Growing Green:

Measuring Benefits, Overcoming Barriers, and Nurturing Opportunities for Urban Agriculture in Boston

By

The Conservation Law Foundation and CLF Ventures, Inc.

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EXECUTIVE SUMMARY

EVERYTHING OLD IS NEW AGAIN: THE PROMISE OF URBAN AGRICULTURE

The Parisian maraîchers of 160 years ago pioneered intensive sustainable urban agriculture, producing year round all the vegetables consumed by Parisians on one-sixteenth of the land within the Paris city limits—with enough left over for export to England.[1] And what made it possible, aside from exceptional skill and innovative season extenders like cloches and cold frames? Horse manure and lots of it — ranging from 100 to 400 tons per acre.[2]

Image Credit: The Hipcrime Vocab

Urban agriculture—growing food in and around cities—is widely practiced around the world today; over 800 million people engage in urban food growing and processing as a means to generate income, and it plays a significant role in building food security, particularly for low income and poor city dwellers.[3] Urban agriculture can make a serious contribution to meeting the food needs of increasingly large urban populations: there are, for example, 80,000 urban farmers in Berlin, and China's fourteen largest cities produce eighty-five percent or more of their vegetables.[4]

Sustainable urban agriculture is a key component in creating more livable, carbon resilient, healthier, economically vibrant, and environmentally sustainable cities, and it holds great promise for the Greater Boston region. Based on practices that have as primary goals the promotion of long-term soil fertility, conservation of water, and efficient energy use, sustainable agriculture is the foundation for a strong food system that provides a healthy food supply and economic benefit and promotes environmental protection and stewardship. The City of Boston has taken important steps over the past two years to advance urban agriculture, and new businesses are taking root. There is a palpable sense of excitement about the potential for this new urban vision for agriculture, and, equally important, for communities; possibilities abound. Inexpensive hoop houses, hydroponics, vertical growing, rooftop market gardens—these technologies can bring more fresh food to more people more months of the year, even in Boston, and even on a limited number of acres.

The example of the Parisian maraîchers shows that Boston's emerging vision for urban agriculture is very possible. But we believe it is more than possible—it is a necessity, and an urgent one at that. Food lies at the intersection of many of our most pressing problems: the obesity epidemic, soaring healthcare costs, a faltering economy, and climate change. By creating a healthier local food system that is integrated within a sustainable regional food system, we can begin to tackle some of these issues. A sustainable food system is more decentralized, produces food in a manner that does not deplete but rather builds precious soil, uses water and energy efficiently and protects water resources. It is a system that values and protects the agricultural labor force, keeps more food dollars in the local economy, and broadens access to fresh healthy food for all. And, it is a system that will help us adapt to the already changing climate we now inhabit.

No less than 6,000 new temperature records were set during the recent March 2012 heat wave.[5] The International Energy Agency's recent projection of a 10.8 degree F temperature increase over pre-industrial levels by the end of this century underscores the fact that a more decentralized food system will be necessary to enable our communities to better adapt to changing climate conditions, including the impacts of more frequent severe weather.[6] Over time, and in the aggregate, sustainable farming practices can also reduce greenhouse gas emissions by sequestering carbon and, though composting, diverting organic wastes from the solid waste stream—the modern version of horse manure—that would otherwise end up in landfills. Urban agriculture can make city

living more attractive and healthier, an important consideration given the significantly lower carbon footprint of modern city dwellers compared to their auto-dependent suburban and rural counterparts.

Not only can Boston begin to produce locally more of the food Bostonians consume, it can also become an increasingly important hub in the development of a strong New England regional food system.

Benefits for Boston

We examined the economic development potential for urban agriculture in Greater Boston, paired with an assessment of environmental and health co-benefits. In addition, we assessed the business model for City Growers, a Boston-based entrepreneurial urban agricultural startup company, to guide our review of opportunities and challenges to expanding urban agriculture in Boston.

Our research shows that placing fifty acres of Boston's urban land in agricultural production would:

- Create between two and five direct, on-farm jobs per acre, or 130 - 220 total jobs;
- Create additional jobs in the agricultural services sector (equipment sales, composting and soil inputs, and food processing);
- Sequester about 114 tons of CO2 in well-maintained soil per year;
- Support the development of compost markets that statewide would yield an additional 4,700 tons of avoided CO2 emissions annually while helping Massachusetts achieve a 35% organic waste diversion goal; and
- Generate approximately 1.5 million pounds of fresh produce for sale into local markets, providing local communities with a nearby source of healthy food.

These benefits are summarized in Figure 1 below. While based on a fifty-acre scenario, these results are scalable.

The greatest potential for job creation occurs when most of the economic value associated with food production and processing remains on the farm, achieved through farm marketing and direct-to-consumer sales. High value retention allows farm businesses to generate the level of revenue needed to support a sufficient number of employees to handle labor-intensive farming practices as well as direct marketing and consumer sales administration. Even using intensive practices, farming an individual small plot may not be economically viable as a commercial operation, but small plots become economically viable when they are aggregated by a single entity that can centrally manage farming operations through pooled resources, and command additional weight in the market through increased supply. Urban agriculture in Boston lends itself to this model due to the relatively close proximity of multiple small plots, and the close proximity to direct-to-consumer markets.

While the number of jobs created on the farm itself remains somewhat limited, urban agriculture supports further local economic development by creating demand for agricultural support services such as equipment sales and services, compost production, and local food processing.

Figure 1. The Benefits of Urban Agriculture in Boston

Getting There

We researched and analyzed barriers to expanded food production including conducting twenty-two interviews with food, agriculture, and environmental policy experts. We organized our research within a food supply chain framework, focusing on key policies and market barriers that affect various stages—pre-production, production, value-add, distribution, marketing, consumption, and waste. For example, policies related to land access and soil quality affect pre-production, production, and potential consumption stages. See Figure 2 below.

Figure 2. Food System Supply Chain

Access to land and tenure arrangements; soil quality and related regulatory concerns; high cost of food processing, storage, and transportation infrastructure; a nascent, undeveloped market for urban farm products; and lack of political infrastructure adequately to represent and advance farming interests emerged as the primary barriers. In particular, we found that:

- There is a need for more low- or no-cost access to land. Sources of such land include the Commonwealth and its subdivisions (e.g., DCR) and cities and municipalities. Boston, for example is now piloting an Urban Agriculture Overlay District that permits urban farming on City-owned land, while retaining the underlying zoning. Properly structured to avoid potential future restrictions on the City's ability to use that land for other purposes, this approach is promising. Nevertheless, the relatively short term of the permitted use (five years) may not be sufficient for farmers to be able to obtain financing for necessary infrastructure investment.

- Currently, there is no inventory of state-owned lands that could be used for agriculture. CLF is working to advance that research.

- Concerns about the quality of urban soils represent technical, political, and legal issues. There is a substantial need for stakeholder education regarding the proper methods, as recommended by the United States Environmental Protection Agency, to grow food safely in urban soils, and the relatively low risks—and significant benefits—associated with growing and consuming fresh foods grown in urban settings. Equally important, existing state law governing reporting and cleanup obligations associated with contaminated soils should be clarified to provide assurance that urban land owners/operators are not liable for contamination present in urban soils at background levels as a result of routine activities such as the now phased out use of leaded gas, use of leaded paints and pressure treated wood, or attributable to fill.

- Urban agriculture is uniquely dependent on large volumes of high quality compost and soil amendments, and currently, there is a lack of sufficient supply to support any substantial growth in urban agriculture. There is real potential for a profitable market for these materials to develop, particularly in light of recent efforts by the Commonwealth to make it easier to site and permit composting and anaerobic digestion facilities.

- Capital and operating costs associated with properly permitted food processing / value-add facilities, refrigerated (or other) crop storage, and transportation is prohibitive. Innovation is occurring—the Massachusetts Mobile Poultry Processing Unit is now fully operational and available to small scale poultry producers for legal, on-site slaughter. There is a need for more shared infrastructure, and more financing to support development of that infrastructure.

- Markets for urban agriculture products are nascent. Small growers lack adequate access to larger scale purchasers that would provide the needed revenue to scale up. There is a need for strategies (both information systems and physical infrastructure) to aggregate the products of smaller urban farms to serve larger institutional customers and mid-size customers such as restaurants and hotels. Programs like Farm to School and laws like the MA School Nutrition Act have helped to facilitate market development, but more is needed. Branding efforts, such as Commonwealth Quality Seal, can be a powerful tool for developing markets and to communicate other benefits—social, economic, environmental—associated with consuming locally grown food.

- Urban agriculture interests—and more broadly, agriculture—often lacks sufficient political support and representation in local land use decisions. Moreover, there is a lack of political infrastructure linking local efforts to state efforts (such as the work of the newly constituted Massachusetts Food Policy Council) and there currently is no structure linking the New England states together to advance the development of a regional food system. Boston can produce substantial quantities of its own fresh food, but the reality is that it will remain the region's largest *consumer* and can play a powerful role in the development of a regional food system. The greatest economic potential for agriculture and related industries in Boston, as well, depends on the City's ability to effectively link to region's developing food system.

Massachusetts and the City of Boston have long been leaders when it comes to innovation, environmental protection, smart energy use, and climate change. Many of us enjoy a high quality of life. Boston can be proud of the fact that it now joins other cities, like New York, Portland, San Francisco, and San Antonio that are reviving and remaking the vision of urban agriculture. Much good work has been done, yet if we are to realize its full potential, we must carefully tend the growing effort to ensure urban agriculture thrives.

Case Study of City Growers

When Glynn Lloyd and Margaret Connors look around the neighborhoods of Boston, they see potential on every street corner. In between houses, buildings, and stores are vacant lots ripe for redevelopment. Some are casualties of the recent economic downturn, but others have remained idle for 30 years, leaving holes in the community.

In Glynn and Margaret's vision, these small parcels can become productive pieces of land, providing jobs for community residents and food for families. In 2009, Glynn and Margaret launched City Growers, a for-profit farming business that targets its growing strategy to the needs of the local market, as well as to the needs of its surrounding community. The founders began converting available spaces into a network of small plots that grow food for local restaurants and retailers. Unlike community gardens, where a household grows just a few plants for its own consumption, these dispersed parcels comprise a single "farm" aiming to drive economic growth. City Growers has gained access to five acres (although it has not been able to grow gardens on all this acreage), and generated $22,000 in sales in 2011. Both of City Growers' founders bring extensive backgrounds in business and food to the venture, and they have assembled a team of similarly experienced individuals to manage business and farming operations. Glynn is also founder and chief executive officer of City Fresh Foods, which provides institutional meals to local schools, child care centers, and homebound elders. He co-founded City Growers to enable City Fresh and others to buy higher quality fresh produce from local, sustainable farms in Boston rather than from large institutional food purveyors across the country. Margaret is a Wellness Coordinator at a local Boston public school, where she actively advocates for more nutritious food in schools. Margaret's vision for City Growers is to grow food within the city limits to help meet the nutritional needs of the most disadvantaged urban residents, including youth, elders, and those struggling with poverty, unemployment, and obesity.

It was important to the founders that City Growers be a for-profit enterprise to bring economic development to the community, rather than a non-profit that merely served the residents. By focusing on building a sustainable business, they would create direct jobs on the farm as well as ancillary jobs with the other local employers that would do business with City Growers. Most importantly, these jobs and the dollars associated with them would go to local residents and remain in the local economy.

Urban farming introduces new complexities to growing food, which is already a very challenging endeavor. Local zoning codes can accommodate residential, commercial, and industrial uses, but may have no provisions for an urban parcel that grows squash and salad for the restaurant down the street. While banks may have well-established frameworks for farm loans based on land ownership and other traditional assets, models have not yet been established for a distributed network of small plots with complex ownership agreements.

One of City Growers' first challenges is building a network of farm plots in Boston, a city in the early stages of implementing agricultural zoning. Unlike a rural setting, where land has been set aside for cultivation, urban plots may have once had industrial uses. Their owners, hoping for commercial redevelopment in the future, may be resistant to cultivation on their land. For urban agriculture to succeed, many issues must be negotiated. What uses will be permitted? How long will the land be available for use? What efforts are required to amend sites for growing food? Who is responsible for building the necessary infrastructure for water and equipment access? Are any permits required? In the absence of the necessary frameworks, City Growers has approached this challenge creatively, working with the owners of each individual plot of land to identify terms that are mutually agreeable.

Building a successful urban farming business requires the support of neighbors; as local residents, Glynn and Margaret understand this. They know that their farmland is sometimes someone else's backyard, and that noise, smells, and appearance matter. If the local residents or their representatives do not want a farm in the neighborhood, they can make it very difficult for City Growers to acquire the land and permits to succeed. On the other hand, if residents see the organization as one that generates jobs and removes urban blight, they can facilitate the process. The primary objection that Margaret and Glynn have encountered is concern over whether the food will be safe to eat due to the potential presence of contaminants in urban soils. To overcome these fears, City Growers has invested in ongoing communication about best practices for safe urban farming, such as raised beds, use of geotextile barriers, and composting.

Initial capital investments for any farm can be high, but urban farms must surmount several expensive barriers. Most obvious is soil preparation, which presents an upfront cost that must be paid before growing can begin. However, there are additional costs to adapting a parcel of land for cultivation, including water hookup, landscaping, curb cuts, and compost. To raise the necessary capital, City Growers has sought funding from a wide variety of sources, including foundation grants, state grants, and private investors. One strategy it has employed is to create a second organization, the Urban Farming Institute of Boston, which is set up as a non-profit. The Urban Farming Institute of Boston will manage the land and infrastructure development necessary to build the farms, separating land acquisition, preparation, and infrastructure development from the operations of growing and selling food. Because it is a non-profit, the Urban Farming Institute will be able to obtain grants and donations that would otherwise be inaccessible to City Grower's for-profit business. As City Growers' business expands, the Urban Farming Institute will advance other aspects of the vision: education, community outreach, and making food available for low- income community members. City Growers hopes to breathe fresh air and vitality into the surrounding communities by creating a profitable enterprise with significant social and environmental benefits.

BENEFITS OF URBAN AGRICULTURE

Urban agriculture can provide economic, environmental, and human health benefits to the communities in which it is practiced. We analyzed the potential for these benefits in Boston, based on putting 50 acres of land into urban agricultural production. Our analysis assumes all 50 acres are used to grow produce and that all produce is grown outside in soil (either in the ground or in raised beds).

JOB CREATION AND ECONOMIC BENEFITS ASSESSMENT

The jobs created by urban agriculture provide direct employment to local community residents and will support further local economic development by creating demand for agricultural support services, including equipment sales and services, compost production, local food delivery, direct sales, and food processing. Jobs generated by support services will further bolster the local economy, although these jobs are more difficult to quantify.

Image credit: NatalieMaynor via Flickr

Our analysis demonstrates that the greatest potential for job creation from farming in Boston occurs when the farm retains control over, and thereby also derives profit from, post-production activities. For example, an urban farm that grows food and adds value to that food by processing it—perhaps by making salsa from vegetables or cheese from milk—will earn more revenue than an urban farm that simply grows vegetables, particularly if all the ingredients are grown on the farm or otherwise inexpensive to obtain. Retaining those job functions allows the farm business to generate the level of revenue needed to conduct intensive farming practices in addition to marketing and consumer sales administration. An urban farm business can support more jobs through aggregated economies of scale. Even using intensive practices, farming an individual small plot may not be as economically viable as a larger commercial operation. Farming small plots can become economically viable, however, when they are aggregated by a single entity, such as City Growers, that can centrally manage farming operations through pooled resources, and can also command additional weight in the market through increased supply. Urban

agriculture in Boston lends itself to this model due limited availability of large tracts of land, and to the relatively close proximity of multiple small plots and the close proximity to direct-to-consumer markets.

Much of the existing research into local, small-scale agriculture is focused on more rural areas, typically in the Midwest, with historical agricultural economies that have been hurt by the modern consolidation and commoditization of the food system. Most studies of such operations have shown that potential exists for local agriculture to supply fresh fruits and vegetables to nearby consumers while creating significant job growth and local economic improvements. [7] There is comparatively little research on the economics of small-scale, for-profit, commercial urban agriculture businesses; there are few commercial urban agriculture businesses from which to gather data. The majority of U.S. urban food growing takes place in community gardens or similar operations that grow food but do not sell it for profit. These are typically operated by non-profits, and are supported by volunteer labor and philanthropy.

