




**URBAN FARMING
IN BOSTON:**

**A SURVEY OF
OPPORTUNITIES**



Denise Chin
Tida Infahsaeng
Ian Jakus
Valerie Oorthuys



*buy
local*

Urban Farming in Boston: A Survey of Opportunities

Denise Chin
Tida Infahsaeng
Ian Jakus
Valerie Oorthuys

Tufts University Department of Urban and Environmental Policy and Planning
May 2013



THE TRUST *for* PUBLIC LAND
CONSERVING LAND FOR PEOPLE



Acknowledgements

Penn Loh, Tufts University UEP

Kevin Essington, The Trust for Public Land

Meaghan Overton, Tufts University UEP

Hugh Joseph, Tufts University

Edith Murnane, Mayor's Office of Food Initiatives,
City of Boston

Barbara Parmenter, Tufts University UEP

Jennifer Hashley, New Entry Sustainability Project

Glynn Lloyd, City Growers

Farmer and Farming Advocate Interview Participants

Laura Delgado, Boston Department of Neighborhood
Development

Jay Lee, Boston Department of Neighborhood Development

Loni Plocinski, MA Department of Conservation and
Recreation

Buzz Constable, A.W. Perry

Tad Read, Boston Redevelopment Authority

Rachel Goldsmith, Transit Realty Associates

Kristopher Carter, Mayor's Office, City of Boston

Urban Farming Institute of Boston



Table of Contents

Executive Summary.....	7
Introduction.....	9
Section 1: Contextualizing Urban Agriculture.....	13
Section 2: Vacant Land Assessment.....	27
Section 3: Interview Design and Analysis.....	31
Section 4: Vacant Land Dataset Creation.....	37
Section 5: Data Mapping and Spatial Analysis.....	41
Section 6: Aerial Scoring and Verification.....	50
Section 7: Ground Truthing.....	59
Section 8: Conclusions and Recommendations.....	64

Figures

1. Article 89 Ground-Based Farming Use Regulations.....	15
2. Number and Acreage of Parcels for Initial Data Sets.....	38
3. Assessor’s Parcel Data Categories - Exempt Ownership.....	39
4. All Vacant Land Without Open Space or Rail Lines.....	43
5. Data Mapping and Spatial Analysis Filtration.....	45
6. Vacant Land After GIS Analysis.....	47
7. Vacant Public Parcels Selected for Tree Density and Slope...48	
8. Vacant Private Parcels Selected for Tree Density and Slope...49	
9. Aerial Light Exposure Rubric.....	52
10. Aerial Density of Vegetation and Debris Rubric.....	53
11. Vacant Public Land After Aerial Verification - 52 Sites...56	
12. Vacant Public Land After Aerial Verification - Neighbor- hoods.....	57
13. Ground Truth Scoring Rubric.....	62



Appendices

I. Interview	72
II. Data.....	75
III. GIS.....	77
IV. Aerial and Ground Truthing: Forms and Site Profiles.....	80

Cover Photo Sources (left to right): Tida Infahsaeng, shutterstock, shutterstock


Executive Summary

The Trust for Public Land, in conjunction with the Tufts Urban and Environmental Policy and Planning Department sponsored a team of graduate students to conduct a vacant land assessment for the city of Boston. The goal of this assessment is to identify suitable land for use in urban agriculture. The project is supportive of the City of Boston's Mayor's Office of Food Initiatives mission to increase access to fresh local food, and the ability to produce that food within city limits. As part of the directives of this office, the city has launched a Citywide Urban Agriculture Rezoning Initiative. The initiative has included the establishment of pilot urban farms and the drafting of amendments to the city's zoning codes to support urban agricultural development. The creation of this report has been informed by the experiences of various groups with substantial experience growing food in Boston, and by those who hope to venture into urban agriculture in the future.

For the purposes of this study urban agriculture is defined as the use of a lot for the cultivation of food in raised beds on the ground plane and "generally for income-earning or food production activities".¹ Although there are many other forms of urban agriculture such as aquaculture, hydroponics, rooftop farming, or community gardens, this report focuses solely on ground-based farming. This re-

port provides and analyzes data to aid in the exploration of ground-based urban agricultural opportunities in Boston, and to assist in the identification of future farming sites. The background information for the report was established by examining similar studies carried out in other major cities in North America. This information was used to develop an interview format and support criteria development. Qualitative interviews with stakeholders were carried out in order to identify specific criteria that make land suitable for urban farming.

In order to demonstrate the scope of vacant land in the city, analysis was performed at several levels of ownership and criteria based on the 2013 City of Boston Assessing Department Property Parcel Data. Vacant land was defined as the lack of a building on a property. Separate data sets are available at different levels of filtering, allowing maximum flexibility for interested parties to look at the land how they best see fit. Data sets were compiled through the use of Microsoft Access and ArcGIS 10.1. This report includes private land, but does not attempt to further analyze the ability to obtain that land nor is it analyzed to the same extent as publicly owned vacant land. Due to the volume of private vacant land, and the complexities involved in having distinct ownership for most parcels, this is beyond the capacity of this project. Public vacant land is defined as tax-exempt property without a building owned by a government entity. Private vacant land is defined as land without



a building that is not designated as public under our definition, and includes institutional and non-profit tax-exempt ownership. Public vacant land is the focus of the analysis because unlike private owners, there are several government agencies that specialize in utilizing vacant land.

The analysis of public land includes the application of criteria through the use of GIS to narrow down parcels that are appropriate for farming. Visual analysis of aerial imagery in conjunction with the maps was used to further determine suitability by giving parcels a score. Ultimately, assessment of the site in person, known as “ground truthing”, was used to verify criteria and to develop site profiles of the most suitable parcels for urban agriculture according to our criteria.

This study determined 52 sites in and around city of Boston that are suitable for urban agriculture based on the criteria application. These sites are largely owned by the Department of Neighborhood Development, the Boston Redevelopment Authority, the Massachusetts Bay Transit Authority, and several other city agencies that fall under ownership of the City of Boston. The evaluated sites are further detailed in the spreadsheet attached to this report, and selected parcels are highlighted in Section 8 (Profiles of Publicly Owned Vacant Land Suitable for Urban Agriculture) of this report.

The data made available through this vacant land assessment is intended to be an accessible resource to any

parties interested in urban agriculture in Boston. The database of information used to create the vacant land maps will be available to any interested parties to assist in efforts to obtain land. Nonprofit organizations, private enterprises, institutions and city government agencies all have the potential to play a role in an innovative and resilient local food economy. While growing food on ground-level vacant land is only one method of carrying out urban agriculture, it has the ability to transform how food is produced, distributed and consumed in Boston.

Section References

- 1 Boston Redevelopment Authority. 2013. Draft Zoning Code Article 89, Urban Agriculture. Accessed March 15, 2013. <http://www.bostonredevelopmentauthority.org/planning/PlanningInitsIndividual.asp?action=ViewInIt&InItID=152>.

Introduction

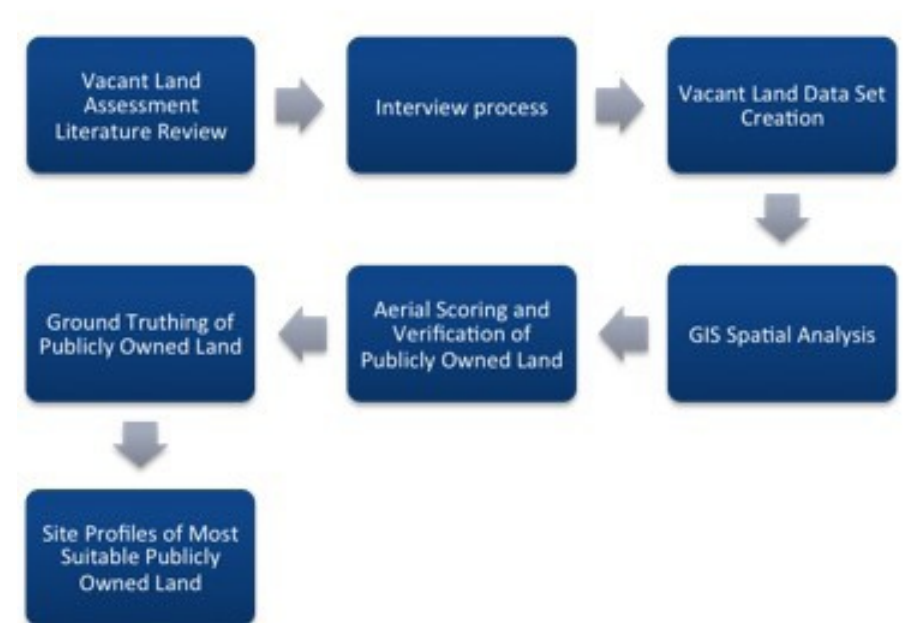
The creation of this vacant land assessment has been guided by the following overarching research questions:


- How much vacant land exists in Boston, who is it owned by, and where is it?
- What public vacant land suitable for urban agriculture is available in Boston and which public agency owns it?
- What are the baseline physical criteria that make the vacant land suitable for urban agriculture, or “farm able”?

Comprehensive data for this specific purpose does not currently exist. This research is not intended to set forth comprehensive policy or planning recommendations on where to prioritize urban agriculture initiatives, but rather to present vacant land opportunities for growing food in the City of Boston. This report provides a starting point for interested parties to determine where vacant land is and how to assess it. Each urban agriculture initiative will be unique to the goals and resources available to participants. Planning and operationalizing urban agriculture initiatives involves collaborative processes that occur at the community

level with government agencies and other stakeholders.

The goal of this research is to identify baseline physical attributes that are necessary for farming, and apply those criteria to vacant land, where possible, resulting in the identification of the most suitable parcels for urban agriculture. A key deliverable of this report is the creation of a multifaceted process for assessing vacant land and the criteria developed for urban agriculture that could be utilized by organizations in their own assessments. The report is designed to reflect that process in a chronological manner. The vacant land assessment process is structured as follows:





Identifying and obtaining land is among the chief challenges to starting an urban agricultural enterprise. Understanding the data can prove technically challenging and time-intensive for individuals or organizations. The City of Boston Assessing Department's Property Parcel Data (henceforth known as assessor's data) is updated yearly and includes detailed information of all the properties and parcels in Boston. The 2013 assessor's data includes over 165,000 separate tax records with over 50 fields for each record, each with unique identifiers. This project allows for the creation of more manageable vacant land data in a user-friendly format in order to increase access to information and lower barriers to entry. It also utilizes data from the Department of Neighborhood Development (DND) for identification of DND land as separate from the City of Boston as it is classified in the assessor's data. With the multiple data outputs from this project an interested party may choose to examine all vacant land, only the highest scored public land according to criteria, or custom data sets that best suit their needs.

Section 1: Contextualizing Urban Agriculture in Boston

This introductory section provides a brief history of urban agriculture and defines urban agriculture around current zoning and policy initiatives in Boston. It also outlines the relevance of urban agriculture in modern urban settings,

including the economic, environmental, public health and social benefits and challenges of growing food in cities. An overview of production types and business models of urban agriculture displays the wide array of urban agriculture possibilities.

Section 2: Vacant Land Literature Review

Land assessments are commonly-used municipal planning tools for identifying vacant land suitable for urban agriculture. Portland, Vancouver, Seattle, Cleveland-Cuyahoga County, Detroit, Chicago, Toronto, New York City, Youngstown, Oakland and San Francisco have conducted vacant land assessments. Our review of these assessments was performed in order to learn more about the techniques, tools, motivations, limitations and results for such research. The suite of physical criteria used to assess vacant land for urban agriculture was gathered to inform our interview design, and subsequent criteria development and filtration methods.



Section 3: Interview Design and Analysis

Regional farmers and urban farming advocates were interviewed to gather information on the physical requirements of land used for food production. Other considerations for urban farming were also recorded to highlight farmer or farm advocate preferences for successful enterprises. The results of the interviews were synthesized to yield a set of physical criteria. The interviews, as well as the literature review, allowed the team to identify physical criteria applicable to ground-based food production, and apply this suite of criteria to the vacant land data through the data analysis process outlined in the following sections. Interviews also informed recommendations and preferences used in the creation of site profiles.

Section 4: Vacant Land Data Set Creation

Vacant land data sets were created from the Fiscal Year 2013 City of Boston Assessing Department's Property Parcel Data. This data was sorted to identify vacant land defined as parcels without buildings. Microsoft Access was used to run queries and create data sets based on vacancy, ownership and size criteria. This provided several data sets for use in further mapping and spatial analysis. Also, Department of Neighborhood Development (DND) vacant lot cluster analysis was performed through a combination of GIS mapping and database queries. This allowed for plots

smaller than the size criteria threshold to be included if they were part of a contiguous DND parcel group with an area greater than the 10,000 square foot size threshold.

Section 5: Data Mapping and Spatial Analysis

The mapping portion of the project was conducted using ArcGIS 10.1. GIS spatial analysis is capable of filtering data according to complex physical characteristics. It was performed on the public and private vacant land data sets. The criteria applied were identified in the interviews as well as some additional criteria that were developed to determine the most suitable parcels. The spatial analysis of publicly owned vacant land filtered for different physical characteristics, creating a data set able to be manually scored through the use of aerial imagery.

Section 6: Aerial Scoring and Verification

Aerial imagery obtained from the city of Boston Department of Innovation and Technology was used to validate criteria application using GIS tools as well as to analyze criteria that could not be assessed through GIS processes within the given time constraints. A scoring rubric was developed to first verify that a parcel is vacant, then to assess light exposure, and density of debris and vegetation. This process allowed for the holistic analysis of a site, including sites composed of multiple parcels. The scoring was used to further refine the selection of parcels as an intermediate



step between spatial analysis and ground truthing.

Section 7: Ground Truthing

“Ground truthing” involves physically visiting a piece of land and examining it to determine the extent to which it is viable for urban farming. Being physically present at a site reveals elements that were not evident from aerial imagery. Ground truthing was employed after aerial scoring, and was performed only on the highest scoring parcels. Ground truthing provided a second round of scoring of these parcels to inform the selection of site profiles. Other considerations revealed in the interviews were noted, such as number of abutters, accessibility, and security. Groups or individuals assessing parcels can replicate these methods by utilizing the ground truthing score form and criteria.

