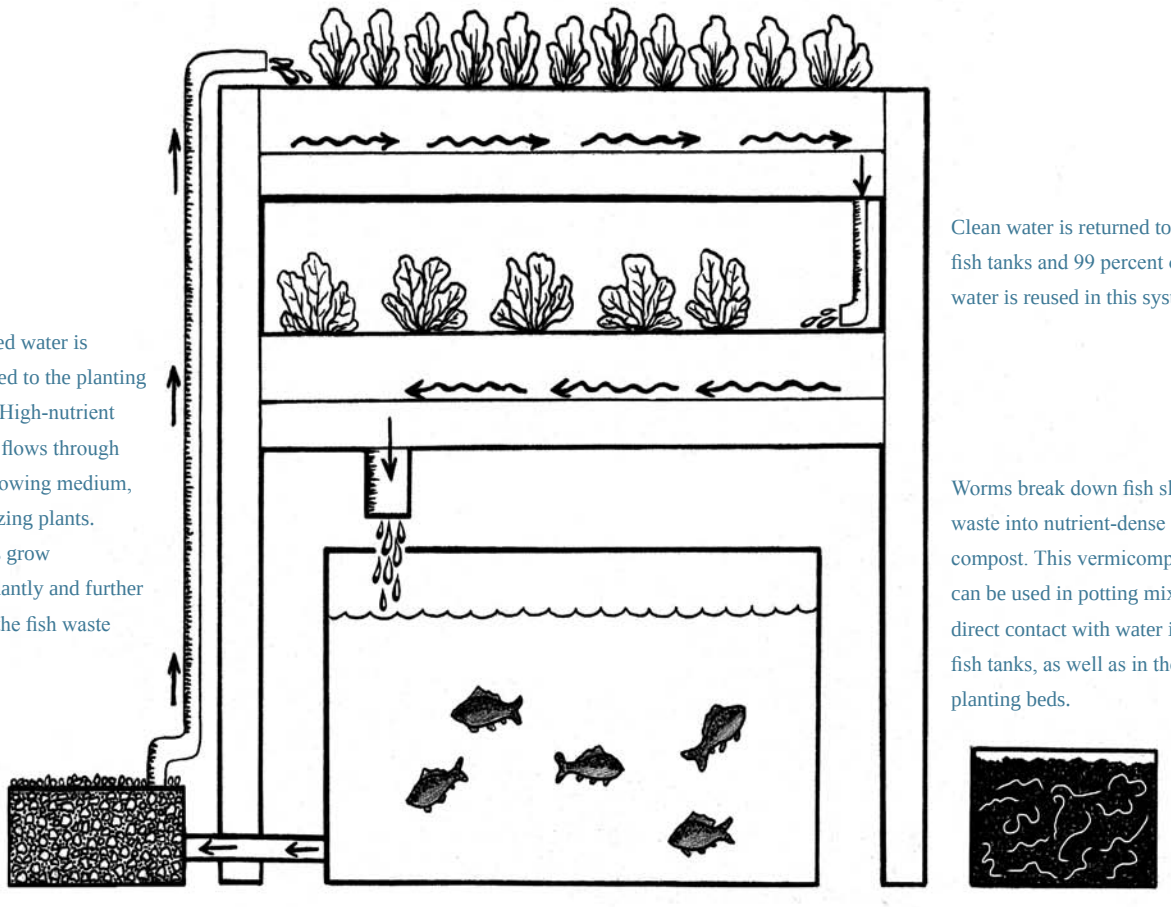
Community Fish Farms

Low-income residents in Lowell express a desire to have access to less expensive fresh fish.

Fish farming could be a part of a more efficient food system. Fish have the highest protein content in their flesh of all food animals, and no other food animal converts feed to body tissue as efficiently as fish (Smil, 153).

Communities around the world farm fish using a variety of techniques. Aquaculture refers to farming fish, shellfish, or aquatic plants in water. There is marine aquaculture, in which saltwater species are raised in oceans, and freshwater aquaculture, which refers to raising freshwater fish predominantly in ponds or man-made structures. Aquaponics is a technique for raising fish and produce together.

Recent research has created more efficient, economically viable, and sustainable models such as recirculating aquaponics systems. In these systems, water is filtered and 95 to 97 percent of it is returned to the tanks, conserving water and energy. Systems are closed and located indoors, where disease and pest control are easier than in outdoor fish farms. Fish raised in recirculating aquaponics systems require no antibiotics, hormones or pesticides (Baughman). An aquaponics system uses less space than land-based vegetable farming and can provide for year-round growing of



A complete waste cycle is created in a recirculating aquaponics system. It requires a delicate balance to the fish-bacteria-plant cycle, but produces a large amount of food when done properly. Fish solids settle in a gravel bed with bacteria, duckweed and other aquatic plants that break down the fish waste, changing ammonia to nitrates which plants can use.

certain vegetable crops in colder climates. Maintaining the correct pH, oxygen and waste balance is critical for fish health.

The decline in wild fish populations is a driving factor in the establishment of fish farms and aquaponics. It is calculated that fish populations are collapsing rapidly and, even with strict fishing bans, will not be able to recover for many decades. Already, half of the fish consumed within the world are raised on farms.

Low-income residents in Lowell express a desire to have access to less expensive fish. Currently, fish is too expensive for their limited incomes. Also, the fish that is available has been frozen or preserved, which can affect its quality. They are also concerned about some of the chemicals used in fish preservation.

According to tests of Growing Power's aquaponics system (described on next page), community fish farms could provide fresh fish to Lowell residents at a lower cost than grocery store prices (Langston University Aquaponics). This research indicates that with the right combination of system size, fish species, produce crop, and business structure, aquaponics can be profitable. "It is possible to reach economies of scale and to attain profitability with a yellow perch and lettuce system. Moreover, there may be ways to increase the margin of profitability or to close the gap between income and expense through such things as alternative business models, value-adding, procuring things for free, and diversifying the revenue stream" (Goodman, 3).

CASE STUDY: THE FISH FARM, CAPE TOWN, SOUTH AFRICA

Allen Fleming has standardized a fish farm system that is small and transportable, fitting into a common forty-foot shipping container. It is capable of producing 4 tons of fish per year. Allen is currently working on fitting the containers with solar panels to make the system more sustainable. He is also testing a hydroponics system to complement it, turning the Fish Farm into a closed-cycle aquaponics system. This standardized system makes starting a fish farm much more straightforward. Since quantities of water and fish are the same for each unit, the farming process can be replicated much more easily (Fleming). Low-income residents in Cape Town are being trained to raise fish to sell for added income for their families.

The Fish Farm creates a mobile and replicable system for fish farming. (Photos Courtesy: Allen Fleming.)

A forty-foot shipping container could fit in many small urban spaces.

CASE STUDY: GROWING POWER, MILWAUKEE, WI

Growing Power has been managing a successful aquaponics system in Milwaukee since 2006. Their goal: "to grow food, to grow minds, and to grow community." Will Allen, designed his own aquaponics system and built it for just $3,000, much less than the $50,000 cost of a commercial system (Bybee). Growing Power supplies 10,000 people in their Milwaukee community with the fish and produce they grow (Growing Power). Part of why Growing Power's aquaponics works is because fish farming is integrated with fruit and vegetable production, distribution, and education. Aquaponics creates a complete cycle for providing nutrients for growing vegetables, and the plants provide the filtering of water necessary for productive fish farming. The organization grows over 150 different crops, on concrete, asphalt, rooftops, inside buildings, and hoophouses (Narang).

Vermiculture, the use of worms in composting, is also a big part of its success. The worms digest the fish sludge solids and create rich organic compost to use for plants. Compost piles and an aerobic digester contribute to warming its greenhouses, significantly cutting down on heating costs in winter. Growing Power diverts over 20 million pounds of food waste from the Wisconsin and Illinois waste stream annually (Growing Power) and grows 10 million pounds of its own compost and vermicompost every year to use in its gardens. Healthy fish create nutrients that worms turn into healthy soil, which creates healthy, abundant plants.

Growing Power also partnered with the Milwaukee public schools to distribute produce at schools, daycares and other public sites by providing low cost CSAs to low-income families. Growing Power's Market Basket program provides about twenty pounds of fruits and vegetables for $16 per week and is designed to provide fresh produce for 2 to 4 people. Families can purchase the produce and take it home from school (Narang).

Critics state that Growing Power's aquaponics system relies too heavily on grants and outside funding to be considered sustainable. Will Allen conters that view by stating that Growing Power's goal focuses on funding people, not creating financial independence. To that end, Growing Power has successfully fed 10,000 residents.

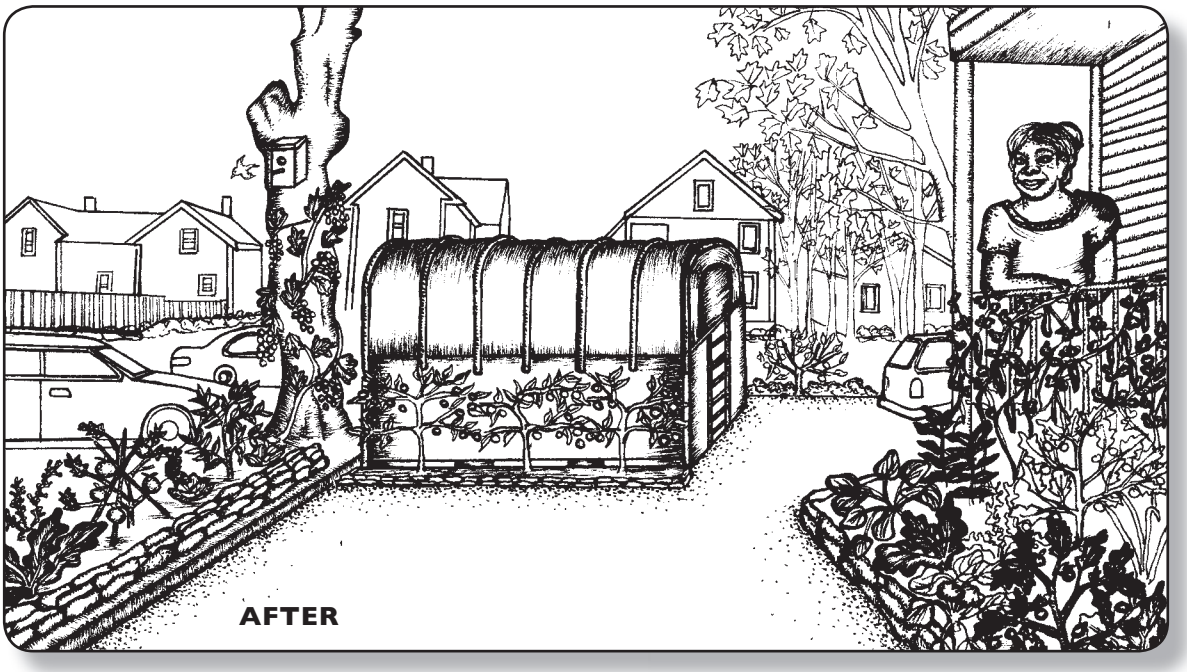
(Photo Courtesy: Growing Power)

ACTION ITEMS

- Identify Lowell neighborhoods that have a high concentration of food insecure individuals.
- Conduct community meetings to engage and educate the community about fish farms and better understand the community's specific needs.
- Survey residents for interest in learning to farm fish, at residential or commercial scale.
- Identify types of freshwater fish each community would be most likely to use.
- Inventory locations for potential fish farms in each neighborhood (see criteria below).
- Create educational materials and workshops for residential-scale aquaponics, translated into Spanish, Portuguese, and Khmer as needed.
- Create job training for large-scale aquaponics.
- Identify organic produce supply needs of local or regional restaurants and markets. Establish a chain of supply.
- Collaborate with UMass–Lowell or Middlesex Community College students to research prototypes for a low-cost residential aquaponics system. Develop into a replicable model.
- Create an inventory of available recyclable materials that can be used to construct aquaponics systems and the sources of these materials.
- Identify value-added products that expand market potential of farmed fish (dressing, smoking, curing, and pickling). Collaborate with community kitchens that are certified with safe food handling licenses to process fish.
- Identify land use requirements and zoning that will affect fish farming activities.
- Collaborate with a community kitchen, such as the United Teen Equality Center, to obtain food handling license or the community kitchen's services, to increase opportunities for creating value-added products.
- Identify funding sources and conduct fundraising activities.
- Collaborate with city and state departments to establish policies for waste water disposal and reuse in gardens.
- Identify residents, community gardens, and farms to use fish waste for fertilizer.
- Work with UMass–Lowell or Middlesex Community College business students and the Lowell Small Business Program to develop a business plan for aquaponics farms and any small businesses that may sprout as a result, such as creating value-added products or aquaponics construction.

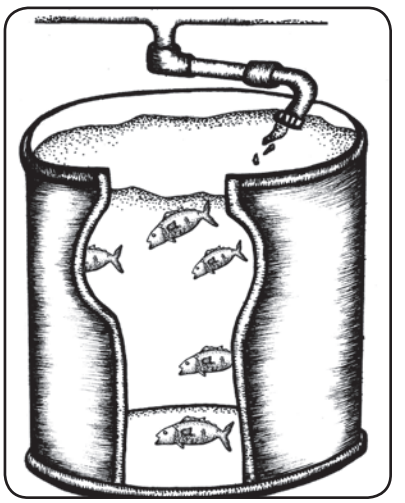
Community Fish Farms

Many neighborhoods in Lowell have very small residential lots, but even these could be used for innovative food production. Storage containers could create a simple, cost-effective residential aquaponics system, while a simple hoophouse provides protection for the fish and season-extension for growing produce. Nutrients from the fish feed the plants and the plants purify the water before it trickles back to the fish container.



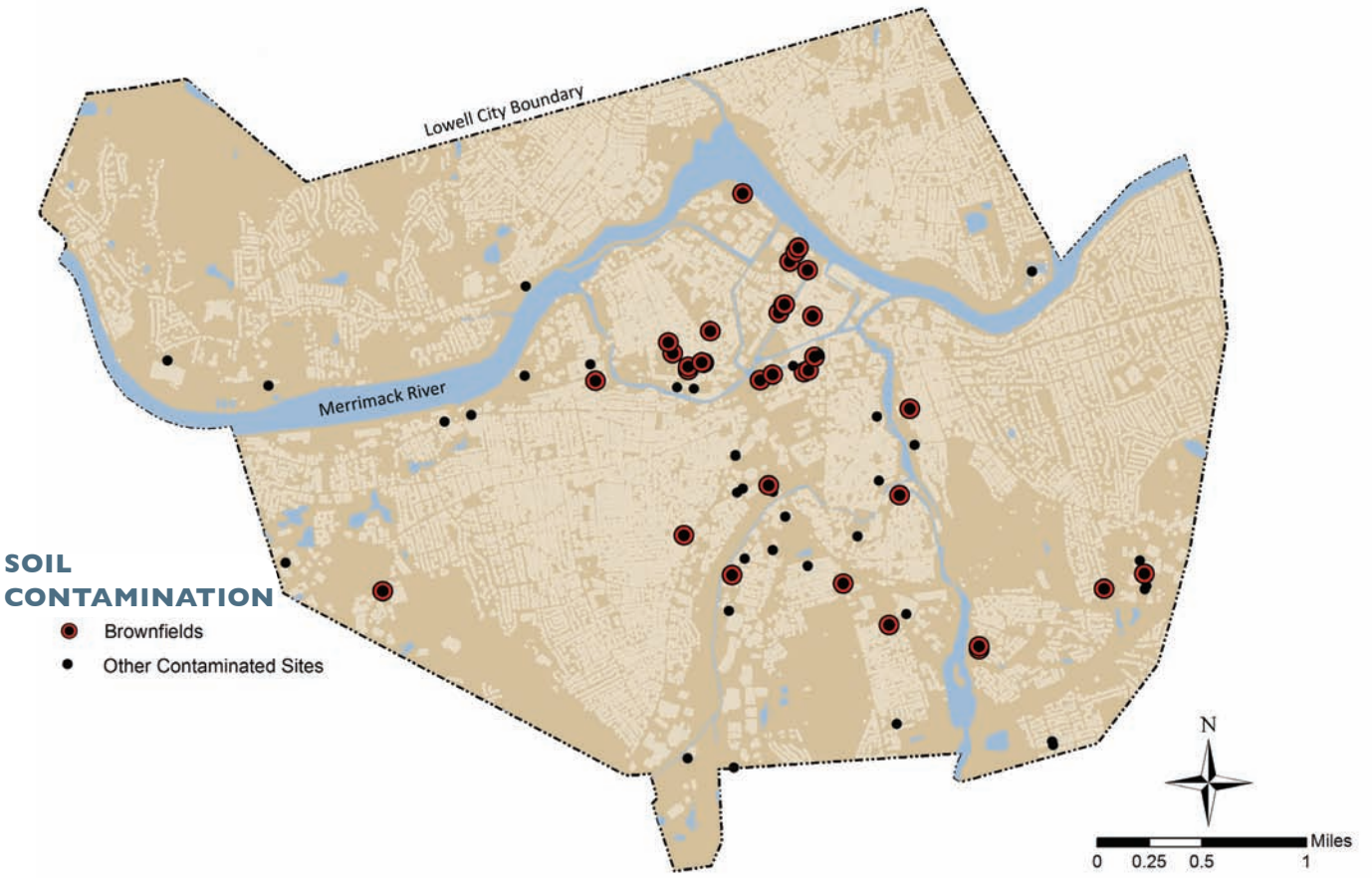
CRITERIA FOR FISH FARMS

- Reliable source of clean, dechlorinated water, or appropriate enzymes to treat water for tanks.
- Energy source for heating water in tanks and grow lights for produce.
- Winter protection such as a hoophouse and insulation should be provided if the aquaponics system is located outside, and additional energy expense for warming tanks should be included in projected costs.
- Emergency energy supply to protect fish and plants during power outages.
- Potential for renewable energy.
- Approved space and method to dispose of solid fish waste.
- Space for fish tanks in a yard, garage or basement. Additional criteria for large scale fish farms:
- Large space for fish farm, including abandoned buildings or vacant lots.
- Wastewater management protocol.