Table 1. Summary of Existing Urban Agriculture Models

Name	Location	Organizational Structure	Production Mode	Market
Backyard Bounty[8]	Portland, OR	For-profit	In-ground	CSA
Magic Bean Farm[9]	Seattle, WA	For-profit	In-ground	CSA
Big City Farms[10]	Indianapolis, IN	For-profit	In-ground	CSA
Little City Gardens[11]	San Francisco, CA	For-profit	In-ground	Restaurant, caterers
Brother Nature Produce[12]	Detroit, MI	For-profit	In-ground	Famers' market, restaurants, CSA
Green City Growers[13]	Somerville, MA	For-profit	Raised beds	Urban agriculture supplier
Sky Vegetables[14]	Needham, MA	For-profit	Hydroponic	Urban agriculture supplier
Gotham Greens[15]	New York, NY	For-profit	Hydroponic	Retail, restaurants
Top Sprouts[16]	Boston, MA	For-profit	Hydroponic	Urban agriculture supplier
City Farm[17]	Chicago, IL	Non-profit	Raised beds	Farmers' markets, restaurants, CSA, farm stand
The Food Project[18]	Boston, MA	Non-profit	Raised beds	CSA
Growing Home[19]	Chicago, IL	Non-profit	Greenhouse	CSA, farm stand, wholesale
ReVision Urban Farm[20]	Boston, MA	Non-profit	In-ground	CSA, farm stand

To analyze the potential job creation benefits associated with for-profit small-scale urban agriculture businesses, we surveyed the few existing examples in Boston and other U.S. cities. While there are many different models, some of which are shown in Table 1, only a small sub-set of the examples are appropriate for drawing conclusions about opportunities in Boston. These are the businesses in the first five rows of Table 1. Our research shows that while small-scale urban agriculture is labor intensive and capable of generating relatively high levels of gross revenue per acre, the farming can be accomplished by a few, well-trained employees. Although most of the models we reviewed are not located in Boston, they are in cities of similar urban density that are beginning to embrace local food production and urban farming as viable businesses that promote economic development in urban centers. The operations summarized in Table 1 benefit not only from increasing market demand, but also from policy changes that are easing market entry for new urban farm businesses.

In addition to our analysis of existing models, we projected job creation potential based on the business model we helped to develop for City Growers. City Growers has a business goal of putting up to 20 acres of underutilized

urban land into agricultural production. Based on that business plan projection and data from the existing models in Table 1, we estimated the job creation potential of in-ground urban agriculture in Boston.

We used two methods to quantify job creation potential. First, we collected data on farm size and number of employees, from the relevant examples in Table 1. We averaged these data to estimate the number of urban farm employees per acre of farm. Second, we researched the gross revenue potential of existing urban farm businesses to estimate the financial resources available to support local employment. We averaged the revenue data and used Massachusetts labor rates – minimum wage and the state living wage – to estimate the number of employees that could be hired per acre of produce sales.

We projected job creation across four scenarios, illustrated in Table 2, that assume an increasing number of acres will be placed into food production in Boston and surrounding communities. Scenarios 1 and 2 are based on City Growers plans, and include mostly plots located within Boston. Scenarios 3 and 4 assume that additional commercial farming businesses enter the market and double the amount of cultivated land in the Greater Boston area. Scenarios 3 and 4 include more peri-urban plots located outside Boston city limits. We assume that over the course of several years, Boston-based urban farming businesses put more and more land into agricultural production and eventually multiple businesses will be farming a total of 50 acres, roughly the size of Boston Common.

Expansion scenario development factors include City Growers' finite managerial resources and the amount of available underutilized land in Boston. According to the Boston Redevelopment Authority, there are over 1,200 acres of privately owned vacant land in Boston. This does not include over 4,400 acres of public open space, some of which could conceivably be made available for urban farming. These data confirm that our expansions scenarios are realistic, and conservative. City Growers estimates that within this acreage there are over 800 acres that may be suitable for urban farming, suggesting the economic benefit estimated by our analysis is conservative.

Table 2. Expansion Scenarios

Scenario	Boston ¼-acre Plots	Boston 1-acre Plots	Outside Boston ¼-acre Plots	Outside Boston 1-acre Plots	Total ¼-acre Plots	Total 1-acre Plots	Total Acres
1	32	4		2	32	6	**14**
2	40	6		4	40	10	**20**
3	48	7	8	14	56	21	**35**
4	52	9	12	25	64	34	**50**

Key Findings

Urban agriculture has the potential to produce between two and five on-farm jobs per acre, a combination of year-round and seasonal jobs. For example, each farm will likely have a year-round farm manager and hire farm labor during the farming season. Our estimates focus on the number of jobs created during the farming season. The number of jobs can also vary greatly depending on the size of the farm plot (or aggregated plots) and the revenue the farm is able to generate. Based on projections from City Growers we calculated 4.5 jobs per acre would be created. We separately reached an estimate of 2.6 jobs per acre based on the number of jobs at existing operations with farming models similar to City Growers (a subset of Table 1). We applied an alternative methodology to estimate job creation potential based on gross revenue projections and estimated salaries. These "Method 1" (existing model) and "Method 2" (revenue-based) estimates are displayed in Table 3.

Table 3. Summary of Job Creation Potential for Greater Boston

Expansion Scenario	Acres	Total Jobs Assuming 4.5 jobs/acre	Total Jobs Assuming 2.6 jobs/acre	Total Jobs Assuming Boston Living Wage	Total Jobs Assuming Min. Wage Salary
1	14	62	**36**	25	**40**
2	20	89	**52**	35	**57**
3	35	156	**91**	61	**100**
4	50	223	**130**	88	**143**

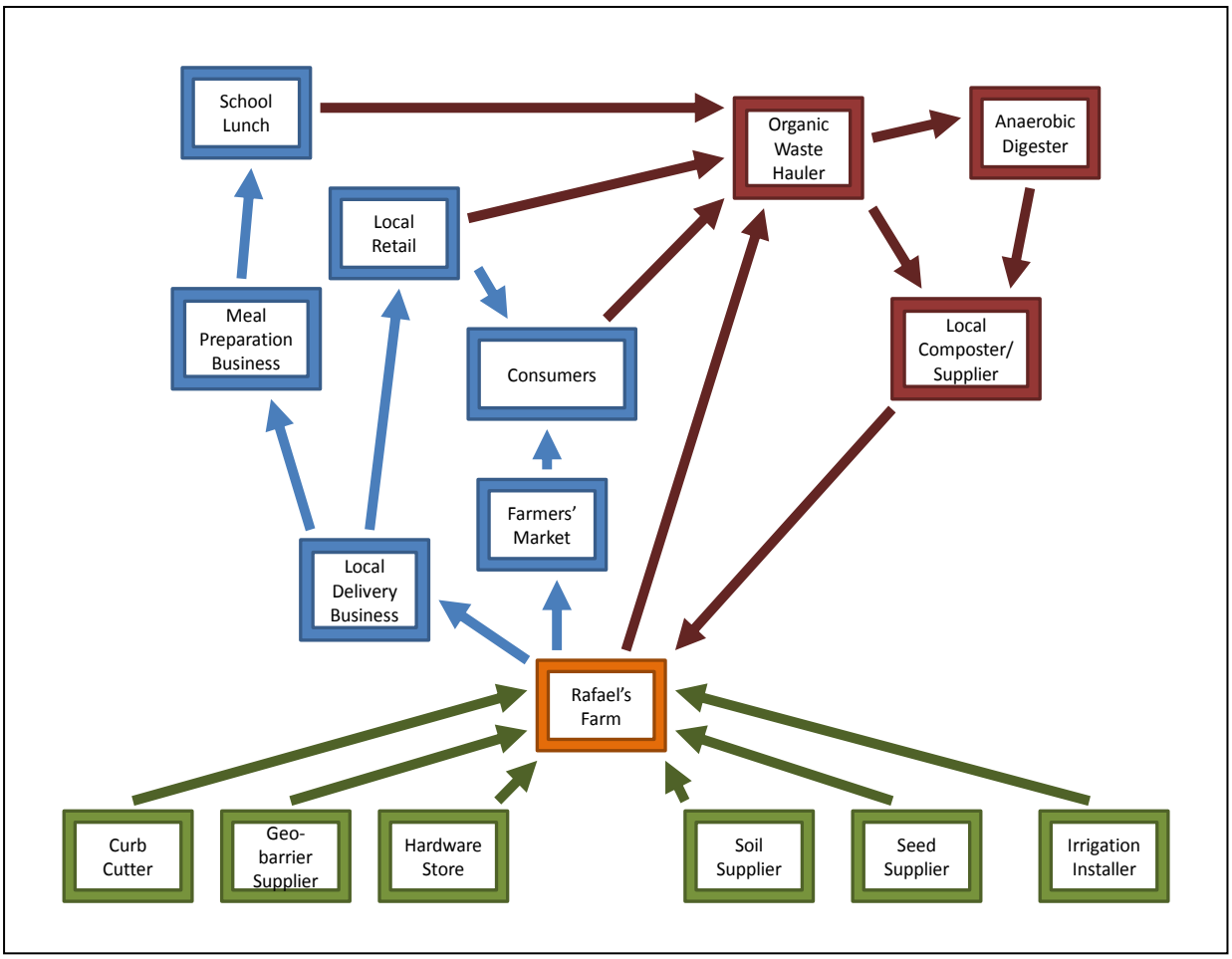
The types of jobs created range from farm managers and farm workers to administrative and sales staff, and all provide a living wage. Farm managers and administrative/sales staff will likely be full time positions while farm worker jobs will be seasonal and paid by an hourly wage. These different positions each represent an important component of the complete commercial urban farm. Farm managers are needed to run the day-to-day operations of the farm, including business planning and annual farm schedule, coordinating farm work, and managing the budget. Farm workers provide the bulk of on-farm labor, including soil preparation, fertilizing, planting, watering, weeding, picking, cleaning, and packaging produce for delivery to market. Administrative and sales staff perform critical marketing work to identify and secure market opportunities for the sale of farm products. Different business models and different scales of business may overlay some of these positions, rolling multiple responsibilities into one role. For example, on a single small plot a farm manager may also be in charge of sales and marketing, with a single farm worker providing any additional labor needs. On a larger plot or group of plots the labor may be divided into different positions and spread across the larger production area.

Our analysis demonstrates the potential for direct job creation due to an expansion of commercial urban agriculture in and around Boston, based only on growing and selling fresh produce. Although the individual plots of land will be relatively small—likely not more than one to two acres in some circumstances and probably closer to one-quarter acre or less in most cases—the land will be worked intensively to generate high revenues and will have to be worked manually because most farm machinery cannot be operated on small plots.

Job estimates based on 2.6 jobs per acre and those based on the state minimum wage and paired with the gross revenue data from existing farms provide similar results, demonstrating that approximately 130 to 140 direct farming jobs would be created by farming 50 acres of urban land. While significantly lower than the 223 jobs estimated using City Growers model projections, we can conclude that 50 acres of urban agriculture in Boston will likely generate at least 130 direct farming jobs and may generate over 200 jobs depending on actual business characteristics and revenue. This may appear to be a small number of new jobs, but these estimates assume a produce farming operation only; estimates could be higher if operations include additional high value products that may provide year-round sales, including spring seedling sales, ornamental plants, honey, and livestock (eggs and meat). This estimate also does not account for the supply chain and transportation infrastructure jobs that will be necessary to process and move the produce from farm to market. Our analysis also stops at 50 acres, which suggests our estimates are the tip of the local-food-jobs iceberg. City Growers claims there are 800 acres of land in and around Boston that could be farmed. If all 800 acres were put into production, this would create at least 2,080 on-farm jobs and an additional 1,200 jobs in supporting businesses.

Our analysis suggests an expansion of urban agriculture will lead to the creation of additional jobs that provide support services to urban farms. Further detail is provided in Table 4 and the simplified scenario narrative below.

Figure 3. Diagram of Local Economic Development Associated with Urban Agriculture



Job Implications for Urban Agriculture in Boston

Figure 3 describes the broader local economic system and ancillary businesses that are necessary to support urban farming in Boston. Over time, the local economy will add more jobs to support and service the urban agriculture sector. To estimate ancillary job creation we assume the farm revenue not spent on labor is spent in the local economy to acquire goods and services. Using an average labor rate and estimating the number of employees that could be hired at that rate, we estimate approximately 1.5 new jobs per acre of urban farms, providing up to 75 new jobs with 50 acres in production, adding another $1.6 million of economic development in the form of wages .

Ultimately, an expansion of commercial urban agriculture has the potential to significantly improve local employment opportunities and community economic development through both direct on-farm jobs and an expansion of jobs that provide support services to the sector.

Environmental Impacts Assessment

Food production and distribution in the U.S. are net producers of greenhouse gas (GHG) emissions, and along with other industrial processes, contribute to global climate change. Greenhouse gas emissions, including carbon dioxide and methane, are prevalent in conventional food production from the manufacturing processes for synthetic fertilizers to the use of heavy farm equipment. In addition, when food scraps are disposed in landfills they rot and release methane gas. Farms tend to be sizable, centralized operations that use large energy-intensive machines to maximize production. Averaging 418 acres nationally and 68 acres per farm in Massachusetts[21], conventional farms require manufactured, synthetic chemical fertilizers, insecticides, and herbicides that

frequently are derived from fossil fuels. Large-scale farming demands substantial industrial output in the form of machinery that is required to farm on hundreds or thousands of acres. Additional fossil fuels are required to fuel the machines and transport the produce to wholesale and retail markets around the country. Studies suggest conventionally grown food travels an average of 1,500 miles from the farm to our plates.[22] Combined, the production and distribution of conventionally grown food produces significant quantities of GHG emissions in the U.S., but actual crop production—planting, fertilizing, maintaining, and harvesting—accounts for a significantly larger portion of total agricultural emissions.[23] Producing food without fuel-burning equipment and fuel-based fertilizers and pesticides significantly lowers the GHG impact of food, regardless of transportation distances. Indeed, conventional agricultural production accounts for 6.5 percent of total U.S. greenhouse gas emissions.

In contrast, small-scale urban agriculture lends itself to manual intensive cultivation methods and organic soil-building practices; it typically avoids chemical applications because of close proximity to urban communities. In addition, urban farms are close to urban food markets, cutting transportation distances and reducing distribution fuel use and emissions.

Urban areas produce a concentrated source of food waste which can be processed with other organic material, like leaf and yard waste, to create compost. Compost is a natural fertilizer that enhances nutrient levels and water retention in soil and improves soil's ability absorb and store carbon. Soil amended with compost can pull greenhouse gases from the air and trap them. The food production and food waste collection system can be designed as a closed-loop, with the food waste being used to make compost that is used to help grow more food.

Image Credit: rfduck via Flickr

Because urban farming production methods use little or no synthetic products and rely on mostly manual labor, they create minimal GHG emissions. If the food waste from the surrounding area is composted and use on the farms rather than disposed in landfills there are further GHG reductions; that food is not rotting in the landfill, and as compost it is actually helping to store additional carbon. This section will detail the potential for urban farming in Boston to mitigate GHG emissions and other pollution by the following:

- Storing carbon in well maintained soil;
- Diverting food waste from landfills for use in composting operations;
- Dramatically shortening the distances required to transport food to a market;
- Mitigating stormwater pollution by increasing permeable surface area;
- Improving soil quality; and
- Increasing vegetated cover to reduce the urban heat island effect.

Our analysis focused on three contributors to greenhouse gas emission reductions from urban agriculture: reduced transportation due to closer proximity to local markets; healthy soil and its ability to capture and store carbon; and diversion of food waste for composting (thereby avoiding landfill generation of methane). We also considered the potential for urban farms to provide additional benefits in the form of urban heat island mitigation and stormwater management.

Key Findings

Our analysis suggests that urban agriculture in Boston will result in a net reduction of GHG emissions. The lack of emissions from farm production, the largest source of emissions from conventional agriculture, combined with the soil's ability to absorb carbon and the methane avoided through the use of compost, more than offsets the emissions created by local transportation from farm to market. It is clear that urban farms have the potential to contribute—albeit on a small scale—to the GHG reduction efforts that the City is already implementing.

The short distances local food is transported will generate approximately less than five tons of CO_2 annually, while the carbon storage potential of healthy agricultural soil will store approximately 114 tons of CO_2 annually. In addition, the use of compost to enhance and maintain soil health will contribute to the market demand for compost. If more food waste is diverted from landfill to compost production, additional GHG reductions will occur. By contributing to the market demand that will help Massachusetts divert 35 percent of all food waste into organic waste management, Boston urban farms will be responsible for 11 percent of the associated GHG emissions reduction. This may result in an additional CO_2 reduction of 800 to 4,600 tons per year, equivalent to the average annual emissions from 142 to 818 cars or combustion of 1,688 to 9,705 barrels of oil[24] depending on assumptions about accounting methods.

Transportation Impacts

A relatively small portion of total GHG emissions resulting from conventional agricultural practices is attributable to transportation of farm products, although transportation-related GHG impacts are difficult to calculate. Economies of scale can achieve great efficiency even over long distances—think of thousands of packages of fresh strawberries being shipped to market in a single tractor trailer—while the seeming GHG emissions benefit of locally grown produce can be nullified by an inefficient distribution system that requires many short trips using less efficient vehicles. For example, multiple passenger cars and SUVs driving thirty plus miles round trip to a pick-your-own strawberry farm. Such factors potentially result in lower per-unit fuel consumption for bulk food shipments over long distances. However, absolute fuel consumption and transportation emissions are less for shorter distance shipments and will be minimal or nonexistent if the food can be transported without the use of fossil fuel-powered vehicles. For example, if an urban farm has an on-site farm stand, many consumers may walk to the stand to purchase produce, emitting zero GHG. If the farm was located further from an appropriate market but still nearby, it may be possible, depending on the volume, to move the produce to market via bicycle. Regardless, food from urban farms in Boston will not have to travel far to reach a market inside Boston city limits.