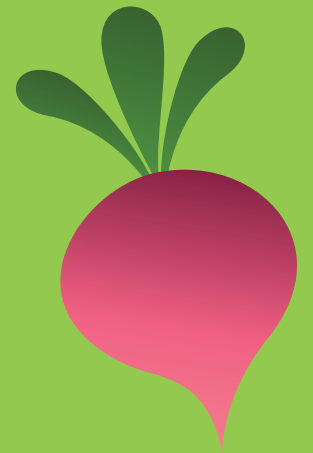
Site profiles will be included in Appendix IV. Site profiles were selected based on parcels with the highest ground truthing scores. The purpose of these profiles is to provide an understanding of how data and criteria translate to vacant land. Photographs and aerial images are included in the profiles. These profiles reflect the application and assessment of physical criteria. There exists numerous parcels other than the ones selected in this report that are suitable for farming, but these profiles illustrate high-scoring parcels.

Section 8: Conclusions and Recommendations

This assessment addressed a specific need in conducting a vacant land assessment for the city of Boston. Reflecting on the processes that were involved in the creation of this assessment, this section provides conclusive remarks and ideas for which this assessment could be used as a starting point to further refine the methodologies, and ultimately provide more comprehensive studies that benefit the pursuits of urban agriculture in the city of Boston.

Section 1

Contextualizing Urban Agriculture



Section 1: Contextualizing Urban Agriculture in Boston

I. What is Urban Agriculture?

Urban agriculture is broadly defined as the production of food within cities¹. The definition of urban agriculture is not stagnant or rigid, but is continuously evolving as the practice is used to address social, economic and environmental issues in urban areas. It can often serve a functional role within cities such as a means to address food insecurity, public health issues, community building and redevelopment, environmental sustainability, equitable economic development and food safety.²

One of the most widely accepted expanded definitions of urban and peri-urban agriculture includes geographic location, stages of production, scale, land tenure, purposes and types of groups involved. This definition was crafted after much research and study travel for the 1996 United Nations Development Program funded publication, “Food, Jobs and

Sustainable Cities”. Jac Smit, widely considered the father of modern urban agriculture, spearheaded this study. The report defines urban agriculture as:

...an industry that produces, processes, and markets food, fuel and other outputs, largely in response to the daily demand of consumers within a town, city, or metropolis, on many types of privately and publicly held land and water bodies found throughout intra-urban and peri-urban areas. Typically urban agriculture applies intensive production methods, frequently using and reusing natural resources and urban wastes, to yield a diverse array of land, water and air-based fauna and flora, contributing to the food security, health, livelihood, and environment of the individual, household, and community.³

In 2007, the Community Food Security Coalition expanded upon Smit’s definition by differentiating between urban core and peri-urban production. Urban core production included community and school gardens, backyard and rooftop horticulture and intensive-small area innovative growing. Peri-urban methods included urban farmers’ market suppliers, community supported agriculture (CSA) and family

farms.⁴ The definition urban and peri-urban agriculture explicitly emphasized the cross-sectoral capabilities of such activities to address community food security, environmental sustainability, land use planning, neighborhood development, agricultural and food systems, farmland preservation and many more issues.

Today, ground-based urban agriculture remains prominent around the globe in both developed and developing cities. Emerging technological advances are allowing people to for grow in increasingly more challenging urban settings limited by access to space. Rooftop farming, aquaponics, hydroponics, vertical farming and greenhouses are controlled environment production methods that are often intensive and allow for extended growing seasons. Operations can often include the keeping of bees, chickens and other

animals. The various iterations of the urban agriculture definition all include, or imply local distribution of the food produced by such initiatives.

The definition of urban agriculture used for the purposes of this report reflects the City of Boston’s Urban Agriculture Rezoning Initiative Draft Article 89. Draft Article 89 defines urban agriculture as:

*...the use of a Lot for the cultivation of food and/or horticultural crops, Composting, Aquaponics, Aquaculture and/or Hydroponics generally for income-earning or food production activities. Such use may include the Accessory Keeping of Animals or Bees where Allowed by Underlying Zoning, and on-site sales where retail uses are Allowed by Underlying.*⁵

The purpose of draft Article 89 is to establish zoning regulations for urban agriculture and provide standards for the siting, design, maintenance, and modification of urban agriculture that is in the best interest of residents and the City. The rezoning initiative attempts to formally define the various types of urban agriculture while making them

allowable in all zoning districts citywide. This study focuses only on urban farms at ground level as defined in Draft Article 89. Figure 1 outlines the size and zoning restrictions for ground level urban farms.

Figure 1 Draft Article 89 Ground-Based Urban Farming Use Regulations

Zoning	Small (less than 10,000 sq.ft.)	Medium (10,000 sq.ft. - 1 acre)	Large (greater than 1 acre)
Residential (i.e. 1F, 2F, MFR)	Allowed	Allowed	Conditional Use
Commercial (i.e. L, LC, NS, B, CC, EDA)	Allowed	Allowed	Conditional Use
Industrial (i.e. I, M, LI)	Allowed	Allowed	Allowed
Institutional (i.e. IS, IN, CF)	Allowed	Allowed	Conditional Use

Source: Boston Redevelopment Authority



II. History of UA in Boston

Urban agriculture is not new to the city of Boston. The recent resurgence of urban agriculture in Boston comes from a confluence of emerging social, economic and environmental issues and political impetus. The current food system is extremely resource intensive and dependent on foods that are grown using the least expensive means to create the greatest profits for agribusiness. Limited space and resources in highly populated urban areas make cities especially reliant on a global industrialized food market that is inequitable. Low-income urban communities are especially vulnerable to market-inflated food prices on products that are often highly processed and low in nutritional value.⁶ The City of Boston and many of local communities have increasingly recognized the need for increased access to healthy and affordable foods, nutrition education, economically

viable local food production and distribution and stronger private-public relationships between local government and food enterprises.⁷

Throughout history Boston public and private lands have been utilized as areas to grow food and raise livestock for consumption. The Boston Commons, America's oldest public park, at the heart of the city was originally used as a common pasture for cattle grazing. In 1830, grazing was outlawed and the park was converted into a recreational destination for Bostonians and visitors.⁸ During World War I, the park was home to several Victory Gardens. Victory Gardens were vegetable gardens planted during both World Wars in efforts to ensure stable food supplies for civilians and troops. The success of Victory Gardens was a result of government, nonprofit, business, schools and seed companies providing land, supplies and training to people across the nation.⁹ Millions of gardens flourished throughout the

country and in 1943 it was estimated that 20 million gardens were producing 9-10 tons of food, or up to 41% of vegetables produced that year. In 1943, 49 areas were designated for Victory Gardens, including large plots on Boston Commons and the Back Bay Fens. During the wars, 30,000 Bostonian participated in victory gardening. The Fenway Victory Gardens still exists to this day with 500 community garden plots available to residents.¹⁰

Post-war economic recovery and subsequent suburbanization signaled the beginnings of disinvestment in urban agriculture. By the mid-20th century, the industrialization of farming made food production increasingly mechanized and chemically dependent, and also more foreign to the urban dweller.¹¹ The current community gardening movement in Boston began in the 1970's in response to deindustrialization, depopulation, increased immigration and failures



failures of urban renewal to revitalize the inner-city.¹² As a result of such trends, large numbers of publicly-owned vacant lots were available throughout the city. Organizations including the Boston Urban Gardeners (BUG), Boston Natural Areas Network (BNAN), The Trust for Public Land (TPL) and Dorchester Gardensland Preserve (DGP) were some of the first to promote community gardens and preserve green space citywide. In 1975, Community Development Block Grant (CDBG) funds were used to create the Garden Revival Program, which established 30 community gardens in Boston. In 1985, the Department of Neighborhood Development (DND) instituted the CDBG-funded Grassroots Program to promote and assist gardens as a means of community development.¹³

In 2010, the Mayor's Office of Food Initiatives was created to address the social, economic and environmental issues related to the production, distribution and consumption of food in

Boston. The directives of the Initiative include:

- *"Increase access to healthy and affordable food in schools, farmers markets, and stores, educate the public about healthy choices, and promote food benefits to reduce hunger and obesity,"*
- *"Expand Boston's capacity to produce, distribute and consume local food through urban agriculture and distribution models to supply schools and local businesses"*
- *"Build a strong local food economy through financing and supporting local food retail and distribution businesses, and"*
- *"Expand private and public partnerships to a to advance the food agenda."¹⁴*

This Initiative has served to help create the Mobile Food Truck Program, expand the Boston Bounty Bucks Program, increase the number of farmers' markets, facilitate the Food Innovation Trust proposal and draft the Citywide Urban Agriculture Rezoning Initiative (spearheaded by the Boston Redevelopment Authority (BRA)).

In the summer of 2010 Mayor Menino appointed a group of stakeholders, including advocates, experts and residents to the Mayor's

Urban Agriculture Working Group. The Working Group has been responsible for advising and guiding BRA and the Mayor's Office staff on urban agriculture zoning recommendations. Members of the Working Group include individuals from The Food Project, Boston Natural Areas Network, City Growers, The Move, NAIOP Massachusetts, Green Dorchester, MIT, Top Sprouts, Warner Larson Landscape Architects, BDLWTG P.C. Law Firm, Bon Savor Restaurant and Chefs Collaborative.¹⁵ Working Group public meetings are held once a month at City Hall and concerned parties are encouraged to participate.

The first phase of the Citywide Urban Agriculture Rezoning Initiative was launched in the fall of 2010 by the DND, the Mayor's Office and BRA. The pilot urban agriculture rezoning project goal was to increase the production of fresh, healthy food for sale in the community. It included an Urban Agriculture Overlay District for four



DND-owned vacant lots in Dorchester. The lots were made publicly available through the issuance of a Request for Proposals seeking prospective farmers. Despite the coordinated outreach efforts, including five community meetings and continuous community leader collaboration, only two new operational farms resulted from this first phase, Victory Programs-ReVision Urban Farm (non-profit) and City Growers (for-profit). Both farms planted their first crops on the new sites in the spring of 2011 and are still operating today.¹⁶

The second phase of the Initiative, Draft Article 89, was launched in January 2012 and aims to amend the City of Boston's Zoning Code to include and support a variety of urban agricultural initiatives citywide. Cities around the country with urban agriculture zoning include Austin, Baltimore, Cleveland, Chattanooga, Denver, Kansas City, Milwaukee, Minneapolis, Nashville, New York City, Philadelphia,

Portland, Oakland, San Francisco and Seattle.¹⁷ The purpose of Article 89 is to “establish zoning regulations for the operation of Urban Agriculture activities and to provide standards for the siting, design, maintenance and modification of Urban Agriculture activities that address public safety, and minimize impacts on residents and historic resources in the City of Boston.”¹⁸ Since the beginning of the second phase, the Working Group has considered the following topics for the draft of Article 89: soil safety, pesticides and fertilizers, and composting, growing of produce and accessory structures, rooftop and vertical agriculture, hydroponics and aquaculture, keeping of animals and bees, farmers markets, winter markets, farm stands and sales.¹⁹ The Working Group, BRA and other related city agencies are currently working complete a final draft of Article 89 to bring to neighborhoods citywide for community feedback. The goal is to complete outreach by the end of

Summer 2013 and finalize Article 89 by Fall 2013.



III. Benefits and Challenges of Urban Agriculture

Benefits

Social and Public Health

Urban agriculture can increase the availability of fresh and healthy produce throughout urban areas, and it can play an especially significant role in increasing food access in low-income neighborhoods. Underserved neighborhoods often lack retail outlets that sell fresh fruits and vegetables at affordable prices, which contributes to food insecurity. Food retail outlets have disinvested in poor urban neighborhoods, and as a result there are less food options at higher prices in such areas.²⁰ Farm stands, farmers' markets, CSA's, community gardens and urban farms are effective vehicles to educate and nourish urban neighborhoods.²¹ In 2009, the USDA found that 50 million Americans were food insecure, of which 17 million were children.²² Food insecurity is

characterized by lack of access to culturally acceptable, nutritionally adequate food at all times, which leads to hunger and inadequate nutrition.²³ Diet-related diseases, including diabetes and obesity, continue to increase in communities across the US, taking their toll on individuals and the healthcare system. Poor nutrition has also been shown to pose increased risks of developing chronic diseases as well. Hunger and poor nutrition decrease the overall well-being of residents, and can affect productivity at school or work.

Urban agriculture provides opportunities for public health programming to not only reconnect residents with all levels of the food system, but also improve nutrition knowledge, mental health and community cohesion while increasing dietary intake and physical activity.²⁴

²⁵ Therapeutic and rehabilitative urban agriculture programs can also benefit communities by creating spaces for training and recovery for

the formerly incarcerated or homeless, individuals recovering from substance abuse and those with physical or mental disabilities. Urban agriculture provides valuable opportunities for overall community engagement and cohesion, social interaction, health and environmental stewardship and active community economic investment.²⁶



Economic Benefits

Urban agriculture can improve the economic resiliency of a community by creating jobs, providing job training and skills development, incubating and attracting entrepreneurial businesses, lowering the cost of locally purchased foods and producing positive multiplier effects.²⁷ Urban agriculture offers alternatives to globally dependent and industrialized food, that is neither economically or environmentally sustainable. The costs and impacts of importing basic necessities such as produce, makes communities susceptible to unpredictable global industrialized food market.


Urban agriculture is an industry that offers economic benefits at all stages of production. The stages of urban agriculture include pre-production (acquisition and utilization of resources, inputs and services), production (generation of raw materials and finished goods) and post-production (processing and

packaging, waste management and reuse, retail sales and distribution and added-value relationships).²⁸ The direct economic benefits of urban agriculture will vary across business models that solely commercial/for-profit, non-commercial/non-profit or hybrids (both commercial/for-profit and hybrids are referred to as social enterprises). The majority of urban agriculture operates under the social enterprise model, guided by non-profits with programming in jobs and skills training, youth education and business incubation.²⁹ Non-profit or hybrid urban agriculture operations often include limited paid staff and extensive volunteer labor to involve community members in all stages of production. Jobs training and skills development for low-income workers can serve as long-term reinvestment in human capital.

Social enterprise or entrepreneurial urban agriculture operations are community-based businesses whose bottom line is not

limited to profits and whose roles are not limited to producers.³⁰ Revenue-generating models include direct sales and marketing at production sites, community supported agriculture, direct relationships with restaurants, value-added producers or retail outlets, on-site urban agri-tourism (tours, special events, merchandise), leasing land to other farmers or gardeners and grant funding for youth development and jobs training.³¹ These methods are often supported by the integration of activities and programming with nonprofit organizations.