(INSIDE OF FISH TANK)

Soil Contamination and Safe Gardening



Lowell's industrial history has left the city with soil contaminated with a variety of heavy metals and petroleum residues, posing a challenge to gardening safely.

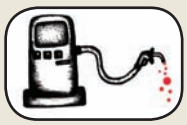
Common sources of contamination in the United States include factories, gas stations, dry cleaners, landfills, highway corridors, parking lots, and older homes with lead paint (North Carolina State University, 2). In Lowell, there are eighty-two sites that the Environmental Protection Agency (EPA) has designated as sites subject to environmental regulation. Forty-five of those sites are considered brownfields, which the EPA defines as "real properties, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."

In Lowell, contaminated sites are concentrated in the

INDUSTRIAL sites often contain lead, PAHs (polycyclic aromatic hydrocarbons), petroleum products, and solvents.

LEADED GASOLINE was used until 1978. Sites located near a busy street often have soil contaminated with lead and other inorganic pollutants.

LEAD PAINT was used until 1978. Sites that contain an older building or that used to contain an older building often have soil contaminated with lead, barium, or mercury.



GAS STATIONS, or sites formerly containing a gas station, often experience petroleum leaks and contain contaminants such as benzene, lead, xylene, PAHs and toluene.

Soil Contamination and Safe Gardening

center of the city, around canals and rivers south of the Merrimack River. These areas also have the highest concentrations of low-income residents, creating environmental justice issues. The residents with the fewest resources are faced with the greatest challenges for participating in urban gardening.

Urban gardening can be a challenge for residents because direct contact with contaminated soil poses a high risk. Humans can uptake soil contaminants by breathing airborne soil particles, absorbing contaminants through skin, eating soil, eating produce with soil particles on it, or eating plants that have absorbed contaminants into their tissue (North Carolina State University, 1). Before starting a garden in urban cities like Lowell, the EPA advises residents to research the previous land use of their site and test the site's soil. Soil testing, including checking for lead, costs $15 through the UMass Soil and Plant Tissue Testing Laboratory in Amherst, which may be an obstacle for some residents.

"The Massachusetts Department of Environmental Protection believes that it is prudent (and cost effective) to assume that soil in most developed areas, including urban locations, have elevated levels of common contaminants, such as lead from lead paint. The Department recommends standard Best Management Practices (BMPs) for gardening in urban areas, including the use of raised beds filled with soil known to be clean. In most circumstances limited resources are best spent implementing the BMPs to ensure safe gardening rather than sampling the existing soil" (Locke). Money for soil testing is best used to test the safety of new soil before adding it to raised beds.

Creating healthy soil and raised beds may not be affordable for many residents. A four-by-eight-foot raised bed with a wood frame costs approximately $150, and has to be replaced about every five years since the wood cannot be treated with preserving chemicals. To make raised beds more affordable, urbanite can be used instead of wood for the frame. Urbanite is concrete that has been removed from sidewalks and buildings and is usually destined for a landfill. Using urbanite to build raised beds could decrease the amount of materials flowing into Lowell's waste stream, add calcium to the soil, and provide Lowell gardeners with a free, long-lasting material.

Along with raised beds, contaminated garden spaces could become safe to grow food in by remediating the soil. More common methods used to remediate soil include excavation, geotextiles, soil washing, and soil vapor, which are effective remediation methods that could be completed in one season. However, they are expensive and can have negative environmental impacts from their waste disposal processes, their heavy equipment disturbances to the site, and their use of fossil fuels to carry out the remediation processes.

Alternative soil remediation methods are bioremediation, phytoremediation, and mycoremediation, which use microorganisms, plants, and fungi to remove or break down contaminants in the soil (see Appendix B, page 88). These biological soil remediation methods are low cost and have beneficial environmental impacts. However, they are more time consuming and require a specialist to carry out effectively.

The method chosen, and specific remediation process required for that method, depends on the level of contamination and the type of contaminant.

Using urbanite, salvaged concrete from the city, to build raised beds offers Lowell gardeners a free, long-lasting, recyclable material.

ACTION ITEMS

- Collaborate with the City of Lowell to create a clear strategy for soil testing and best management practices for gardening on public land.

- Increase soil contamination awareness and safe gardening education.
  - Integrate soil contamination education into all urban food production programs.
  - Work with soil contamination experts, such as the Department of Civil and Environmental Engineering at the University of Massachusetts Lowell, to create educational materials and programs for school children and Lowell residents.

- Assess available resources. Determine:
  - How much money can be allocated towards creating a safe gardening environment.
  - How much time can be given towards creating a safe gardening environment.
  - If a soil remediation expert is available.
  - The level of soil contamination and type of contaminant by testing the soil.

- Determine a method for creating a safe gardening environment. Each site is different, and the method chosen depends on the type of contaminant and level of contamination, but as a general starting point:
  - If funds are minimal and time is limited, raised beds can be used.
  - If funds are minimal, time is available, and a soil remediation expert is available, a biological soil remediation method can be used.
  - If funds are sufficient, time is limited, and a soil remediation expert is available, a resource-intensive soil remediation method can be used.

Waste Cycling

Lowell has an opportunity to turn food that is normally thrown into the trash into healthy soil for gardens.

Linear Food Systems

Forty percent of edible food produced in the United States is wasted. Food spoils as it travels on the long journey from farm to plate, and some of the food that does make it onto plates is often thrown away. In linear food systems, this food waste is destined for landfills, creating negative environmental impacts. One-third of the material sent to landfills is food waste, stressing landfills for space and driving the construction of new landfills at the cost of losing valuable land. Food waste also releases methane into the atmosphere as it breaks down in a landfill's anaerobic (without oxygen) environment. Methane is a greenhouse gas that is twenty times as powerful as carbon dioxide in trapping heat in the atmosphere, and landfills are responsible for contributing 20 percent of methane emissions in the United States (Ackerman).

Not only is landfilled food waste accelerating climate change and contributing to the loss of valuable land, it is also a leading cause of nutrient depletion in soil. As plants grow they take nutrients out of the soil, and once they are harvested and taken off farms, they take nutrients with them. When plants and food end up in landfills, the nutrients never get cycled back into farms' soil. The lack of nutrient cycling in linear food systems contributes to the 1.7 billion tons of agricultural soil that is lost annually in the United States. Large-scale industrial farms are dealing with nutrient depletion by adding synthetic fertilizers to their soil. However, synthetic fertilizers require petroleum for their production, increasing the negative environmental impacts of the system. The lack of nutrient cycling in linear food systems leads to fossil fuels being used to

LINEAR FOOD SYSTEM

Annually 1.7 billion tons of agricultural topsoil are lost from the United States. A leading contributor to the loss is the lack of nutrient cycling.

Forty percent of edible food produced in the United States is wasted.

One third of the material sent to landfills is food waste.

Twenty percent of the United States' methane emissions come from landfills.

manufacture nutrients on one end of the system, and on the other end of the system nutrients are wasted and create environmental degradation (Ackerman).

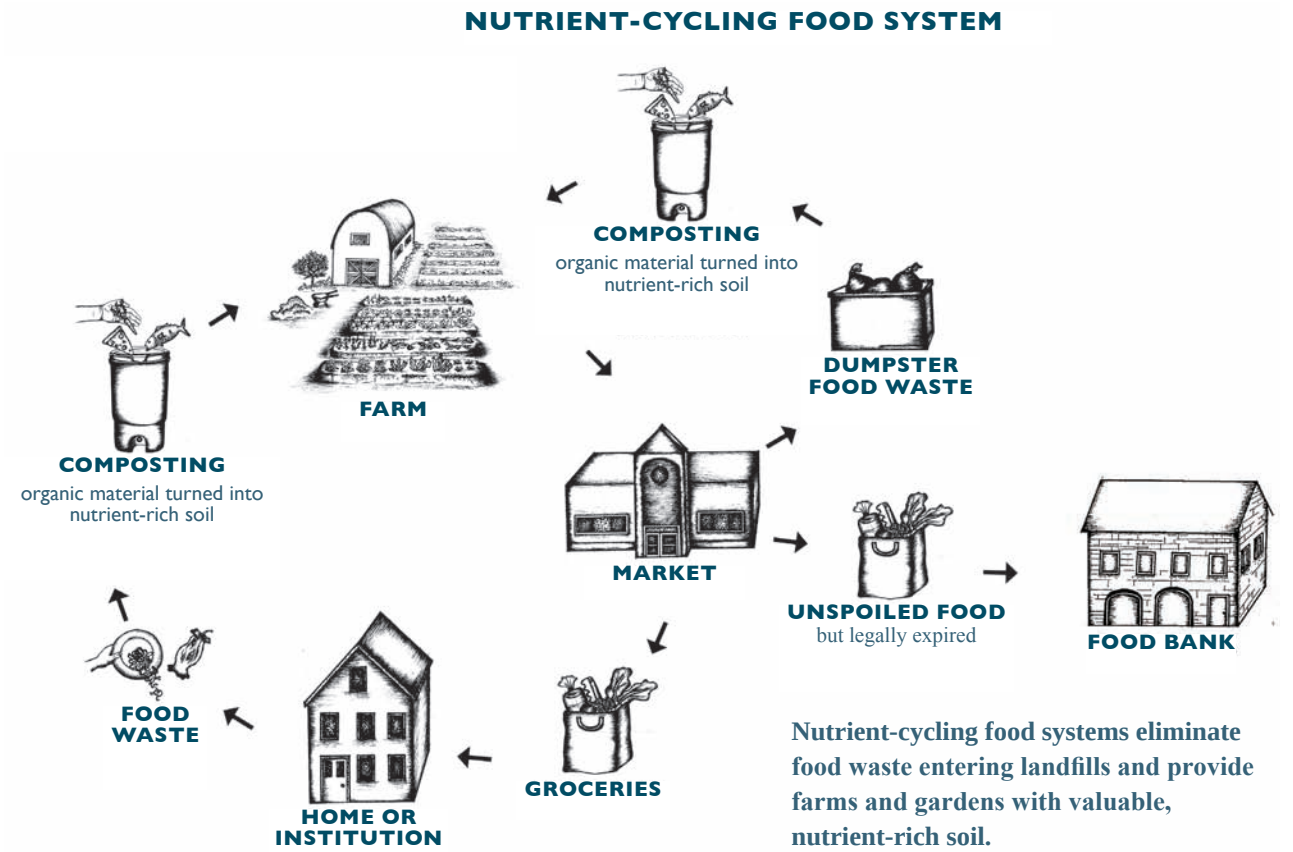
Nutrient-Cycling Food Systems

In nutrient-cycling food systems, waste is eliminated. Uneaten food and garden waste is broken down into valuable, nutrient-rich soil through composting. As a result, wastes are directed away from landfills and onto farms and gardens, solving two problems simultaneously.

Lowell's Solid Waste and Recycling Department is aware of the benefits of nutrient cycling, and promotes directing the city's organic material away from landfills. Lowell requires residents to separate their yard waste from their trash, and has a truck pick up yard waste on the same day trash is collected. Their efforts have a large impact, and in 2012 Lowell sent 4,200 tons of yard waste to composting operations, saving the city $295,000 in waste disposal costs (Lowell Sun).

Lowell's Solid Waste and Recycling Department also promotes composting on a residential scale. They sell residents New Age Composter bins and Earth Machine bins at a reduced cost of $55 (Lowell Sun Online). The reduced cost, though, may still be a barrier for many residents.

Increasing the composting system in the city and making the soil created from composting available to Lowell residents will support urban food production. Currently, Mill City Grows, an organization leading urban food production in Lowell, is sourcing soil from outside of the city (Sisson). Giving Lowell's urban gardeners a source of healthy soil from within the city could strengthen Lowell's food security, since most food is dependent on fertile soil.



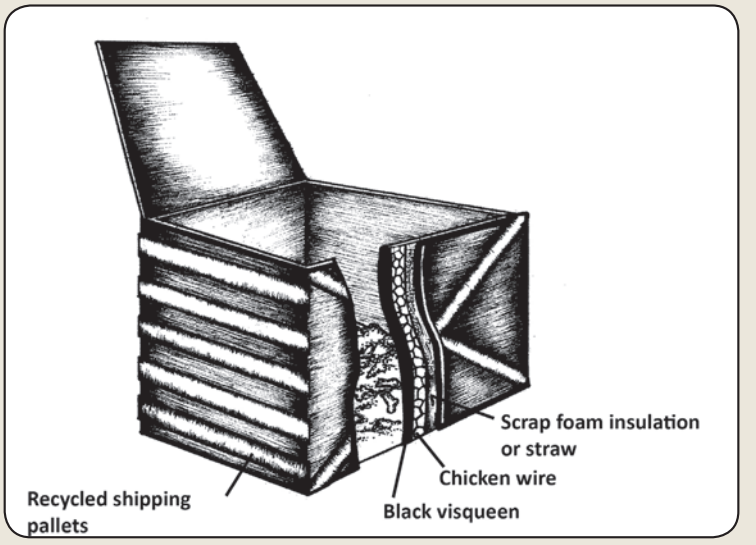
Nutrient-cycling food systems eliminate food waste entering landfills and provide farms and gardens with valuable, nutrient-rich soil.

CASE STUDY: GARDENS FROM GARBAGE, GREAT FALLS, MT

The Montana non-profit organization Gardens from Garbage is on the forefront of developing sustainable local food sources within communities by reducing waste and building soil using bokashi fermentation (see next page).

Gardens from Garbage helped the Great Falls Community Food Bank jumpstart their bokashi waste cycling program in 2010. Food banks are often given food that is on the verge of spoiling, making it challenging to distribute it before it goes bad. As a result, food banks are left with food waste that is costly to truck away to a landfill. Since starting the bokashi waste cycling program, the Great Falls Community Food Bank saves $2,000-$3,000 per year in solid waste disposal costs and recycles 24 tons of food annually (Sunburst Unlimited, Inc.).

The nearby Valley View Elementary School in Great Falls has also started a bokashi composting program. The school, enrolling 357 students, generates 30 pounds of food waste daily, which adds up to 3 tons every school year (Sunburst Unlimited, Inc.). Each ton of food waste can be composted with 1.5 pounds of bokashi mix, produced by the Great Falls Community Food Bank for $5 per pound (Sunburst Unlimited, Inc.). Since starting the bokashi composting program, the school has cut its food waste management costs down to $22.50 a year, which is used to buy the bokashi mix, and in the process they are creating 3 cubic yards of nutrient-rich soil to put in their school garden (Sunburst Unlimited, Inc.).