Soil as Carbon Sequestration

Soil has the ability to store carbon, and healthy, well-maintained soil will absorb and store more carbon than poorly maintained soil. Soil, which already contains some amount of carbon, will continue to absorb additional carbon from the atmosphere until it reaches capacity. As plants grow and die and organic matter in the soil decays, some carbon will be released. Improving soil health will allow soil to absorb carbon from the atmosphere until it reaches its storage capacity; this process may take as little as 20 years.[25] Applying compost to soil improves the soil's ability to absorb additional carbon from the atmosphere.[26]

The UK-based Soil Association has studied extensively the ability of soil to store carbon and estimates that soil can store approximately 0.81 tons of carbon per year per acre. [27]Additional research from the Rodale Institute provides a range of carbon sequestration estimates based on crop rotations and the use of different soil improvement methods, from spreading raw manure (0.44 tons per year per acre) to using cover crops (0.25 tons) to using composted manure (1 ton).[28] Averaging the Soil Association and Rodale estimates, we assume a carbon storage capacity of 0.6 tons of carbon per year per acre. This number represents only the storage capacity of the soil and does not include any carbon or carbon dioxide that may be absorbed by plants that are growing in the soil.

That number may appear small, but as urban farms expand and put more land into agricultural production, the total storage capacity of the aggregated acreage adds up. While carbon sequestration related to urban agriculture will never be a significant source of GHG emissions reductions, it represents one of the many small steps we can take to decarbonize our food system.

Organic Waste Management (Composting)

Regardless of the GHG accounting method used, our analysis indicates that food waste diverted to produce compost that can be used by urban farms results in significant local reductions in GHG emissions, along with other meaningful ancillary environmental and economic benefits. An expanded composting infrastructure will require additional local jobs to haul and process food waste and to deliver finished compost to farm sites. In addition, affordable, locally produced compost will be critical to the soil health of Boston urban farms, which translates directly into healthy, high-quality produce that will allow the farms to earn relatively high revenues. Compost production also creates a closed-loop system in which food is grown, consumed, and disposed of locally to create compost, which is then used to grow more local food. Good organic waste management and proper compost production is thus not only an important driver of the ancillary health and environmental benefits of urban agriculture, but also important for the economic success of Boston urban farms.

One way to improve soil health and improve soil's ability to absorb carbon is to apply compost. Compost typically consists of yard and food waste, and can include other organic waste streams, such as manure and animal bedding. When properly layered, frequently turned to promote air circulation, and monitored to ensure appropriate moisture and temperature levels are maintained, the materials break down into a nutrient-rich, soil-like substance. Compost contains carbon along with varying amounts of other beneficial soil nutrients such as nitrogen. Composting relies on aerobic decomposition. A well-managed composting process prevents the methane (a potent greenhouse gas) generation associated with anaerobic decomposition of organic material that typically occurs in landfills. When food waste is placed in a landfill, it sits in a static pile, covered by other waste. The lack of oxygen leads to the creation of methane gas.

Image Credit: Clarity J via Flickr

Properly composting local food and organic waste and applying the finished compost to fertilize local, urban farms, closes the nutrient cycle. As a result, the use of compost as fertilizer prevents the need to apply fossil-fuel based fertilizers.[29] The improved soil better retains nutrients and water, meaning it requires less frequent fertilizer application and helps to prevent nutrient runoff into nearby waterways,[30] which protects water quality. Compost must be made using appropriate methods and applied in correct amounts; improper production and overuse can result in the release of GHGs and nutrient runoff, just like with conventional fertilizers.

Vegetated and Permeable Surfaces

Because plots will be maintained by the farm businesses, the City will benefit from both stormwater management and heat mitigation at no cost to the municipality. These "green infrastructure" improvements will accompany the previously described economic development associated with the expansion of urban agriculture in Boston.

Stormwater management is an important concern in urban settings, which tend to have a high percentage of impervious (non-porous) surfaces. Rather than being absorbed into the ground, stormwater (along with any pollutants) is collected and channeled into the sewer system. This happens most frequently during heavy precipitation events. Urban stormwater can be managed by expensive technological solutions, such as increasing the capacity of the sewer system. It can also be managed to some extent through lower impact or "green" infrastructure, including increasing the amount of permeable and vegetated surfaces. Urban farming accomplishes this and further makes use of water to irrigate crops. In addition to absorbing any precipitation that falls on the

farm plot, urban farms may set up catchment systems to capture and store water for later use. These activities help to mitigate the impact of stormwater on urban environments.[31]

Temperatures in cities tend to be higher than in surrounding areas due to extensive asphalt coverage, a lack of vegetation, and a concentration of heat-releasing machinery. Increased vegetative coverage helps to mitigate the urban heat island effect, and such coverage does a better job of this than other solutions such as light-colored rooftops.[32] An expansion of urban farms in a city like Boston increases the amount of vegetated surface area, helps to absorb heat created by building infrastructure and machinery, and helps to break up developed, asphalt-covered areas that absorb, retain, and release heat.[33]

Implications for urban agriculture in Boston

Table 4 demonstrates the overall greenhouse gas mitigation potential of the urban agricultural acreage of our four expansion scenarios.

Table 4. Boston Urban Farming Potential Overall GHG Mitigation Summary

Scenario	Net GHG Low Est.	Net GHG High Est.	Net GHG w/o Methane Avoidance (Low)	Net GHG w/ Methane Avoidance (High)
1	-32	-31	-832	-4680
2	-45	-44	-845	-4693
3	-79	-77	-879	-4726
4	-113	-110	-913	-4758

Note: All GHG numbers are expressed in tons of CO_2

The Net GHG Low and High Estimate Columns estimate the net GHG impact of each scenario, based only on the storage capacity of the soil. Even if we do not attribute any organics diversion or composting GHG mitigation to urban farming, the farms still reduce overall Boston-area GHG emissions.

The columns that reference methane avoidance demonstrate the much larger overall GHG reduction that urban farming can help achieve if we include reductions from organic waste diversion and composting.

These numbers are based on our four expansion scenarios, (14 to 50 acres of urban farms). As described earlier in this report, there may be as many as 800 acres suitable for urban agriculture in Boston, 16 times the acreage of our largest scenario. At 50 acres, up to 5000 tons of GHG emissions could be avoided; at 800 acres, urban farming could reduce greenhouse gas emissions as much as 80,000 tons, just under one percent of total Boston GHG emissions. Although relatively small, this GHG reduction would be achieved as a result of a significant increase in local economic development, compared with most economic development that generally increases GHG.[34]

Health Benefits Assessment

Fresh, nutritious food is important to human health. Although large grocery store chains are relatively prolific in suburban areas, they are less commonly found in cities and rarely located in low- income areas, forcing residents to leave their neighborhoods in order to buy fresh foods, thereby incurring the cost and inconvenience of driving, taxis, or public transportation. The problem is of special concern for Boston; a recent study by the Massachusetts Public Health Association found that Boston has 30 percent fewer grocery stores per capita than the national average.[35]

Urban agriculture can improve consumer access to fruits and vegetables by operating in neighborhoods that currently lack fresh produce retailers. Small-scale urban farms often sell directly to consumers, and this business model has great potential for increasing the availability of fruits and vegetables. Farm stands, CSAs, and farmers' markets are all methods of direct sales that can also be structured to be affordable and convenient.

As described more fully in the policy discussion below, urban soils may often be contaminated with pollutants common in an urban environment, including lead and pesticides. As a precaution to mitigate any risk of exposure (through coming into contact with soils or ingestion of crops) to contaminants that may be present in urban soils, methods like capping existing soils and importing clean soil for planting are commonly used and recommended by the U.S. Environmental Protection Agency. For our health assessment, we assume that Boston residents have access to the food grown on Boston urban farms at convenient locations, affordable prices, and subsidized as necessary through programs such as the Supplemental Nutrition Assistance Program ("SNAP") (including electronic benefits transfer ("EBT") cards) and Boston Bounty Bucks[36]. Second, we assume that all the food can be grown in safe, healthy soil, and harvested and handled safely to maintain high nutritional value.

Image Credit: tcd123usa via Flickr

Based on these assumptions, we estimate the amount of food that can be grown by Boston urban farms and analyze the potential health impacts of making this food available to Boston residents based on USDA recommendations for the daily consumption of fruits and vegetables. We then recommend best practices to ensure any food grown by Boston urban farmers will be safe and healthy. This qualitative assessment is based on a literature review of current knowledge regarding urban farming and post-harvest handling practices that maximize the nutritional value of fresh produce.

Based on our estimates of the amount of produce that can be grown for each expansion scenario, we calculated the number of Boston residents that could fulfill their fruit and vegetable requirements, assuming a six-month retail season, roughly from May through October. The term "fully served" represents the number of people that could get all their fruits and vegetables from Boston urban farms during the retail season. This calculation assumes that all the food is being sold to local consumers.

Many variables affect the nutrient content of food, which makes estimates of the potential nutritional benefit of urban agriculture difficult to quantify. Rather than calculate potential changes in the nutrient content of Boston diets, we use qualitative data about the nutrient content of fresh food, as well as nutrient degradation over the supply chain, to develop a set of Boston urban farming best practices. Food nutrient levels are closely related to the quality and health of the soil in which it is grown, such that practices that improve nutritional value simultaneously reduce potential health risks associated with farming in urban environments.

Key Findings

Food Access Impacts

A diet low in fruits and vegetables is associated with an increased risk of cardiovascular disease, hypertension, anemia, premature delivery, low birth weight, obesity, and diabetes.[37] Adequate intake of fruits and vegetables can help protect against these health concerns and has been linked to reduced incidence of heart disease and certain types of cancer.[38] Currently, Americans eat well below the recommended amount of fruits and vegetables. Experts recommend two cups of fruit and 2.5 cups of vegetables per day. However, on average, Americans consume only about half of the recommended amount.[39] In 2009, only 36.8 percent of adults in Massachusetts ate more than the recommended two servings of fruit per day, and 28.1 percent ate more than the recommended three servings of vegetables per day.[40] Urban communities in the United States generally have access to sufficient absolute calories, but lack access to healthy and affordable options for meeting caloric needs. Surveys show that low-income individuals, including many urban residents, know the health benefits of fruits and vegetables and express a desire to buy healthy foods. Cost, however, is a significant barrier preventing low-income people from eating fresh fruits and vegetables. According to the Boston Medical Center, the average monthly cost of a "healthy diet" in Boston was $148 more than the maximum monthly SNAP benefits.[41] Local production has been predicted

to potentially lower food prices by reducing "middleman" transactions as well as transportation and storage costs.[42] One U.S. study found that locally grown foods purchased at a farmers' market were less expensive than retail prices at a supermarket during the growing season; farmers' market produce was priced at 68 to 88 percent of the retail prices at area supermarkets.[43]

Fifty acres in agricultural production would provide enough fresh produce to fulfill the dietary requirements of over 3,600 people over a six-month retail season. However, if the produce were made available for school lunches in Boston Public Schools, 50 acres could provide more than one serving of fresh produce per lunch to each student eligible for free or reduced school lunch over a six month period. We assume fresh produce could be made available to schools from September through November and from April through June. We do not count July and August when school is not in session.

Table 5. Fruit and vegetable servings produced by four expansion scenarios

Number of Acres	Annual Pounds of Produce Grown	Annual Number of Servings Grown	Servings per Eligible BPS Student	Servings per Lunch over 6 Months
14	423,403	1,693,613	40	0.3
20	604,862	2,419,447	57	0.5
35	1,058,508	4,234,032	100	0.8
50	1,512,154	6,048,617	143	1.2

For a final example, Mattapan has an approximate population of 37,600. The food produced from the 50 acres in urban farm production would fully serve about 10 percent of Mattapan residents during the six-month retail season or provide approximately 160 servings per resident during the same period. While not providing all the food needed by Mattapan residents (much less the entire city), the simple existence of urban agriculture would enhance the neighborhood in other ways. Mattapan would reap the benefits of locally grown, fresh, healthy food, as well as environmental benefits, the potential for job creation and local economic development.

If 800 acres of potentially available City-owned land were put into agricultural production, approximately 10 percent of Boston's total population could be fully served during a six-month retail season. This could be further expanded through the use of season-extending measures such as hoop houses or green houses.

Food Safety

Several factors influence the nutritional quality of fresh produce: variety, yields, production practices, post-harvest practices, processing, chilling, and transit. Local foods may have advantages in some of these categories.[44] Farmers who grow food close to where it is consumed can choose plant varieties that prioritize taste and nutrition over yield and durability in transport. Growing methods are also important to nutrition; practices that improve soil health, through cover crops or adding compost or green manures, enhance nutrient uptake by plants.

Since the health of soil and the health value of food are intimately linked, urban plots need to be prepared prior to any farming activity. The nutrients in the food are formed as the food grows and are a product of the nutrient contents of the soil. In addition, certain crops can absorb contaminants from the soil, such as heavy metals. For that reason, urban farming best practices include use of a barrier over existing soils and importing clean fill for food production in traditional or raised beds. Construction materials such as pressure-treated wood can leach contaminants into soils and should be avoided in urban farming. Of course, it is important to bear in mind that food produced by more traditional or large scale agriculture operations is also likely to have some level of contamination, due to pervasive global pollution or pesticide use. For example, a study by the University of Texas School of Public Health found that of thirty-one types of food sampled, including produce, meat, and dairy, persistent organic pollutants, were found to be widespread. Perfluourinated compounds were found in seventeen food types, polychlorinated biphenyls were found in salmon and canned sardines, and pesticides were found in twenty-three of the foods tested.[45]

Food can also become contaminated at any point along the production chain—growing, processing, distribution, and retail.[46] Many of the risks of food-borne disease are associated with large scale mass-produced food and can be more easily controlled through urban agriculture where more food is produced closer to the consumer or with less processing.[47] While many food-borne illness risks are linked to animal products, a study of fresh produce items revealed that leafy greens, potatoes, tomatoes, sprouts, and berries were among the top ten riskiest foods regulated by the U.S. Food and Drug Administration.[48] Local food producers must still follow safe practices in order to protect consumers and their business.

Image credit: David Barrie via Flickr

Since urban agriculture takes place in close proximity to dense human settlements, there is a risk of excess nutrients or chemicals entering urban waterways and causing environmental pollution. To our knowledge, no study has addressed the rates of chemical use in urban agriculture, but the small scale at which it is often practiced lends it to organic production practices that use more labor and fewer chemicals, thereby minimizing or negating the risk of environmental contamination from chemical use.

The U.S. EPA requires water testing and treatment in all urban areas, so the risk of using contaminated water to irrigate crops is not a major concern. An important issue, however, is water "run-on," where contaminated water from nearby yards, surrounding streets, or flooding waterways enters the farm, potentially polluting the soil and crops. This can be managed through physical design features, such as planting in raised beds.

EPA currently has "no definitive standards for soil contaminant levels safe for food production that reflect the soil site conditions and management practices common at agriculture sites."[49] Existing guidelines address exposure from air, water, or soil inhalation or ingestion, but not from contaminated food consumption. Neither FDA nor USDA has standards that regulate the quality of soil as a growing medium, although there are international standards for the level of contaminants allowable in final food products. However, the EPA has issued interim guidance on safely practicing urban agriculture that includes investigating prior uses of the site, sampling and risk management.[50] If food will not be grown directly in site soils, soil testing is not necessary.

Additionally, a study on raised bed gardening in the Roxbury neighborhood of Boston, Massachusetts showed that imported, uncontaminated soil became re-contaminated by wind-transported lead-contaminated soil particles from nearby yard space.[51] In urban soils, farmersfarmers may need to periodically remove the top two inches of soil and replace it with clean soil or use crop covers over plants.[52]

Best Practices to Ensure Safe and Healthy Food in Urban Soils

Fresh-picked produce stored for a short time under optimal conditions and consumed raw most likely conveys the highest rate of nutrients.53 It all starts with healthy soil. The overall nutritional quality of food, however, depends on the specific dynamics of the supply chain and food processing techniques, most of which have been understudied with regard to urban versus conventional agriculture. 54 In the absence of concrete, quantitative data, the following section outlines best practices that farmers should follow to ensure nutritional quality and discusses the implications for urban agriculture supply chains.

Best practice: Install barrier and import clean soil

There is insufficient published science about the uptake of various toxins into edible plants[55] and how the toxins are transmitted throughout our bodies.[56] However, agricultural scientists and public health professionals have studied many methods for safe gardening in contaminated soils. These include using clay or geotextile fabric barriers over existing soil and importing clean fill and using physical barriers, such as netting, fencing, or shrubbery to reduce on-going airborne contamination from motor vehicles and other sources. Many experts agree that, because of the limited mobility of heavy metals and other contaminants in soil and plants, the greatest risk of exposure to contaminants is through direct exposure to soils during farming— from inhalation, skin contact, or ingestion.[57] Capping existing soils and planting in clean soils substantially reduces such risk, and prevents uptake of contaminants into plants.

Best practice: Replenish nutrients in the soil and practice appropriate nutrient application

Organic production may help achieve high yields while replenishing the nutrient content of soil and produce.[58] Over-application of nitrogen fertilizers has been shown to decrease the concentrations of vitamin C in many fruits and vegetables.[59] Urban farms often follow organic agricultural practices, so the main risks of contaminating nearby waterways are from excess nutrients running off from applied compost (not from agricultural chemicals). As with any form of agriculture, soil amendments and fertilizers will have to be applied in appropriate volumes, between 200 and 400 pounds per 100 square feet,[60] to avoid potential environmental problems like nutrient runoff. In addition, the farm site should be designed in ways that prevent potentially polluted water from contaminating food crops, such as planting in raised beds.