Household and citywide economic health can benefit from urban agriculture. Self-employment, jobs, job training and skills development, savings on food and healthcare expenditures can be seen at the household level. Public budgets can benefit in terms of reduced public healthcare costs, crime expenditures and unemployment while potentially expanding the tax base, increasing



property values and efficient economic use of vacant or under-utilized land and decreasing solid waste costs.³²

Multiplier and Indirect Effects

Urban agriculture has the potential to support other local businesses, thereby creating multiplier and indirect economic benefits. Multiplier effects circulate money spent at local businesses to other local businesses, thus benefiting the community as a whole. Resources and funds that are used for urban agriculture are mostly redistributed and reinvested into the communities in which they are located.³³ Examples of resource reinvestment include the purchasing of farming equipment and supplies, including compost, from local vendors. Calculating economic multiplier effects can be very complicated due to the difficulty of tracking spending habits, but some scholars contend that every dollar spent at a local urban farm is estimated to be 2-4 times greater


than from an outside business.³⁴ In contrast to conventional food retail outlets, urban agricultural enterprises can effectively redistribute money back into local communities instead of outside corporate conglomerates that own food retail chains.³⁵ In addition to multiplier effects, urban farms can contribute to indirect municipal cost savings, including waste disposal and landfill expenses, reduced need for storm water infrastructure and management, improvements in air quality and reduced costs of public health.^{36 37} The creation of sustainable urban agricultural enterprises can also help attract and retain other locally-minded businesses, which is especially important to economically challenged neighborhoods.

Lowering Cost of Food for Consumers

Food is the second highest cost of living for U.S. households with averages of \$6100 being spent on food per year. Hybrid urban farms are often the most effective models for

lowering food expenses and providing avenues for supplemental income.³⁸ Urban farms can save community members money by lowering the cost of food, supplementing some of their food expenses and potentially providing income. It is estimated that urban agriculture can yield up to \$500-\$2,000 (dependent on market price and optimal production) worth of produce per family per year (5 individuals). It is also estimated that every dollar invested yields \$6 worth of produce.³⁹

Through farm stands, farmer's markets, community supported agriculture and on-site sales, urban farmers are able to sell directly to customers instead of wholesalers. Customer bases, including individual consumers, added-value producers, restaurants and institutions, are in close proximity and plentiful in cities. Products of UA are transported shorter distances, often directly to buyers, which obviates the need



for resource intensive processing and packaging. This decrease in distribution and packaging costs is passed along directly to consumers. Farmers' markets and CSA's can provide less expensive produce options to consumers with limited budgets. A 2008 study found that organic farmers' market produce was less costly than organic produce being sold in traditional grocery stores.⁴⁰

Environmental Benefits

Urban agriculture promotes awareness of food systems ecology, environmental stewardship, conservation, storm water management, soil improvement, biodiversity and habitat improvement.⁴¹ The current global-industrial food system depends on the import of products from around the world with heavy reliance on fossil fuels contributing to climate change.⁴² The majority of agriculture in the United States is conventional, meaning that large quantities of food are grown

using chemical inputs and distributed long distances to packaging and distribution facilities before reaching consumers. Urban agricultural development has the potential to reduce the expansion of farming onto undeveloped land, and thus could help preserve open space and natural habitats.⁴³

Urban farming has the potential to mitigate green house gas emissions and other types of pollution by storing carbon in well maintained soil, reducing food transportation, mitigating stormwater pollution, improving soil quality and reducing urban heat island effect.⁴⁴ Urban farming typically relies on manually intensive practices, not heavy farm equipment; this is a result of growing on parcels smaller than conventional farming and the use of less synthetic fossil-fuel based fertilizers. The application of compost over soil used for ground-based urban farming improves soil health and its ability to absorb carbon from the atmosphere.

Conventionally grown food travels an average of 1,500 miles from farm to plate in the United States. The proximity of urban farms to retail outlets severely decreases the fossil fuel air pollution and greenhouse gas emissions. Urban stormwater that is typically managed through the sewer system is better absorbed by the expanding pervious and vegetated surfaces of ground-based urban farming. Increased soil areas, in place of asphalt or concrete, also contribute to the reduction of the urban heat island effect in which temperature increases as a result of concrete infrastructure.⁴⁵



Challenges

Land Access

The majority of urban farmers do not own the land that they use for food production, and lack long-term land access.⁴⁶ Farmers often lease or informally use land to grow, and do not have the option of buying land within city limits.⁴⁷ Identifying the limited areas of land suitable for food production is an additional challenge for urban farmers who may be skilled in food production, but lack knowledge of how to lease land with complex zoning regulations. Land values in cities with dense development are costly and are a barrier to purchasing land. This can be problematic because urban farming involves start up costs that include expensive infrastructure projects to make land farmable. Infrastructure inputs can include machinery, water line access and sorting, storage, and refrigeration facilities.⁴⁸ Local government agencies can designate land or districts dedicated to urban agriculture through easements or more informal agreements.⁴⁹ Cities also have

the ability to sell public land at below market value or donate land directly to urban farming enterprises.⁵⁰

Start Up and Operating Costs

Start up and operating costs vary depending on size, location, purpose and type of urban farm. Farm operations can require intense initial investment before profits are made and many even struggle to digest the city policies and permits required to even start farming. Accessing traditional bank loans or any type of financial assistance and budgeting can be barriers to farmers who lack business skills and knowledge or are low-income.⁵¹ Green for All estimates that a half-acre urban farming plot will incur approximately \$10,000 in start up costs associated with equipment, sales, and marketing. Operating costs for an urban farm less than a half-acre, seeking gross revenue of \$60,000, are estimated at \$5,000-10,000 per year. Operating costs will vary across different farms, but generally they will include seeds, bags, transportation and labor.⁵²

Access to Markets


Urban farmers who pursue direct sales to institutions, grocery stores and restaurants may be faced with competition from wholesale distributor monopolies.⁵³ Because urban farmers are growing on less land than their conventional counterparts, they may not be able to produce year-round high yields demanded by larger scale purchasers. Aggregating food from multiple urban farms, or the creation of a food hub, is an increasingly viable solution to compete with wholesale distributors.⁵⁴ Directly bringing products to market requires labor, transportation and time for marketing, sales and distribution. Local governments and nonprofits can help urban farmers navigate complicated and highly competitive food markets by creating citywide “buy local” campaigns, removing financial and technical obstacles to entering new retail markets (e.g. farmers’ market permitting) and offering low-cost financial or technical training.³



Section References

- 1 Conrad, Michael, Patricia Culligan, Eric Dahlgren, Ruth Katz and Richard Pluntz. 2012. The Potential for Urban Agriculture in New York City: Growing Capacity, Food Security and Green Infrastructure. Prepared by Kubi Ackerman. New York: The Earth Institute, Columbia University. Accessed March 20, 2013. <http://admin.urbandesignlab.columbia.edu/?pid=nyc-urban-agriculture>.
- 2 Bailkey, Martin, Marcia Caton Campbell and Kimberley Hodgson. 2011. "Urban Agriculture: Growing Healthy, Sustainable Places." American Planning Association Planning Advisory Service: Chicago.
- 3 Smit, Jac, Joe Nasr and Annu Ratta. 2001. Urban Agriculture: Food, Jobs and Sustainable Cities, Chapter 1 Cities That Feed Themselves. The Urban Agriculture Network, Inc. Accessed March 21, 2013. <http://www.jacsmit.com/book/Chap01.pdf>.
- 4 Bailkey, Martin, Marcia Caton Campbell and Kimberley Hodgson. 2011. "Urban Agriculture: Growing Healthy, Sustainable Places." American Planning Association Planning Advisory Service: Chicago.
- 5 Boston Redevelopment Authority. 2013. Draft Zoning Code Article 89, Urban Agriculture. Accessed April 30, 2013. http://www.bostonredevelopmentauthority.org/pdf/PlanningPublications/Urban%20Agriculture%20Draft_Article_89_3.7.13.pdf.
- 6 Peters, Kathryn A. 2010. "Creating a Sustainable Urban Agriculture Revolution." University of Oregon School of Law Journal of Environmental Law and Litigation. 25(1): 203-247.
- 7 "Office of Food Initiatives," City of Boston, Accessed March 17, 2013. <http://www.cityofboston.gov/food/>.
- 8 "Boston Common," A View on Cities, Accessed March 17, 2013. <http://www.aviewoncities.com/boston/bostoncommon.html>.
- 9 "Within These Walls – Victory Garden," Smithsonian National Museum of American History, Accessed March 17, 2013. amhistory.si.edu/house/yourvisit/victorygarden.asp
- 10 Bailkey, Martin, Marcia Caton Campbell and Kimberley Hodgson. 2011. "Urban Agriculture: Growing Healthy, Sustainable Places." American Planning Association Planning Advisory Service: Chicago.
- 11 City of Boston/Department of Neighborhood Development. Boston's Grassroots Program: CDBG Funding for Community Gardens. Accessed March 16, 2013.
- 12 Ibid.
- 13 City of Boston/Department of Neighborhood Development. Boston's Grassroots Program: CDBG Funding for Community Gardens. Accessed March 16, 2013. http://www.cityofboston.gov/dnd/PDFs/D_Boston_Grassroots_CDBG.pdf.
- 14 "Office of Food Initiatives," City of Boston, Accessed March 17, 2013. <http://www.cityofboston.gov/food/>.
- 15 Boston Redevelopment Authority. 2010. November 9, 2010 Working Group Meeting Notes. Accessed March 16, 2013. <http://www.bostonredevelopmentauthority.org/pdf/PlanningPublications/Urban%20Agriculture%20November%209,%202010%20Working%20Group%20Meeting%20Notes.pdf>.
- 16 "Planning Initiatives: Urban Agriculture Rezoning," Boston Redevelopment Authority, Accessed March 15, 2013. <http://www.bostonredevelopmentauthority.org/planning/PlanningInitsIndividual.asp?action=ViewInits&InitID=152>.
- 17 Project Overview January 30, 2012 Kickoff & Visioning Meeting – Urban Agriculture Project. Accessed March 17, 2013. <http://www.bostonredevelopmentauthority.org/pdf/PlanningPublications/Urban%20Agriculture%20Project%20Overview%20Jan%2030,%202012%20Kickoff%20and%20Visioning%20Meeting.pdf>.
- 18 Boston Redevelopment Authority. 2013. Draft Zoning Code Article 89, Urban Agriculture. Accessed March 15, 2013. http://www.bostonredevelopmentauthority.org/pdf/PlanningPublications/Urban%20Agriculture%20Draft_Article_89_3.7.13.pdf.
- 19 Ibid, 3
- 20 Brown, Katherine H. 2002. "Urban Agriculture and Community Food Security in the United States: Farming from the City Center to the Urban Fringe." Urban Agriculture Committee of the Community Food Security Coalition. Accessed March 19, 2013. <http://foodsecurity.org/publications>.
- 21 Flournoy, Rebecca, Allison Hagey and Solana Rice. 2012. "Urban Agriculture: Equitable Strategies and Policies for Improving Access to Healthy Food and Revitalizing Communities." Policy Link. Accessed March 20, 2013. http://www.policylink.org/site/c.lkIXLbMNJrE/b.8370635/k.ADC3/Urban_Agriculture.htm#UJ1xv4V9k7A.
- 22 Gorgolewski, Mark, June Komisar and Joe Nasr, Carrot City: Creating Places for Urban Agriculture. New York: Monticelli Press, 2011.

- 23 Brown, Katherine H. 2002. "Urban Agriculture and Community Food Security in the United States: Farming from the City Center to the Urban Fringe." Urban Agriculture Committee of the Community Food Security Coalition. Accessed March 19, 2013. <http://foodsecurity.org/publications>.
- 24 Bailkey, Martin, Marcia Caton Campbell and Kimberley Hodgson. 2011. "Urban Agriculture: Growing Healthy, Sustainable Places." American Planning Association Planning Advisory Service: Chicago.
- 25 Gorgolewski, Mark, June Komisar and Joe Nasr, Carrot City: Creating Places for Urban Agriculture. New York: Monticelli Press, 2011.
- 26 Bailkey, Martin, Marcia Caton Campbell and Kimberley Hodgson. 2011. "Urban Agriculture: Growing Healthy, Sustainable Places." American Planning Association Planning Advisory Service: Chicago.
- 27 Ibid., 13-15
- 28 Ibid., 13
- 29 Ibid, 13
- 30 Bailkey, Martin and Jerry Kaufman. 2001. "Farming Inside Cities: Entrepreneurial Urban Agriculture in the United States." Land Lines. 13(1): 2-124.
- 31 Conrad, Michael, Patricia Culligan, Eric Dahlgren, Ruth Katz and Richard Pluntz. 2012. The Potential for Urban Agriculture in New York City: Growing Capacity, Food Security and Green Infrastructure. Prepared by Kubi Ackerman. New York: The Earth Institute, Columbia University. Accessed March 20, 2013. <http://admin.urbandesignlab.columbia.edu/?pid=nyc-urban-agriculture>.
- 32 Petts, James. 2008. "The Economics of Urban and Peri-Urban Agriculture." CPUL: Continuous Productive Urban Landscapes, edited by Andre Viljoen, 65-78. New York: Elsevier.
- 33 Flournoy, Rebecca, Allison Hagey and Solana Rice. 2012. "Urban Agriculture: Equitable Strategies and Policies for Improving Access to Healthy Food and Revitalizing Communities." Policy Link. Accessed March 20, 2013. http://www.policylink.org/site/c.IkIXLbMNJrE/b.8370635/k.ADC3/Urban_Agriculture.htm#.UJ1xv4V9k7A.
- 34 Ibid., 21
- 35 Caton-Campbell, Marcia. 2004. "Building a Common Table: The Role of Planning in Community Food Systems." Journal of Planning Education and Research. 23(4): 341-355.
- 36 Petts, James. 2008. "The Economics of Urban and Peri-Urban Agriculture." CPUL: Continuous Productive Urban Landscapes, edited by Andre Viljoen, 65-78. New York: Elsevier.
- 37 Ibid., 71
- 38 Meter, Ken. 2009. "The Potential for Urban Agriculture." Crossroads Resource Center. Accessed March 20, 2013. www.crcworks.org.
- 39 Flournoy, Rebecca, Allison Hagey and Solana Rice. 2012. "Urban Agriculture: Equitable Strategies and Policies for Improving Access to Healthy Food and Revitalizing Communities." Policy Link. Accessed March 20, 2013. http://www.policylink.org/site/c.IkIXLbMNJrE/b.8370635/k.ADC3/Urban_Agriculture.htm#.UJ1xv4V9k7A.
- 40 Ladner, Peter. 2010. "Economic Potential of Urban Agriculture." In Agricultural Urbanism, edited by Janine de la Salle and Mark Holland, 163-175. Green Frigate Books: Winnipeg Manitoba.
- 41 "Impact of Urban Agriculture," Five Borough Farm, Accessed March 20, 2012. <http://www.fiveboroughfarm.org/impact/>.
- 42 The Conservation Law Foundation and CLF Ventures, Inc. 2012. Growing Green: Measuring Benefits, Overcoming Barriers, and Nurturing Opportunities for Urban Agriculture in Boston. Accessed March 20, 2013. <http://www.clf.org/our-work/healthy-communities/food-and-farm-initiative/urban-agriculture/>.
- 43 Peters, Kathryn A. 2010. "Creating a Sustainable Urban Agriculture Revolution." University of Oregon School of Law Journal of Environmental Law and Litigation. 25(1): 203-247.
- 44 Ibid., 15
- 45 The Conservation Law Foundation and CLF Ventures, Inc. 2012. Growing Green: Measuring Benefits, Overcoming Barriers, and Nurturing Opportunities for Urban Agriculture in Boston. Accessed March 20, 2013. <http://www.clf.org/our-work/healthy-communities/food-and-farm-initiative/urban-agriculture/>.
- 46 Brown, Katherine H. 2002. "Urban Agriculture and Community Food Security in the United States: Farming from the City Center to the Urban Fringe." Urban Agriculture Committee of the Community Food Security Coalition. Accessed March 20, 2013. <http://foodsecurity.org/publications>.
- 47 Ibid., 19