Large bokashi bin used by the Great Falls Community Food Bank and the Valley View Elementary School in Great Falls, Montana. The bin is made out of recycled shipping pallets insulated with recycled foam insulation or straw. The insulation is held in place by chicken wire and covered with visqueen plastic sheeting to give a protective layer between the food waste and the bin.

Valley View Elementary School Implementation Steps

1. Had the carpentry and agriculture class work collaboratively to build the compost bins. Built 10' x 4' x 4' insulated and sealed bins with three compartments capable of holding 6 tons of waste. Estimated cost = $200.00

2. Held a compost kick-off week to educate students and teachers about the importance of waste cycling, and the bokashi waste cycling method. Made flyers and hallway signs and created a sixth grade leadership team to teach younger kids how to separate food waste.

Bokashi Fermentation

Bokashi fermentation is a method of composting that is well-suited to urban agriculture conditions in Lowell. Bokashi fermentation is a Japanese composting method that ferments organic waste by using specialized microbes (Bokashi mix), and a sealed container to exclude oxygen from the process. When the fermented process is complete, the organic material's chemical form has been changed drastically, and it will break down rapidly in soil.

Currently, Lowell's composting methods are limited to breaking down yard waste, fruit and vegetable scraps, egg shells, tea bags, and coffee grounds. Bokashi fermentation, however, can also break down meat, fish, bread, cheese, processed foods, and cooked foods. Bokashi's ability to break down all food scraps will significantly increase the composting yield and direct more organic material away from landfills. The bokashi process also works rapidly, taking ten days to complete, whereas traditional composting methods take months to break down organic material. In addition, the bokashi process requires less maintenance than traditional composting and eliminates the need for heating and mixing. The sealed container that the process takes place in makes it ideal for urban areas as insects and rodents will not be attracted to it, and on a residential scale the process requires little space to carry out. Constructing a bokashi bin out of two five-gallon containers costs less than $15. At the end of the bokashi process, the fermented material to be put into the soil has a higher nutrient and water content than traditional compost, benefiting plants (Merfield, 6).

Bokashi fermentation can be carried out on both a residential and institutional scale using a business model that is self-sustaining. On a residential scale residents can be motivated to compost through city incentives that lower residents' garbage pick-up fees if they participate in the composting program. The compost can then be picked up weekly from residents' homes and taken to the neighborhood's Community Food Resource Center, if established, by a small start-up composting business. The composting business could make money producing and selling the bokashi mix, and turning the organic material into soil to sell to urban gardeners in Lowell. The neighborhoods' resource centers could provide a good location for the composting business because of their proximity to surrounding residences, and because many potential customers pass through them for other services.

On an institutional scale, residents can be motivated to participate in the composting program with reductions in waste disposal fees. Some institutions, like schools, that are starting gardens can also be motivated to participate in the program because they will create their own soil, lowering their gardening costs. With cuts in school funding, the startup of new programs like school gardens will be more successful if they have lower start-up costs.

ACTION ITEMS

- Identify residents interested in starting a composting business and connect them to a small business startup support organization, such as the Lowell Small Business Assistance Center, where they can obtain education, tools, and resources to create a small business
- Form a collaborative relationship between a composting business and the Department of Public Works and Lowell's Solid Waste and Recycling Department
  - Develop composting incentives for city residents.
  - Develop a congruent trash, yard waste, and compost pick-up schedule for the ease of residents.
- Identify spaces at the Community Food Resource Centers where large bokashi fermentation bins can be set up.
  - A 40' by 20' space located within the building on the first floor, or outside of the building against a south-facing wall.
  - A space where a cargo bike or truck can easily access the bins.
- Provide workshops on bokashi fermentation at the community food resource centers, and hand out educational step-by-step manuals explaining the bokashi process.
  - Translate the step-by-step manuals into Lowell's dominant languages, such as Khmer.
- Have an organization focused on reducing waste, such as the YWCA Green Team, promote the composting business by meeting with larger institutions, such as schools or restaurants, to build participation in the composting program.

Food Hub

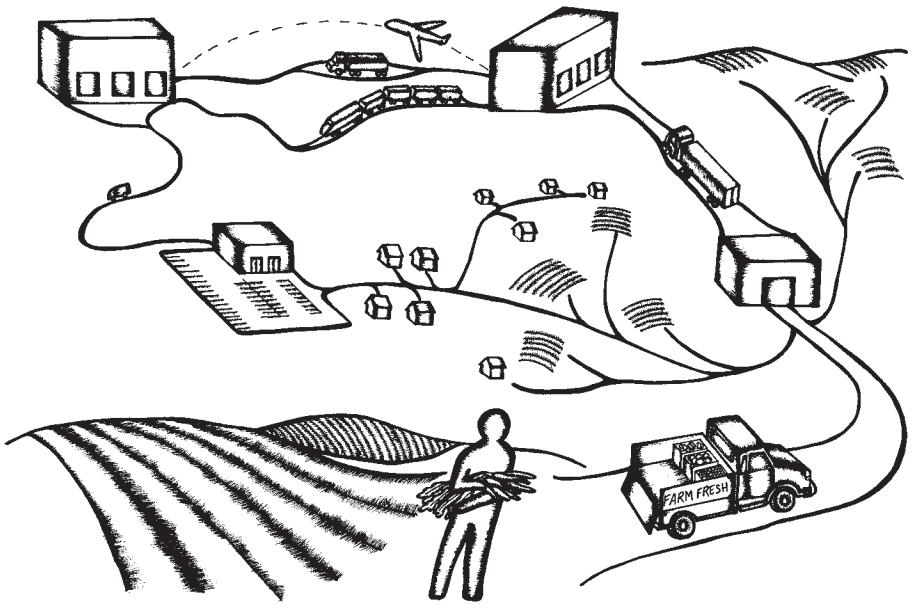
Schools, universities, hospitals, and other large institutions with dining facilities can be among the more difficult components of a food system to change, but if changed they could affect a large number of people.

Institutional food facilities are run by large food suppliers, and in Lowell the main supplier is Aramark. Aramark operates as an aggregation system that collects food from across the world, from various producers and processors, then distributes the food to customers who are also all over the world. This system is in many ways inefficient, and results in low-quality food that has traveled the world in order to get to its final destination.

One of the benefits of a local system is that there is less time and fewer resources wasted between when produce is harvested and when it is either eaten by a consumer or processed into a value-added product. One model that has worked in many cities is a regional food hub. Lowell has already established a food hub through New Entry called the World PEAS Food Hub (see Lowell in Focus: World PEAS Food Hub on page 61).

The National Good Food Network defines a food hub as "a business or organization that manages the aggregation, distribution, and marketing of food products primarily from local and regional producers to strengthen their ability to satisfy wholesale, retail, and institutional demand" (Food Hub Center). The USDA Agricultural Service's Food Hub Resource Guide outlines the ways that regional food hubs are affecting their communities by "increasing market access for local and regional producers, complementing and adding considerable value to the current food distribution system, having significant economic, social, and environmental impacts within their communities, and fueling entrepreneurial thinking and sound business practices coupled with a desire for social impact" (Barham and Tropp). The food hub acts as a middleman where farmers can go to sell their product and retailers can buy farm-fresh goods. Small-scale farmers who do not produce enough to meet large institutional food demands sell their produce to the food hub, which aggregates produce from several farms to meet the demand of larger businesses. This allows both farmers and retailers to focus on their business while the food hub works to find, manage, and distribute the products from one central location.

Each food hub typically provides programming and services to the community, from finding farmland for local farmers, to urban garden training, to programming for low-income residents. A food hub could take local



The global industrial food system moves food from the farm where it was grown to a storage facility, to a processing facility, to a distribution center, and then finally to a grocery store, which may be near the place where the food was originally grown.

produce that otherwise would not be used and transport it to emergency food providers or transform the raw goods into frozen or value-added products that could be used throughout the year.

There are many farmers in the Lowell region and throughout New England, and New Entry's World PEAS Food Hub program has created a centralized space where farmers can bring their food to be sold within Lowell and the Greater Boston Area. However, there are a variety of ways that the food hub could expand its services in Lowell in order to bring larger quantities of fresh local food into Lowell's schools, university, hospital, and other institutions.

World PEAS Food Hub has an established network of farmers who could provide a great deal of food for the city. By establishing a relationship with Aramark, the World PEAS Food Hub could provide local, fresh, and healthy fruits and vegetables to supplement Aramark's food services in Lowell's schools, universities, and hospital. This could provide higher quality food in dining facilities operated by Aramark, and allow the World PEAS Food Hub, and local farming operations, to

LOWELL IN FOCUS: WORLD PEAS FOOD HUB

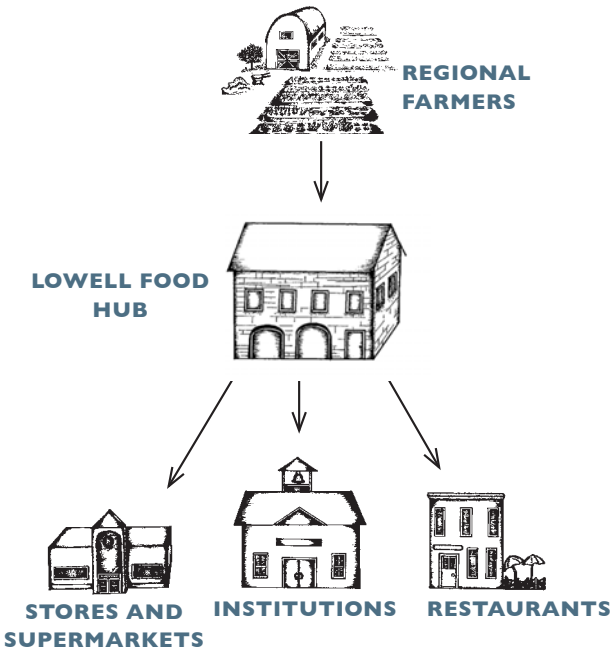
World PEAS Food Hub is an initiative of New Entry. World PEAS offers a central place where new farmers who are a part of the New Entry Farmer Training Program can sell their product. The produce grown by the farmers is bought by the food hub, aggregated into CSA shares for the Lowell and Boston areas, and sold. "Most participating farmers do not have a large enough volume, means of transportation, time or English language skills to effectively access viable markets on their own. By forming a cooperative, small, beginning, immigrant and refugee farmers are able to combine their products to more efficiently and effectively connect with local consumers" (World PEAS Marketing Cooperative).

World PEAS also offers several programs that sell and donate food from its farmers to low-income families. The Share-A-Share program allows CSA members to buy a share for a low-income family in need. World PEAS also teams with Lowell WIC to distribute produce free of charge to WIC clients. In 2011, they gave $804 worth of produce to WIC participants (2011 World PEAS Annual Report). In 2012, World PEAS started a low-income CSA share that is purchased each week. SNAP participants were able come to the Lowell farmers market each week and use their EBT cards to purchase half of the share cost. The other half of the share was covered by funds raised by World PEAS. In 2012, 188 shares were sold. The weekly low-income CSA program will continue at the farmers market in 2013 with hopes that it will expand.

(Photos Courtesy: New Entry)

World PEAS also sells produce wholesale to several businesses in Lowell. Their 2,000-square-foot facility in Lowell temporarily stores for twenty-four hours or less fresh produce dropped off by farmers. They sell to Bridgewell, a social services organization that has a homeless shelter in Lowell, as well as a federally funded school program called the Summer Feeding Program, which provides fresh food throughout the summer to youth who depend on school lunches during the school year. During the school year, World PEAS provides food for a pre-school program. They also sell to a youth organization that buys food from the food hub and then sells the fresh produce at retail prices at a stand outside of Lowell General Hospital (Fitch).

Food Hub



The Lowell food hub connects local and regional farmers with a variety of buyers within the city, increasing the amount of fresh and local food available.

expand their operations. World PEAS has already begun negotiations with Aramark, but so far with no concrete results. The LFSC has connections to a widespread network of people throughout the community who already work with decision-makers at local institutions. These decision-makers, many of whom also already have professional relationships with members of the LFSC, could be brought into closer contact with World PEAS, along with Aramark representatives, to learn about its mission, goals, and work in Lowell. For example, to further negotiations to supply Aramark with local produce, World PEAS could host a dinner for decision-makers and Aramark representatives, featuring food grown by their farmers and telling the stories of the food hub's farmers. Developing personal relationships with Aramark's representatives and other local decision-makers could lead to local foods being purchased to serve in institutional dining facilities, which could help World PEAS grow and expand its services in Lowell.

As World PEAS prepares for expansion, more in-depth tracking of income, sales, amounts, and types of food sold in Lowell may be necessary. While World PEAS already tracks these items for both Lowell and the greater Boston area for all of its programs, it will become important as the programs expand for records to continue to be kept for Lowell specifically as a way to understand growing and buying patterns. Having specific and separate financial, and programming records will help the organization track sales numbers and customer preferences.

Before expansion, an assessment of current World PEAS facilities is needed. If Aramark agrees to purchase produce from World PEAS, World PEAS will have a larger and year-round demand to fill. This will entail weekly deliveries by World PEAS to institutions and schools, expanding the amount of food its facilities can hold, increasing the number of farmers that it buys produce from, and adding employees who will deliver produce and conduct the day-to-day operations. Additional refrigerated trucks or storage units will be needed at some point. World PEAS should also investigate the costs of a flash freezer and industrial kitchen facilities to expand the amount and types of products they could offer year round. World PEAS could also partner with UTEC's Fresh Roots Culinary Training Program to develop recipes and produce value-added products such as soups, salsa, pesto, and tomato sauce. These products could be prepared by Fresh Roots and sold through World PEAS to institutions, local supermarkets, and corner stores.

CASE STUDY: LOCAL FOOD HUB, CHARLOTTESVILLE, VA

Local Food Hub in Charlottesville, Virginia, is bringing food from over 70 small family farms within 100 miles and distributing it to more than 150 schools, hospitals, and other institutions in the central Virginia region (Local Food Hub - Mission). It has a 3,500-square-foot warehouse with multiple temperature zones, an 18-foot refrigerated delivery truck, and a smaller refrigerated van. It promotes equal access to fresh, local, healthy food that is "one call away" and donates 25 percent of the produce from its educational farm to local food banks. Its staff visits every farm that it works with and understands their story, growing practices, and families. Local Food Hub also provides technical and marketing assistance to ensure that farmers are successful in all aspects of their business (Local Food Hub - Mission).

Local Food Hub participates in the Virginia Farm to School Program that connects local farmers with schools, not only to provide local food in school cafeterias, but for students to connect to local farms and understand where their food comes from. Local Food Hub has a Bridge the Gap fund that raises money so that cafeterias can afford to buy more local products given their limited food budgets. In 2010 and 2011, this fund provided more than 4,000 servings of hormone-free, grass-fed beef to students in the Charlottesville area (Local Food Hub - Farm To School).