Best practice: Select varieties for taste and nutritional value

Studies have shown that selecting crop varieties known for high vitamin C content is a more important factor for nutritional value than external factors like climactic conditions or farming practices.[61] The nutrient concentrations in many commonly consumed foods in the United States have declined over the past 60 years; studies show a nine percent decline in phosphorus, a 15 percent decline in iron, and a 20 percent decline in vitamin C. This is attributed to newer, high-yielding varieties, which may sacrifice nutrient content in order to increase yields.[62] Boston urban farmers should avoid this trap by using good soil management and intensive farming practices to increase yield, while also selecting crop varieties that are high in nutrient value.

Best practice: Pick produce at peak ripeness and transport it to market quickly

Ripeness level at harvest affects nutritional content; in conventional supply chains, some fruits and vegetables destined for distant markets are harvested before they are fully ripe. Consequently, they will have a lower vitamin content than fruits and vegetables harvested at peak ripeness. For example, the total vitamin C content of red peppers, tomatoes, and peaches has been shown to be higher when these crops are picked ripe from the plant. Because urban agriculture does not require extensive shipping, local farms may be able to pick produce closer to ripeness and allow higher levels of nutrients to be preserved in certain fruits. One supply chain estimate suggests that locally sourced food travels an average of 45 miles from farm to market while conventionally sourced food travels approximately 1,500 miles from farm to market.[63]

Post-harvest handling and storage plays a large role in maintaining nutritional quality. Careless handling can bruise a plant and diminish nutritional quality. Refrigeration is often necessary to maintain nutrients in fresh produce, although some nutrients are not significantly affected by long-term storage.[64] Larger producers may have better access to processing and storage facilities and refrigerated trucks than smaller urban producers, but urban producers benefit from close proximity to their markets and a better understanding of actual customer demand based on personal relationships they have built.

Boston urban farmers should pick produce at peak ripeness whenever possible to ensure maximum nutritional value. The ability to pick at peak ripeness will depend heavily on a functional and efficient local distribution network that allows farmers to get their produce from farm to market quickly. Onsite farm stands are one option, but a thriving local food economy will also need access to offsite retail markets. Good supply chain management

and efficient local distribution networks will allow Boston farm businesses to pick and sell their products on the same day, thereby helping to maintain freshness and nutrient content at the point of sale.

Best Practice: Handle food in a safe manner

All food producers, regardless of size or location, are susceptible to potential contamination of their food through improper growing or post-harvest handling practices. For example, the improper application of manure to fields can transfer pathogens to crops. Using non-sanitized knives, tools, or field bins during harvesting and processing can quickly spread contamination. All growers and farm staff should be trained in safe practices that ensure their consumers and businesses are protected. Training programs can ensure new and existing farmers have a shared, consistent understanding of best practices and ensure uniform safe handling practices. Training programs should be designed and taught by organizations with appropriate expertise and authority, such as the Boston Board of Health or the Massachusetts Department of Agriculture. In the interim, farmers should look to existing safe handling guidance such as the USDA and FDA growers guide titled "Food Safety Begins on the Farm."[65]

Image credit: schrierc via Flickr

Implications for Urban Agriculture in Boston

Urban agriculture can be practiced safely and contribute to the health of Boston residents though increased availability of fruits and vegetables. Many of the potential health benefits of urban agriculture, including better access to nutritious food, depend on best management practices that ensure clean, healthy soil and safe food handling.

Improve access to certified production/processing and storage facilities

Access to proper storage facilities can help urban produce maintain its nutritional quality and provide the maximum nutritional benefit to consumers. Small urban farms will not necessarily have the financial or physical space resources to build and operate individual facilities. Access to shared space will allow numerous small urban farms to safely store produce prior to retail sale.

Develop market models to increase food access for low-income communities

Throughout this section we have assumed that Boston residents have access to the food grown on urban farm plots. In practice, however, farmers may need to sell to high-value retail markets (e.g., high-end restaurants and retailers) in order to remain profitable. For urban farms to serve a socio-economically diverse customer base, new food sale models will need to be developed.

Develop effective distribution channels

As shown in this analysis, a key component of maintaining the highest level of nutritional value in food is ensuring that it gets to market quickly and efficiently. In order to do so, urban farmers need distribution channels in place that they can easily access and that can scale up or down as necessary. This quickly evolving portion of the urban agriculture sector requires research into different distribution models and the challenges and opportunities they bring to producers and buyers.

POLICY BARRIERS AND OPPORTUNITIES

Urban agriculture is hot. Interest in building a healthier, more locally-based food system is strong and growing, and that interest is spawning a new generation of innovators and entrepreneurs. The movement toward locally grown food and a sustainable food system is diverse—it attracts people interested in health, social and economic justice, environmental sustainability and climate change, fair labor practices for farmers, foodies, and urban livability. How do we leverage this interest to expand our ability to grow better food in Boston while spurring economic development and supporting sustainability goals? The first step is to identify the potential roadblocks and unexamined opportunities. To really expand urban agriculture, farmers need land, high quality compost, better financing options, facilities to store crops, and better ways to distribute and transport products.

Regulatory systems governing land use, processing of poultry and milk, food preparation, and state purchasing should facilitate—not hinder—robust local food systems; yet, often that's not the case. Policies that promote the markets for locally grown foods should be encouraged. We analyzed a range of policy and market opportunities that have the potential to advance urban agriculture in Boston. Our analysis included information gathered from 22 interviews with agriculture policy experts and extensive research into different urban farming practices and business models being used around the U.S. Our assessment is organized around the stages in the food supply system (Fig. 1) to better illustrate the points at which these market and policy issues influence that system.

PRE-PRODUCTION AND PRODUCTION

LAND ACCESS

The pre-production and production stages encompass the startup of the farm business and the physical farm, and the actual work of farming. A primary barrier to in-ground urban agriculture is access to land. Urban land is expensive to purchase, and the need for land modification to make a site suitable for farming adds additional costs. Apart from financial barriers to land acquisition, zoning and other land-use rules may limit agricultural uses. For urban agriculture to flourish, creative measures to overcome these hurdles are necessary.

ZONING

Zoning is the process by which land use authorities determine the types of uses—for example commercial, residential, and agricultural—permitted on the parcels within their jurisdiction. To lawfully be used for agriculture, land must be zoned for that use.

Urban Agriculture Overlay District

In 2010, the City of Boston, in coordination with the Boston Redevelopment Authority (BRA) and Department of Neighborhood Development (DND), proposed to lease—for very low cost—to qualified applicants certain small plots of City-owned land available for for-profit fruit and vegetable production. In order to permit that land use on plots not currently zoned for agricultural use, the City proposed to put in place an urban agriculture overlay district (UAOD). Such zoning permits use of the land for agriculture, while retaining the underlying residential zoning.[66] Mayor Thomas M. Menino and the City of Boston have stated that the goal of the program is "to establish an environment in which all of our citizens--particularly the most underserved--have direct access to locally produced fresh food, the ability to produce food for themselves, and access to education and knowledge about healthy eating."[67] According to the City, its objectives are to:

- Increase access to affordable and healthy food, particularly for underserved communities;
- Promote economic opportunity and greater self-sufficiency for people in need, including increasing the capacity of Boston residents and business [to] grow and distribute local and healthy food;
- Increase education and knowledge around healthy eating and food production, particularly among youth;
- Increase partnerships with, and/or between, local and regional food producers; and
- Increase healthy food supplies to local schools, organizations, institutions and corner stores.[68]

The UAOD code amendment originally would have permitted raising small livestock (*e.g.*, chickens and goats) and beekeeping; however, there was strong community opposition. As a result, the UAOD was modified to permit cultivation of fruits and vegetables.

UAOD Text

SECTION 60-28 Establishment of Urban Agriculture Overlay Districts. This section 60-28 establishes Urban Agriculture Overlay Districts ("UAOD") as overlays to underlying subdistricts within the Greater Mattapan Neighborhood District. UAODs are established to improve public health and environmental sustainability and promote economic development by supporting the local production of fresh food. UAODs shall consist of land appropriate for and limited to: a) the cultivation of plants, herbs, fruits, flowers, or vegetables, including the cultivation and tillage of soil and the production, cultivation, growing and harvesting of any agricultural, floricultural or horticultural commodity; and, b) composting (the accelerated biodegradation and stabilization of organic material under controlled conditions for beneficial garden use) only of materials produced on site. The cultivation of any and all edible produce shall comply with all applicable federal, State and City requirements. There are four designated UAODs in the Greater Mattapan neighborhood District as shown on Maps 8B and 8C.

Two primary legal issues are implicated by UAOD. First, the potential applicability of Massachusetts Constitution Article 97 (Article 97), and second, liability associated with potential soil contamination pursuant to Massachusetts General Laws Ch. 21E (Ch. 21E). Because Chapter 21E has broader implications for urban agriculture, it is addressed separately in this report.

Article 97 declares certain public rights to clean air and water and resource protection, and authorizes the Legislature to enact legislation protecting those rights, and agencies to take lands to protect those rights. Specifically, Article 97 provides that "[l]ands and easements taken or acquired for such purposes shall not be used for other purposes or otherwise disposed of except by laws enacted by a two thirds vote . . . of each branch of the general court."[69] Its purpose is, in part, to authorize the acquisition of land for conservation purposes, and ensure that such land made part of the Commonwealth's holdings is not altered in use or disposed of without legislative authorization. The Commonwealth has articulated a clear policy goal of ensuring no net loss of Article 97 land.[70]

Article 97's "public purpose," is construed broadly. If the land at issue was not acquired for conservation-related purposes set forth in Article 97, however, Article 97 will not restrict the transfer of the land.[71] A disposition of land, pursuant to Article 97, includes transfer and/or conveyance of ownership or other interest; change in physical and/or legal control; and any change in use in Article 97 land owned and/or held by the Commonwealth whether by deed, easement, lease, or other instrument.[72] Concerns about potential Article 97 restriction on future transfers should not deter the City from making more City-owned land available for for-profit farming. The parcels at issue were not taken or acquired for Article 97 purposes in the first instance, the land is not being made available for general public use, and there is and will be no change in control.

The proposed UAOD was approved by the BRA Board on February 10, 2011, and was approved unanimously by the Zoning Commission on November 15, 2011. There have been ongoing concerns raised by the community about soil contamination, and there is some continuing level of opposition attributable to what has been perceived to be the City's lack of community involvement early in the process. To its credit, DND and the City have redoubled their efforts to work directly with community members to address their concerns. The successful RPF proponents are all neighborhood residents.

If well implemented, this program has the potential to expand significantly the number of urban farming businesses within the City, thereby increasing the availability of fresh, locally grown produce and jobs. Because the City is leasing the land for very low cost, the policy is a big step in the direction of reducing the land access barrier. As one interviewee stated, "Municipalities and other players need to subsidize these early efforts . . . [we need to] think about it as a systematic effort to green the City." That individual also suggested that the City help support farmers' efforts through actions like subsidizing the costs of food for low income purchasers, creating a way to link youth from various programs with farms so they can learn about growing food and help the farmers, and building a network of support. A collateral benefit of the policy will be to give City residents a better opportunity to learn

about where food comes from, the benefits of healthy food, and how agriculture can be integrated into an urban neighborhood.

Nevertheless, the program has some drawbacks. For example, the City has structured the land leases to have a relatively short term (for example, five years). That limited tenure likely will make it difficult for farmers to obtain necessary financing for their operations. There is, as well, still a degree of skepticism and concern among the communities where the properties are located; specific concerns relate to the question whether the soil is contaminated. At least one City councilor has organized opposition to the program.

CLURPA

The Massachusetts Comprehensive Land Use Reform and Partnership Act (CLURPA), is a bill introduced by State Senator James B. Eldridge. Broadly, the proposed state legislation seeks to transform the manner in which cities and towns plan for and review development. The bill is the product of collaboration among diverse stakeholders, including housing, planning, environment, state, regional, and municipal interests. Among other outcomes, CLURPA would foster housing affordability, diversity, agricultural preservation, transportation choice, smarter growth, low impact development, clean energy, and environmental protection, and provide communities with new tools to achieve those ends, including impact fees and inclusionary zoning.

CLURPA Bill Text

CLURPA provides that the purpose of Section 40U is to "[s]upport the revitalization of city and town centers and neighborhoods by promoting development that is compact, conserves land and integrates uses; [s]upport the construction and rehabilitation of homes near jobs, infrastructure and transportation options to meet the needs of people of all abilities, income levels, and household types; [a]ttract businesses and jobs to locations near housing, infrastructure, and transportation options; [p]rotect environmentally sensitive lands, natural resources, agricultural lands, critical habitats, wetlands and water resources, and cultural and historic structures and landscapes; [c]onstruct and promote developments, buildings, and infrastructure that conserve natural resources by reducing waste and pollution through efficient use of land, energy and water; [s]upport transportation options that maximize mobility, reduce congestion, conserve fuel and improve air quality; [m]aximize energy efficiency and renewable energy opportunities to reduce greenhouse gas emissions and consumption of fossil fuels; [p]romote equitable sharing of the benefits and burdens of development; [m]ake regulatory and permitting processes for development clear, predictable, coordinated, and timely in accordance with smart growth and environmental stewardship; and [s]upport the development and implementation of local and regional plans that have broad public support and are consistent with these purposes." See S. 1019 at Section 40U:1.

In addition to updating and modifying the Zoning Act (Mass. Gen. Laws Chapter 40A) and the master planning and subdivision control provisions of Chapter 41, CLURPA would create a new Massachusetts law, Chapter 40U, The Land Use Partnership Act, an innovative framework establishing an incentive system for cities and towns that elect to plan and regulate in accordance with Massachusetts' Sustainable Development Principles.

The bill provides that communities opting to be "Partnership Communities" must develop, at a minimum, planning to ensure prompt and predictable permitting for compact housing, economic development, and alternative energy facilities, and require more environmentally-sensitive subdivision development. Partnership Communities that accomplish those goals are eligible to receive priority consideration for state infrastructure funding and certain capital funding and technical assistance for planning. The new Chapter 40U would also confer on Partnership Communities the powers to regulate the rate of development; implement natural resource protection zoning; enter into development agreements; and enjoy expedited vesting of zoning rights in connection with Partnership Community subdivision plans. These incentives have the potential to spark a new, smarter approach to development that will make Massachusetts' cities and towns more walkable, more reliant on clean renewable sources of energy, and, by helping to protect farmland, more easily able to access fresh, locally grown foods.

Through the lens of built environment and land use, CLURPA has the potential to promote beneficial outcomes in several policy sectors, including renewable energy, climate change, food and agriculture, housing, economic development, and transportation. CLURPA's implications for Boston urban agriculture are limited, but could be

significant with respect to enhancing protection for peri-urban farmland. This year, the Legislature publicly communicated greater support of CLURPA. Health advocates in Massachusetts have become increasingly vocal champions of CLURPA, invoking its potential health benefits. CLURPA is pending in the current legislative session which ends in July 2012; as of this writing, however, competing legislation targeted to expedite permitting for new development to spur economic growth has been introduced and efforts are underway to retain core CLURPA provisions in a compromise bill.

Land Tenure

There are a variety of land use arrangements for farming. Land can be directly owned by the farmer (or multiple private entities); urban agriculture organizations that farm privately owned land enjoy the benefits of longer term security (so long as any existing mortgage obligations can be satisfied) and have greater incentive to make costly investments. Private ownership of urban land for agriculture is more common in cities, such as Detroit, where a struggling economy and low development pressure makes land relatively inexpensive. Private land owners may also make land available for growing food at no cost, allowing organizations to operate decentralized "farms" that are spread over multiple sites, sometimes including private front or back yards. Some real estate developers are allowing vacant lands they own to be used for agricultural purposes until the real estate market rebounds.

Land may also be leased. For example, a land trust may purchase land and lease it to a farming business; The Trust for Public Land, for example, purchased four acres of land along the Connecticut River in Holyoke and leased the land back to Nuestras Raices for its farming enterprise. Lease to purchase arrangements (where a farmer cannot afford to make a down payment or may have difficulty accessing credit) are also increasingly common. CLF, in partnership with the University of Vermont and others, recently completed a report, *Guide to Financing the Community Supported Farm: Ways for Farms to Acquire Capital Within Communities*, detailing various legal arrangements available to farmers for acquiring an interest in farmland (and establishing business models).[73] Cities and states may also grant permission through leasing or other arrangements for farming to occur on their lands. Currently, DCR permits farming on one parcel within its portfolio, Brookwood Farm in Canton, Massachusetts. The farm has thrived and expanded its operations over the years. It now boasts a devoted CSA membership.