- 
- 48 Flournoy, Rebecca, Allison Hagey and Solana Rice. 2012. "Urban Agriculture: Equitable Strategies and Policies for Improving Access to Healthy Food and Revitalizing Communities." Policy Link. Accessed March 20, 2013. http://www.policylink.org/site/c.IkIXLbMNJrE/b.8370635/k.ADC3/Urban_Agriculture.htm#.UJ1xv4V9k7A.
- 49 Ibid., 23
- 50 Morales, Alfonso and Nina Mukerji. 2012. "Zoning for Urban Agriculture." Zoning Practice 3: 1-8.
- 51 Ibid., 24-26
- 52 Green for All. "Is Urban Agriculture Economically Sustainable?" in Opposing Viewpoints Series: Urban Agriculture. Ed. Nancy Dziedzic and Lynn M. Zott. (New York: Greenhaven Press, 2012), 89-90
- 53 Brown, Katherine H. 2002. "Urban Agriculture and Community Food Security in the United States: Farming from the City Center to the Urban Fringe." Urban Agriculture Committee of the Community Food Security Coalition. Accessed March 20, 2013. <http://foodsecurity.org/publications>
- 54 Ibid., 20
- 55 Flournoy, Rebecca, Allison Hagey and Solana Rice. 2012. "Urban Agriculture: Equitable Strategies and Policies for Improving Access to Healthy Food and Revitalizing Communities." Policy Link. Accessed March 20, 2013. http://www.policylink.org/site/c.IkIXLbMNJrE/b.8370635/k.ADC3/Urban_Agriculture.htm#.UJ1xv4V9k7A.

Section 2

Vacant Land Literature Review





Vacant Land Assessment Literature Review


The research team conducted a review of vacant land assessments and inventories performed in nine U.S. and Canadian cities. The purpose of this review was to better understand the methodologies and results of analyzing vacant land suitable for urban agriculture. The reports provided background information and specific techniques used to explore the potential for urban agriculture in cities. The physical suitability criteria applied to vacant land has helped inform what physical attributes could promote or hinder ground-based farming in Boston. This review and interviews with local farmers and urban farming advocates lead to the development of a suite of physical criteria applied in this vacant land assessment.

For the purposes of this study, vacant land is defined as parcels of land that do not contain built

structures. A vacant land inventory is an effective tool to integrate urban agriculture into public policy and planning as a land management use strategy. Vacant land inventories can identify opportunities for urban agriculture initiatives and promote better understanding and analysis of the potential of urban agriculture.¹ This tool does not function in isolation, but can be employed in conjunction with other tools, strategies and processes, such as surveys or scenario planning, to advance cross-departmental municipal goals such as reducing carbon emissions, increasing food access and supporting workforce development.² U.S. cities, including Detroit, Chicago, Philadelphia and Trenton, have vast supplies of vacant land due to deindustrialization and the subsequent decrease of urban populations. Vacant land can impose fiscal maintenance burdens on local governments, and without adequate development interest many cities have opted to reuse vacant land

for community open space.³ Urban agriculture can transform vacant land riddled with crime, waste and overgrowth into productive community and entrepreneurial spaces with environmental, economic and social benefits.⁴ Property values abutting cultivated green spaces generally tend to be higher than those surrounding underutilized or dilapidated lots.⁵

In cities across North America, local governments, nonprofits, academic institutions and community groups have conducted vacant land assessments to explore potential land suitable for urban agriculture production.⁶ Many of the inventories have involved such stakeholders in research and analysis phases, but have been less inclusive when performing time-intensive technical analysis (GIS, aerial imagery assessment, site visits or ground truthing).⁷ Inventories have been performed in Portland, Vancouver, Seattle, Cleveland-Cuyahoga County, Detroit, Chicago,



Toronto, New York City, Youngstown, Oakland and San Francisco.⁸ The types of urban agriculture included in each study have varied from controlled environment production (i.e. hydroponics, greenhouse, rooftop, vertical), ground-based agriculture, permaculture, fruit trees, agroforestry, livestock production and beekeeping.⁹ Inventories have also differed in business types being considered as urban agriculture, including nonprofit (e.g. community gardens), for profit entrepreneurial businesses or hybrids of both. Generally the assessments have followed the framework of identifying vacant land by ownership type, creating urban agriculture suitability criteria (physical and socioeconomic), assigning ranking or scoring systems for criteria and presenting study results as publicly-available reports.¹⁰ The common physical attributes analyzed by the studies reviewed were size, slope and light exposure. Vacant land assessments for Toronto and Oakland have gone farther to develop models

for assessing production potential and the ability to feed city residents. These studies have made basic estimates of fruit and vegetable dietary requirements and yield assumptions.^{11 12}

Urban agriculture vacant land assessments have resulted in greater awareness and understanding of food systems issues and their value in exploring local alternatives to current industrialized food production and distribution models. Impacts have included integration of urban agriculture into planning and policymaking decisions as well as strengthening of linkages to existing sustainability initiatives.¹³ Stakeholders have built upon these assessments and conducted more targeted, in depth studies that relate to issues of public health, economic development, food security, community engagement, and environmental sustainability. Toronto and Seattle experienced notable changes resulting from urban agriculture vacant land assessments. In Toronto, local zoning bylaws and guidelines were altered, and urban

agriculture private development guidelines were created. Seattle's collaborative process increased public participation and inclusion of urban agriculture in city sustainability planning.¹⁴ Urban agriculture vacant land assessments have the power to evaluate the promise of urban agriculture, but the process and resulting impacts will be unique to each city. The impacts and reach of our vacant land assessment for Boston cannot be fully predicted, but our goal throughout this process has been to make information on vacant publicly-owned land more readily available to interested parties. The transparency of research and analysis methods used to identify vacant land suitable for urban agriculture will allow others to use and interpret our data and findings as needed. The vacant land parcels profiled through this process will be able to highlight possible locations for urban agriculture, and it will be in the control of communities to envision the future of vacant land throughout the city.



Section References

- 1 Mendes, Wendy, Kevin Balmer, Terra Kaethler and Amanda Rhoads. 2008. "Using Land Inventories to Plan for Urban Agriculture," *Journal of the American Planning Association* 74 (2008): 435-49, accessed March 19, 2013, doi: 74.406/335659.
- 2 Ibid, 3
- 3 Bailkey, Martin and Jerry Kaufman. 2001. "Farming Inside Cities: Entrepreneurial Urban Agriculture in the United States." *Land Lines*. 13(1): 2-124.
- 4 Bailkey, Martin, Marcia Caton Campbell and Kimberley Hodgson. 2011. "Urban Agriculture: Growing Healthy, Sustainable Places." American Planning Association Planning Advisory Service: Chicago.
- 5 Conrad, Michael, Patricia Culligan, Eric Dahlgren, Ruth Katz and Richard Pluntz. 2012. *The Potential for Urban Agriculture in New York City: Growing Capacity, Food Security and Green Infrastructure*. Prepared by Kubi Ackerman. New York: The Earth Institute, Columbia University. Accessed March 20, 2013. <http://admin.urbandesignlab.columbia.edu/?pid=nyc-urban-agriculture>.
- 6 Mendes, Wendy, Kevin Balmer, Terra Kaethler and Amanda Rhoads. 2008. "Using Land Inventories to Plan for Urban Agriculture," *Journal of the American Planning Association* 74 (2008): 435-49, accessed March 19, 2013, doi: 74.406/335659.
- 7 Horst, Megan. 2011. "A Review of Suitable Urban Agriculture Land Inventories." American Planning Association. Accessed March 19, 2013. <http://www.planning.org/resources/ontheradar/food/pdf/horstpaper.pdf>.
- 8 Mendes, Wendy, Kevin Balmer, Terra Kaethler and Amanda Rhoads. 2008. "Using Land Inventories to Plan for Urban Agriculture," *Journal of the American Planning Association* 74 (2008): 435-49, accessed March 19, 2013, doi: 74.406/335659.
- 9 Horst, Megan. 2011. "A Review of Suitable Urban Agriculture Land Inventories." American Planning Association. Accessed March 19, 2013. <http://www.planning.org/resources/ontheradar/food/pdf/horstpaper.pdf>.
- 10 Ibid., 2-3
- 11 MacRae, Rod, et al., "Could Toronto Provide 10% of its Fresh Vegetable Requirements From Within its Own Boundaries? Matching Consumption Requirements with Growing Spaces," *Journal of Agriculture, Food Systems, and Community Advance Online Publication*. Accessed March 18, 2013, doi:10.5304/jafscd.2010.012.008.
- 12 McClintock, Nathan, Jenny Cooper and Snehee Khandeshi, "Assessing the potential contribution of vacant land to urban vegetable production and consumption in Oakland, CA," *Landscape and Urban Planning* 111 (2013): 46-58. Accessed March 18, 2013, doi: 10.1016/j.landurbplan.2012.12.009.
- 13 Mendes, Wendy, Kevin Balmer, Terra Kaethler and Amanda Rhoads. 2008. "Using Land Inventories to Plan for Urban Agriculture," *Journal of the American Planning Association* 74 (2008): 435-49, accessed March 19, 2013, doi: 74.406/335659.
- 14 Ibid, 13-14, 19-20

Section 3

Interview Design and Analysis



Interview Design and Analysis

Interviews informed the rubric of physical criteria necessary for farmable land. Eleven interviews were conducted with stakeholders representing a range of experiences with agriculture and food justice. Interviewees were identified by contacting project stakeholders and members of the Mayor's Urban Agriculture Working Group. While the majority of those interviewed have vast experience as farmers, others are involved in such work as community gardening, landscape architecture, and environmental justice advocacy.

The structure of the interview design was drawn from suggestions in Steinar Kvale's *Doing Interviews*.¹ According to Kvale's work, introductory framing sections were added to the interview questions, seen in the design as the briefing. Informed by the literature review, interview questions covered physical and operational requirements of urban farms, as well as land and

infrastructure, funding, business models, and sales (see Appendix I for detailed interview design). While the focus of the interviews was on obtaining information to establish physical criteria, other questions were asked to illustrate additional preferences and concerns, such as security. Further refinement based on additional research on crafting useful questions produced a stronger interview script.

Responses were grouped to bring forward common themes for ease of analysis, following Strauss and Corbin's model of "Meaning Coding".² Interview notes were divided into sections relating to chosen words and phrases. By combining notes from all interviews along common themes, similarities and differences among the responses gathered were more easily analyzed. The following paragraphs detail the most reported requirements for choosing land to be farmed in an urban setting.

Light Exposure

Every interviewee noted sunlight

as a priority in finding a parcel to farm. Light exposure in urban environments is limited by shading from trees and adjacent buildings. Most crops need eight to ten hours of sunlight per day for optimal growth, yet a farmer could choose to specialize in shade-tolerant crops, such as spinach. In nearly a third of these interviews, the conversation surrounding sunlight quickly turned to tree trimming or removal. While it may be cost prohibitive, a farmer noted that in order to achieve adequate light a clear "Southern exposure is ideal". Predicting the fees for tree removal is difficult and varies based on whether limbs would need to first be cut back or whether the entire stump needs to be taken out. A gardener stressed the importance of keeping urban trees intact, and that there are "efforts to protect and plant more trees. If you're clear cutting a site, then it's not the right site."



Water Access

All but one of the interviewees listed water access as a requirement for selecting a parcel to farm. A vacant lot does not guarantee access to water, as one interviewee discovered: “When a parcel becomes vacant, the water connection is supposed to be tapped off. You might be able to find a partial hook-up.” Affordability of water access is a barrier to beginning a farm in Boston. Many farmers mentioned cost saving methods, such as using a rain barrel to catch rainwater. While strong neighborhood relationships may grant a farmer shared use of a water source, others will look for lots with existing pipes and spigots.

An interviewee with considerable community gardening experience estimated that the average cost of water at a community garden to be approximately \$15 per garden plot per year, although it would depend “what they grow, how much, and if it’s been a wet or dry year”. Community gardens do not pay for sewer, which is more than

half of a residential water bill. Moreover, community gardens have small plot sizes: around 300 square feet. The most cost prohibitive element of water access is paying for surveys, laying pipes, and setting up the system. One of those interviewed reported, “at this point, it costs \$15 to 20,000. [Farmers] need a stamped survey of the site and a stamped engineering drawing. Already, you’ve spent close to \$5,000”.

Slope

Eight interviewees highlighted slope as a main consideration in determining a valuable parcel. Defining a specific range of slopes is challenging without precise measurements. Responses included, “The flatter the better,” “An average of 3%,” and a “20 degree slope,” although “A slope over 30% [would be] too much.” No one reported considering parcels with over a 30% slope, and “Even around 30, the farmer should be considering terracing.” One urban farmer interviewed works on a half-acre plot with a section of high

slope. This area has been partially terraced and offers the farm an added unique working space. Because of creative uses such as terracing, a slope of 20 or 30% is “not a deal breaker”. In choosing a parcel with high slope issues, the farmer would factor in the cost of leveling with machinery. An interviewee advised to look for “evidence of ledges and foundations” to provide clues to the labor involved in leveling.

Urban farms with steep slopes may raise the issue of run-off. One farmer we interviewed sited mitigating run-off by using “cover crops to stabilize soil”. Another pointed out “urban agriculture can only improve [run-off] because most vacant lots are paved or contain contaminated soils. Farmers would not be using phosphorous heavy chemicals or fertilizers, and drainage is not a concern”. Best practices for farmers include learning how to control drainage so that investments such as fertilizers and compost don’t leave the land.