ACTION ITEMS

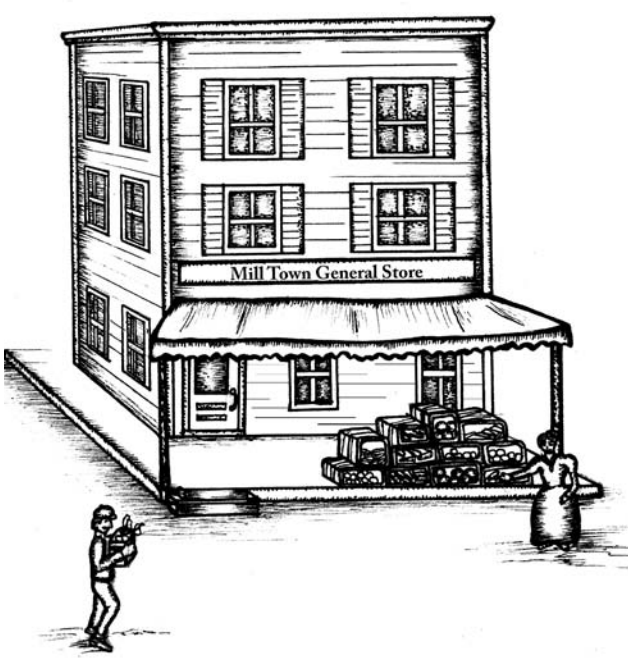
- Work with Aramark representatives and institutional decision-makers to negotiate supplying local foods to Lowell's schools, hospital, and universities.
  - Invite Aramark representatives and institutional decision-makers to an informational dinner at World PEAS Food Hub. The dinner could feature World PEAS farmer's produce and provide an opportunity for telling the stories of the program's farmers.
  - Hire a community organizer to work with Aramark, institutional decision-makers, and residents who could be impacted by these decisions.
- Expand World PEAS programming, marketing, and public relations in Lowell.
  - Hire a Lowell Outreach Coordinator who could conduct public relations campaigns to increase awareness around World PEAS's CSA programs.
  - Continue to expand availability of World PEAS CSA and low-income CSA programs by providing pick-up locations at the Lowell farmers market and two other locations in low-income neighborhoods that are not near grocery stores.
  - Work with CTI, WIC, and Mass in Motion to source local fruits and vegetables for corner stores participating in the Healthy Corner Store Program.
  - Assess current facilities for projected expansions including refrigerators, trucks, flash freezer, and industrial kitchen.
  - Continue tracking Lowell's finances separately in order to understand buying patterns.
  - Continue tracking types and amounts of products sold in order to understand consumer preferences.
- Evaluate expansion progress after one year to:
  - Improve the progression of negotiations with Aramark.
  - Improve the expansion of CSA programs especially in low-income neighborhoods by surveying low-income CSA members about price, food preferences, and CSA drop-off points.
  - Analyze financial data to create goals and objectives specific to continuing to expand services in Lowell.

Healthy Corner Stores

Offering fresh produce in corner stores throughout Lowell will make healthy and local foods easier to access and help build community, especially in low-income neighborhoods.

History of Corner Stores

Small neighborhood food stores used to be where people in urban neighborhoods bought food and other household goods. You could go to the baker to get your bread and pastries, the butcher for meat, the market for vegetables and fruits, and the general stores for household supplies. These small locally owned stores also served as a place you would go to hear the local news, catch up with friends and neighbors, and learn of the happenings around town, creating many opportunities for neighbors and friends to interact on a regular basis.



Before supermarkets, general stores were located within each neighborhood and provided convenient access to fresh produce.

The rise of the supermarket in the 1960s meant that you could instead go to one place to get your entire household needs under one roof at lower prices. Slowly, the corner butcher, baker, and other specialty stores either closed down or became what they are today: modern corner or convenience stores filled with candy, soda, and overpriced processed foods.

In Lowell, corner stores are primarily located in low-income neighborhoods in the midsection of the city where there are no large supermarkets, making them the most convenient option for nearby residents without much time or a vehicle to purchase food. However, the *Lowell Community Food Assessment* shows that most residents buy their food at Market Basket, a large chain grocery store (Camp and Sisson, 27). For city residents who do not own cars and must take public transit, getting to and from the grocery store is a major undertaking that can take hours. Many residents in neighborhoods not near a large grocery store could use corner stores on a regular basis if they offered more vegetables, fruits, and other ingredients for home cooking, but currently residents prefer taking a longer trip to Market Basket.

Healthy Corner Stores

In Lowell, corner and convenience stores could provide fresh produce to low-income residents who do not have the time or transportation means to get to a larger grocery store on a regular basis.

More information is becoming available across the U.S. about food deserts and a lack of affordable healthy foods available in low-income neighborhoods. Corner stores can provide one possible solution to providing healthy, affordable, and culturally appropriate foods in low-income neighborhoods. However, based on the Healthy Food Retail Program Guide, corner store-owners are hesitant to transition to providing healthier foods, saying that they make little profit from vegetables and that processed foods make their stores money (DC Central Kitchen, 3). They worry that no one will want to buy the healthy food. Many initiatives have emerged throughout the country to assist store-owners who are willing to try shelving fresh fruits and vegetables in their stores. One successful initiative has been in Washington, D.C. led by the D.C. Central Kitchen (DCCK) (see page 66).

What is Currently Happening in Lowell?

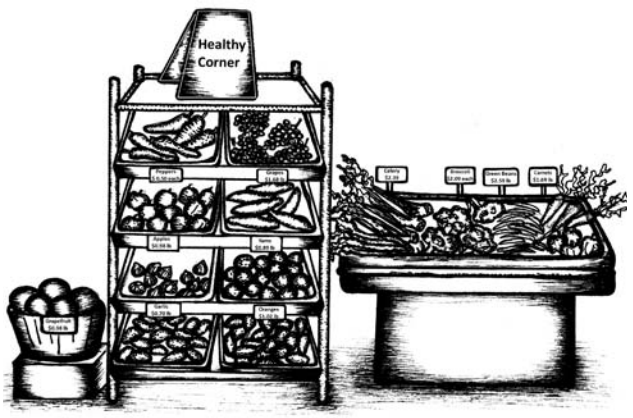
Efforts are already underway in Lowell to assist store-owners who are interested in selling fresh, local produce in their stores. Lowell receives funding from the Massachusetts Department of Public Health (DOPH) through the Mass in Motion Program to monitor WIC store-owner adherence to WIC policies. The stores that accept WIC benefits are asked to replace some of their junk food with healthy fruits, vegetables, and snacks (Fullam). Store-owners are required to showcase an abundance of fresh fruits and vegetables in prominent locations within the store and Lowell DOPH officials survey the stores quarterly to make sure stores are compliant; if a store does not meet the standards set forth by the program, the store is contacted by the Lowell DOPH (Fullam). Currently, Community Teamwork, Inc. (CTI) administers the WIC program in Lowell. There are quarterly meetings where store-owners can meet with CTI's WIC program staff and health officials to receive support, but owners are only required to attend one meeting each year. The Mass in Motion Program hopes to continue to work with corner store owners to increase the availability of healthy foods in corner stores, but there are currently no guidelines directing store-owners as to where they might purchase the fresh fruits and veggies. Store-owners often buy conventionally grown produce that is not local and there are currently no financial or technical incentives available for store-owners as they transition to offering more healthy fruits and vegetables.

Lowell's Healthy Corner Store Program Revamp

The healthy corner store program offered in Lowell has successfully made available more fresh fruits and vegetables while reducing sodas, candy, processed, and other junk foods in corner stores and making healthy and fresh foods more accessible to WIC participants and other residents who are seeking more fresh produce in their diets (Fullam). If Lowell were to adjust its program based on the model of DC's Healthy Corner Store Program by increasing their incentives and support for store-owners, corner stores can become not only a place where residents can go to buy healthier foods, but also a place where local foods, farmers, organizations, and cultures are celebrated. If the program were modeled on DCCK's program, it would still be funded by the Massachusetts Department of Public Health, but co-managed by a Lowell community organization. By having a local organization work with CTI's WIC staff and the Lowell DOPH, the program can enhance its assistance, support, and incentives.

The LFSC could be the organization that provides this additional support. Mill City Grows and World PEAS Food Hub could sell fresh vegetables and fruits grown by their farmers to corner stores. Signs and labeling could showcase local farmers and gardeners and increase interest and pride for customers. The funding could allow for food to be sold initially at reduced costs while stores are transitioning, as in the DCCK model. After a transition period, foods could be sold to stores at market value so that store-owners could mark up the products appropriately.

Another area where the program could follow the DCCK program is through their $1,500 mini-grant for new store equipment. In Lowell, stores may not be properly equipped with refrigerators and shelving for fruits and vegetables, so the produce goes bad very quickly. If each store could receive $1,000 from Mass in Motion for new equipment that is needed to keep the produce fresh, the produce would be fresher for longer, reducing food waste and possibly increasing sales.



Healthy foods in Lowell's corner stores could feature fruits and vegetables grown nearby or in the city.

By working with the LFSC, corner stores could also support the World PEAS Food Hub (see page 61) and its

CSA program by having CSA delivery in front of their stores. CSA members could pick up their shares and then go into the corner store to buy additional food to complete their weekly grocery run in one location. By having the CSA delivery in front of the corner store, more customers are likely to visit the store during these hours and more neighborly interactions on a regular basis are likely to occur, bringing back the atmosphere and community created by small specialty stores before the advent of large supermarkets.

Lowell's corner store owners may need nutrition education in order to properly advertise and promote their healthy products. UMass–Lowell's Nutrition Program already sends interns to work with various Lowell programs such as WIC, SNAP, and the Merrimack Valley Food Bank. Students could work with the corner store program to develop nutrition education materials for store-owners and conduct direct nutrition education with customers through simple cooking demonstrations, sampling, recipe cards in multiple languages, and educational pamphlets. Owners would be able to promote their products and customers could learn how to prepare foods that might be new to them.

United Teen Equality Center's Culinary Training Program or small businesses that emerge out of a community kitchen (see page 29) could sell their products to corner stores. Through organizations and small businesses selling products for a program that is supporting Lowell youth and small culinary businesses, store-owners can continue to promote a positive image for their store and support other programs in the city that are promoting health, well-being, and job training for youth.

All of these additions in programming could be started as small pilot projects with five to ten stores that already accept WIC benefits. By starting small, funding can be focused on particular stores located in areas where residents have the least access to large supermarkets. After six months, evaluations of each store should be conducted to identify if the program has potential to expand and where adjustments or improvements can be made. If the program is deemed a success, additional funding could be obtained to expand the program to the other stores that accept WIC and SNAP.

CASE STUDY: D.C. CENTRAL KITCHEN, WASHINGTON, D.C.

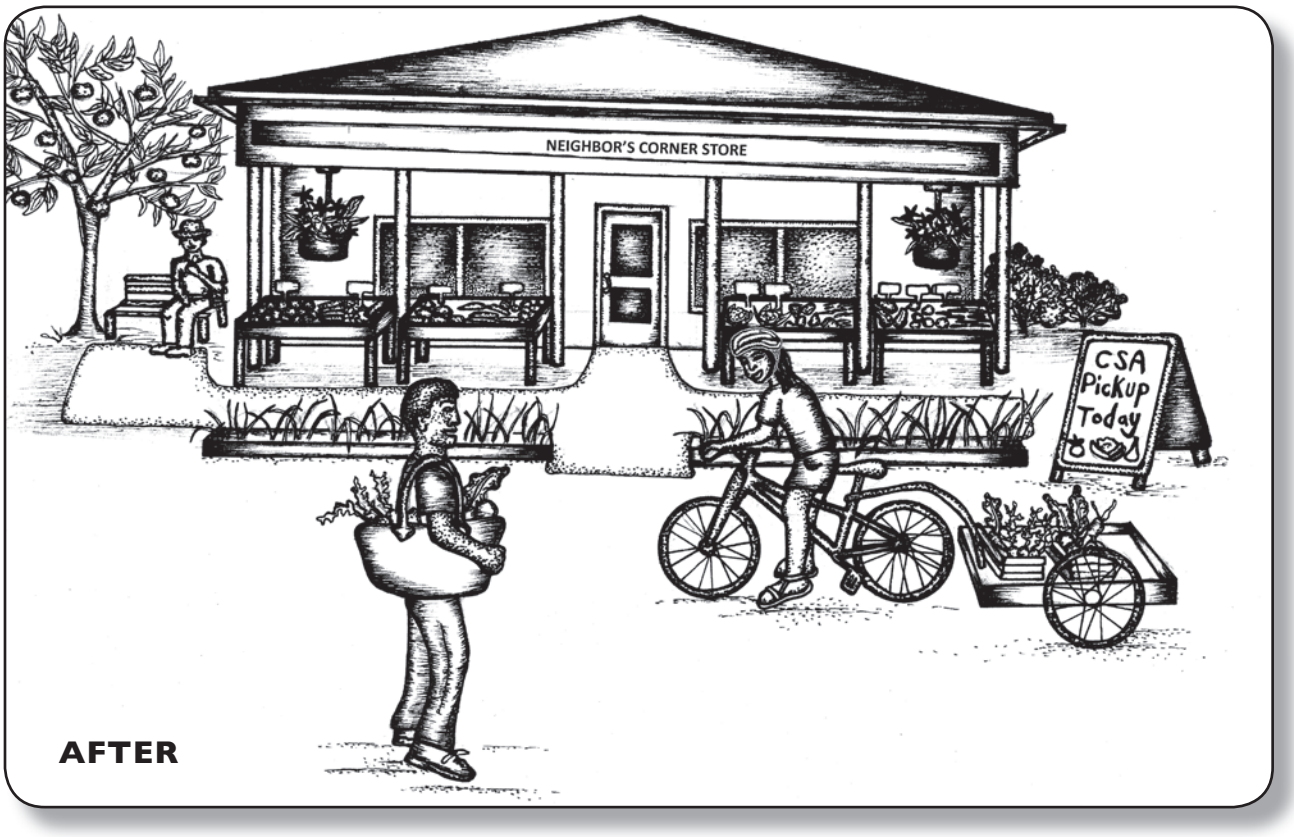
In 2011, the D.C. Department of Health awarded $300,000 to DCCK to launch a six-month pilot project with thirty corner stores in some of the most impoverished areas of the city (Thomas). DCCK assumed most of the risk and responsibility by providing local fruits and vegetables, healthy snacks prepared by youth in a culinary training program, a $1,500 mini-grant to purchase shelving and refrigeration, business assistance, and nutritional information (DC Central Kitchen, 11). In the span of the six-month pilot, DCCK sales to corner stores went from several hundred dollars per month to over $10,000 per month (Thomas).

There are several components that made the project successful:
DCCK phased in pricing of products for store-owners. During the first two months, the products were given to store owners for free with suggested sale prices for each item. During the third and fourth months, products were sold to the stores at cost, and in the final two months products were sold at normal wholesale prices. This allowed store-owners to see if the products would sell before using their own finances to purchase food (Thomas). In addition, store-owners met regularly with business consultants who assisted with product placement and store design to feature these healthy products over unhealthy foods (DC Central Kitchen, 11).

(Photo Courtesy: DC Central Kitchen)

The program still exists, with twenty-nine stores participating. By adding healthy and affordable food, store-owners give their business a positive image and are supported and promoted by DCCK through their nutrition education program in schools and at food-related events in the community.

The average corner store that currently sells candy, soda, and processed food could become the neighborhood market for healthy, affordable, and culturally appropriate foods featuring food grown locally or even from inside the city limits.



Healthy Corner Stores

ACTION ITEMS

- Identify specific areas in Lowell neighborhoods that could benefit from having more fresh, local fruits and vegetables in corner stores. These areas should:
  - Be in low-income neighborhoods.
  - Be half a mile or more from a grocery store.
  - Have corner stores with owners who are interested in featuring more fresh fruits and vegetables and already accept WIC and/or SNAP.
- Launch a six-month Healthy Corner Store pilot project with five corner stores in Lowell modeled on the DCCK Healthy Corner Store Initiative. The pilot project could include:
  - Direct communication with DCCK, the Healthy Corner Store Network, and other successful corner store initiatives to learn from their projects.
  - Featuring fresh, local, and culturally appropriate fruits and vegetables from places such as Mill City Grows and World PEAS Food Hub. Healthy snack options could also be sold in stores and created by organizations such as UTEC and/or other local culinary businesses.
  - Price phasing of all healthy products as store-owners begin introducing new products into their stores along with appropriate signs and labeling.
  - A $1,000 mini-grant for each store to purchase any new shelving or refrigeration equipment. Nutritional education assistance from organizations such as WIC that could also be supported by nutrition students at UMass–Lowell.
  - Nutrition assistance could include a nutrition education workshop for each store-owner, quick and healthy recipe cards available for customers in multiple languages, and sampling of healthy products in each corner store.
  - Business management assistance from organizations such as the Lowell Small Business Association and business students at UMass–Lowell.
- After the six-month pilot project has been completed, a thorough evaluation should be conducted. The evaluation could:
  - Survey store-owners to understand if the program will be financially viable in the long-term, what additional support and incentives would be helpful, and other ways the program could be improved.
  - Survey corner store customers to understand which products they use the most, if prices are affordable, and what other healthy products they would be interested in.
  - Survey producers to understand if delivery options and product pricing were appropriate for their needs.
- After the evaluation has been completed, improvements could be made and the program expanded appropriately to other corner stores with owners who are interested and where there is a community need for more fresh, local, and culturally appropriate food.