City Growers Context

City Growers is working to obtain access to a variety of vacant parcels, including publicly-owned land in areas newly zoned for agricultural production and land owned by other institutions. This helps it take advantage of a broader array of available land in Boston, where farmable land is not readily available. The City Growers model aggregates small parcels of land that, on their own, would not provide a profitable enough opportunity for growing. Once combined into one farm entity, the parcels create the economies of scale necessary to support the business. City Growers is in the process of negotiating a long-term lease with the New Boston Fund for Olmstead Green, a four-acre parcel in a mixed income residential development. Access to this parcel will provide City Growers with enough concentrated land in one location to use as its base of operations and allow it to grow to scale more quickly.

The UAOD put in place recently by the City of Boston makes City-owned land available for urban agriculture. As discussed previously, the use is permitted, however, for a relatively short term of five years. The benefit of low or no cost access must be weighed against the limitations of a short term and / or revocable tenure; farming on "borrowed time" requires that farmers regularly explore new land-use opportunities and negotiate the longest lease terms possible. It also requires planning on the production side (*e.g.*, choosing crops that can be profitable within the given time frame). Water use, site access, and site security are all issues that must be negotiated with public land owners.

GIS Research

Based on our research, there currently is no inventory of municipal- and state-owned land that identifies which holdings would be suitable for agriculture. Such inventories are a key first step in understanding what the available

land for agriculture is within a given geographic area. Through an affiliation with Tufts University, CLF currently is collaborating to complete a GIS mapping survey of municipal- and state-owned land overlaid with data regarding state agricultural soils to determine which of the municipal- and state-owned lands could be used for farming. CLF will use that survey as a tool for advocating for more low-cost access for farmers to state-and municipal-owned lands for agricultural operations.

Soil Quality

Soil quality determines the ultimate quality of the food produced. As described earlier, farming on urban soils requires access to large volumes of high quality compost and soil amendments. Farming in urban soils requires addressing potential contamination and consideration of potential legal obligations associated with soils that may be contaminated.

Massachusetts General Laws Chapter 21E - Oil and Hazardous Material Release Prevention and Response Act

Massachusetts General Laws Chapter 21E (21E) governs the allocation of liability for releases of hazardous material and oil. With certain exceptions, 21E makes owners and operators liable for releases of hazardous materials on property. In certain circumstances, owners and operators that did not cause the release may be subject to liability solely because of their status as owners / operators. The Massachusetts Contingency Plan (MCP) is the regulatory framework that implements 21E, and the MCP sets forth the requirements for reporting, assessing, and cleanup of oil and hazardous material.

Image credit: suavehouse113 via Flickr

Urban soils are frequently contaminated with pollutants common in the urban environment: lead, polycyclic aromatic hydrocarbons (PAHs), residual pesticides and herbicides, arsenic, and asbestos. These contaminants are associated with everyday city activities over the course of decades, including, for example, the use of leaded gas until phased out beginning in 1975, the use of leaded paints, pest control in offices and residences, herbicides used to control plant growth in parks and on rail lines, asbestos from building insulation, arsenic from the use of pressure treated wood in construction, and PAHs from auto exhaust and ash associated with fill. Landowners are understandably and not uncommonly concerned that soil testing could lead to expensive reporting and remediation obligations. In some respects, 21E has created a perverse incentive not to test, since landowners fear potential liability. On the other hand, those who would use urban lands for growing food often question the safety of urban soils, and reasonably seek to learn, through testing, whether the soil is safe.

In 2011, EPA issued guidance titled *Reusing Potentially Contaminated Landscapes: Growing Gardens in Urban Soils* (EPA 542/F-10/011). The guidance describes the common contaminants found in urban soil, and ways to identify contaminants and reduce exposure.[74] EPA's recommendations (presented previously) to reduce exposure to contaminants that may be in urban soils include building raised beds, using a geotextile fabric to completely cover the existing soil, and introducing clean fill into the garden bed. These practices are generally understood to be sufficiently protective, and are the methods that the City is planning to use for the UAOD sites. Nearly every activity undertaken by people is associated with some degree of risk, and on balance, the benefits of gardening and farming (in terms of exercise and social connections) as well as the enhanced access to fresh fruits and vegetables, outweigh the risk of exposure to potentially contaminated urban soils when practiced with the EPA-recommended safeguards in place.

Those technical measures, however, do not mitigate potential 21E liability. MassDEP should develop "best management practices" (BMPs) for growing food on urban land and provide assurances that owners / operators

implementing the recommended BMPs would be shielded from 21E liability. For residential urban areas contemplated for urban agriculture uses, MassDEP could, for example, require a "Phase I" type investigation prior to commencement of farming activities. A Phase I is typically a "paper" investigation that reviews aerial photographs, tax records, and Sanborn fire insurance maps to ensure a property was used consistent with its zoned purpose. A required visual inspection / site walk would ensure no obvious hazards are present and barring any unanticipated discoveries in the Phase I or site walk, the land could be used, pursuant to the BMPs. The presence of typical urban contamination would be assumed. BMPs must be sufficiently strong to protect farmers and others coming into contact with soils.

The MCP currently exempts certain common urban contaminants, at background levels, from 21E's reporting obligations. The MCP defines "background" as "those levels of oil and hazardous material that would exist in the absence of the disposal site of concern which are either: (a) ubiquitous and consistently present in the environment at and in the vicinity of the disposal site of concern; and attributable to geologic or ecological conditions, or atmospheric deposition of industrial process or engine emissions; (b) attributable to coal ash or wood ash associated with fill material; (c) releases to ground water from a public water supply system; or (d) petroleum residues that are incidental to the normal operation of motor vehicles." 310 CMR 40.0006(12). The Massachusetts Oil and Hazardous Material List (Subpart P of the MCP; 310 CMR 40.1600) (the "MOHML") is a list of oils and hazardous materials that are subject to the MCP along with their reportable quantities and concentrations. The reportable quantities included on the MOHML are provided in pounds. Reportable concentrations are provided for two categories of groundwater (GW1 and GW2) and two categories of soil (S1 and S2). GW1 is groundwater that is protected for its current or potential future use as drinking water, and GW2 is groundwater that may act as a source of volatile material to indoor air.[75] S1 is soil that is considered to have a potential for exposure to people, such as surface soil in residential neighborhoods, while S2 is soil that would have less potential for exposure. The most relevant concentration for urban gardening is S1, which includes surface soils in densely populated areas.

While certain common urban soil contaminants are exempt from MCP reporting obligations, without further guidance from MADEP, the exemptions may not be sufficiently well defined to provide a landowner with the assurance necessary to encourage more use of urban lands for agriculture. For example, coal ash that is associated with fill material is considered background and therefore not reportable; however, coal ash—even that associated with fill—may contain "contaminants like mercury, cadmium and arsenic," each of which is listed in the MOHML and reportable in the following quantities:

- Mercury: Reportable at a quantity of 1 lb. and S1 concentration of 20 mg/kg.
- Cadmium: Reportable at a quantity of 5 lbs. and S1 concentration of 2 mg/kg.
- Arsenic: Reportable at a quantity of 1 lb. and S1 concentration of 20 mg/kg.

Given its prevalence in the area, it is conceivable that MassDEP could consider lead "consistently present in the environment at and in the vicinity of the disposal site of concern" and therefore a background material. 310 CMR 40.0006(12). Nevertheless, lead is not specifically listed as a background material like coal ash, and it is listed in the MOHML with a reportable quantity of 5 lbs and reportable concentration for S1 of 300 mg/kg. Similarly, asbestos does not categorically meet the definition of "background." It is listed in the MOHML as reportable in quantities of 1 lb. or more (concentration listed as N/A). *See* 310 CMR 40.1600.

The MCP's definition of "release" provides that "releases of hazardous material indicated by residues in the environment[,] . . . resulting from the application of pesticides in a manner consistent with their labeling" are "exempt from the notification requirements set forth in 310 CMR 40.0300." 310 CMR 40.0317(8)(c). Thus, pesticides are only reportable if they are present in quantities that exceed those levels consistent with approved application methods.

To effectively encourage more land owners to make land available for urban agriculture without fear of 21E liability, any MassDEP guidance will need to spell out clearly that levels of common urban soil pollutants will be considered background to the extent levels fall below applicable reportable quantities, and resolve lingering issues with respect to coal ash.

Addressing 21E liability is a key step in opening more urban and peri-urban land to agriculture. MassDEP's budget, however, is severely constrained at this time. Even with the best of intentions, it will be a challenge to elevate this issue as a priority within MassDEP. Even assuming such guidance was developed, community members and other stakeholders may remain reluctant to support growing food in locations where underlying soils have not been tested, even when exposure is mitigated. A thoughtful, science-based outreach to stakeholders regarding risks posed by urban farming and gardening—assuming BMPs are in place—will be a necessary complement to this policy work. While such guidance would mitigate risk of 21E liability, it would not insulate landowners from potential tort liability (for example, a farm employee claiming that he was injured as a result of coming into contact with contaminated urban soils) and landowners / operators may still determine that the liability risks outweigh potential benefits.

Regulatory Reform—Management of Organic Wastes in Massachusetts

As the number of urban and peri-urban farms and gardens increase, the demand for high-quality compost and soil amendments is also increasing. Policy reforms that encourage commercial development of facilities that compost and reuse of organic material will help advance more sustainable agriculture practices, while reducing landfill waste and associated greenhouse gas emissions and providing new sources of clean energy through processes like anaerobic digestion.

Organic wastes refer to wastes of biological origin, such as leaves, cardboard, garbage, wood, and manures. When landfilled, such wastes are a source of methane, a greenhouse gas. The Massachusetts Clean Energy and Climate Plan for 2020 (Climate Plan) sets ambitious greenhouse gas emissions reduction targets. MassDEP's Solid Waste Master Plan, 2010-2020, consistent with the Climate Plan's goals, sets targets of reducing the quantity of waste disposed of in the Commonwealth by thirty percent (two million tons) by 2020 and by eighty percent (5.2 million tons) by 2050. As discussed, reducing, and ultimately eliminating, the volume of organic material in the solid waste stream is critically important, and will help Massachusetts to mitigate greenhouse gas emissions, reduce landfill waste and related environmental impacts, and facilitate growth of technologies and businesses that can transform that waste stream into clean energy and healthy soil amendments to support a more sustainable food system.[76] MassDEP aims to achieve this goal, in part, through diversion of organic wastes from the solid waste stream. In early 2011, an organics capacity task force was created to identify a framework for organic material management in Massachusetts, leading to the release later that year of draft and final proposed rules amending regulations governing solid waste disposal (Site Assignment), 310 CMR 16.00, and Wastewater Treatment Works and Indirect Dischargers, 314 CMR 12.00. MassDEP has proposed to exempt from the Site Assignment requirements municipal food material collection activities; composting at non-farm and non-residential locations of up to five tons and ten cubic yards of vegetative and food materials or animal manures; and MDAR-regulated farm-based composting and other aerobic digestion activities.[77] MassDEP also proposed to make small windrow composting operations eligible to obtain permit by rule and determined that the Massachusetts Department of Agriculture ("MDAR") should regulate organics management on farms, and that farm-based projects not covered by MDAR's program should seek permit by rule or site-specific permitting from DEP, as appropriate.[78] At bottom, these exemptions will have the effect of reducing the regulatory burden on composting facilities, making it much easier to site and operate such facilities—a very positive step for the Commonwealth. The proposed amendments, however, included no specific provisions to ensure the quality of the pre-sorted materials that would feed a permit by rule composting operation, or that the final outgoing products are suitable for their intended purposes, which is inconsistent with the principles articulated by MassDEP for managing such materials. See *Building Capacity for Managing Organic Material in Massachusetts*, § 2 Basic Principles at 5 (Public Hearing Draft, Nov.10, 2011).

In particular, the general performance standard for permit by rule composting operations, see proposed 310 CMR 16.04(2)(a)(2) is too vague, and therefore provides neither adequate notice to operators of what is required, nor an enforceable standard.[79] MassDEP should develop screening protocols for inputs and adopt appropriate monitoring and reporting requirements for finished compost that is intended for sale, application in agriculture, or other distribution. Monitoring should include at least quarterly sampling and independent analysis for, at a minimum, the following parameters: pesticides, lead, invasive species, and bulk contaminants (*e.g.*, glass, plastics). There have been occasions when community gardens within the City of Boston had to reject finished compost because of high lead levels, and recently, the problem of lead in City compost was the subject of a Boston Globe story. Such a requirement is necessary to protect consumers or other end users from contaminated compost and

ensure a level playing field for composting businesses. MassDEP should solicit stakeholder input on an appropriate industry standard for periodic sampling and independent analysis of finished compost.

To ensure the long term success of its efforts, DEP should consider implementing a regular inspection protocol for permit by rule composting facilities in the first years of the program. A significant potential danger is that, despite MassDEP's proposed performance standards for composting sites, operations will be poorly run, setting a bad precedent for an activity that Massachusetts urgently needs. Good management will lead to broader acceptance of composting operations in Massachusetts communities. It will be important to take the steps now that are necessary to ensure that composting operations will be operated in a manner that does not cause nuisance conditions, or otherwise reinforce public perception of such activities as undesirable land uses. That concern becomes elevated when such operations are located in communities that already are subject to higher concentrations of polluting or otherwise undesirable land uses.

Image credit: urbanfoodie33 via Flickr

City Growers Context

City Growers will need a reliable source of quality compost and is poised to benefit from regulatory changes being proposed by MassDEP that should make it easier for small composting operations to get up and running. One concern will be ensuring consistent quality of the compost. Compost quality is determined by a combination of good management process and appropriate input material. In addition, the new MassDEP rules may make it possible for City Growers to compost some agricultural residuals on farm sites where there is sufficient space.

The Farm Business—Structuring for Success

We analyzed the corporate forms and land procurement strategies of 18 local and national urban agriculture enterprises.

The pre-production phase of an urban farm requires substantial capital investment, not just in land, but also in equipment, materials, and the labor required to prepare land for cultivation. From its inception, the organization must be structured around these needs and the strategies used to address them. The complexity of conducting urban agriculture in Boston leads us to conclude that a joint venture —in which a for-profit business collaborates with a non-profit partner—can help overcome some of the many challenges urban farms face in the land procurement phase and beyond.

A distinguishing feature of urban agriculture is that the farms and farmers are intentionally embedded into an urban economic and social system and therefore have a number of opportunities and responsibilities beyond production. The majority of urban farms, both non-profit and for-profit, seek to serve the triple bottom lines of

economic viability, environmental stewardship, and social justice. We categorize the major models as non-profit, for-profit, and partnership between a for-profit and non-profit.

Non-profit

Despite its relative high density and lack of available growing space, the Boston area hosts a number of gardening- and farming-related non-profit organizations. Many organizations (such as CitySprouts and Groundwork Somerville) use schoolyard gardens to engage young children during the school year and teen interns during the summer months. Other area organizations (such as Boston Natural Areas Network) support community gardeners with garden space, tools, and training. The non-profits distribute their produce in a number of ways, including donation (for example, The Food Project cultivates food that it donates to the Pine Street Inn), sales at local farmers' markets (for example, Groundwork Somerville participates in the Union Square Farmers' Market), or distribution through neighborhood CSAs (as in the case of ReVision Urban Farm).

The non-profit model is appealing for a number of reasons:

- With 501(c) 3 status, an organization can generate foundation, government, and individual support. Increasing interest in food, sustainability, and community health makes urban agriculture a compelling giving priority (though at the same time, overreliance on donations can put an organization at risk).
- Incorporating as a non-profit allows an organization to focus on a mission of community change rather than financial gain.
- It is easier to access public land as a non-profit organization.
- The non-profit model is well suited to one-time donations for land acquisition.

For-profit

In our research we did not find any examples of for-profit urban core farms in Massachusetts other than City Growers, but there are a small number in other states. Offering urban agricultural consulting services is another profit-generating model. A few organizations (such as Green City Growers and Recover Roofs) provide fee-for-service technical assistance to "food roof" installers and gardeners. Through grower or market cooperatives, growers collaborate to set up market stands, purchasing insurance, tents, tables, and other equipment collaboratively.

Creating change through enterprise is a compelling reason to pursue the for-profit model. Other benefits include:

- Job creation;
- Capitalizing on the demand for fresh, locally grown produce; and
- Freedom from the restrictions and obligations associated with non-profit status.

For-profit partnered with a non-profit

Partnerships between non-profit and for-profit organizations are new in urban agriculture, but they have great potential in Boston where land and infrastructure costs are relatively prohibitive to new farm businesses. The City Growers model demonstrates the issues.

As City Growers scales up, its sales revenue will cover more and more of the operating costs. However, in order for their business model to succeed, City Growers determined that it will need a non-profit partner and operate within a hybrid framework. While the land itself is free, preparing one acre of vacant land for cultivation costs close to $50,000. The expenses include site preparation, landscape development, water hook-up, and administrative processes associated with the land acquisition. City Growers will collaborate with a non-profit partner that will generate foundation support; procure, and prepare land for cultivation; and then lease the land to City Growers for growing purposes. The non-profit will also have an educational (e.g. job training) and community development mission that aligns with that of City Growers. The ongoing costs of labor and supplies are associated with producing and delivering crops to urban markets will be self-supporting from sales.

The experiences of City Growers—and the other organizations we studied— illustrate the importance of contemplating these issues early on in an organization's life, and of choosing the structure that matches its mission, goals, and financial realities.