Size

Seven interviewees reported that the size of a parcel would affect their impression of its ability to be farmed. There appeared to be some discrepancy surrounding the minimum acceptable area of tillable land to be considered commercially viable. While three people said $\frac{1}{4}$ acre (roughly 10,000 square feet) is needed, two reported smaller requirements such as 8,000 square feet, and others listed alternative variations. Of those alternatives, the most popular was the notion of clustering parcels- grouping multiple lots that are in aggregate $\frac{1}{4}$ acre or larger. One interviewee stated that farmers tending to clustered lots would “need to be able to move gear between lots” and suggested that farmers could work to rotate their time spent on each plot. If time allows, clustering is “probably realistic to keep extending the market and profitability”. Others interviewed currently farm in suburban or rural areas and so this urban-specific profitability calculation

would not be as relevant to their needs, and their stated preference is “at least three to five acres”.

Additional considerations include the need to have storage space on the site, as well as ample room for composting (“sites need to be big enough for on-site composting”), a greenhouse, or a washing station. If a farmer were able to be productive on 10,000 square feet of farmed land, an ideal parcel size may need to be larger to accommodate these necessary activities. Size relates directly to profitability, and is dependant on the business model. Size can vary more when farming “for non-profit purposes, [such as] agriculture combined with education”. If growing produce is a means of achieving an alternate mission, profitability, and therefore parcel size may not be a priority.

Density of Vegetation and Debris

Vacant parcels in urban areas vary in the amount of labor required to prepare the land for farming. Density of vegetation is listed under farmer

preferences because of the assumed costs of clearing a lot. A farmer could choose to enlist numerous volunteers to help manually prepare a lot, or to cut back vegetation with machinery. One interviewee stated their understanding of the cost of cutting back overgrowth; “If two-thirds of the plot were open already, [a farmer could afford to] clear a quarter to a third [of the plot] to get started, otherwise this could seem daunting.”

Furthermore, three people highlighted the cost and labor associated with farming a parcel with invasive species, such as Japanese knotweed. Using organic methods, some invasives can take multiple seasons to effectively get rid of, however this may also be mitigated if the farmer can afford other means.



Security

Security on a farm is nuanced and site-specific. Several farmers defined security physically; choosing a plot with streetlights, locking sheds, or building fencing as a way to discourage theft and prevent animal entry. Others spoke of security in terms of the neighborhood's relationship with the farm. Five of the interviewees cited strong community support of their farm as a means of protection: "Neighborhood gardens need to have community ownership and facilitate community building. Securing a parcel reduces that function. The supposed problems with theft or vandalism in community gardens are another layer of criminalization."

Transportation

For staff, volunteers, customers and community alike, transportation to an urban farm is an important consideration. Adequate parking accessibility is vital for farmers handling a large yield; "If you're harvesting 300 pounds of produce, how do you

get this to market?" Five of those we interviewed mentioned some aspect of transportation needed, including curb cuts needed for uses such as "the ability to get a large truck onto the site for a soil dump."

Soil

While soil is a primary concern for each of those we interviewed, it will not be taken into account as a physical criteria for this project. Following the regulations detailed in Boston's Citywide Urban Agriculture Rezoning Initiative, all commercial farmers are required to bring fresh, healthy soil to their lot. It will be necessary to purchase soil that is free of lead and other heavy metals and toxins that are common in vacant lots in the city, which can be cost prohibitive for some farming operations.



Discussion of Results

The criteria established from the interviews, in conjunction with information from the literature review and Article 89, form the attributes used in the development of thresholds for use throughout the multistage data filtration process. From these suggestions, this project will focus on parcels of at least 10,000 square feet, although some smaller parcels in clustered plots are also considered. For zoning purposes Article 89 classifies parcels from 10,000 square feet to 43,560 square feet (1 acre) as a medium sized parcel, which is known to be the smallest acreage advised for profitability of a commercial farm. While preferences for slope ranged widely, parcels with a maximum slope under 20% were targeted. This reflects both the desire to farm on very level land while accommodating farmers comfortable with terracing. Additionally, this project will focus on parcels with an open Southern exposure to insure adequate light for crops.

Responses gathered that were not strictly land attributes were therefore not operationalized in the data filtration process, however these were later considered in the final creation of site profiles.

Section References

- 1 Kvale, S. 2007. *Doing Interviews*. London: SAGE Publications.
- 2 Ibid.

Section 4

Vacant Land Data Set Creation



Vacant Land Data Set Creation

Data sorting was required to obtain information on vacant land from the Fiscal Year 2013 (FY 13') City of Boston Assessing Department Property Parcel Data. This sorting was performed using Microsoft Access queries and GIS. Queries were utilized as the most efficient way of filtering the large sets of data, and for creating new data and sorting. The purpose of this step was the creation of the core data sets that identify vacant land. Data was organized by public and private ownership, as well as size, and was done prior to the spatial analysis. This allowed for more efficient and reliable data management for running further GIS analysis.

Vacant Land

Assessor's data contains detailed information about each parcel in the city and is updated annually. The FY 13' data was released in January 2013 and was the most current data available at the time of this project. The first step in identifying vacant land was to establish which fields in the data determine that a parcel is vacant; for our purposes vacant means the lack of a building. The field AV_BLDG is defined as "the total assessed building value" and the GROSS_AREA is defined as the "gross floor area for commercial properties". If both GROSS_AREA and AV_BLDG field values were equal to zero then the parcel was designated as vacant.

Figure 2 Number and Acreage of Parcels for Initial Data Sets

Data set	Total # parcels	Total acreage
All vacant land (including open space)	13,318	8,103
Privately owned vacant land*	9,102	1,281
Private vacant land >= 10,000 sq. ft.*	640	674
Publicly owned vacant land**	2,646	702
All publicly owned vacant land >= 10,000 sq. ft.**	717	564

*Open space excluded

** DND clusters included. Open space rail lines excluded.

Source: City of Boston Assessing Department Department

Condos

Filtering the total 165,608 records for the vacant criteria initially yielded 21,929 parcels. This included condos that meet the requirements for vacant status because only the main condo parcel includes the GROSS_AREA and AV_BLDG fields. Vacant land with a condo main ID (CM_ID) would implicate its attachment to a condo main parcel so only parcels with a CM_ID equal to null were kept. This removed all condo properties and there remained a total of 13,318 vacant parcels with a total acreage of 8103 acres. This includes both private and publicly owned land.

Determining Private and Public Land

To determine publicly owned parcels the property type (PTYPE) field was used. Since some tax exempt land is privately owned, by institutions, or non-profits only the PTYPE's for public agencies were selected: 900,901,902,903,908, and 910-918. Figure 3 displays the various PTYPE categories.

A new field was created called "private" and all of these public parcels were assigned the value of "0" for the private field. Any non-government owners within that pool were manually assigned a value of "1" for the private field. All other non-public parcels were assigned a value of "1" for the private field. This resulted in 3,724 publicly owned parcels and 9,594 privately owned parcels.

Figure 3 Assessor's Parcel Data Categories - Exempt Ownership

P Type	Owner	Land use
900	U.S. Government	E
901	Commonwealth of MA	E
902	City of Boston	E
903	Bost Redevelop Auth	E
904	Priv School/College	E
905	Charitable Org	E
906	Religious Org	E
907	121-A Property	E-A
908	Boston Housing Auth	E
910	MA Dept Environ Mgmt	E
912	MA Dept of Youth Services	E
914	MA Dept of Mental Health	E
915	Metro Dist Comm	E
917	MA Dept Edu	E
918	MA DEP	E

Source: City of Boston Assessing Department Department



Public Land Renaming

Assessor's data lacks consistent naming protocols for public ownership and PTYPE is not specific enough for the purposes of this report. Ownership was reclassified through the use of queries to make naming consistent. Any ownership similar to Boston Redevelopment Authority for example "Boston Redev Auth" or "Boston Redevelopment Auth" was renamed to "BRA" to ensure consistency. This process was repeated with City of Boston, MBTA, and DND (Dept. of Neighborhood Development). The DND renaming was different as it utilized a separate data set from DND.

Data for DND-owned vacant properties was obtained from the DND and was the most current data as of January 2013. In the assessor's data all DND owned properties are included under the owner title of City of Boston. In order to classify vacant properties from the assessor's data specifically as DND ownership, the DND data was cross referenced with all the vacant land

parcels and all the parcels with matching Parcel ID numbers were renamed "DND" in the owner field.

Other Ownership Category

To keep public ownership simple within the maps, a new field was created called "other" and public owners that were not City of Boston, MBTA, DND, or BRA were given a value of "0". Having a separate field for "other" allows the distinct ownership to be maintained and searched, but in the maps they can be a separate color for simplicity. The "other" category includes owners such as Massachusetts Port Authority, Massachusetts Highway, Commonwealth of Massachusetts and Boston Water and Sewer to name a few. These owners were less numerous and did not warrant separate highlighting, except in the case of Commonwealth of Massachusetts, which was designated "other" because it is not a city specific agency.

DND Contiguous Parcel Analysis

DND parcels are often developed,

or sold in groups, often contiguous but sometimes separated by short distances (e.g. across a road). There are many DND parcels smaller than 10,000 square feet, which is the minimum size being utilized for this urban agriculture vacant land assessment. In order to overcome this issue, parcels that are contiguous were dissolved, using GIS, into single parcels. Dissolved parcels that added up to 10,000 square feet or more were included in the creation of the public land greater than 10,000 square feet data set (to account for potential aggregation of parcels). This process is explained in more detail in Section 5.

Section 5

Data Mapping and Spatial Analysis





Data Mapping and Spatial Analysis

Arc GIS 10.1 was used to apply the physical criteria from the interviews to the vacant land data. The purpose of this process was to filter vacant land in order to determine the most suitable parcels of land for further analysis. This is the most crucial step in refining the data from a large and unwieldy number of parcels toward a more manageable data set. The data was filtered through several criteria determined from the interviews and adapted from GIS data layers. In attempting to obtain the most farmable parcels of vacant land, decisions were made to use stringent criteria that would filter out many parcels that could be farmed on. It is for this reason that data sets have been supplied with this report prior to the application of different criteria, allowing other interested parties to adopt their own criteria and apply it.

The data layers used were obtained from the City of Boston

Department of Innovation and Technology (DOIT), MassGIS, the Department of Neighborhood Development, and the Tufts GIS Repository. These layers include the property parcels in Boston, open space, rail lines, wetlands, trees, impervious surfaces, and a digital elevation model of Boston. Further detail about these data sets can be found in the Appendix II.

Boston Parcel Data

Central to using GIS for analyzing vacant land is the City of Boston parcel data obtained from the assessor's data. The parcel data forms the basis of the maps and contains the polygons that provide a geographic representation of the location of parcels. Any vacant land data set can be joined to this layer based on the Parcel ID number. More information on this layer can be found in Appendix II.

Open Space and Rail Lines

Open space and rail lines were the first criteria for which GIS filtering was used.

The assessor's data, inclusive of land designated as open space as vacant, lead to large land area for the vacant land data. Although open space meets the initial definition of vacant land as the lack of buildings, it is not vacant; it has a current use. For this project that current use is not considered to be suitable for farming. Starting with the all-vacant land data set the select by location function was used to determine vacant parcels that intersected with the open space layer. These parcels were removed for the creation of public and private land data without open space. Additionally this was done for rail lines as long narrow parcels along the railroad tracks were included as vacant. These seemed unlikely candidates for growing as they are dangerous and often inaccessible. The DOIT rail layer was used and any parcels that intersected with it were removed.

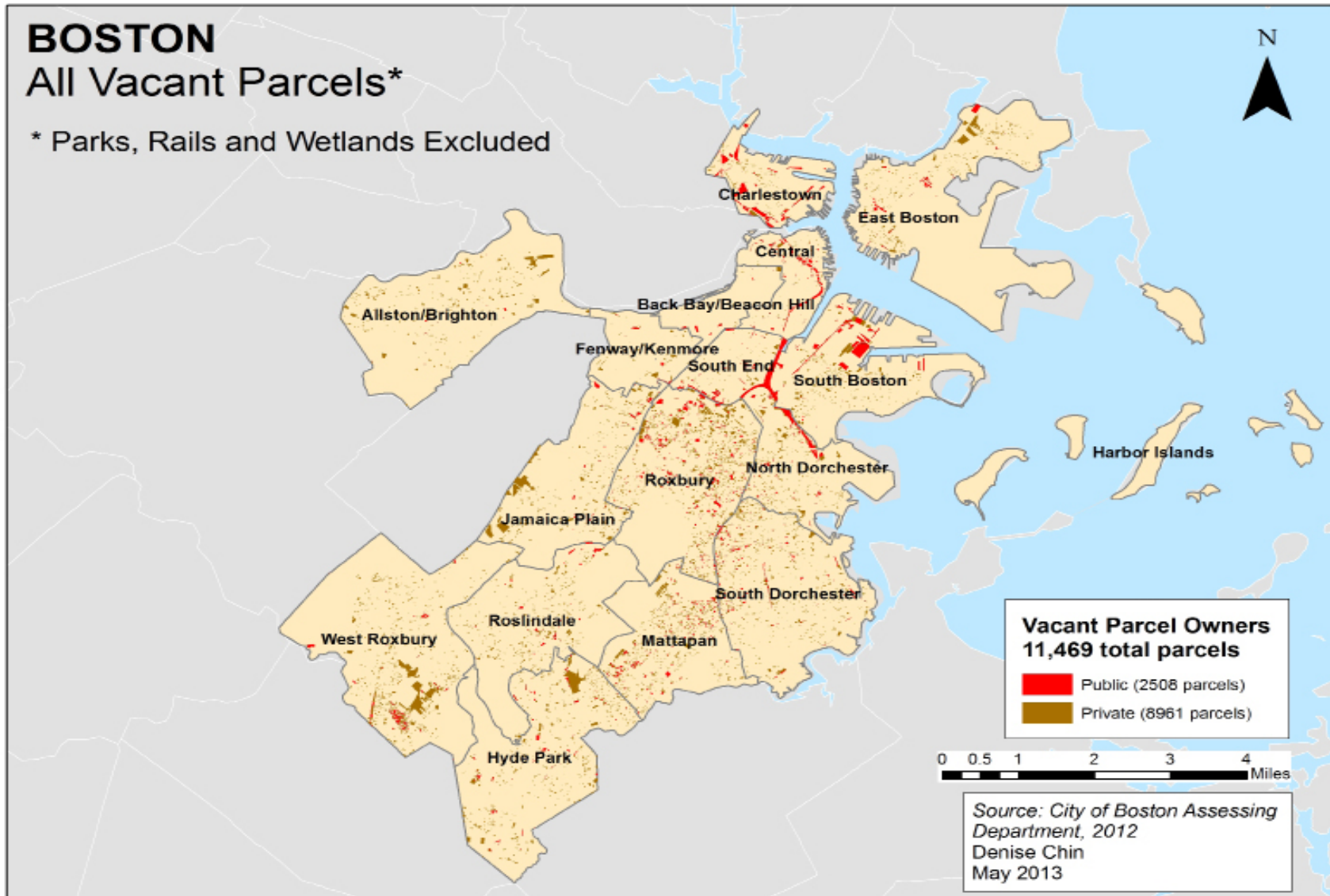


Figure 4 All Vacant Land Without Open Space or Rail Lines

Figure 4 shows a graphical representation of the data without open space or rail line parcels. Included in this report are the digital versions of this map by neighborhood.