Zoning

"Determining the activities that need to be located near each other is primary in efficient design." Randolph Hester, Design for Ecological Democracy*)*

The following section includes summaries of portions of Lowell's Zoning Book and Charter that apply to urban agriculture. The few times that terms like garden, farm, agriculture, and orchard appear in Lowell's zoning and charter is characteristic of most other municipalities, and evidence that, until recently, public food policy and planning have not been at the forefront of city planning (Ackerman-Leist).

Gardens

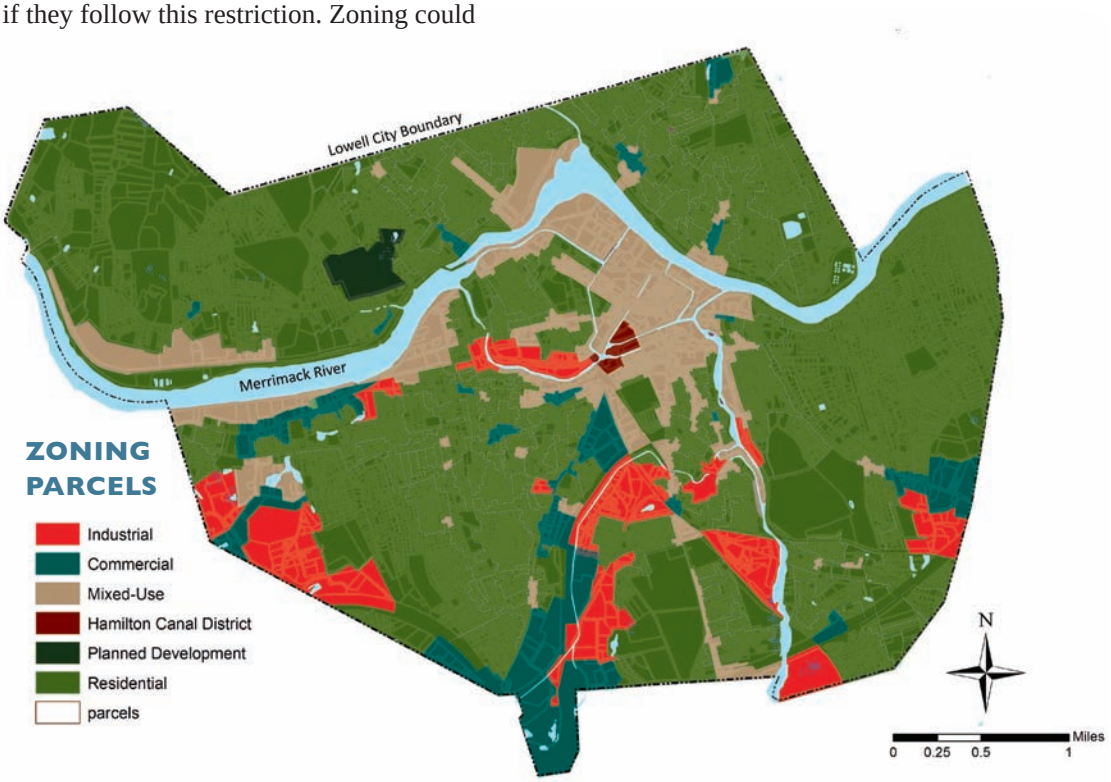
Under current zoning definitions, gardens are included in the definition of Lowell's Usable Open Space (Article II Definitions, Zoning Book, City of Lowell). Usable open space must be five feet from any lot lines and at least fifteen feet square. There are no restrictions on location of gardens in front, side or back yards.

Implications: Gardens in front, side, or backyards are permitted if they follow this restriction. Zoning could be amended with a definition of gardening that includes food production, and remove the five-foot lot line restriction so residents can take advantage of vertical growing space along fences.

Agriculture Zoning

The City of Lowell does not currently have a zoning designation for agricultural land. One parcel in Lowell is under 61A protection, a ten-acre Christmas farm. The zoning code permits single-family residential construction on that lot. Former land protected under Chapter 61A has been developed.

Implications: Since Lowell is almost completely built out, it is likely that this last parcel of agricultural land protected under 61A will eventually be developed too, since other forms of development are considered more profitable than farming in Lowell (Lowell Open Space and Recreation Plan). In order to promote sustainability and access, Lowell could consider increasing the priority of food production as a land use by supporting efforts to increase food production on privately owned land, including individual, institutional, commercial, and industrial properties.



Chickens

Currently, chickens and other livestock, such as pigs and goats, cannot be raised in the city. Up to 75 pigeons per parcel are allowed in all residentially zoned areas, as long as regulations concerning coops and waste are followed (§ 104-34 -§ 104-42), and under license of the Lowell Health Department. Permits are $50 every three years (Chapter 150. Fees, Zoning Book, Attachment 1:21).

Implications: Considering that similar care is required for pigeons, allowing chickens and ducks in residential areas should be considered. A survey of other cities and their livestock regulations could be helpful to Lowell in their discussions concerning urban agricultural animal food production.

Bees

Bees may be kept within the city of Lowell if bee colonies are kept within fifty feet of any exterior boundary of the property and a five-foot-high plant or artificial barrier is installed along the exterior boundary of the property to prevent bees from flying through it. Fresh, clean water must be provided for the bees, and state statutes concerning beekeeping must be followed (§ 104-30). This regulation is not meant to restrict the keeping of bees located within a school or university building for the purpose of study or observation (§ 104-31).

State beekeeping regulations focus on disease and pest control of all bee colonies in the state, and require annual inspection of bee colonies by the state apiary inspector at no cost to the beekeeper. Bees and bee equipment must be accessible to the inspector, and stickers showing the beekeepers contact information, date and results of inspection must be visible for each colony (M.G.L. Ch. 128, §§ 32 – 36B – Bees and Honey).

Implications: Lowell's fifty-foot boundary regulation would prevent many residents in Lowell from participating in beekeeping because many residential parcels are small, but schools, universities, and businesses that can comply with the fifty-foot boundary currently should be able to raise bees for food production. If Lowell residents have an interest in beekeeping, it could be helpful to evaluate the reasons for the fifty-foot boundary to see if changes could be made to increase residential beekeeping.

Sales of Produce

Outdoor sales of flowers, garden supplies and agricultural produce is permitted in multi-use, traditional or residential zones, special purpose, and industrial zones (12.5), so a small farm stand at these locations is allowed. If agricultural products are sold from a house, a special home-based business permit from the Zoning Board of Appeals (ZBA) may be required. Selling agricultural products in public spaces is licensed by the city's License Commission, and license fees are set by the Board (§ 243-11, Charter). Sales of produce or value-added products from areas like the back of a truck parked on a public street might therefore require a license and might require case-by-case consideration by the ZBA.

Implications: These codes can act as a support or barrier to residents and, as the Lowell community considers increasing urban agricultural activities within the city, should be evaluated as to how they impact residents, particularly those with fewer resources, like low-income residents and immigrants.

Zoning for Downtown Community Gardens, Green Roofs and Green Walls

The Hamilton Canal District (HCD) is a downtown area in which mixed use redevelopment has been proposed. The form-based code (FBC) for this district allows garden areas, such as in setback areas of buildings, which can have formal landscaped areas, including community gardens, i.e. food production (10.3.11, HCD

Chicken tractors can be small and attractive additions to the backyard.

FBC, 65). Zoning for green walls and green roofs has been included in the form-based code for the Hamilton Canal District (10.3.2, HCD FBC, 8).
Implications: Explicit inclusion of food production as allowed land use in areas where many low-income residents live, would provide more opportunity for residents to participate in food production. This could allow downtown businesses to participate in food production, which could help create more sustainable, local food sources, and increase residents' access to fresh produce. Green roof and wall form-based codes could act as models for permitting and promoting rooftop gardens, green roofs, and green walls throughout the city.

Farm Equipment Noise

Running farming equipment or other farming activity performed during the hours of 6:00 a.m. to 11:00 p.m. is exempt from noise regulations (§ 204-5, Charter).
Implications: This noise exemption allows for a long agricultural working day and would not need to be changed.

School Facilities for Community Use

Massachusetts General Law 71, Section 71, states that school committees may decide to use school facilities for "such educational, recreational, social, civic, philanthropic, and similar purposes as it considers appropriate for the interest of the community," as long as those activities do not interfere with school activities.
Implications: Food production through school gardens and public orchards and establishment of community food resource centers could be considered an approved use of school facilities if the Lowell school committee considers it beneficial to the community. Conversations with the school committee, Office of the Superintendent, student families, and community agencies could be helpful in discovering interest and support for these activities.

CASE STUDY: SEATTLE AGRICULTURE RE-ZONING

Seattle has a long history of urban agriculture and provides many examples for cities like Lowell who are considering rezoning to increase residents' access to healthy food and improve food security. Although Seattle is a larger city than Lowell, it shares similar traits like high poverty, large immigrant populations, a densely populated downtown, rising rates of diabetes and obesity, and increasing food insecurity of children, seniors, and other low-income populations.

In September 2010, Seattle's city council passed an urban agricultural zoning ordinance in response to resident and civic interest to improve residents' health, increase self-reliance of residents, create community-building opportunities, and develop a more sustainable and livable city. Grassroots and professional advocates, Seattle's Acting Food Policy Council, The P-Patch Program, and the Department of Planning collaborated to establish food priorities, assess policies that restricted or promoted urban agriculture in Seattle, and recommend actions. Success for Seattle's rezoning might be measured by the fact that planting for the Beacon Food Forest started in 2012, and many Seattle residents continue to look for land where they can grow their own food, but considering that the rezoning was passed in 2010, it might be too soon to measure whether there has been success.

General land use categories now allow for community gardens, urban farms and farmers through new urban agriculture zoning. The city now uses broad definitions of open space and parks to include community gardening and made community gardens an approved land use for all residential, multi-use, and industrial zones. In almost all zoning districts, it allows for chicken farming, rooftop greenhouses, and the sale of food grown within the city limits. The number of allowed domestic fowl (chickens, ducks, and geese) increased from three to eight for each residential unit (Seattle Tilth). Through policy, the city also supports initiatives that emphasize greater access to healthy food for low-income residents, youth, the elderly, disabled and other food insecure populations, that expand markets for local growers, and that increase use of local produce in Seattle's government, schools, hospitals, and other institutions (Lerman).

REZONING DRAFTING PROCESS, BOSTON

Through the Boston Redevelopment Authority's Citywide Urban Agriculture Rezoning Initiative, a pilot program to explore the feasibility of changing Boston's zoning to support urban agriculture began in 2010 (Boston Redevolpment Authority). Phase I included the creation of an Urban Agriculture Overlay District in two city-owned South Dorchester properties. Requests for proposals, the rezoning process and selection of farmers involved community participation through five community meetings, and dialogue with community leaders. Two farms were established as a result of Phase I — City Growers, run by a private company, and Victory Programs, run by a non-profit organization. In spring of 2011, both farms planted their first crops.

Phase II began in January 2012 and includes proposals for zoning revisions that could allow for increased urban agriculture activities throughout all zoning types in Boston. The drafted proposal, Draft 89, is going through revisions at committee level and will be introduced to the public process in the summer of 2013. The categories under review include:

- Soil safety, pesticides and fertilizers, and composting
- Growing of produce, in greenhouses, hoophouses and other structures
- Rooftop agriculture
- Aquaculture, hydroponics and aquaponics
- Keeping of animals and bees
- Farmers markets, farm stands and sales

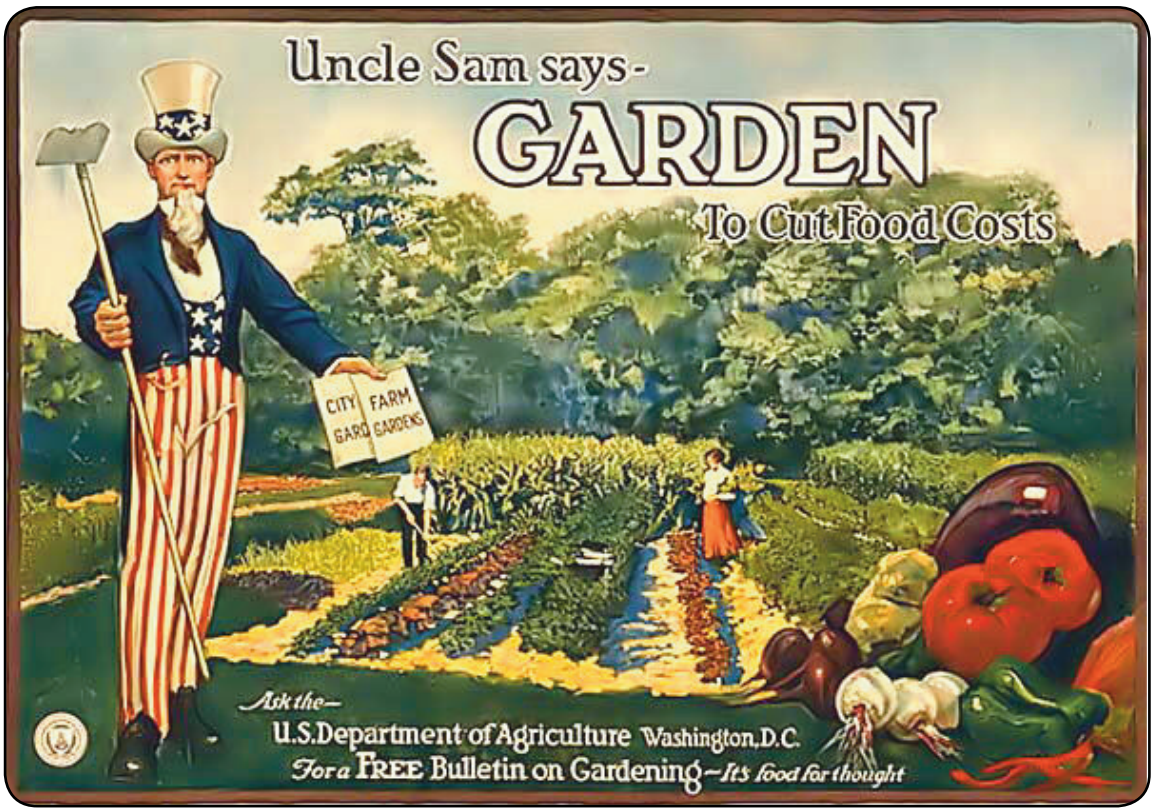
A Public Working Group consisting of residents, farm advocates, and experts from various fields was selected by Mayor Menino in 2010. This group had a kick-off and visioning meeting in January 2012 and have met monthly since to research the above topics and make recommendations for rezoning. All meetings have been open to the public. Meeting agendas and publications of recommendations are available to the public online, along with established periods for public comment.

Although this draft has not yet been approved by the public, there are many documents available online that show the process the committee is going through to establish parameters and definitions concerning urban agriculture activities. Draft 89 could be a valuable resource for Lowell if the city decides to move forward with creating policies that promote urban agriculture because if agricultural activities are not expressly permitted in zoning, they are expressly prohibited.

"Agriculture is our wisest pursuit, because it will in the end contribute most to real wealth, good morals, and happiness."
Thomas Jefferson

ACTION ITEMS

- Work with Lowell Department of Planning and Development, City Counselors, North Middlesex Council of Governments, urban agriculture advocates, and community to assess current zoning and amend to promote an urban agriculture ordinance that is comprehensive and appropriate to Lowell.
  - Amend definitions and descriptions to zoning or codes that are applicable to urban agriculture.
  - Evaluate and streamline permitting processes and fees for urban agriculture activities for ease of use by residents, including immigrant and low-income residents.
- Increase potential small business options: food carts, selling of produce in more places.
- Outline process for legally selling produce and value-added goods in Lowell.
- Educate public about urban agriculture ordinance proposal and create public presence in support of the ordinance at city council meetings.
- Participate in supporting agricultural initiatives in region to increase food stability in areas near Lowell.



Growing one's own food was once considered a civic duty, even in the city. (National Archives)

The following is a sample of state and federal food regulations. This is not meant to be a comprehensive list.