A partnership model allows organizations to take advantage of the best of both the non-profit and for-profit approaches. With this approach, organizations can:

- Generate profit for their owners and investors and leverage growing interest in agriculture, local food, and health.
- Attract grants and donations, to help urban agriculture businesses become profitable more quickly and enable them to provide food to low-income communities below cost while still paying staff a fair wage.

Urban Farming Technique

Limited space and soil quality issues make alternatives to traditional in-ground growing attractive to urban farmers. We broadly considered start-up costs, regulatory barriers, maintenance, and safety considerations associated with in ground growing and four alternative growing methods: raised beds, hydroponics, rooftops, and greenhouses. When sufficient growing space is available, in-ground and raised beds are the most affordable, however more expensive rooftop and hydroponic techniques may be necessary where little or no land is available.

Beyond farming technique, the most effective urban farmers build trust with their neighbors to develop a "social license to operate" – the support of the community and relevant stakeholders. A successful urban farm business needs to reach out to its neighbors to engage and educate about the farm.

In-ground and Raised Bed

In-ground cultivation consists of tilling clean soil that has been brought to the site. Additional issues related to urban soils have been described previously.

Raised bed cultivation is similar to in-ground, but cultivation takes place in a constructed "raised" bed. The cost of new soil is a significant expense, but the start up costs for in-ground and raised bed farming are lower than hydroponic and rooftop.

Image credit: jbolles via Flickr

Hydroponic

In hydroponic systems, plants are grown in water (rather than soil) with added liquid nutrient supplements. Hydroponics can be practiced in many indoor facilities, including in a plastic or glass greenhouse or in a renovated industrial building.

Image credit: missdrummajorette via Flickr

Hydroponic systems are especially appropriate for brownfield sites, where in-ground growing is precluded due to contamination. Hydroponics can also be practiced indoors using artificial grow lights, potentially utilizing abandoned warehouse space. Hydroponic growing offers other advantages over soil-based growing, such as using less space per plant, recycling water (thereby utilizing a fraction of soil-based systems), and year-round cultivation.[80] Though certain plants, such as cucumbers, tomatoes, and lettuces, are well-suited to hydroponic growing, some have derided the lack of flavor of hydroponically grown foods.[81] Additionally, hydroponic growing can be energy, capital and labor intensive – Gotham Greens operates from a $2 million greenhouse in a 15,000 ft^2 space – and requires advanced technical skills to operate and maintain the system.[82] During its start-up phase, it is one of the costliest modes of production. Though not yet widespread in Boston, Sky Vegetables, a Needham-based company, plans to build the area's first facility, a 440,000-square-foot enterprise in Brockton.

Rooftop

A new trend in urban agriculture is the use of rooftops for growing, and a number of rooftop farms exist in Boston. Rooftop growing can take a number of forms, including soil-based, greenhouses, hydroponics, or a combination thereof. Rooftop opportunities are abundant in many cities, but may be challenged by the logistics of bringing in and taking out materials such as growing mediums, manure fertilizer, or plant wastes, in addition to city building codes and zoning issues. Rooftop growing requires a flat, structurally sound roof with a high weight-per-square-foot rating (in order to safely hold the combined weight of soil, water, plants, and workers), water access, solar exposure, wind protection, tool storage area, and waste disposal. Additionally, building codes generally require two exits and perimeter barriers for safety.[83] Rooftop sites also require extensive engineering to design and to install root barriers, drainage mats, and growing mediums. New products, such as Rooflite soil, are being developed which offer an alternative, lighter-weight soil-like growing medium than typical soil.

Image credit: kthread via Flickr

Roof top gardens are more expensive than in-ground gardens, for a variety of reasons, such as the costs of reinforcing the underlying structure to support the weight of materials (and, in Boston and other northern climates, the weight of snow), the costs of moving materials onto multi-story roofs, and the increased expense of engineered growing medium versus regular soil. However, rooftop gardening can create new careers for technicians trained in the construction, installation, and maintenance of rooftop sites. Training is crucial to ensure that the growing practice does not damage the surface of the roof and that any grower is safe at such a height. Building owners that

allow rooftop gardening may reap rewards such as reduced utility and sewer costs, winter insulation, potential LEED credits, and increased building energy efficiency.[84]

There are new rooftop farms at the Boston Medical Center (a collaboration with The Food Project), b.good burgers in Brookline, and Ledge Food and Drinks. The latter two initiatives are partnerships between the restaurants, Green City Growers, and Recover Green Roofs.

Greenhouses

Greenhouses and hoop houses capture the sun's heat or add artificial heat to create a warm, protected environment for plant production, making it possible to extend the growing season. A typical greenhouse may be glass or plastic encased, with plants growing in-ground or in a growing medium on tables, and can be heated to provide added warmth on colder days. Passive-solar hoop houses (also called high tunnels) are constructed with double-layered plastic sheeting stretched over a metal "hoop" framework. They are easier to construct than standard greenhouses, and some are mobile and can be moved around the farm site depending on season or site conditions.

A few commercial greenhouses exist in the Boston area, including an abandoned glass greenhouse complex in Somerville. The Food Project recently renovated existing greenhouses (owned by the Dudley Street Neighborhood Initiative) in Dorchester, with funding from the Boston Public Health Commission and the Mabel Louise Riley Foundation, and is using them for year-round production and community growing spaces.[85] The Boston Urban Agriculture overlay zone allows for season-extending structures such as cold frames, hoop houses, and greenhouses.[86]

Image credit: USFS Region 5 via Flickr

Social License to Operate

Urban agriculture businesses face challenges in obtaining community support that are not shared by their rural and suburban counterparts. Because the farming use is located in much closer proximity to other residential and commercial uses, urban farm activities are subject to heightened community scrutiny. Odors, visibility of farming implements, working farmers, dirt, vegetable matter, noise, and other impacts can have a magnified effect in urban settings.

Urban farms need to identify the key stakeholders in the community, including plot neighbors, politicians, and community activists, and communicate with these stakeholders early and often about any community concerns, including efforts to ensure food produced in urban environments is safe. Urban farmers must also make the case in deed and word for the positive impact their businesses bring to the community, such as jobs, economic development, environmental improvements, and health (including food access) benefits.

Implications for Urban Agriculture in Boston

Unless the business model specifically dictates a particular farming method (e.g., a rooftop growing project in a business district) the production technique should be chosen based on the makeup of the available parcels of land. In-ground farming can be the cheapest technique provided extensive work is not required to improve the soil quality. Raised beds offer a good balance of limiting start-up costs while addressing soil safety concerns. Greenhouses and hoop houses can be effectively used to extend the growing season for both in-ground and raised bed farming.

Post-production: Adding Value to Farm Products

Whenever possible, urban farms should capitalize on the fact that value-added products (processed foods such as pickles, jams, and triple-washed lettuce) yield higher profit margins than produce alone. Such products also build brand recognition in a way that produce cannot. However, enhancing the value of raw produce is out of reach for many small operations due to a lack of capacity and access to facilities to process their products after harvest. Further, urban farmers, especially those raising livestock, must comply with health and processing regulations that are primarily designed for much larger-scale operations.

Food Processing Facilities

Some farms own their own processing facilities. Czajkowski Farms in Hadley, MA, for example, owns its own on-site food processing facility and caters to schools and other institutional customers looking for processed produce, including peeled and diced sweet potatoes, sliced carrots, snipped green beans, berry jams, and coleslaw. However, for most small farms, owning and constructing on-site processing facilities is not financially feasible, so farmers either forego the opportunity or turn to community-based solutions. Through interviews with regulators, leaders of community-based value-added operations, and farmers, we identified the critical role that community-based infrastructure plays in enabling farmers to refine and enhance their products, thereby increasing revenue and brand recognition.

Image credit: laura padgett via Flickr

Because of the expense of privately-owned facilities, many value-added product makers choose to share space in a community kitchen. Users pay a fee to share equipment and storage space, and they often receive business advice from kitchen managers. Alternatively, farmers can serve as community kitchen suppliers, leaving the processing and sales to other businesses.

The processing of farm products introduces more risk of introducing bacteria or other health hazards, so value-added processors may need to obtain extra training, equipment, licensing, or insurance to be able to sell their products. For example, a state or county health department generally requires that all food businesses have a full-time employee who is "food safety certified." Maintaining this staff with this additional certification is beyond the reach of many smaller operations.

While the City of Boston currently prohibits the raising of poultry and other animals, the regional food system incorporates animal husbandry. (However, a number of surrounding cities do allow chickens.) Fears of contaminated animal products have resulted in extremely detailed processing requirements that are geared towards large, industrial processors. The lack of midscale food processing facilities has made it difficult to meet the demand for locally raised meats and other products.

While value-added products provide significant new revenue opportunities for urban agriculture, the higher margins exist for a reason: the costs associated with post-processing are significant. In addition to special training to comply with relevant regulations, specific infrastructure needs to either be constructed or shared with another organization. The location of existing infrastructure is sparse and not conducive to local food production.

The most effective strategy for expanding the ability of local farmers to enter these markets is to grow the availability of community-based infrastructure that would be accessible to urban agriculture businesses. The fact that there is both a market for farmers wanting access to facilities to create the products and businesses that want to buy the products from local vendors makes this a significant economic development opportunity.

There are several examples of community-based infrastructure within Massachusetts. They include:

- **Crop Circle Kitchen**: Located in Jamaica Plain, this kitchen is Boston's only shared kitchen and culinary business incubator. The space is over 3000 sq. ft. and provides cooking space, stoves, ovens, blenders, and cold and frozen storage.[87]
- **Western Massachusetts Food Processing Center**: Operated by the Franklin County Community Development Corporation, the center provides infrastructure as well as business planning assistance to food entrepreneurs in Franklin County. Producers must apply to participate in the center and pay a fee for use and membership.[88]
- **Dorchester Food Co-op**: Founded by Dorchester residents, this cooperative grocery store is in nascent stages to become an affordable, healthy, sustainable option for residents to purchase groceries within the community. The store will be community-owned and operated.[89]

City Growers Context

City Growers currently produces a mix of products that are sold with minimal processing and packaging, but plans to evaluate a mixed salad-green product that would include cutting and washing the greens. If cut and washed greens are added to the crop production and processing chain, one or more commercial washing machines and a slow-speed sorting and packing line would be added to an expanded wash station housed within the greenhouse.

While creating additional revenue for City Growers, this value add product will also incur additional costs. The product will require regular testing, and quality control procedures will need to be put in place. Staff will need to be trained on how to properly wash, process, and package the products while conforming to local regulations and maintaining product quality.

Mobile Poultry Processing Unit (MPPU)

National poultry trends point to consolidation and vertical integration within the industry, with the number of farms raising over 500,000 birds annually increasing by nearly 25 percent between 2002 and 2007.[90] Large animal processing operations have adverse environmental and food safety impacts. Consumers are increasingly interested in locally produced poultry, and in response, new poultry producers are entering the market. Barriers to entry in poultry production are relatively low since initial capital investments in chicks, fencing, and feed are minimal. In Massachusetts, the number of farms selling broilers and other meat-type chickens increased from 81 to 94 between 2002 and 2007, but the average number of birds sold annually per farm fell from 363 to 184, indicating the emergence of smaller operators.[91] A survey conducted by the New Entry Sustainable Farming Project (New Entry) of 82 small farm operators reports that 83 percent of potential poultry producers cite "ability to process" as the foremost barrier to entry.[92]

The Mobile Poultry Processing Unit (MPPU) arose out of a need to create a cost-effective poultry processing alternative. The MPPU Pilot Program is a joint project between Massachusetts Department of Public Health (MDPH), MDAR, the New England Small Farm Institute and New Entry. The project began in 2008 as an attempt create value-add infrastructure and licensing that fit the needs of small, local poultry producers. Eligible users are those who raise fewer than 20,000 chickens or 5,000 turkeys in a year on their own farms, and seek to process them for direct sale of whole, raw birds to consumers. The MPPU, owned by the New England Small Farm Institute and managed by New Entry, is a mobile trailer fitted with poultry processing equipment. It can be driven to farms around the state.[93]

According to the New Entry *Handbook for Small Scale Poultry Producer-Processors* that details how to apply for a license to process poultry using the MPPU, "poultry producers in Massachusetts who raise and slaughter less than 20,000 birds annually, who do not engage in the business of buying and selling birds, and who do not conduct any interstate commerce are exempt from USDA inspection."[94] Other state and local regulations govern poultry

operations, however. Poultry producers that wish to sell poultry must obtain a license from MDPH pursuant to M.G.L. Ch. 94, section 120. A producer must comply with applicable sanitation requirements for meat and poultry processing establishments, see 105 CMR 530.00, and obtain local board of health approval to proceed with slaughter activities as required by M.G.L. Ch 111, section 151. Producers must attend state-approved trainings, certain records must be maintained, and the unit must be operated consistent with requirements set forth in MDPH's 2011 guidance.[95]

The MPPU was piloted for four years, beginning in 2008. Such pilot programs allow state agencies to observe and improve project operations, as well as gain a better understanding of any potential regulatory issues before full commercialization. As MDPH has also observed, a pilot was necessary in this instance where there is a lack of resources available to agencies to support an entirely new program. New Entry and the New England Small Farm Institute worked closely with state agencies and created training materials and programs to educate small poultry producers regarding regulatory requirements. After the first two years of the pilot, MDPH released a report with recommendations in 2009. Starting in 2012, Massachusetts' first MPPU will be open for business on a fee for service basis.[96]

Of major concern to stakeholders is the time it took the Department of Public Health to respond to the need for regulation and/or guidance governing this innovative business process. New poultry operations have found the multiple licensing requirements difficult to navigate, and board of health approval can be unpredictable, leading to business uncertainty.

The Commonwealth must be commended for the efforts of its agencies—MDAR, MassDEP, MDPH—to coordinate in advancing the MPPU Project. However, feedback on the regulatory requirements suggests that there is a need for even better coordination, and a streamlined permitting process. The physical site requirements should allow for more flexibility to take into account differences among farms and slaughter locations. Massachusetts should continue to advance innovative means to allow farmers to add value through the use of shared infrastructure.

Distribution

Urban farmers need to find effective ways to get their product to individual consumers, aggregators, and retailers. Distribution strategies are determined by the markets (whether farmers sell to restaurants, individuals, or retailers). The target market depends on the quality, quantity, and consistency of product that a farm can deliver. For example, if a farm cannot produce high-end products, it is unlikely to distribute to upscale restaurants. It is a particular challenge to reach communities—such as low-income neighborhoods and schools— that don't have established channels to market fresh foods. Selling to public schools presents additional barriers because of extensive regulations, which are discussed below.

Ultimately, while there are specific challenges to reaching different markets and different farms may pursue different distribution strategies based on their target markets, a uniform barrier exists for everyone: the food transportation and distribution infrastructure is not designed to serve the scale at which urban agriculture operates.

Aggregation and Transportation

Through interviews and case studies, we analyzed two distribution strategies that are particularly relevant to small urban farmers: the use of aggregators and specialized transportation methods. Though we recommend that in order to maximize profitability urban farms integrate value-added activities into their business model, in cases where there is insufficient staffing or scale, the use of aggregators (entities that consolidate produce from multiple sources and sell it at the wholesale level) can help. Aggregators eliminate the need for a farm to conduct its own marketing and distribution. Small growers opting not to sell to aggregators can use creative strategies like bike delivery, the sharing of delivery trucks, or CSA models that bring the customer to their doorstep. In addition to their cost-efficiency, these distribution methods minimize businesses' GHG emissions.

Aggregators assist farmers with processing, packaging, storage, and distribution of produce. Working with an aggregator reduces the number of deliveries the farmer must contend with, freeing up time to focus on production or direct marketing. Farmers can also take advantage of aggregators' resources, such as insurance or refrigerated

trucks, that allow them to access retail markets that would not otherwise be accessible. Aggregators don't charge growers to market their produce, but they do charge nominal delivery fees based on distance and volume.

There are challenges associated with using aggregators, however. Economies of scale are important when transporting produce, so mid- to large-size farms see the greatest efficiencies. Aggregators generally set shipping rates based on a pallet unit, which can be difficult for a small producer to fill regularly. Some aggregators may take smaller orders only if orders are brought to their distribution centers; urban farmers may not be able to spare the time to do this consistently, depending on their proximity to the distribution center. However, farmers can collaborate to fill a pallet or fill a delivery truck, especially if they are located near each other. The aggregator often helps with these logistics, but it requires farmers to be flexible.

Though few aggregators currently exist in New England, those in operation are creating significant opportunities for local growers to get their product to market. Two of these, Organic Renaissance FoodEx and Red Tomato, serve hundreds of farms in the area.

Aggregator example: Organic Renaissance FoodEx, New England

FoodEx is an online food marketplace where buyers browse, select, and purchase from a large variety of regional growers. FoodEx charges for order delivery based on travel time. Growers are able to list their goods at no charge; buyers pay a monthly fee to view the listings and place orders. FoodEx offers dry, cold, or frozen storage facilities for growers.[97] While FoodEx's services are best suited for medium- to large-scale growers (who produce food by the pallet unit), small growers can still benefit from using FoodEx by taking advantage of FoodEx's small case delivery options, provided the farmer could drop off the produce to a FoodEx hub (currently located in Boston and Athol, Massachusetts; Rockingham, Vermont; and Long Island City, New York). Another important advantage is that smaller growers can now access institutional markets that require higher levels of insurance or certification of their suppliers[98] because FoodEx insures the transportation and products and has access to refrigerated trucks.