DND Cluster Parcels

The Department of Neighborhood Development often groups parcels and considers them one site for leasing or development. When sorting the vacant public land data for parcels greater than 10,000 square feet, many small parcels that should be considered a group with an area over 10,000 square feet would be filtered out. To accommodate for this fact DND owned parcels that were contiguous were combined using the dissolve tool in GIS. Adding a new field to the attribute table, the area of the contiguous groups was calculated using the calculate geometry function. These dissolved sites that added up to 10,000 square feet or more were then selected by attribute, and a new layer was created from this. To determine which parcels were included in these clusters this new layer was intersected with the complete DND parcel layer and given unique identifiers. These separate parcels were then included in the creation of the vacant public land by

size (10,000 square feet) data set. A total of 327 DND contiguous sites were added to this data set.

There are a few limitations to the inclusion of DND cluster parcels. The process was limited to including only parcels that formed contiguous groupings, and could not accommodate for clusters that were separated but close-by. In addition, the parcels that compose the group are analyzed separately and thus the group does not keep cohesion through the filtering process. This is accommodated for during the aerial verification and scoring stage.

Public Land Filtering Process

With the establishment of the Public Vacant Parcels Over 10,000 square feet with DND Cluster Sites data set, several more criteria were operationalized using GIS. For the purposes of demonstrating the GIS criteria filtering process in the remainder of this section this is the data set that will

be used. Since this project is focusing on vacant public land this is appropriate for leading to the next phase. The process is organized to demonstrate how the number of parcels was reduced through the filtering process, but there is no particular order to how the criteria were filtered, ultimately the order does not affect the outcome. It should be kept in mind that this filtering process is used to find the most suitable parcels not the only suitable parcels, and judgment calls were used in establishing certain criteria thresholds for the purpose of narrowing the selection to a manageable number for further analysis. The figure below demonstrates how the filtering process looks as a whole starting with Public vacant land 10,000 square feet or larger without parks or rail with DND cluster parcels: 717 parcels.

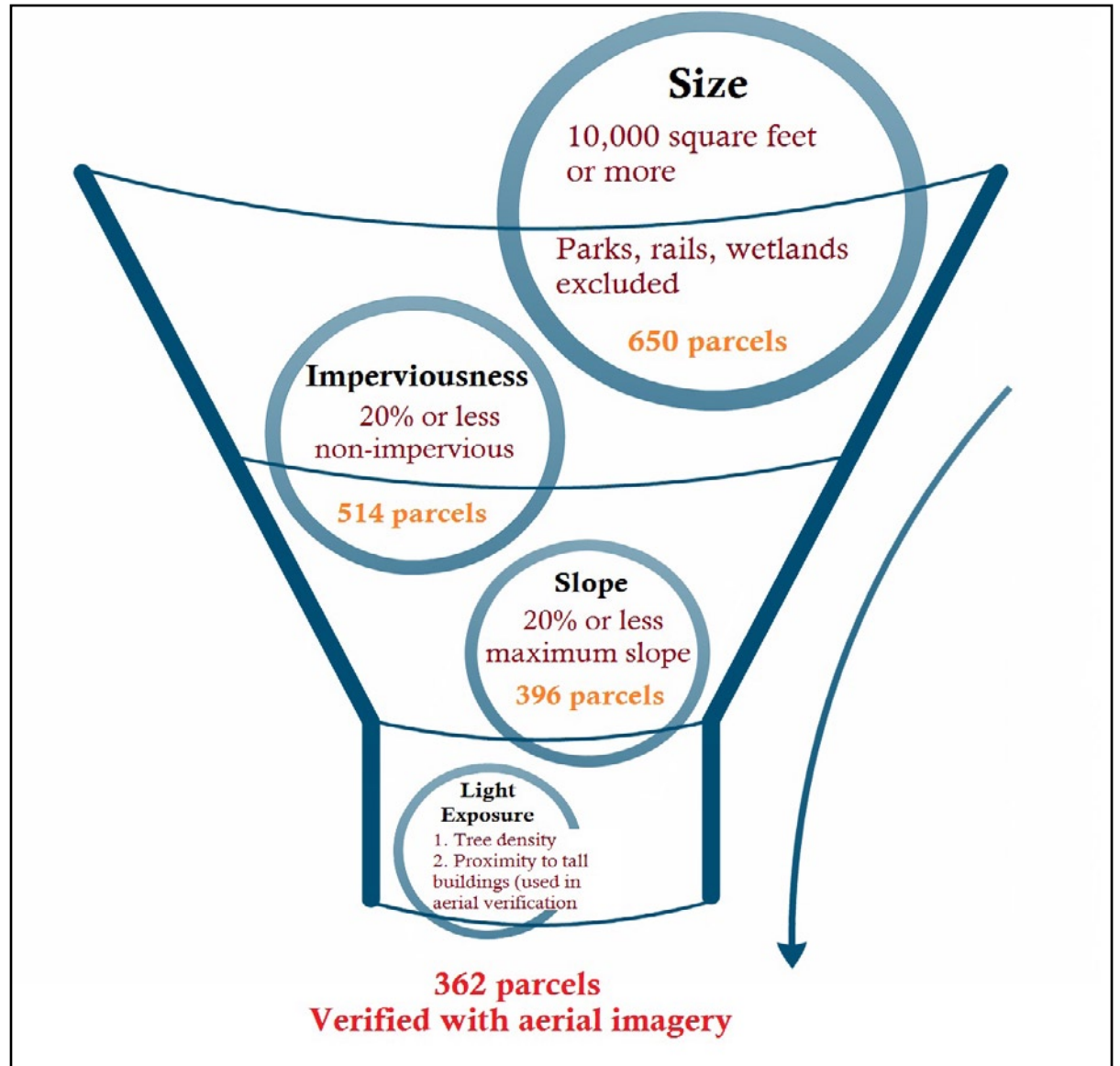
Wetlands

Using the MassGIS Wetlands layer parcels were filtered out if they intersected with a designated wetland area. Although some areas that intersect wetlands can be farmed mostly ocean parcels were filtered out this way and areas near wetlands were deemed to be risky for farming. 650 parcels remained after filtering for the wetlands criteria.


Impervious Surface

Examining the data it was apparent that large industrial sites, docks, airport runways, highways and parking lots were included in the vacant data. Most of these sites are not appropriate for urban agriculture. It is possible to farm on an impervious surface using raised beds while vacant, but for the purposes of finding the most suitable sites it was deemed best to filter out sites with extensive coverage of impervious surface.

Figure 5 Data Mapping and Spatial Analysis Filtration



Source: Denise Chin 2013



Parcels more than greater than 80% impervious (20% or less non-impervious) were filtered out. The percentage non-impervious surface of a parcel was determined using the Erase tool. Using the impervious surface as the input layer and public vacant land as the erase layer, non-impervious surfaces were left. A new field was added to the attribute table to calculate the area of the non-impervious surfaces of each parcel. Another new field was added to calculate the percentage of non-impervious surface of the parcel, which was done using the field calculator, dividing the non-impervious area by the total square feet of each parcel and multiplying by 100. Parcels that were less than 20% non-impervious were filtered out this resulted in a remaining 514 parcels.

Slope

Farmers were commonly concerned about the elevation level of a parcel. Too steep a slope would render the parcel unsuitable for starting a farm, as the growing on steep land would be technically problematic and the cost of terracing a large area of a parcel would be too high. Taking heed of advice from our interviewees that the “flatter [the parcel] the better” and considering the slope threshold requirements utilized in other urban agriculture vacant land assessments, parcels with 20% or more slope were filtered out.

Using the digital elevation model (DEM) of Boston, a slope raster layer was created. The projection for this layer

was adjusted to be in accordance with the rest of the layers. The slope for Boston was created using the slope tool (see Appendix III). To determine the slope for each parcel, a zonal statistics table was created, using the parcels layer as the input layer and selecting parcel ID for zone field. This layer was then joined to the parcel layer. Opening the attribute table of this joined database, the Max attribute was selected, which explained the highest slope of a parcel. Parcels with a maximum of 20% slope or more were excluded, and the remaining parcels totaled 396.

Light Exposure

The interviews and literature review determined that 8-10 hours of light exposure is achieved through an open southern exposure on a parcel. The measure for light exposure was operationalized in two different ways: tree density and presence of tall buildings in close proximity to parcels. Parcels with high tree density, as explained below, were filtered out. The presence of tall buildings, however, came into play during the aerial scoring portion of the project and was not used for filtering.

Tree Density

Too many trees in a parcel could provide shade coverage and would require tree removal that can be cost prohibitive. In the interviews it was stated that even a few large trees could make a plot undesirable. For this reason, 5 trees per 10,000 square feet was set as the threshold at which to filter out parcels. The tree layer obtained from Boston DOIT was used to select by attribute street trees only and a new layer of street trees was made. Street trees do not include the trees in all parcels, but does count them in a substantial amount of parcels. This data is not holistic but in the parcels where the trees are counted it is helpful for filtering. The size of trees is not able to be determined although it appears that medium to large trees are counted.

To determine the number of trees in each parcel, a spatial join of the public vacant land and street trees was made which also determined the sum of total trees in each plot. A new field was added to the attribute table to calculate tree density. The number of trees divided by the area of each parcel was calculated.

Parcels with more than 0.0005 density (5 trees per 10,000 square feet) were filtered out from the database. This was the last criteria used for filtering and resulted in 362 parcels totaling 177 acres to be examined in the aerial scoring and verification phase.

Proximity to Tall Buildings

This layer was created to aid in the subsequent aerial scoring and verification phase. Determining how much shade a building casts over a parcel is technically complex. Due to limited resources, determining shadows cast from buildings could not be automated through GIS. Building shade, therefore, was assessed during the aerial scoring portion of the project. A layer of tall buildings (40 feet or taller) within an 80-foot range was created using GIS. A building height of 40 feet was determined to be taller than most residential homes, and would result in a long shadows, often upwards of 80 feet long.

Buffer zones at an 80 feet distance were created around the 362 parcels that were filtered through the

spatial analysis. Using the buildings layer, buildings taller than 40 feet were selected by attribute and made into a new layer. Tall buildings that intersected with the 80 feet buffer zone were then determined by selecting by location. By selecting the 40 feet buildings layer as the target layer and buffer as the source layer, a new layer was created that showed buildings taller than 40 feet within 80 feet of a parcel. This layer was used as a reference during aerial verification.

Figure 6 Vacant Land After GIS Spatial Analysis

Vacant Land After GIS Filtration	Total # parcels	Total acreage
Public	362	177
Private	404	256