MASSACHUSETTS

Land Use

330 CMR 18 – Land Use (including community gardens)

Unprocessed Foods

M.G.L. Ch. 94, §§ 96 - 117L – Fruits, Vegetable, Nuts, Apples, Cranberries, Farm Products & Potatoes
M.G.L. Ch. 94, §§ 89 - 92A – Eggs
M.G.L. Ch. 94, § 152A & B – Live Poultry
M.G.L. Ch. 128, §§ 32 – 36B – Bees and Honey
330 CMR 5 – Poultry (including egg quality standards)
330 CMR 6 – Seeds, apples, potatoes 330 CMR 8 – Apiary Inspection
M.G.L. Ch. 94, §§ 185 - 196 – Food Adulteration
M.G.L. Ch. 128 §§ 36B & C – Labeling of Honey and Maple Syrup

Processed Foods

M.G.L. Ch. 94, §§ 304 – 306
105 CMR 520.000 (does not include nutrition labeling)
05 CMR 500.000 – Good Manufacturing Processes
105 CMR 510.200 – Standards of Identity: Fruit Butter, Jellies, Jams, Preserves
105 CMR 530.000 – Sanitation in Meat/Poultry Processing Establishments
105 CMR 531.000 – Inspection of Meat Slaughtering and Processing
105 CMR 532.000 – Inspection of Poultry and Poultry Products
105 CMR 590.000 – Sanitation (“Chapter X”)
M.G.L. Ch. 94, §§ 2 – 10 – Bakeries and Baking Products
M.G.L. Ch. 94, §§ 118 – 139G – Slaughterhouses
M.G.L. Ch. 94, §§ 142 – 153A – Sale of Sausages and Meat
M.G.L. Ch. 94, §§ 185 – 196 – Food Adulteration and Misbranding
M.G.L. Ch. 94, § 305B – Food Handlers and Medical Examination
M.G.L. Ch. 94, § 305C – Wholesale Licensing for Food Processors

Sales of Processed Foods

M.G.L. Ch. 64H – Tax on retail sales M.G.L. Ch. 94, §§ 176 – 180 – Sales by weight
M.G.L. Ch. 101 – Transient vendors, hawkers, peddlers Note the exemption in § 15 for those who are only selling their own fresh produce.

FDCA § 402 – Food adulteration

FEDERAL

Unprocessed Foods

7 CFR 51 – Fresh Fruits, Vegetables, and Other Products
FDCA § 408

Processed Foods

21 CFR 100 – 189
9 CFR 317 – Meat labeling (USDA)
9 CFR 381 – Poultry labeling (USDA)
21 CFR 101 – FDA labeling
FDCA § 403 – Misbranded food & nutrition labeling
21 CFR 110.00 – Good manufacturing processes
21 CFR 113.00 – Thermally processed low-acid foods
21 CFR 114.00 – Acidified foods
21 CFR 130.00 – 169.00 – Food standards
FDCA § 401 – Food standards

M.G.L.: Massachusetts General Laws

CMR: Code of Massachusetts Regulations

CFR: Code of Federal Regulations

FDCA: Food, Drug & Cosmetics Act FDA = Food and Drug Administration

USDA: United States Department of Agriculture

"To forget how to dig the earth and to tend the soil is to forget ourselves."

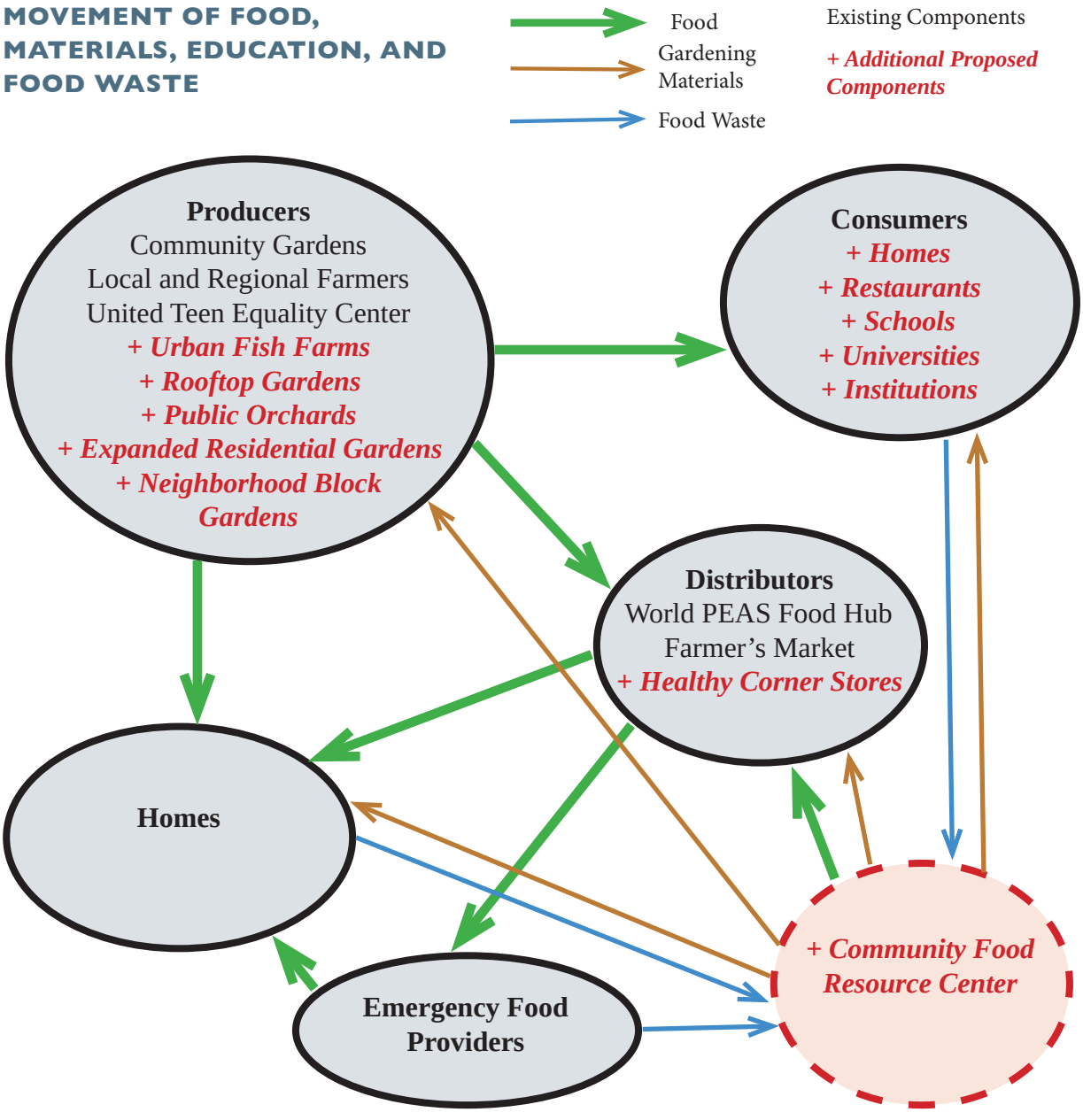
Mahatma Ghandi

III. Strengthened Food System

While Lowell is a part of global food systems, the LFSC has assisted in shifting the city towards a more local food system. This local system comprises a web of relationships that connects farmers, buyers, homes, community organizations, and businesses. The recommendations in the previous pages suggest ways this system might be further strengthened to provide more access to fresh, local, and culturally appropriate foods for more residents.

The graphic below illustrates how new initiatives might supplement current programs and operations. The arrows show the movement of food, food waste, and gardening materials as they move through the system, contributing to greater food security in Lowell.

MOVEMENT OF FOOD, MATERIALS, EDUCATION, AND FOOD WASTE



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What should be the outcome of the Lowell Urban Food Security Plan?
Rate 0-4
0-Not a Priority 1-Low Priority 2-Somewhat of a Priority 3-Priority 4-High Priority

(0-4)

___ Increased food access
___ Decreased end of the month food shortage from WIC and SNAP participants
___ More community gardens
___ Creation of food related jobs
___ Increased educational opportunities for residents to learn about:
- ___ Food preparation
- ___ Emergency food services
- ___ Urban gardening
- ___ Soil contamination
- ___ Small business loans and start-up
- ____ Farmer training
- ____ Bio-intensive gardening
- ____ Other _____ _____

___ Increased youth summer employment opportunities
___ Allowing flexible food production in the city:
- ___ Changes to land use
- ___ Raising livestock in city limits
- ___ Easier approval for gardening on vacant land
- ____Other _____

___ Improved WIC and SNAP acceptance at community stores
___ Increased opportunities for development of local food production
___ Decreased reliance on fossil fuels
___ Increased networking with local farms
___ Creation of more ethnic food celebrations
___ Increased access to culturally acceptable foods
___ Decreased reliance on emergency food centers
___ Improved quality of produce
___ Strengthened overall health of residents
___ Strengthened communication between organizations
___ Increased food production within Lowell
___ Creation of new spaces for gardening
___ Increased local food use in businesses and schools
___ Increased financial investment to start-up food businesses
___ Improved food distribution
___ Improved access to resources for home gardeners (tools, seeds and seedlings, compost, supplies for raised beds)
___ Increased individual food self-reliance

(0-4)

___ Increased food access
___ Decreased end of the month food shortage from WIC and SNAP participants
___ More community gardens
___ Creation of food related jobs
___ Increased educational opportunities for residents to learn about:
- ___ Food preparation
- ___ Emergency food services
- ___ Urban gardening
- ___ Soil contamination
- ___ Small business loans and start-up
- ____ Farmer training
- ____ Bio-intensive gardening
- ____ Other _____ _____

___ Increased youth summer employment opportunities
___ Allowing flexible food production in the city:
- ___ Changes to land use
- ___ Raising livestock in city limits
- ___ Easier approval for gardening on vacant land
- ____Other _____

___ Improved WIC and SNAP acceptance at community stores
___ Increased opportunities for development of local food production
___ Decreased reliance on fossil fuels
___ Increased networking with local farms
___ Creation of more ethnic food celebrations
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___ Increased local food use in businesses and schools
___ Increased financial investment to start-up food businesses
___ Improved food distribution
___ Improved access to resources for home gardeners (tools, seeds and seedlings, compost, supplies for raised beds)
___ Increased individual food self-reliance
___ Strengthened language/interpretation services
___ Increased use of green space
___ Creation of community leadership opportunities

Survey Summary

Increased educational opportunities for residents to learn about:														Total
Food preparation	1	1	1	1	1	1	1	1	1	1	1	1	1	13
Emergency food services	1	1	1	1	1	1	1	1	1	1	1	1	1	13
Urban gardening	1	1	1	0	1	1	1	1	1	1	1	1	1	12
Farmer training	1	1	1	0	1	1	1	1	1	1	1	1	1	12
Soil contamination	0	0	1	0	1	1	1	1	1	1	1	1	1	10
Bio-intensive gardening	0	1	1	0	1	1	1	0	1	1	1	1	1	10
Small business loans and start-up	0	0	1	0	1	1	1	0	1	1	1	1	1	9
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Allowing flexible food production in the city:														Total
Changes to land use	1	1	1	0	1	1	1	1	1	1	0	0	1	10
Raising livestock in city limits	1	1	1	0	1	1	1	1	1	1	1	0	1	11
Easier approval for gardening on vacant land	1	1	1	0	1	1	1	1	1	0	1	0	1	10
Other	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Financing for gardening/remediation projects	0	0	0	0	0	1	0	0	0	0	0	0	0	1

Increased access to food processing facilities for:														
Canning, preserving, dehydrating, and flash freezing foods	0	0	1	0	1	1	1	1	1	1	0	1	1	9
Value added products	0	0	1	0	1	1	1	1	1	1	0	1	1	9
Grains (esp. chix - Francey)	0	0	1	0	1	0	1	1	0	1	0	1	1	7
Small livestock	0	0	1	0	1	0	1	0	1	1	0	1	1	7

Developing centralized local food distribution center(s) for:														
Local farmers to sell fresh produce	1	1	1	0	1	0	1	1	1	1	0	1	1	10
Residents to increase access to fresh produce	1	1	1	0	1	0	1	1	1	1	0	1	1	10
Local grocers to buy local produce	1	1	1	0	1	0	1	1	1	1	0	1	1	10

Providing more opportunities for Lowell residents to farm:														
Low tech farms (backyard and community gardens, public orchards)	1	1	1	0	1	1	1	1	1	?	0	1	1	10
Intermediary farms (large urban or regional farms, rooftop greenhouses, procesing centers)	1	0	1	0	1	0	1	0	1	?	0	1	1	7
High tech farms (industrial farming like hydroponics and aquaponics)	1	0	1	0	1	0	1	0	0	?	0	1	1	6

Is it a priority to improve food access in Lowell?														
Y	1	1	0	1	1	1	1	1	1	1	?	1	1	11
N	0	0	1	0	0	0	0	0	0	0	?	0	0	1
For everyone	1	1	0	1	1	1	1	1	1	1	?	1	1	11
Food Insecure Only	0	0	0	0	0	0	0	0	0	0	?	0	0	0

Is it a priority to improve food distribution in Lowell?														
Y	1	1	1	1	0	1	1	1	1	1	?	1	1	11
N	0	0	0	0	0	0	0	0	0	0	?	0	0	0
For everyone	1	1	1	1	0	0	1	1	1	1	?	0	1	9
Food Insecure Only	0	0	0	0	0	0	0	0	0	0	?	1	0	1

Is it a priority to increase food production in Lowell?														
Y	0	1	1	1	1	1	1	1	1	0	?	1	1	10
N	1	0	0	0	0	0	0	0	0	0	?	0	0	1
For everyone	0	1	1	?	1	1	1	1	1	0	?	1	1	9
Food Insecure Only	0	0	0	?	0	0	0	0	0	0	?	0	0	0

What groups should be the beneficiaries of the food security plan?														
All Lowell Residents	1	1	1	1	1	1	1	1	1	1	1	1	1	13
Farmers	0	1	0	1	0	1	1	1	1	1	0	1	1	9
Businesses	0	1	0	0	0	1	1	1	1	0	0	1	1	7
City of Lowell	0	1	0	0	0	1	1	1	0	0	0	1	1	6
Low Income Residents	0	0	0	1	0	1	1	1	1	0	0	0	1	6
Other	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Elderly	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Community Organizations	0	0	0	0	0	0	0	0	0	0	0	1	0	1

(? - didn't know enough about the topic to answer question)

LFSC Focus Group Questionnaire Results

Answers ranked by sum of respondents' scores for each question
0 - 4 (0 being not important, 4 most important)

52 total points possible for each question

Question
Increased educational opportunities for residents to learn about
Improved access to fresh produce throughout the city
Increased food access
Increased individual food self-reliance
Strengthened overall health of residents
Increased opportunities for development of local food production
Strengthened communication between organizations
Decreased end of the month food shortage from WIC and SNAP participants
Improved quality of produce
Increased local food use in businesses and schools
Providing incentives to local or regional farmers to grow food for the Lowell community
Increased use of green space
Developing centralized local food distribution center(s)
Increased networking with local farms
Decreased reliance on emergency food centers
Creation of new spaces for gardening
Increased access to culturally acceptable foods
Allowing flexible food production in the city
Creation of community leadership opportunities
Decreased reliance on fossil fuels
Increased youth summer employment opportunities
Creation of food related jobs
Improved food distribution
Decreased reliance on foods from distant farms (over 500 miles away)
Increased food production within Lowell
More community gardens
Increased public food orchards (trees and bushes planted on public open space)
Growing enough food to feed all of Lowell's residents
Improved WIC and SNAP acceptance at community stores
Elimination of the need for WIC and SNAP
Providing more opportunities for Lowell residents to farm
Strengthened language/interpretation services
Improved access to resources for home gardeners (tools, seeds and seedlings, compost, supplies for raised b
Creation of more ethnic food celebrations
Increased financial investment to start-up food businesses
Allowing residents to raise small livestock in the city
Increased access to food processing facilities

(? - didn't know enough about the topic to answer question)