Most urban farms own at least one pick-up truck-type vehicle, which they use for a variety of production tasks, such as importing soil or transporting harvested produce to storage. Vehicle expenses can be minimized or eliminated by sharing vehicles with other businesses, outsourcing deliveries to aggregators, or using bike delivery methods. In the Boston-area, a bike delivery company, Metro Pedal Power, partners with many farms to deliver either CSA shares to urban customers or produce to local stores and restaurants. Farmers attending Boston-area farmers' markets pack the store or restaurant's order and Metro Pedal Power transports the order from the farmers' market to the retail outlet.[100]

Aggregator example: Red Tomato, Northeast United States, based in Canton, MA[99]

Red Tomato coordinates the sale and distribution of produce in the New England region. Growers in the Red Tomato network harvest, process, pack, and store their produce at their own farms, but Red Tomato staff help to market it to retailers and coordinate the delivery from farm to outlet. Either farmers will deliver their produce to the buyer or Red Tomato will hire a trucking company to pick up and deliver the order. The farms they currently work with range from 20 to 200 acres, but there is no specific acreage minimum or production minimum required to participate. Red Tomato requires that growers be equipped to produce wholesale goods and manage their own processing, packing, and storage. Smaller growers have partnered with larger growers or institutions to share processing and storage facilities or combine their products to fill a delivery truck. Red Tomato can help facilitate these connections.

BUYING CLUBS—SPECIAL DISTRIBTUTION CONCERNS FOR RAW MILK

Pasteurization of milk was first introduced as a food safety and sanitation practice in the early 1900s as a means of combating poor quality and contaminated milk often produced in "urban confinement dairies." Compulsory pasteurization laws became common in the 1930s. Many sustainable farming, local food, and natural foods advocates, however, believe that pasteurization kills good bacteria in milk, diminishes vitamin content, and denatures proteins valuable to the human body.[101]

In Massachusetts, farmers currently may sell raw milk only from the farm where it was produced. Raw milk is not allowed to leave the premises, even if only to go to a farmer's farm stand on an adjacent property. The law requires milk dealers to be licensed, and defines "milk dealer" to include those who distribute or otherwise handle milk. With no legal distribution network in place, consumers must travel directly to the farm to purchase raw milk, sometimes over great distances. In response, customers organized raw milk buying clubs. Club members share the transportation cost and time required for direct farm purchases of raw milk by rotating responsibility for weekly milk pickups among members. In January 2010, MDAR issued cease and desist orders to four raw milk dairies in the state on the ground that the buying clubs were purportedly inconsistent with the requirement to sell directly to customers.

MDAR proposed amendments to the Standards and Sanitation Requirements for Raw Milk, 330 CMR 27, which would have expressly outlawed raw milk buying clubs. In response to strong opposition and concerns about economic impacts on raw milk producers, MDAR pulled the proposed rule for further study, yet made clear it still considers the clubs to be unlawful.[102] MDAR held a public hearing on the issue in spring 2010. The contemplated ban on buying clubs contradicts basic principles of agency law, which would permit a private citizen, in this case, to contract with another person to buy the raw milk dairy, or even the cow that produced the raw milk. It seems an absurd result that an adult could not then purchase raw milk for use by another. MDAR's motivation appears, in part, to relate to concerns that the risk of consuming raw milk may not be adequately communicated to members of clubs that do not make the actual on-farm purchase. MDAR should consider appropriate labeling requirements, as are often used to communicate risks associated with use of potentially dangerous products, including tobacco and alcohol.

New England dairies have suffered over the last several decades, with the number of dairies in Massachusetts alone dropping from 829 in 1980 to 189 in 2007.[103] Raw milk enhances the viability of dairies through reductions in production costs and increased market value of the final product. One gallon of raw milk can sell for $10 to $14 per gallon, with revenues feeding local economies, and the number of raw milk dairies in the state nearly tripled between 2006 and 2011.[104] Raw milk dairy owner and former MDAR dairy inspector Terri Lawton of Lawton Family Farms sells up to 100 gallons of raw milk per week, providing a critically important revenue stream to the farm.[105] In response to the controversy over raw milk sales spawned by MDAR's actions, state representative Anne Gobi introduced legislation that would allow licensed raw milk dairies to deliver raw milk to customers and sell their milk on land that they own or rent that is not contiguous to the land where animals are milked.[106] If passed, the legislation, H.1995, An Act Relative to the Distribution of Raw Milk, would give a green light to the state's 27 raw milk dairies to deliver milk directly to customers.

It is easy to imagine buying clubs being organized for purchase of locally grown MPPU processed poultry (which, as set forth above, may also be sold only directly to consumers). If small animal husbandry is one day permitted in Boston (as the City has hoped), fresh poultry and raw goat or other milk could soon be available to urban consumers. Balancing the need to encourage these markets and support efficient distribution networks with the need to effectively control risk of food borne illness will continue to be an important—and hotly debated—issue.

MARKETING & CONSUMPTION

There are a number of channels through which urban farmers can sell fresh produce, each with its own advantages and disadvantages. The channels are limited because many markets are unaccustomed to working with small, independent producers. The barriers to marketing and consumption essentially parallel the distribution barriers; individual urban farms may not produce enough food to gain access to existing, traditional markets. The infrastructure to move food from farms to consumers is not scaled to small, local farms. This effectively limits the

size of farms that might otherwise seek to expand their operations. A lack of access to key markets is a critical barrier that currently limits the potential of urban agriculture.

Image credit: NatalieMaynor via Flickr

The scope for the research and analysis for this year did not include a focus on consumption. However one significant challenge in the context of consumption is who can purchase the product, both in terms of cost and distribution outlets within communities.

To be successful in direct and indirect sales, effective urban farms build relationships with customers, strive to raise product of consistent quality and quantity, and position themselves within the broader local and regional food supply chain. While urban farms can't compete with conventional Mid-western or West Coast growers—who can offer high-volume, inexpensive product year-round—they can capitalize on their local status, networks, and niche. Customers are increasingly interested in partnering with locally-owned businesses, and there is growing understanding about the value of food produced close to where it is consumed.

City Growers Context

Over their many years in the food industry, City Growers' founding team have created strong relationships with a variety of outlets, including higher-end, high-volume restaurants and hotels, community retailers, and institutional food-service companies. In 2011, City Growers sold fresh produce to seven restaurants, two commercial enterprises, and one retailer. City Growers focuses on crops that are in demand and known to be profitable. It targets crops that build brand identity, yield reasonable product per square foot, and allow for sustainable production. City Growers has found that there is more demand for its product than it can currently supply. The team is focusing on meeting this demand, which will be its challenge for the next growing season.

We explored direct and indirect marketing channels by interviewing representatives in seven categories: farmers' markets, on-farm stands, community supported agriculture (CSA), neighborhood stores, local restaurants, Whole Foods Market, and large institutions. We used the data to generate specific challenges and opportunities for working with each market, and we have included two specific examples in each section to provide more detail.

Direct Sales

Direct sales are those in which a farmer sells directly to a customer. Massachusetts ranks second in New England for direct sales of farm products to consumers, with $42 million in direct sales in 2007.[107] Most small-scale farmers participate in direct sales, as they can yield higher profits margins than wholesale and allow farmers to form strong personal relationships with their customer base. For example, one study of five national locations found that direct sales netted growers 70 percent to 80 percent of retail prices while indirect sales was typically 45 percent to 50 percent of retail price.[108] The following presents the benefits and costs associated with direct sales

Benefits	*Costs*
Instant payment, usually in cash (or pre-season payment, in the case of CSAs).	Reduced productivity—Time at the farmers' market is time away from the farm, which can be detrimental if the farm organization has limited farm labor available.
Consistent personal interaction with consumers resulting in increased and/or loyal customer base and help differentiate products from those of competitors.	Fluctuating customer base—Farmer's market attendance decreases in bad weather, CSA shareholder numbers can vary.
Minimal packaging costs—Produce is usually displayed in reusable containers and sold in standard bags.	Fees—Vendor's fees for farmers' markets or licensing/permitting fees for on-farm stands (vendor's license and/or Board of Health permit) can be costly.
Exemption from the packaging, grading, or labeling requirements found in other retail settings.	Spoilage and damage—Produce is more likely to spoil while sitting out on a market stand or be damaged in transit.[109]
Potential to increase food access for low-income communities. Subsidized CSA models have proven successful in this area.	

Direct Sales example: ReVision Urban Farm's CSA program, Dorchester neighborhood, Boston, MA[111]

In addition to a farmers' market and farm stand, ReVision Urban Farm also operates a community supported agriculture program. ReVision usually partners with other farms to fill shares, especially in 2011, when its main farm site was under construction, and it coordinated orders for the CSA with orders to supplement its market stands. Full shares are $550, Franklin Field shares are $200 (for low-income families living in Dorchester and Mattapan).[112] Of the 75 shares distributed at sites around the Boston area, 11 are low-income.

Direct Sales example: Boston Public Market

Located in Boston's Haymarket district, the Boston Public Market is a non-profit, public-private initiative to build a year-round, local food market in a high-transit area of the city. The project is designed to mimic the popular food terminals of other major cities, such as the Ferry Building in San Francisco, showcasing Massachusetts agriculture and aquaculture.[110] The project is intended to address several policy issues, acting as a vehicle for jobs creation, food-access expansion, and local-food viability. Supported by Governor Patrick's administration as well as MDAR, the project has been a beacon for local food and economic development advocates at the state and community level.

Supporters of the Boston Public Market believe the market will attract tourists and residents alike. Those who oppose the market fear that this project will interfere with the nearby, longstanding Boston Haymarket, which for decades has provided affordable produce to city residents as well as employment. In addition, there are concerns that the market's focus on high-end products ignores city residents' need to access affordable food, though it plans to accept SNAP benefits.

Indirect Sales

A grower makes indirect sales when it sells products to a wholesaler, broker, or store, which then sells the products to some other entity or to customers. Avenues for indirect sales include neighborhood stores, chain stores, local restaurants, and institutions such as schools, hospitals, and universities.

Some farmers prefer to focus on farming and production and choose to outsource the sale or marketing of their products to a broker, aggregator, or wholesaler. Often there is a fee involved for a third party to sell these products. Most farms that utilize an indirect sales model are large farms, where operations are on a much bigger scale than urban farms.[120] Growers must recognize that retailers are accustomed to paying wholesale prices for produce and adjust revenue forecasts accordingly. We have identified the following costs and benefits associated with indirect sales:

Benefits	***Costs***
The food service industry networks may easily lead to more customers and the opportunity to create long-term relationships.	Administrative time spent collecting payments from buyers after delivery—Some restaurants will pay on delivery while others only pay monthly.[113]
Urban farmers can customize their offerings and meet specific needs of buyers (e.g., producing a special kind of lettuce for a restaurant's signature salad[114]).	Specific packaging, grading, and food safety requirements add cost and complexity for the small farmer.
Ability to market the farm's "brand" to a wider customer base.	Certification and/or liability requirements can be time- or cost-intensive for small farmers.
Stable, predictable market if consistency is achieved.	Most large food distributors participate in recall programs that provide food safety updates and track food shipments. Regional or local farmers may not be able to do the same.
Potential to increase food access for low-income communities. Subsidized CSA models have proven successful in this area.	Time spent delivering to the restaurant distracts from on-farm duties.
Ability to sell produce more efficiently through mass deliveries to retailers.[115]	Narrow delivery schedule—Stores and restaurants may only accept produce deliveries at certain times of the day.
Higher percentage of the product is sold for profit.[116]	Costs of delivery if store/outlet is not nearby decrease profit.
	Certain customers may request a grower carry product liability insurance (PLI), which usually costs a few hundred dollars annually for $1 to $2 million in liability protection.[117]
	Large food buyers may require vendors to use refrigerated trucks to transport their produce and for vendors to follow specific food safety standards that were designed with large farms in mind.[118]
	Traceability technology or procedures that enable vendors or customers to trace each food item back to its source, especially important in the case of a food-borne illness, may be time- or cost-prohibitive for small growers or value-added food producers.[119]

Indirect Sales example: Journeyman Restaurant, Somerville, MA[121]

Journeyman Restaurant focuses on making "food that tells a story about the ingredients." To achieve this, the restaurant relies on high-quality local produce, picked up daily from farms or farmers' markets. Journeyman staff typically purchase about $1,000 in perishable produce per week (about $100 to $300 each market day). Journeyman's main challenges include some unpredictability in supply, and time spent sourcing produce (for example, Journeyman's blueberry orders were affected by Hurricane Irene). More importantly, the restaurant often competes with farmers' other outlets; as a result, produce might instead be sold directly to customers for higher-than-wholesale prices. Because of this, staff relies on "redundancy"—sourcing similar products from multiple vendors. Journeyman chefs value high-quality food and like to be able to touch and smell their selections; they spend a great deal of time visiting the farms or meeting the farmers at nearby markets. Using a produce aggregator or a delivery service would reduce their ability to be as selective.

Indirect Sales example***: Private K-12 school, Boston suburb***

This school is a private co-ed, pre-K-12 institution. It's cafeteria serves 500 students, faculty, and staff. The school's food service director, new in 2008, has worked to replace all of the school's processed, precooked items with locally-sourced produce and foods made in house. The director started by changing the salad bar, trading canned and frozen vegetables for whole grains and legume salads. Now, between 15 percent and 20 percent of all vegetables (including almost 90 percent of fresh apples) are purchased locally and tend to be less expensive than purchasing from other suppliers, although there is typically a longer time between placing an order and delivery with local suppliers than with national or global sources. The kitchen utilizes the Massachusetts Farm to School Project Cookbook[122] when looking for recipes that both incorporate locally grown food and are adapted to school-meal nutritional standards.

One element that has helped the school's ability to source more local produce is the informal cooperation between multiple farms; the school places a call to one farmer who then connects with others to fill in any gaps in the order. Because of its relatively small size, the school is sometimes challenged to meet the farmer's purchase minimums and benefits from being located close to other local institutions that place larger orders with the farms, allowing farmers to justify the expense of delivering to the school. The food director expects that increasing the consumption of local foods will depend on how many other value-added products the school is able to purchase. Currently, it buys carrot sticks and pickles from a farm that does on-farm processing, which, although more expensive, cuts down on prep time for the school. Other possible value-added products might include triple-washed lettuce for the salad bar.[123]

Encouraging Markets for Locally Grown Food

The following laws and ordinances provide examples of how state and local policy can advance markets for locally grown food.

School Nutrition Act

In July 2010, the Massachusetts legislature passed the School Nutrition Act (HR 4459),[124])[125], addressing growing concerns over childhood obesity by providing recommendations and provisions for exercise as well as foods sold in schools. The bill was supported by public health advocates across the state, as well as institutions seeing economic and industry benefits to opening the local foods market to schools. The Act's key provisions:

- Establish preferences for state colleges and universities to purchase foods grown within Massachusetts;
- Permit state procurement officers to award contracts for under $25,000 to local food producers without quotations;
- Include nutrition and exercise in state educational goals and standards;
- Regulate "competitive food" (i.e., from vending machine) sales within public schools;
- Require MDAR and Department of Elementary and Secondary Education to coordinate with Farm to School and similar programs, to assist public schools in acquiring local agricultural or locally-harvested fish products;
- Establish a commission on school nutrition and childhood obesity for the purpose of completing an investigation and study of childhood obesity; and
- Establish Wellness Advisory Committees within each public school district responsible for advisory and oversight of the proper implementation of the Act and elated policies.

Wellness Advisory Committees currently are being established in school districts and Farm to School programs are continually expanding their reach to engage more school districts in local purchasing. School district concerns over costs associated with implementation of the School Nutrition Act and the loss of competitive food revenue may impede full implementation. Research shows, however, that schools do not necessarily lose revenue as a result of replacing unhealthy competitive foods with healthier options.

Farm to School Program

The Massachusetts Farm to School program began in 2004 as a grassroots initiative modeled on the National Farm to School program. The program's original intent was to create sustainable food purchasing relationships for local farmers, and in turn encourage the consumption of healthy, nutritious produce at schools.[126] MDAR has supported the program by providing technical assistance and matching farmers with schools seeking to participate.

Less than 10 years later, MDAR reports that over 250 school districts and 110 farms are participating in the program.[127] Advocacy opportunities to increase farm to school program participation may arise as school district procurement contracts expire. The Wellness Advisory Committees established by the Massachusetts School Nutrition Act, may be an appropriate vehicle to encourage greater school participation in the Farm to School program. The Massachusetts Food Policy Council (discussed further below) may also be able to set goals or quotas on local food purchasing that would encourage higher participation rates in this program. Farm to School program participation across all school districts will require significant changes in institutional culture, especially in how school administrators approach food sourcing and preparation. The ability of farms to supply predictable types and qualities of food on a year-round basis will also affect school participation.

Food Truck Initiative

In 2011, the City of Boston passed the "Ordinance Promoting Economic Development and the Food Truck Industry in the City of Boston," citing the increasing popularity of food trucks in other municipalities as well as the increasing demand of people ages 18 to 44 for freshly prepared, high-quality, quick, and cheap food.[128] The ordinance is framed as an economic development tool that will increase the number of local food purveyors and small businesses by streamlining the administrative processes to obtain permits and inspections for mobile food vehicles.