Source: City of Boston Assessing Department

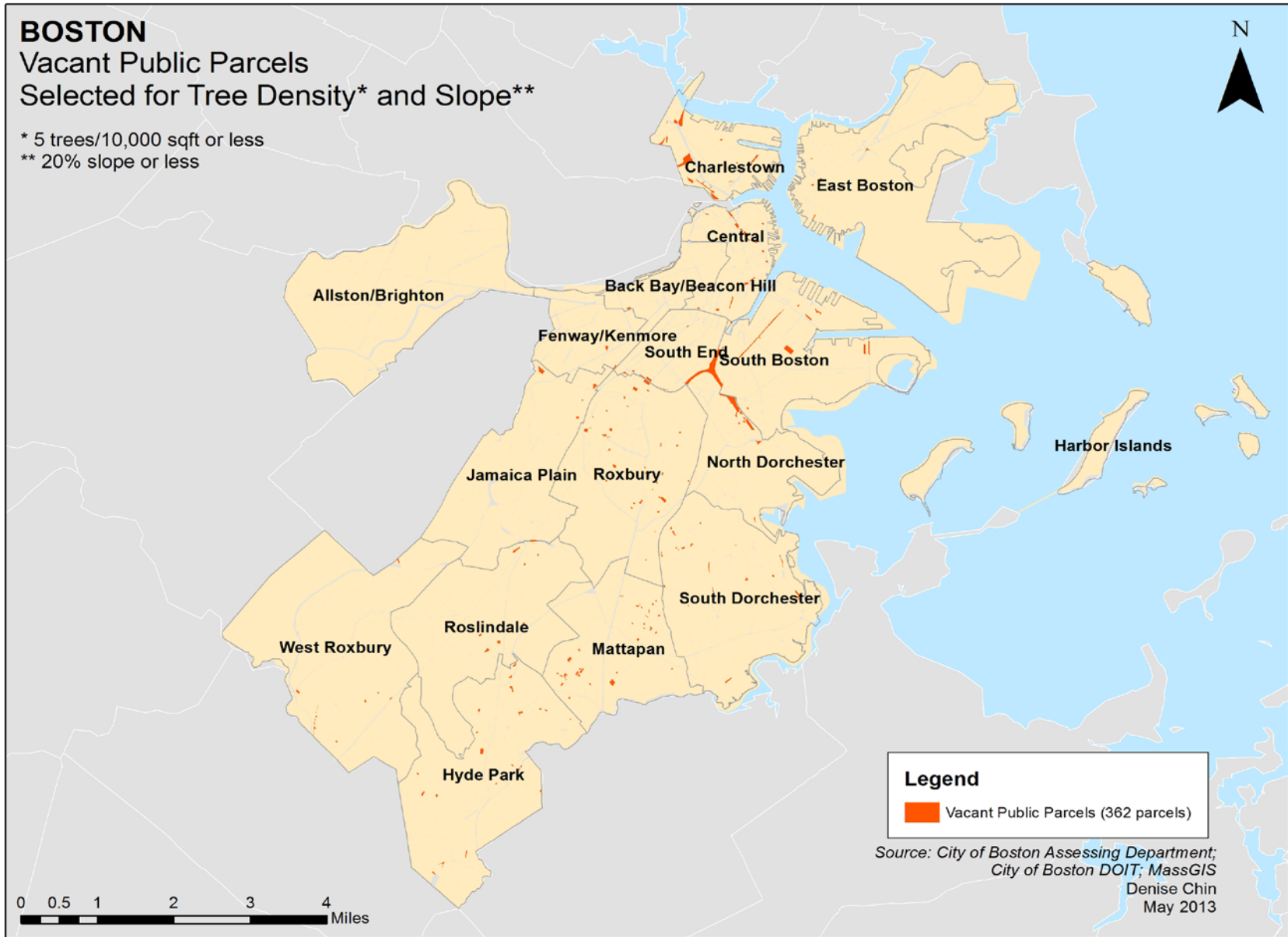


Figure 7 Vacant Public Parcels Selected for Tree Density and Slope

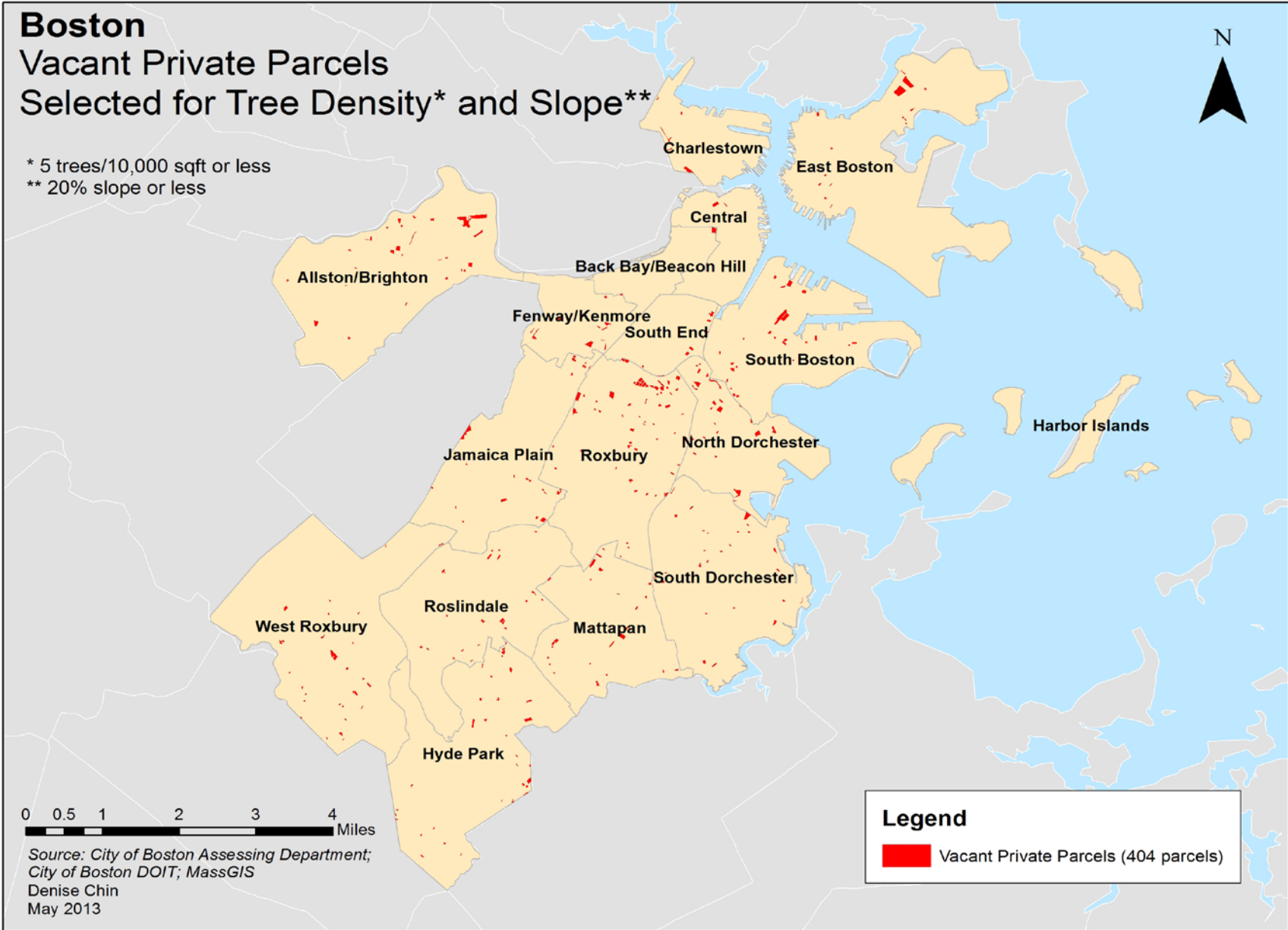


Figure 8 Vacant Private Parcels Selected for Tree Density and Slope

Section 6

Aerial Scoring and Verification





Aerial Scoring and Verification

The purpose of the aerial analysis was to consider criteria that could not be easily applied through GIS analysis. The two criteria examined through the use of aerial photography were light exposure and density of debris and vegetation. To accomplish this task, 2011 aerial imagery from the City of Boston Department of Innovation & Technology was used within ArcGIS. A scoring rubric was developed based on a 4-point scale for each criteria for a total high score of 8 points. Scoring allowed for differing levels of stringency when selecting parcels for further analysis, for example, only the parcels that scored a 7 or 8 were examined for the ground truthing stage due to time constraints. Scores should not be interpreted as limiting the number of farmable parcels, many low scoring parcels are potentially farmable, but might require more intensive investment or heavier shade crop production. This report interpreted

the results of the scoring narrowly to highlight the most suitable parcels. With additional time and resources, another group or organization can examine the parcels that scored 4, 5 and 6 to identify additional growing opportunities.

Scoring

Aerial criteria are divided into two scoring categories: light exposure and density of vegetation and debris. Both categories are scored on a 4 point scale with 1 being the worst, 4 the best, for a top total score of 8, and 0 meaning the parcel is not vacant. Parcels that were clearly being used for other purposes, such as a newly developed park, or a highway median, scored double zeros. During the GIS spatial analysis, tree density was used to operationalize the light exposure criteria, as a substantial number of trees would block the sun and/or necessitate costly removal. The data for street trees and park trees often does not recognize all the trees on vacant parcels, so it is necessary to manually view the plots. Light exposure

that accounts for tree and building blockage could not be calculated given the limited availability of resources for this project. Light exposure criteria filtration was performed manually through aerial scoring.

Attributes of a 4-point plot were first established to evaluate the light exposure criteria. According to the interviews, full sun exposure on the south, southeast and southwest with no buildings on those sides and no significant blockage by large trees was considered optimal. Each lesser score had a higher degree of shade, defined as shade during any part of the day. This shade could be caused by trees in the middle of the plot, on the south side, or buildings on the south side.

To evaluate the density of debris and vegetation criteria, a 4-point plot was defined as a well-maintained plot with little to no overgrowth. Vacant lots commonly attract illegal dumping or are allowed to overgrow. The more trees, debris or vegetation that needs to be removed the higher the costs are

to prepare a plot for urban agriculture and thus achieved a lesser score. Large amounts of debris, such as abandoned vehicles would require professional removal services and thus would score low. Scattered trash or broken concrete would not warrant as low a score. Trees are also taken into account here, since trees in the middle of a plot would often obstruct growing, and might require professional removal. A wooded plot would receive a low score because of the high costs of clear-cutting a plot; wooded is defined as full coverage by the tree canopy. Undergrowth is interpreted as waist high growth, and is taken into account as much as possible in aerial photography, but is often difficult to decipher.

Aerial Verification and Scoring Process

The remaining 362 parcels of land left after the GIS criteria filtering were sorted by parcel ID and divided among each team member for analysis. Aerial imagery viewed through the use of GIS was used for the aerial scoring along with 4 layers:

- The 362 publicly owned parcels that resulted from the spatial analysis filtering process
- The layer of Buildings greater than 80 ft. tall within 40 ft. of a parcel created from the buildings layer from City of Boston DOIT, as explained in the previous section
- A layer of DND-owned vacant property used in order to identify individual parcels that are part of a larger cluster


- An aerial imagery layer from City of Boston DOIT taken in 2011

Each team member used GIS to identify and view the parcels. The group performed initial scoring together for calibration. Scores were input into Microsoft Excel with the corresponding parcel ID number. If parcel images were difficult to interpret, team members consulted with one another to ensure accuracy and consistency in scoring.

Figure 9 Aerial Light Exposure Rubric

Score	Description
1	Over 50% shaded: large trees along all borders or scattered OR building obstruction on S facing side
2	25-50% shaded: large trees on Southern (S, SE, SW) borders/scattered OR building obstruction on S facing side
3	Up to 25% shaded: trees only along borders, at least 1 side with no/few trees, buildings on Northern (N, NE, NW) sides only
4	Trees only along borders, with open Southern (S, SE, SW) sides, no building obstruction

Source: Valerie Oorthuys



Following this scoring process, the scores were joined onto the data by parcel ID and this data set is included in this report.

The buildings layer within 80 feet of a plot greater than 40 feet tall was switched on so each group member was clearly aware of the presence of a tall building in close proximity. The DND layer was used to identify if one parcel within a larger cluster was selected. Although parcels that were collectively over 10,000 square feet were included in the data, they were still listed as separate parcels and were filtered separately. This results in clusters where only one section may be selected, but by having a DND layer it is clear if that parcel is part of a cluster. In this case contiguous parcels were included in the scoring, and the cluster was assessed as a whole.

Figure 10 Aerial Density of Vegetation and Debris Rubric

Score	Description
1	Wooded plot OR would require contracting dumpster
2	25-50% covered in waist high growth, medium/large trees in center, rubbish removal would require mix of machinery and manual labor
3	Up to 25% covered in waist high growth, 1+ medium tree in center, rubbish able to be removed manually
4	Isolated patches of overgrowth, little to no debris

Source: Valerie Oorthuys

Examples

In these examples the pictures are oriented with North at the top. All examples were sourced from the City of Boston Department of Innovation & Technology.

Example 1



Total Score: 0

In this example the parcel was not filtered out because of the grassy areas along the highway, even though a highway runs through it. This is clearly not an appropriate parcel for farming, and it was given a total score of 0 for that reason.

Example 2



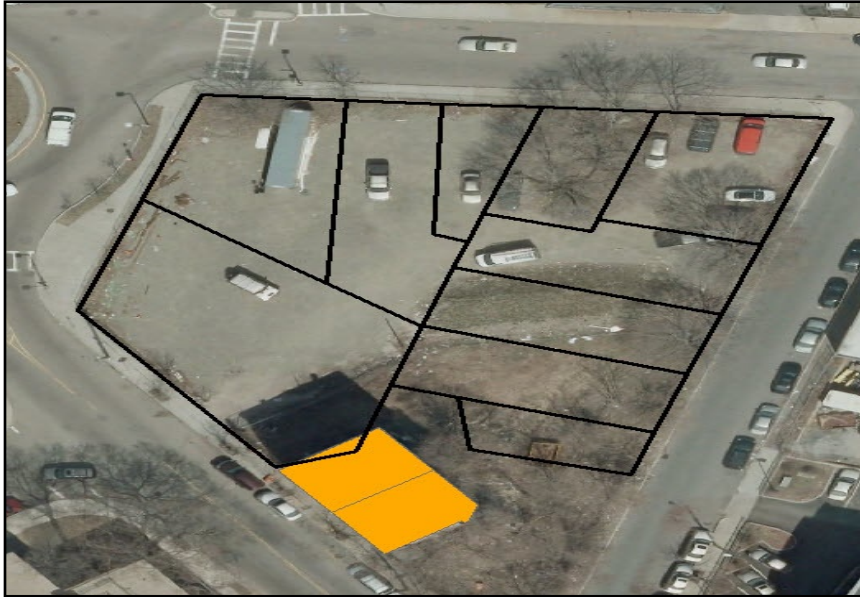
Light Exposure: 2

Density of debris and vegetation: 2

Total score: 4

In this example two parcels are clustered and considered as a whole. Buildings and trees lie outside of the plot on the immediate south side. There are significant amounts of trees in the center covering up to 50% of the plot resulting in a light exposure score of 2. The plot is not completely covered in trees and therefore is not considered wooded. Tree removal would be required, and there is scattered concrete on one side that could be an issue, thus it received a debris score of 2.

Example 3



Light exposure: 3

Density of debris and vegetation: 3

Total Score: 6

This site is an example of a difficult scoring situation. It is a large clustered plot, and when taken as a whole has good light exposure. By strict definition there is a building on the south side that is tall signified by the orange color with a few trees on the south side that resulted in a score of 3. For debris there are cars, but they do not look like abandoned cars and are therefore discounted. Nothing looks like illegal dumping, the trailer is most likely associated with a construction project elsewhere. There are some trees, and some trash and thus the site was given a debris score of 3.

Example 4



Light exposure: 4

Density of debris and vegetation: 4

Total score: 8

This site is well maintained and mowed without trees and a full Southern exposure.