Respondent Score													Total
3	4	4	4	4	4	4	4	4	4	4	4	4	51
4	4	4	4	4	4	3	4	4	4	4	4	4	51
4	4	2	4	4	4	3	4	4	4	3	4	4	48
4	4	4	3	3	4	3	3	4	4	3	4	3	46
4	4	4	4	3	3	3	4	4	1	4	3	4	45
4	3	4	3	3	3	3	3	3	4	3	4	4	44
4	3	4	3	3	4	4	3	4	2	3	3	3	43
4	2	3	4	4	3	4	3	4	1	3	3	4	42
4	3	3	3	3	4	4	3	2	4	3	3	3	42
3	4	4	2	2	3	4	3	3	4	3	3	4	42
3	3	4	4	2	3	3	3	3	4	4	3	3	42
3	4	4	2	4	4	3	3	3	1	3	3	4	41
4	4	4	4	3	0	3	3	3	4	0	4	4	40
4	3	4	2	2	2	2	3	3	4	3	4	4	40
3	3	4	3	2	4	4	4	2	2	3	3	2	39
3	4	4	3	3	4	2	3	3	1	3	3	3	39
3	4	3	1	3	4	4	3	3	1	3	4	3	39
4	3	4	0	3	4	3	3	3	4	3	1	4	39
2	3	4	3	4	3	4	3	3	1	3	2	3	38
3	3	1	2	3	3	3	3	2	4	4	4	3	38
4	3	4	0	4	4	2	3	1	4	3	2	3	37
3	3	4	3	2	2	2	4	2	4	3	2	3	37
4	4	4	2	?	2	2	3	3	4	3	3	3	37
3	3	4	3	3	3	1	4	2	4	0	3	3	36
3	3	2	3	2	4	2	3	3	1	3	4	3	36
3	3	4	3	3	3	2	3	3	1	3	2	2	35
3	2	4	1	4	2	2	3	2	1	4	3	4	35
3	4	4	2	2	1	3	3	2	4	0	3	4	35
4	3	0	1	3	2	4	3	2	2	3	3	4	34
2	4	4	0	3	3	4	3	0	4	0	3	3	33
2	3	4	2	3	4	2	2	3	1	0	3	4	33
4	3	2	3	?	2	4	3	2	1	3	3	3	33
3	3	3	2	2	4	1	2	3	1	4	2	3	33
4	3	2	1	1	2	3	3	1	1	4	3	3	31
3	2	1	2	2	2	2	3	2	4	3	2	3	31
2	3	4	0	4	2	2	2	1	4	0	2	3	29
2	2	4	0	?	3	2	2	2	4	0	3	3	27

ed beds)

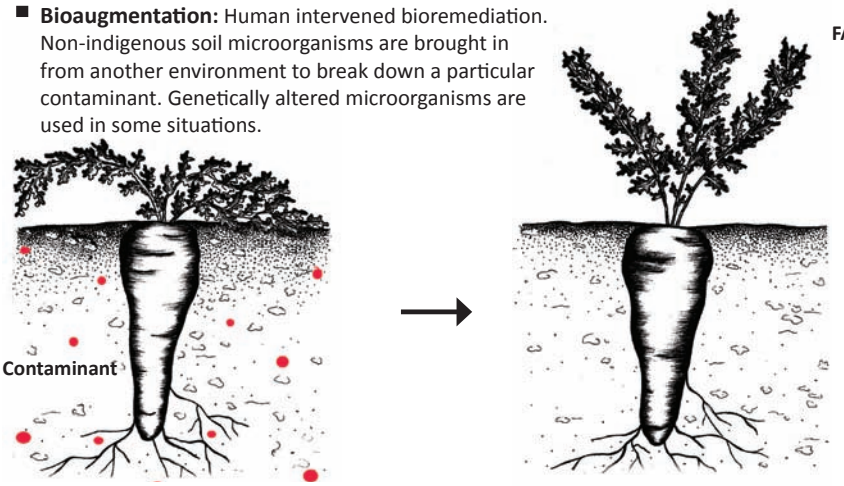
Appendix B: Soil Remediation Methods

Sources: United States Environmental Protection Agency, "A Citizen's Guide to Bioremediation" and "Phytoremediation Resource Guide," Heinegg et al. "Soil Contamination and Urban Agriculture," and Stamets *Mycelium Running*.

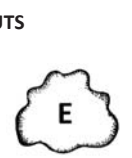
BIOREMEDIATION

A biological soil remediation process that uses bacteria, fungi, and plants to break down contaminants into a less harmful form.

- **Natural Attenuation:** The natural occurrence of bioremediation through microorganisms that are indigenous to the soil. Process takes place without human intervention.
- **Biostimulation:** Human intervened bioremediation. Indigenous microbial populations are used but soil conditions, such as moisture, temperature and nutrient availability, are controlled to enhance the natural process.
- **Bioaugmentation:** Human intervened bioremediation. Non-indigenous soil microorganisms are brought in from another environment to break down a particular contaminant. Genetically altered microorganisms are used in some situations.



INPUTS



Electron Acceptor allows microorganism to gain energy by breaking chemical bonds and transferring electrons away from the contaminant. Ex. oxygen, nitrate, and carbon dioxide.

Contaminant

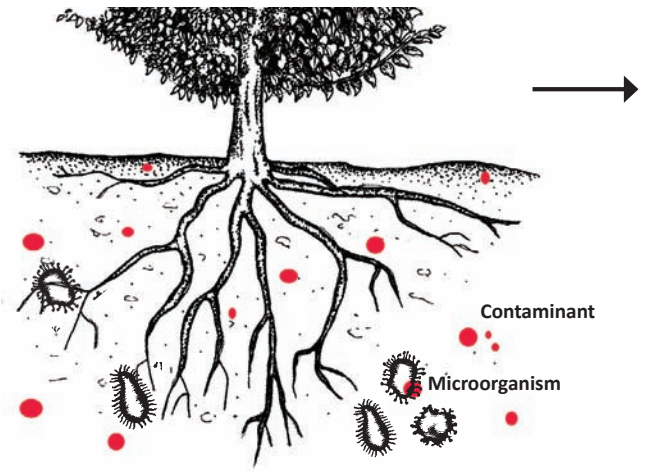
Microorganism capable of degrading the specific contaminant.

FACTORS AFFECTING SUCCESS

- **Moisture** allows water and nutrients to be transported, through diffusion, into and out of the cell.
- **Temperature** controls the rate of enzymatic reactions within microorganisms. Generally activity within cells increases with a rise in temperature.
- **Nutrient Availability** determines the amount of energy microorganisms have. Essential nutrients include nitrogen and phosphorus, as well as minor elements such as sulfur, potassium and calcium.
- **pH** affects the availability of nutrients, and many microbial species require a specific pH range for survival.

RHIZODEGRADATION/ PLANT-ASSISTED BIOREMEDIATION

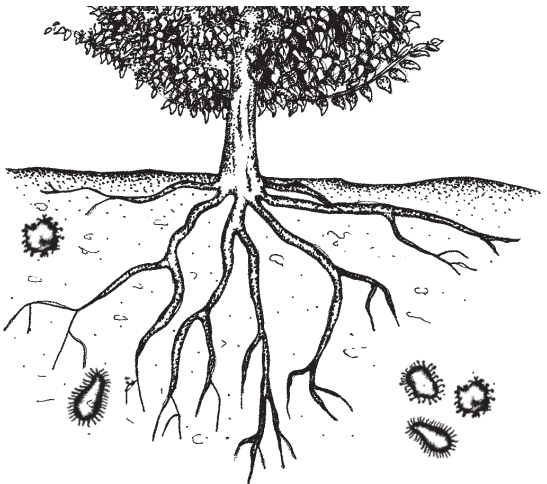
An in situ (on site) soil remediation method that uses the rhizosphere of plants to help microbes, such as yeast, fungi, or bacteria, break down contaminants into a less harmful form.



Plants help microorganisms break down contaminants by releasing sugars, alcohols, and acids from their roots which provides nutrients for microorganisms. Plants also loosen soil with their roots and allow water to move into the soil, giving microorganisms moisture and allowing them to transfer nutrients and water into their cell bodies.

ADVANTAGES: inexpensive, process powered by energy from the sun, aesthetically pleasing, causes little disturbance to the environment, and degrades contaminants.

DISADVANTAGES: time-consuming.



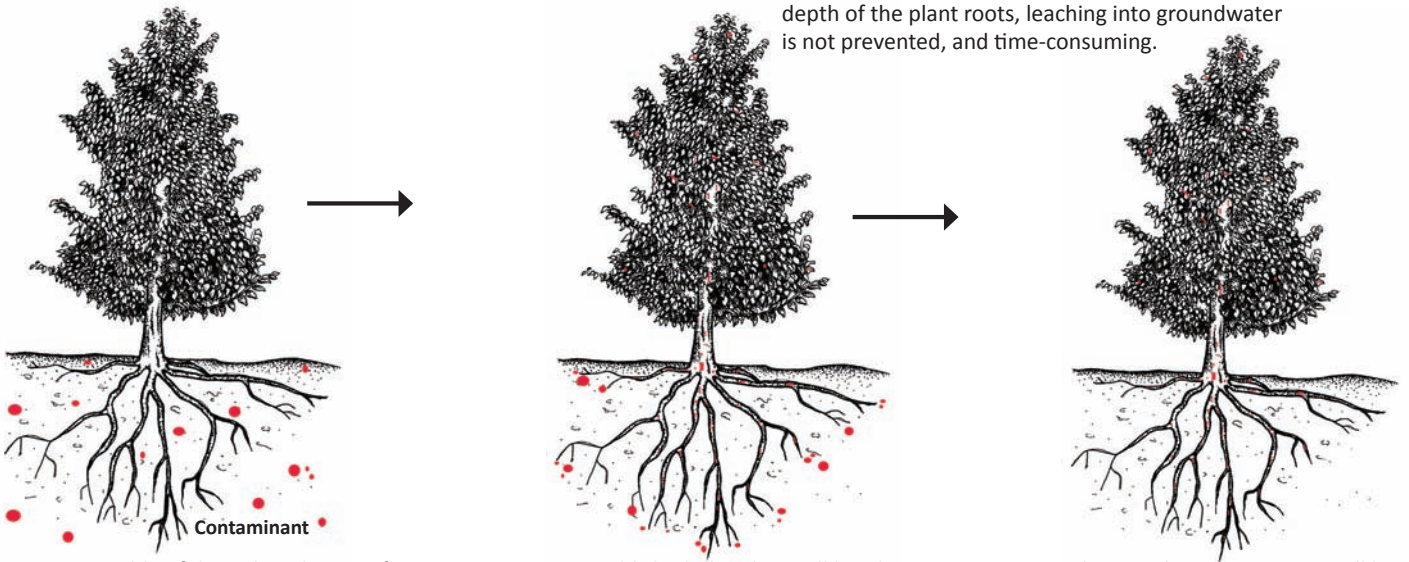
With the help of plants, microorganisms can more rapidly break down contaminants into a non-harmful form leaving the soil free of contamination.

PHYTODEGRATION

An in situ (on site) soil remediation method that uses plants metabolic processes to break contaminants down into a less harmful form.

ADVANTAGES: inexpensive, process powered by energy from the sun, aesthetically pleasing, causes little disturbance to the environment, and degrades contaminants.

DISADVANTAGES: remediation confined to the depth of the plant roots, leaching into groundwater is not prevented, and time-consuming.



A species capable of degrading the specific contaminate is planted into the soil. Poplar trees are fast growing and efficient at breaking down contaminants on many sites.

Once established, the plant will break down the contaminants and take them up into its tissue to use as nutrients.

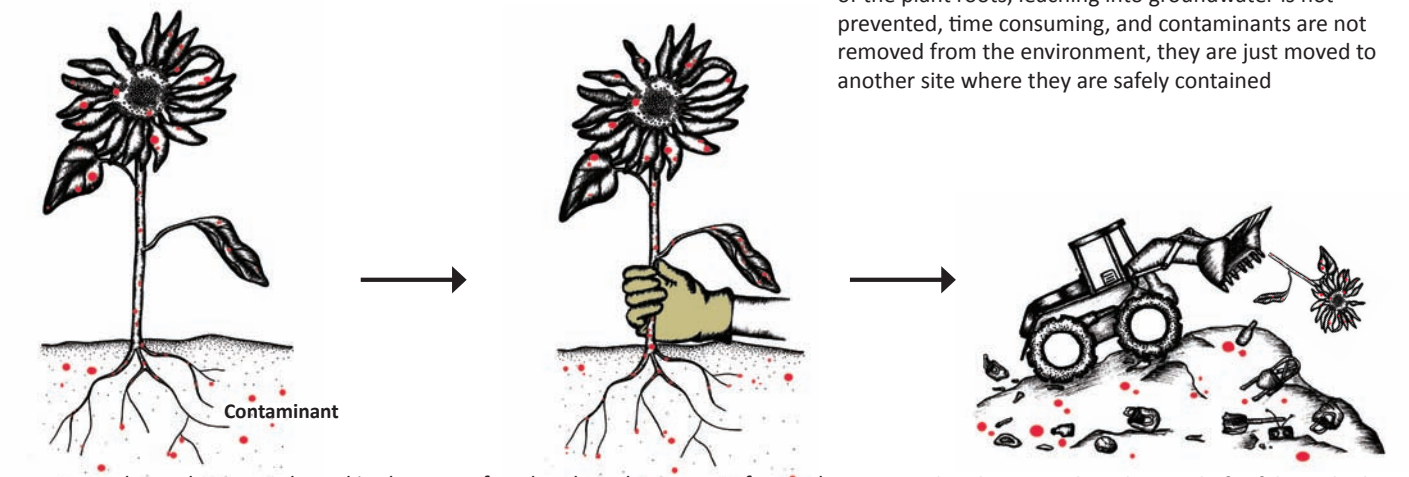
With time, the contaminants will be broken down into a less toxic form and removed from the soil.

PHYTOEXTRACTION

An in situ (on site) soil remediation method that uses hyperaccumulator plants to pull contaminants out of the soil, and store the contaminants in the plant's above-ground biomass.

ADVANTAGES: inexpensive, process powered by energy from the sun, aesthetically pleasing, and causes little disturbance to the environment

DISADVANTAGES: remediation confined to the depth of the plant roots, leaching into groundwater is not prevented, time consuming, and contaminants are not removed from the environment, they are just moved to another site where they are safely contained



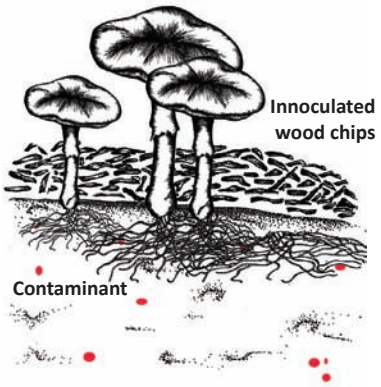
Hyperaccumulator plants are planted in the contaminated soil. Hyperaccumulator plants accumulate trace elements in their above-ground biomass. Ex. sunflowers, geraniums, and Indian mustard.

After the plants have grown for weeks or months, their roots pull up the surrounding contaminants. The plants are then removed from the soil using gloves.

The plants are then disposed of safely, and taken to a waste management site such as a landfill. Some metals can be composted and recycled if taken to a site specializing in carrying out this process.

MYCOREMEDIATION

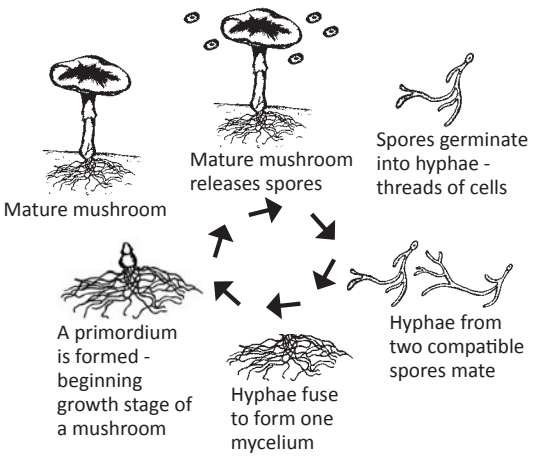
An in situ (on site) soil remediation method that uses fungi, molecular disassemblers, to break contaminants down into a form that is less harmful.