After the food truck ordinance passed, the City of Boston sponsored the Boston Food Truck Challenge to establish mobile food vending at Boston City Plaza. Winners are awarded technical assistance in permitting and obtaining debt financing to support new businesses. There currently are three recipients of the Boston Food Truck Challenge—Clover, Momogoose, and Bon Me; all three of these businesses source locally. Additionally, Clover uses compostable serving ware and Momogoose participates in the World Food Programme "Meal for Meal" initiative, donating proceeds to international aid. Other local businesses, such as Redbones of Somerville, also participate in mobile food vending.

The food truck initiative has the potential to encourage growth of the City's sustainable food business sector, and demand for the products of urban agriculture. The initiative also has the potential to fill the food access gap

through routing and pricing. The City of Boston should continue to support these efforts. Specifically, the City should respond meaningfully to recent criticisms of the program raised by food truck operators. Operators have repeatedly called for the City to designate more parking spots for trucks (there currently are 16), particularly in profitable neighborhoods like Back Bay.[129] Rather than having to share and rotate among existing spaces, operators have also requested fixed spaces for their businesses, so that customers know that a certain truck will always be available at a certain location.

Commonwealth Quality Seal

The Commonwealth Quality Seal is a new branding program developed by MDAR to promote the market for local agriculture and products of farms that grow and harvest their crops

sustainably. The program offers certification for produce, aquaculture, dairy and forestry. Certified products carry the Commonwealth Quality Seal, providing assurance to consumers that the product is produced locally and in a manner consistent with best management practices as defined by MDAR and federal regulation. Interested producers can apply for the Commonwealth Quality Seal and must self-report their management practices. The program is designed to be accessible, with only a small one-time registration fee. It is unclear whether MDAR will inspect seal recipients to ensure practices adhere to those reported.[130] High producer participation rates show that the program is of interest to Massachusetts food producers. Data on consumer behavior is yet to be collected. To ensure confidence in the brand, producer practices should be monitored to confirm conformance with program standards.

Image credit: http://www.mass.gov/agr/cqp/

Bounty Bucks

The Food Project and the City of Boston jointly developed the Bounty Bucks program, which matches SNAP beneficiary produce purchases up to $10.The program is now run by the Boston Collaborative for Food and Fitness There are 82,000 SNAP beneficiaries in Boston. The program was created in an effort to increase low income consumer access to fresh, local produce and enable market expansion for city farmers' markets. Financial support for the program is provided by the Mayor's Fresh Food Fund, Project Bread, Farm Aid, and Wholesome Wave Foundation.[131, 132]

A 2009 study conducted by The Food Project in conjunction with an Emerson Congressional Hunger Fellow shows that 87% of surveyed SNAP customers reported consuming more fresh produce because of the Bounty Bucks program. Additionally, SNAP and matching Bounty Bucks sales exceeded $20,000 in 2009, up from $1,310 in 2008.[133] These statistics, along with several other measures, indicate that the program has positively impacted both SNAP beneficiaries and local producers.

Waste

Some waste haulers have begun to collect source-separated organics, including residential and commercial food waste, and transport this material to area compost facilities. An expansion of commercial urban farming will create new demand for additional compost, which will send a market signal to expand composting operations, which in turn will send a signal to supply more organic material inputs to create compost. As discussed earlier in the section addressing soil quality, regulatory reforms currently underway will help advance new waste processing facilities and technologies, as well as the market for compost and soil amendments.

Food waste is wet and heavy, which makes it expensive to transport long distances. The existing composting capacity in Massachusetts is in more rural areas. Urban farms will need a source of quality compost that is close by.

Source-separated food waste can be an input to compost operations, turning this waste into a resource. As discussed previously, MassDEP has a stated goal of diverting at least 35 percent of food waste from disposal by 2020; if successful, that diversion would result in an additional 350,000 tons per year of organic material that will need to be appropriately managed. The existing composting capacity in Massachusetts can handle over 200,000 tons of material per year, but MassDEP estimates that another 250,000 to 300,000 tons of processing capacity will need to be developed to handle the organic material associated with achieving the 35 percent diversion goal.

Cross-Cutting Issues

Up to this point we have discussed barriers to specific stages of the production supply chain, but there are barriers that cut across multiple stages, as well as high-level market and policy solutions that help overcome these cross-cutting barriers.

Need for Political Infrastructure

There is a need for political institutions—at the local, state, and regional levels—that can help advance our vision for urban agriculture in Boston as an element of a sustainable regional food system. Such bodies provide a voice for agriculture in decision making, and can represent the interests of those working to advance urban agriculture.

Massachusetts Food Policy Council

Food policy councils (FPC) are typically comprised of representatives from city or state agencies (depending on the jurisdiction of the FPC) that may not usually work together, but regulate differing aspects of the food system. They may be informal, non-governmental bodies, or formal bodies authorized by ordinance or statute. The strong version of the FPC is authorized by statute or ordinance, and has specific duties spelled out in the law. FPCs typically are tasked with analyzing a state, city, or regional food system, and making recommendations about how to strengthen it.[134] The chief benefit of FPCs are their ability to "de-silo," bringing together decision makers to analyze comprehensively all aspects of a food system to arrive at better solutions for addressing needs. Depending on its specific charge, an FPC could be empowered to, for example, direct the state to undertake an inventory of state-owned land available for agriculture.

Massachusetts has a legislatively mandated state FPC. The MA Food Policy Council Act (FPCA), HR 4568, was passed in August, 2010 and charges the Council with developing specific recommendations to advance enumerated food system goals. Section 6C(d)(1) sets forth the Council's specific mandate:

> (d)(1) The purpose of the council shall be to develop recommendations to advance the following food system goals for the commonwealth: (A) increased production, sales and consumption of Massachusetts-grown foods; (B) the development and promotion of programs that deliver healthy Massachusetts-grown foods to Massachusetts residents, through programs such as: (i) targeted state subsidies; (ii) increased state purchasing of local products for school and summer meals and other child and adult care programs; (iii) double coupon initiatives; (iv) direct market subsidies to communities with identified needs; (v) increased institutional purchases of Massachusetts-grown foods and other programs to make access to healthy Massachusetts products affordable, and (vi) increased access to healthy Massachusetts-grown foods in communities with disproportionate burdens of obesity and chronic diseases; (C) the protection of the land and water resources required for sustained local food production; and (D) the training, retention and recruitment of farmers and providing for the continued economic viability of local food production, processing and distribution in the Commonwealth.[135]

The Council is also required to make recommendations regarding how agencies can work more effectively together to achieve food policy goals; whether public-private partnerships can advance Massachusetts goals; necessary changes in the law; necessary new policies; and criteria for measuring progress toward achieving goals. The Council must meet four times annually, and it must prepare an annual report to the Governor by December 31 of each year.

If well implemented, the FPCA will improve coordination among state agencies that regulate all aspects of the food system, and will play a meaningful role in strengthening the MA food system, and improving its linkage to the New

England regional food system. With State agencies reeling from unprecedented cuts in staffing and lack of resources, the MA FPC has been relatively slow in getting off the ground. No additional funding was appropriated by the Legislature to fund the work of the FPC. The FPC was not fully appointed until over a year after passage of the legislation. The advisory council was only recently appointed, and there have been limited opportunities for meaningful stakeholder participation in the work of the FPC thus far.

Agricultural Commissions

There is often no formal institutional voice for agriculture in the context of local decision-making that is often dominated by interests that, at best, may not prioritize the needs of farmers, and at worst, are unaligned with agricultural interests. Agricultural commissions can offer an effective counterpoint to the traditionally well represented interests of developers and local planning boards and boards of health. As an institution, these commissions serve as convenient focal points for advocates who work on issues in the farming community.

Image credit: laura padgett via Flickr

Agricultural commissions are formed through the passage of a local bylaw at Town Meeting.[136] The creation of an agricultural commission in a city requires a recommendation from the city council and approval of the mayor.[137] This process generally begins with an exploratory meeting, organized by interested residents and local leaders, to determine whether the municipality would benefit from the establishment of an agricultural commission. A steering committee is then formed to develop an article for the Town Meeting warrant and educate the public and town officials in advance of the Town Meeting. The article is presented, discussed, and voted on at Town Meeting.[138] If the article is passed, the Board of Selectmen solicits applications to staff the agricultural commission.[139] All residents are eligible to sit on a town board or commission for their municipality, including agricultural commissions. The terms of the bylaw creating the agricultural commission determine the number of members and composition of the commission. For instance, an agricultural commission may include voting, alternative, and advisory members.[140] Staffing for existing agricultural commissions appears to range from four to nine members. Some agricultural commissions specify that a certain percentage of their members shall be engaged in the business of farming, and the remainder shall have an interest in farming.[141]

In Massachusetts, agricultural commissions do not have any state-derived regulatory authority. Thus these boards do not have any legal mandate or enforcement authority.[142] As a result, it is up to each agricultural commission to determine what the scope of its work will be. Agricultural commissions' roles in local politics and community awareness can be significant, nonetheless. Given that agricultural commissions in Massachusetts do not have any regulatory authority, their role is flexible and can be unique to a particular municipality's needs. For example, right-to-farm bylaws help to promote agricultural opportunities by minimizing conflicts between farmers and abutters or town agencies. These bylaws do not create any new rights, but rather emphasize provisions that already exist in state law.[143] As of October 2011, 116 agricultural commissions in Massachusetts had right-to-farm by-laws.[144] MDAR and the Massachusetts Farm Bureau Federation created a model right-to-farm bylaw for agricultural commissions to use.[145] The model bylaw includes a declaration regarding the right to farm (which appears to be aimed at reducing nuisance claims), a disclosure notification requiring landowners to provide buyers/future occupants with notice that farming activities occur nearby, and a provision regarding resolution of disputes. In 2010, the Massachusetts Association of Agricultural Commissions (MAAC) was formed to provide support of agricultural commissions (similar to the Massachusetts Association of Conservation Commissions).

Agricultural commissions can also help make sure that farming interests are incorporated into local planning efforts, both in terms of business and land use needs. This could include making sure that agriculture is sufficiently

addressed in the local master plan, community development plan, or open space plan.[146] Agricultural commissions can also participate in the development of zoning bylaws to protect agricultural land uses, such as agricultural overlay zoning districts. This type of overlay district could include relaxed zoning restrictions for farming uses and buffer requirements to both protect farms from encroaching development and reduce conflicts with abutters.[147] Agricultural commissions can also promote "transfer of development rights" (TDR) bylaws.[148] TDR bylaws give developers the opportunity to buy credits for transferable development rights by protecting farmland in a designated "sending area." Developers can then transfer their credits to a designated "receiving area" (to increase the density or intensity of development). According to the MDAR, "[t]his allows farmers to recoup the development value of their land while protecting their farms, without sacrificing opportunities for non-farm development and growth in the town. [Agricultural commissions] can ensure that TDR bylaws treat landowners fairly and are effective in protecting the most important agricultural lands."[149]

Agricultural commissions can also collaborate with local boards that do have regulatory authority to review specific development proposals in order to protect agricultural interests. For instance, agricultural commissions can provide site plan review for certain subdivisions to ensure that some land remains undeveloped and accessible for continued agricultural use or to reduce conflicts with nearby existing farms.[150] Given that agricultural commissions are not limited by any particular regulatory scheme, there are a variety of ways in which they can collaborate with other local boards and lend agricultural expertise to land use decisions.

Other opportunities for agricultural commissions to affect local land use include:

- Education: Provide information to farmers on such issues as intergenerational transfer of property, conservation restrictions, agricultural preservation restrictions, statutory and regulatory programs/provisions applicable to farmers, and funding sources. Provide information to residents regarding what to expect when living in a farm community and how to reap the benefits of local farms.[151]
- Funding: Work to develop local funds matching for state programs like Agricultural Preservation Restrictions and the Community Preservation Act, as well as the federal Farm and Ranch Lands Protection Program. Develop local agricultural preservation trust fund to preserve agricultural land (e.g., Town of Dartmouth's proposed Agricultural Preservation Trust Fund).[152]
- Conflict Resolution: Mediate disputes between farmers and abutters.[153]
- Technical Assistance: Provide farmers with resources such as guidance on conservation farm planning, nutrient management, environmental stewardship, and pollution management.[154]

As of October 2011, there were 148 agricultural commissions in Massachusetts.[155] Most of the existing agricultural commissions are located in the Western part of the state.

Existing agencies, *e.g.*, local boards of health, conservation commissions, and planning boards, may be wary of agricultural commissions and resistant to accommodating the needs and perspectives of agricultural interests. Communicating the important role the commissions can play is an important part of the process of educating communities about the vital role of agriculture.

Establishing an urban agricultural commission in Boston would be a useful way to bring more cohesion to current advocacy and regulatory efforts.

Legal Services for Farmers

While not related to a particular institution, legal support for farmers can help protect farmers' interests and further the goals of expanded urban agriculture and a sustainable regional food system. In the course of interviewing and speaking informally with farmers and growers, a common theme emerged: farmers face a number of routine legal issues related to the business of farming and lack access to affordable legal service. Examples of the types of legal issues identified include wetlands impacts of proposed driveway graveling (Lexington); Title V (septic) impacts related to construction of new farmhouse and proposal to slaughter chickens on site (Lexington); permitting for farm stand (Holyoke); formation of non-profit entity (Dorchester); regulation of rabbit slaughtering and storage operation (Concord). None of these issues is particularly complex, and many

implicate a broader political conflict regarding land use. In the Holyoke example, Nuestras Raices, a non-profit farm that trains primarily Latino and immigrant workers to farm, would like to sell its produce at a farm stand next to its downtown Holyoke offices. The area has a lot of foot traffic and the farm stand would bring fresh affordable food to low income areas that lacks healthy food options. The city however, has raised concerns about traffic and odor impacts..

While not a policy issue per se, there is a need for free or low cost legal services for farmers to address routine legal issues. Several years ago in Boston, Alternatives for Community and Environment (ACE) launched the Massachusetts Environmental Justice Network (MEJN).[156] MEJN consists of a network of lawyers and environmental professionals that provide services to low income and communities of color that need assistance with environmental and/or health problems. MEJN provides a good model of the type of network that could be organized to provide pro bono legal assistance to farmers.

RECOMMENDATIONS

The City should be commended for its work to promote urban agriculture, and in particular, for its support of agriculture as a for profit business within the City. As we've seen, Boston can produce a significant share of its own produce, creating jobs and benefitting the health of the City's residents and the environment in the process. Boston should also position itself as a key hub in the emerging New England regional food system. Whether making and selling craft beers from New England grown grain, marketing artisanal cheeses produced around the region, or developing the technology and businesses that will make it easier to move food around the region, Boston can play a lead role in developing the market to sustain a regional food system.

Boston, through the Massachusetts Food Policy Council, MDAR, or other entities, should take the lead in coordinating with other regional states and cities to advance a vision for a New England regional food system and make it happen. Efforts to develop that vision are underway—the New England Good Food Vision, led by Food Solutions New England through the University of New Hampshire and Brian Donahue of Brandeis University—is a promising model, and now is the time for Boston to engage, both as a voice for the benefits of urban agriculture, and as the region's largest potential consumer of New England produced food.

Boston should expand the number of properties in the Urban Agriculture Overlay District program, and work in advance with communities to obtain their input on the properties that should be included and the uses permitted. Where there is community support, Boston should expand the UAOD to include small animal husbandry and beekeeping. The City should continue its efforts to expand permitted uses under current zoning to allow more gardening and for profit farming operations. As these efforts are rolled out, the City should track and quantify the results. How much healthy food is being grown and consumed, and what is its value? What are the GHG and other environmental benefits? How many new jobs are being created?

The City should analyze current requirements related to non-traditional forms of growing including rooftop and hydroponic operations—and identify opportunities to streamline permitting. Currently, as provided in the City's 2009 procedure for permitting rooftop gardens, approval may be required from the City's Environmental Department, Landmarks Commission, Boston Water and Sewer, and the Fire Department, in addition to the Inspectional Services Department. These uses should also be explored as the City advances its current urban agriculture rezoning efforts.

Policies should be developed at the state level permitting certain state owned lands to be used for agricultural purposes, and guidance should be developed to define eligible properties and uses and applicable requirements.

The City should evaluate means to provide financing incentives to local agriculture businesses including those engaged in local food processing and transportation. BRA currently provides a variety of financing options and assistance for certain sectors (life sciences, green businesses) and business stages (expansion and growth)—could these programs be tailored to the unique needs of urban farmers and related value-add businesses?

Boston should consider requiring all City schools and departments to source separate organics from the waste stream and contract to have those wastes composted or anaerobically digested.

The Massachusetts Department of Environmental Protection should develop best management practices for farming in urban soils, and should issue guidance clarifying its interpretation of the applicability of Ch. 21E to urban soils contaminated with common, background level urban pollutants. The Department should also issue the final amendments to the Site Assignment rules, require monitoring of finished compost, and provide sufficient oversight of new compost facilities to ensure high quality output and minimal conflicts between those operations and surrounding communities.

END NOTES

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