Sample Method
Wood chips are innoculated with mycelium that are a native species. The mycelium are then spread over the contaminated soil as a layer of sheet mulch. The mycelium will receive energy by taking the long-chained toxins and breaking them into smaller, less toxic forms.

Sample Method
Spawn, any material innoculated with mycelium, is raked or laid on top of the contaminated soil. It is then covered with a layer of cardboard and a loose layer of straw to create a mulch layer about one and a half feet deep.

Life cycle of a mushroom



ADVANTAGES: inexpensive, process powered by energy from the sun, causes little disturbance to the environment, degrades or removes contaminants, and brings life back to the soil increasing microbial communities .

DISADVANTAGES: remediation confined to the depth of the mycelia, time-consuming and may take more than one application depending on the level of contamination, and a fungi expert is needed to make the remediation process a success.

ENERGY AND RESOURCE INTENSIVE SOIL REMEDIATION METHODS

The remediation methods excavation, geotextiles, soil washing, and soil vapor are effective at removing contaminants from the soil, and they are efficient with time, taking only a season to carry out. However, the methods are expensive and they pollute the air, use tremendous amounts of energy, and harm the environment with the effects of their disposal.

Excavation uses heavy machinery to physically remove the contaminated soil and take it, in most cases, to a landfill. After the contaminated soil is removed, new clean soil is brought in to the site to replace it.

Geotextiles takes the excavation method one step further. After the contaminated soil has been removed with heavy machinery, a synthetic material (geotextile), that is impermeable to contaminants, is laid down before new clean soil is brought in. This synthetic material acts like a protective barrier and prevents any remaining contaminants that the excavator was unable to get from migrating into the clean soil.

Soil Washing physically removes the contaminated soil and takes it to a specialized treatment site. Once the soil has been treated it is returned to the site.

Soil Vapor extracts the contaminants from the soil through wells and pipes that are placed in the soil on site. This is the most effective remediation method, but also the most expensive.

Appendix C: Map Data Attribution

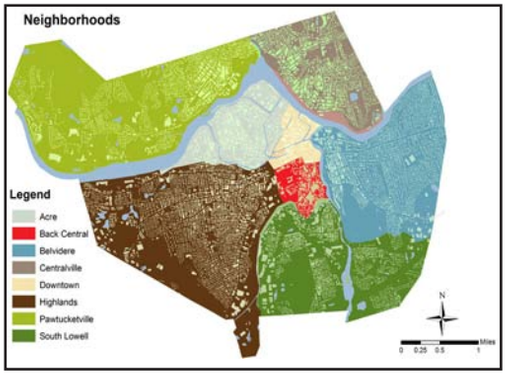
Unless otherwise indicated, the maps in this document are for planning purposes only. These maps were created using data from multiple sources. These include:

MassGIS. Office of Geographic Information Commonwealth of Massachusetts, Information Technology Division

USDA NRCS Geospatial Data Gateway

City of Lowell. Management Information Systems Department. Joseph Donovan.

Original Data Produced by Authors



loca tion of neighborhoods

Context: Ethnicity, Page 5

Map shows the location of the eight main neighborhoods in Lowell.

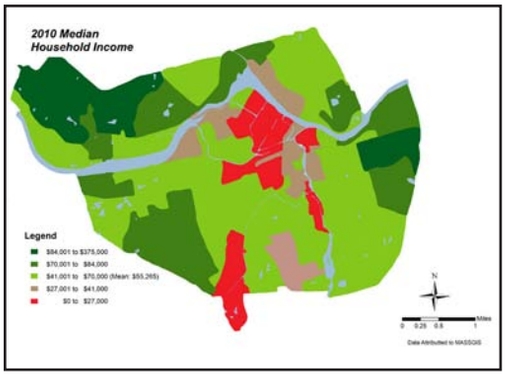
data sources

MassGIS.

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
- Towns. Towns_MA_2008. Accessed Jan 5, 2013.

Original Data Produced by Authors

- Neighborhood Boundaries. Information taken from the city of Lowell. Created Jan 6, 2013.



2010 Median h ousehold inco Me

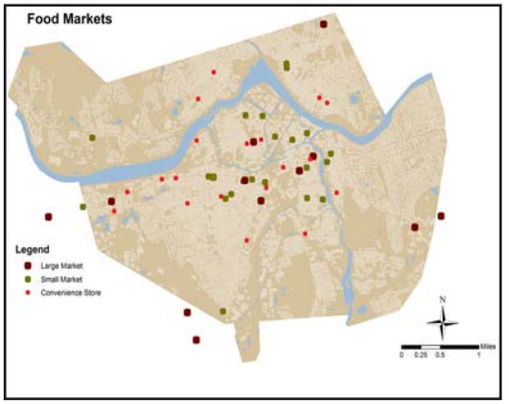
Access, Afford, Page 10

Map shows the spacial distribution of income levels in Lowell.

data sources

USDA NRCS Geospatial Data Gateway

- Income. Demographics_USA_Median_Household_Income. Accessed March 6, 2013.



l oca tion of food Markets

Access, Location, Page 13

Map shows the location of food markets in Lowell.

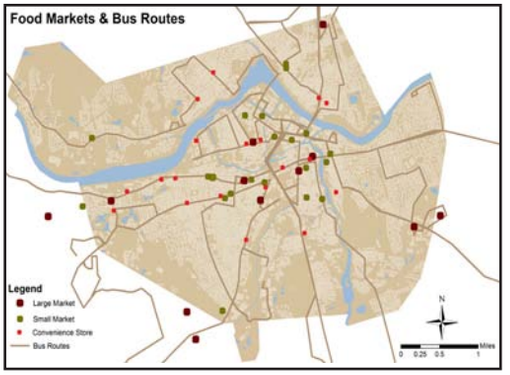
data sources

MassGIS

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
- Towns. Towns_MA_2008. Accessed Jan 5, 2013.

Original Data Produced by Authors

- Large Markets, Small Markets, Convenience Stores. Information taken from the 2013 *Lowell Community Food Assessment*. Created Feb 4, 2013.



location of food Markets and bus routes

Access, Location, Page 14

Map shows the location of food markets and bus routes in Lowell.

data sources

MassGIS

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
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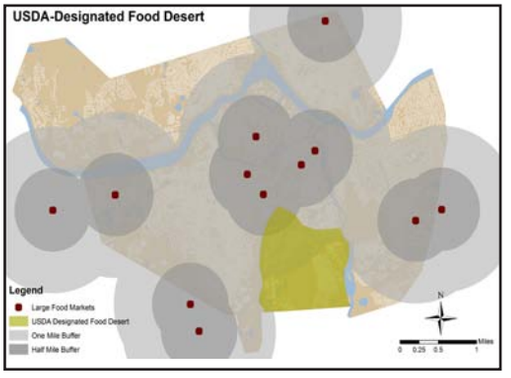
Original Data Produced by Authors

- Large Markets, Small Markets, Convenience Stores. Information taken from the 2013 *Lowell Community Food Assessment.* Created Feb 4, 2013.
- Bus Routes. Information taken from the Lowell Regional Transit Authority. Created Feb 4, 2013.



location of usda-designated food desert

Access, Location, Page 15

Map shows the location of the USDA-Designated Food Desert in Lowell, and large food markets with a half-mile and one-mile buffer.

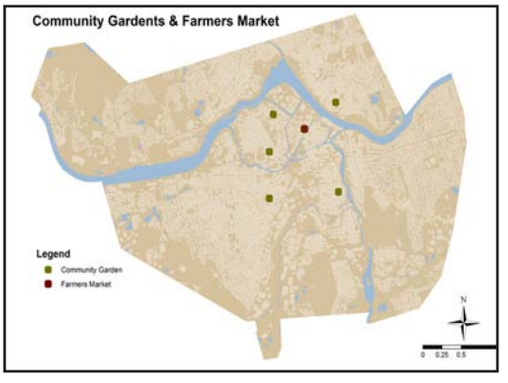
data sources

MassGIS.

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
- Towns. Towns_MA_2008. Accessed Jan 5, 2013.

Original Data Produced by Authors

- Large Food Markets. Information taken from the 2013 *Lowell Community Food Assessment*. Created Feb 4, 2013.
- USDA-Designated Food Desert. Information taken from the USDA Food Desert Locator. Created Feb 4, 2013.
- One-Mile Buffer. Information processed Feb 4, 2013.
- Half-Mile Buffer. Information processed Feb 5, 2013.



location of coMMunity gardens and the farMers Market

Access, Location, Page16

Map shows the location of community gardens and the farmers market in Lowell.

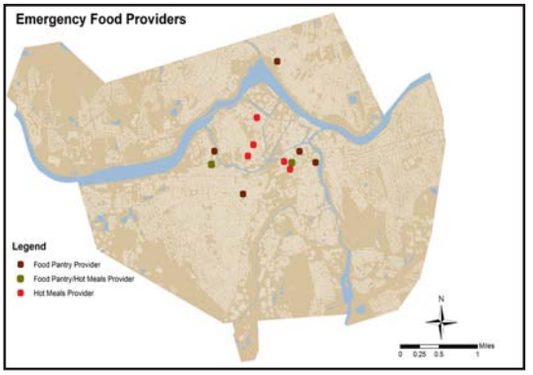
data sources

MassGIS

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
- Towns. Towns_MA_2008. Accessed Jan 5, 2013.

Original Data Produced by Authors

- Community Garden and Farmers Market. Information taken from the city of Lowell. Created Feb 4, 2013.
- Bus Routes. Information taken from the Lowell Regional Transit Authority. Created Feb 4, 2013.



location of emergency food providers

Access, Location, Page 18

Map shows the location of emergency food providers in Lowell.

data sources

MassGIS

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
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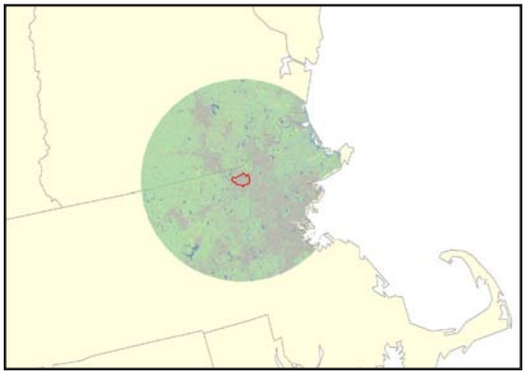
Original Data Produced by Authors

- Food Pantry, Food Pantry and Hot Meal Provider. Hot Meal Provider. Information taken from the 2013 *Lowell Community Food Assessment*. Created Feb 6, 2013.



cropland within a thirty-Mile radius of lowell

Context, Lowell's Food Needs Page 19

Map shows existing farmland within a thirty-mile radius of Lowell.

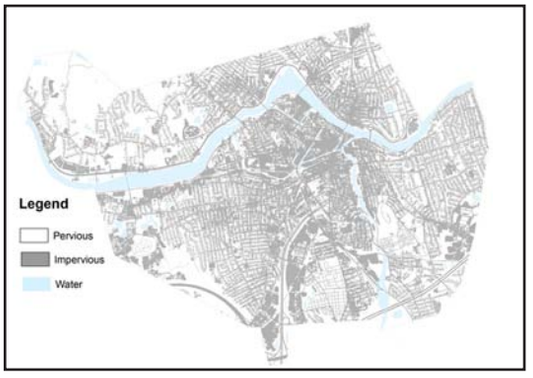
data sources

MassGIS.

- Towns. Towns_MA_2008. Accessed Jan 5, 2013.
- State Boundaries. NEWENGLAND_POLY.shp. Accessed Jan 24, 2013.

Original Data Produced by Authors

- 30-Mile Buffer. Processed Jan 24, 2013.



iMpervious surfaces

Recommendations, Backyard Neighborhood Block Gardens, Page 32

Map shows the impervious surfaces in Lowell.

data sources

MassGIS

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
- Towns. Towns_MA_2008. Accessed Jan 5, 2013.
- Impervious Surface and Pervious Surface. Imp_ne2.img. Accessed March 13, 2013

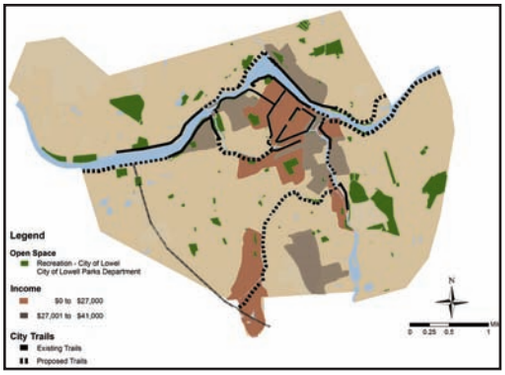
flat rooftops for potential rooftop gardens

Recommendations, Rooftop Gardens, Page 37

data sources

Bing Maps

- Bing Maps Aerial Photo. Bing Maps. Accessed March 13, 2013



potential spaces for public orchards

Recommendations, Public Orchards, Page 43

data sources

MassGIS

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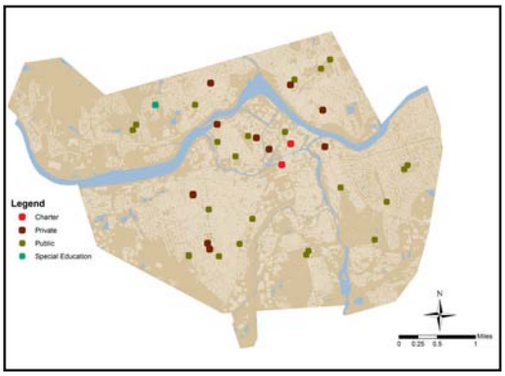
- Towns. Towns_MA_2008. Accessed Jan 5, 2013.
- Income. Demographics_USA_Median_Household_Income. Accessed March 6, 2013.
- Open Space. OPENSPACE_Poly.shp. Accessed Feb 11, 2013.

Original Data Produced by Authors

- Location of Food Resources. Information taken from the Lowell Community Food Assessment. Created April 20, 2013.



lowell schools

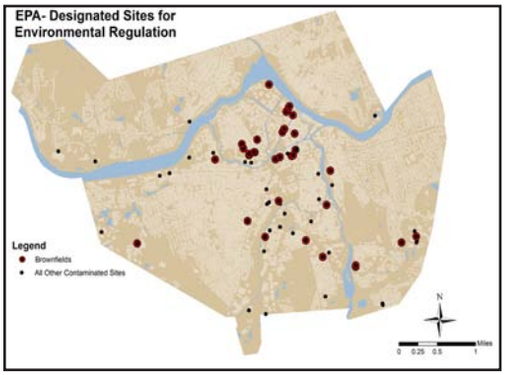
Recommendations, Public Orchards, Page 46

Map shows the location of the types of schools in Lowell.

data sources

MassGIS

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
- Towns. Towns_MA_2008. Accessed Jan 5, 2013.
- Schools. Schools_PK_to_High_School. Accessed March 13, 2013.



epa-designated sites for environmental regulation

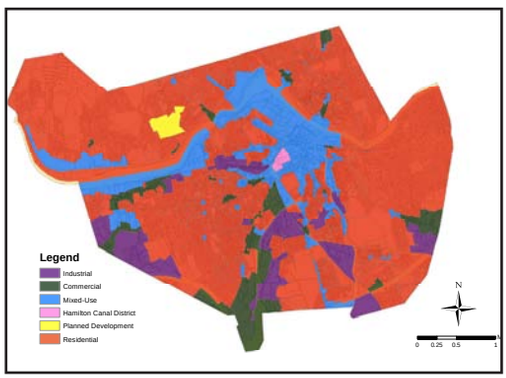
Soil Contamination, Page 53

Map shows the location of the EPA-Designated sites for environmental regulation in Lowell.

data sources

MassGIS.

- Structures. Buildings_12. Structures_poly 160. Accessed Jan 5, 2013.
- Hydrology. Hydro_2009. HYDRO25K_ARC. Accessed Jan 5, 2013.
- Towns. Towns_MA_2008. Accessed Jan 5, 2013.
- Brownfields and All Other Contaminated Sites. GEODATA_Featureclass_MAR2013. Accessed March 11, 2013.



lowell zoning parcels

Zoning, Page 69

data sources

MassGIS.

- Town lines. TOWNS_POLY. Accessed January 15, 2013.

City of Lowell

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- City Parcels. parcels. Accessed February 15, 2013.