Figure 11 Vacant Public Land After Aerial Verification - 52 Sites

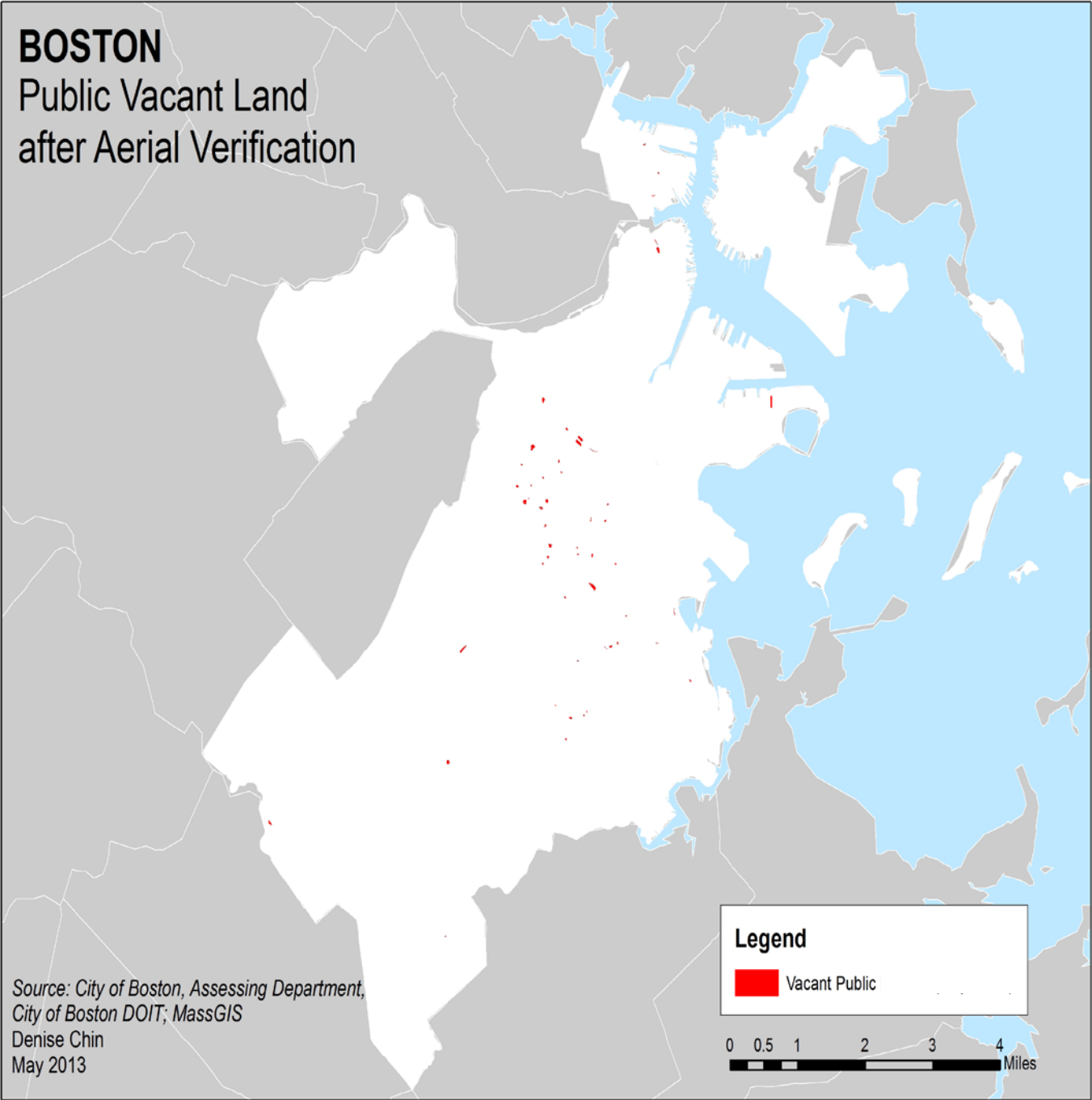
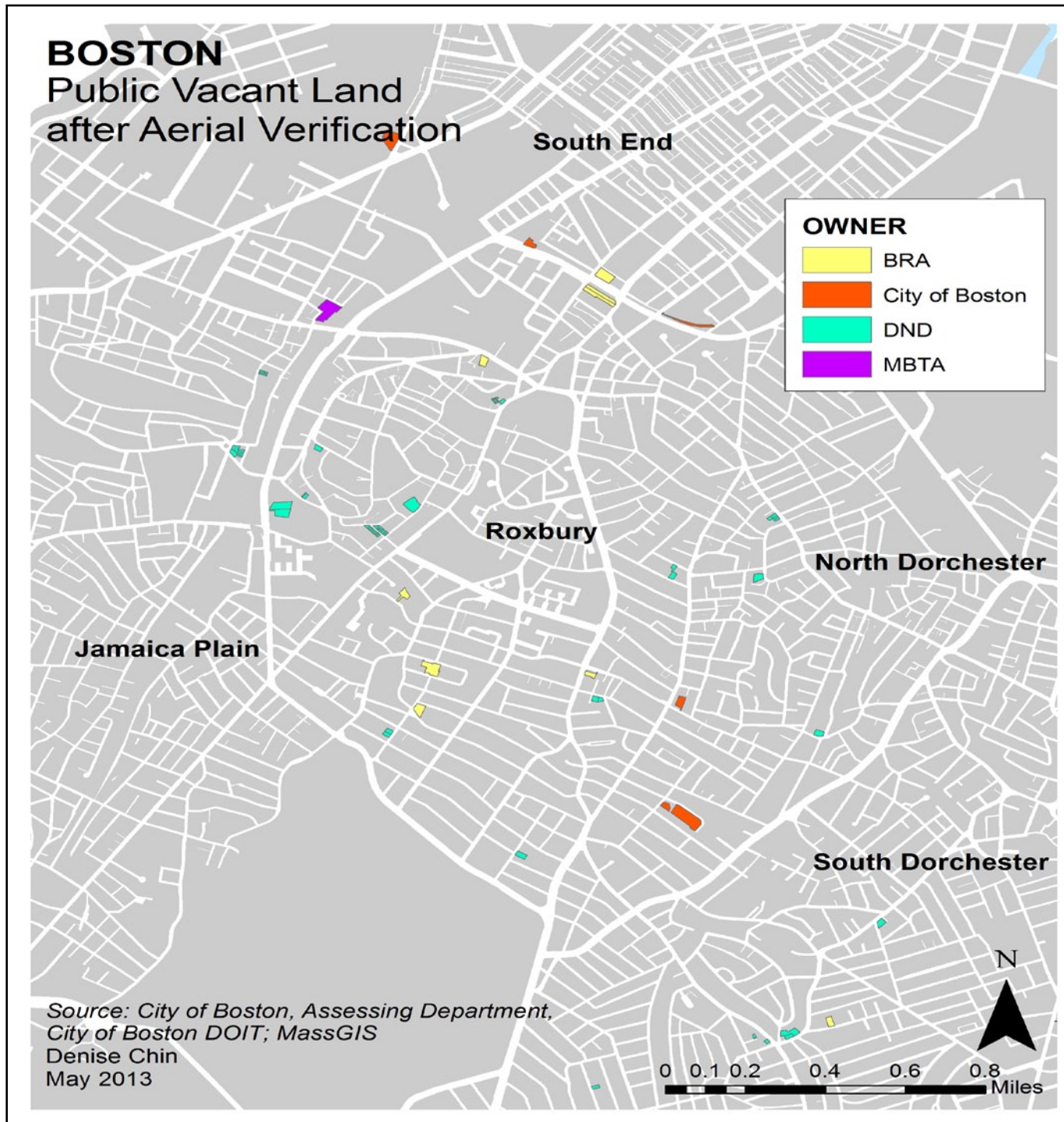


Figure 12 Vacant Public Land After Aerial Verification - Neighborhoods



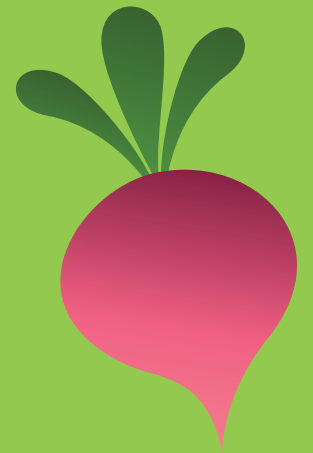


Discussion of Results

Approximately 52 sites received a score of six, seven, or eight, and were considered very suitable for urban agriculture. Sites include groupings of separate parcels and therefore the data reflects a higher number of individual parcels. Due to the fact that some parts of clustered sites were filtered out, the acreage of the top scoring sites is calculated to be 28 acres, but can be estimated to be in the range of thirty to forty acres. These sites were targeted for the subsequent ground truthing phase.

Section 7

Ground Truthing




Ground Truthing

“Ground truthing,” or on-site analysis of the parcels followed the aerial verification process. This final data analysis process was essential to ensuring that physical characteristics assessed in aerial verification did not change since the GIS aerial photographs were gathered in 2011. It also led to the selection of the site profiles that are representative of suitable sites for urban agriculture according to our criteria. Ground truthing also revealed physical characteristics of parcels that were not discernable or evident from the 2011 GIS aerial photographs due to quality of satellite imagery (resolution and season in which photo was taken) or layout of specific parcels (e.g. border tree locations). Examples of such changes to parcels also included trash that may have recently been dumped on a site, additional fallen trees or newly erected built structures. Parcels that received between a 6 and 8 out of 8 in aerial verification were visited and assessed by the research team in order to verify vacancy, observe and confirm key physical attributes (light exposure, slope) and density of vegetation and debris.

Light exposure included the assessment of the location and presence of trees and built structures that would impose shadows on parcels during prime sun exposure time period throughout the day. From our vacant land assessment review and interviews we were able to determine that 8-10 hours of sunlight are optimal for growing food, but our lack of technical

landscaping knowledge and access to sunlight measuring tools limited our abilities to determine specific hours of daylight for each parcel. The ground truthing scoring system used to assess light exposure allowed the research team to determine significant physical barriers to sun exposure without completely eliminating plots unless completely shadowed by trees and/or buildings. Parcels were scored on a scale of 1 through 4, with 1 representing 50% or greater tree coverage, or southern building obstruction, and 4 representing minimal to no observed light exposure obstructions. Refer to Figure 13 to see how each parcel was scored for light exposure.

Parcels with average slopes of 20% or greater were filtered through the GIS analysis of public vacant land and were not included in the aerial verification or subsequent ground truthing. Farmers with substantial upfront access to capital could potentially level parcels with large areas of steep slope and farmers with varying technical skills could choose to grow by terracing. Ground truthing for slope included the visual identification of steep or high slope in certain percentages of the each parcel. The need for mechanized or manual leveling of parcels with steep slopes was also taken into account when assigning scores. Parcels were scored on a scale of 1 through 4, with 1 representing 50% or greater area with steep slope that requires machinery and 4 representing parcels with little to no steep slope areas that could be easily leveled with manual labor. Figure 13 shows how the numeric values were assigned to ground truthed parcels.



Density of vegetation and debris assessment includes the observation of undergrowth, debris and any other objects that would need to be removed in order to grow on parcels. This ground truthing physical attribute requirement is especially important because GIS aerial images were taken during the winter season and could not account for the density of growing vegetation (overgrowth). GIS aerial images are limited in their abilities to show debris such as trash, rocks/boulders, fallen vegetation or built structures or any other objects placed into parcels over time. The potential for mechanized removal needs versus manual removal capabilities was also taken into account when observing densities and types vegetation and debris. As with slope, the ability to remove inhibitive vegetation and debris will vary between each farming entity (considering access to resources and varied farming operations). Parcels were assessed on a scale of 1 through 4, with 1 representing completely wooded or debris-covered parcels that require machinery, and 4 representing little to no observable dense vegetation or debris removal by manual labor. Figure 13 displays details for density of vegetation and debris ground truth scoring.

Other considerations for urban farming viability, as revealed in the interviews, were noted but not included in ground truth scoring. They include existing structures (fencing, concrete slabs), abutters (number, type and location), accessibility (street parking restrictions, water or electricity meters, curb cuts and ADA accessibility), visible on-site water

access and number of street lights. The highest score possible for each parcel was 12 points. A total of 30 parcels (about 10% of the public vacant land assessed through GIS analysis and aerial verification) were ground truthed, but only 10 top scoring sites were profiled. Parcels that were found to be currently in use were excluded from ground truthing results and analysis. Completed ground truthing forms are included in Appendix IV.

Figure 13 Ground Truth Scoring Rubric

Attribute	Description
Light exposure	1: Over 50% shaded: large trees along all borders/scattered OR building obstruction on S facing side 2: 25-50% shaded: large trees on Southern (S, SE, SW) sides OR building obstruction on Southern sides 3: Up to 25% shaded: trees only along borders with at least 1 side with no/few trees OR buildings on Northern (N, NE, NW) sides only 4: Trees only along borders, with open Southern sides AND little to no building obstruction
Slope	1: Over 50% high slope; needs leveling with machinery 2: 25-50% high slope; requires heavy investment/terracing 3: Up to 25% uneven slope, some may need to be leveled with machinery 4: Easily leveled plot, likely little labor
Density of vegetation and debris	1: Wooded plot OR requires contracting dumpster and removal service, use of machinery 2: 25-50% covered in waist high growth, medium/large trees in center, rubbish removal requires mix of machinery and manual labor 3: Up to 25% covered in waist high growth, 1+ medium trees in center, rubbish manually removable 4: Isolated patches of overgrowth, little to no debris

Source: Valerie Oorthuys



Profile Selection and Ground Truthing Results

Of the 30 plots selected for ground truthing 10 were selected as high scoring examples representative of the most suitable plots for urban agriculture according to our criteria. Ten top ground truthing scored sites are included as independent profiles in the Appendix IV of the report. The selection of parcels displays a variety of ownership types that were found suitable for urban agriculture through our multi-stage data analysis (GIS, aerial and ground truth). This report is not endorsing that the selected parcels should be used for urban agriculture over other potential uses. The selection and profiling of vacant land sites instead represent the use of the physical criteria through GIS analysis, aerial verification and ground truthing. It will provide a quick overview of the different types of sites that exist in Boston and the physical issues or opportunities they present. Considerations including abutters (number, type and location), accessibility (street parking restrictions, utility meters, curb cuts and ADA accessibility), visible on-site water access and number of street lights should be taken into account, but their availability and importance cannot easily be determined with available resources and research techniques. Profiles also include proposed zoning regulations as outlined in the Citywide Urban Agricultural Rezoning Initiative

Section 8

Conclusions and Recommendations





Conclusions

With the Citywide Urban Agricultural Rezoning Initiative there is much excitement around the city about urban agriculture. Many of the agricultural activities possible in the city go beyond the limited scope of this report to include methods like rooftop farming or controlled environment farming. However, the use of land and dirt is the most familiar way of farming to many people, and this report should be a tool for interested parties in exploring this option.

The gathering of literature review and interview information helped to inform the vacant land assessment suite of criteria for Boston. Upon synthesizing this information, it was clear that the size, slope and light exposure to a parcel are important elements to consider for a land assessment focused on urban agriculture. The criteria used in this assessment is replicable for other cities with similar interests in urban agriculture.


The data sorting and mapping portion were key steps in this land suitability assessment. Employing various tools and sourcing for appropriate data sets were crucial parts of the process, allowing the team to determine suitable sites to the best of our knowledge. By manipulating data and specific tools, this report displays the replicability of these methods and provides opportunities for further refinement.

This urban agriculture vacant land assessment has

revealed that over 8,000 acres of vacant land with 5,800 acres under public ownership exists in Boston, with vacant land defined as a parcel lacking any built structure. When open space and rail parcels are filtered out a clearer picture of land is provided: there are 2,646 parcels of vacant public land totaling 702 acres, and there are 9,102 parcels of privately owned land with a total acreage of 1,281 acres.

Many of these parcels will be too small to be farmed on effectively, so applying a minimum size is helpful. According to the 10,000 square foot size criteria adopted in this report there is 674 acres of privately owned vacant parcels, and 564 acres of publicly owned vacant parcels. The 564 acres of publicly owned vacant land includes contiguous DND parcel groups that collectively are greater than 10,000 square feet.

The application of the criteria established in the interview process using GIS spatial analysis resulted in 177 acres of publicly owned vacant land, and 256 acres of privately owned vacant land. The actual number of publicly owned vacant land after filtering is estimated to be slightly higher, as some separate parcels composing a cluster were filtered out, but in reality all parcels in a cluster should be counted together. The discrepancy here could not easily be accounted for but is relatively small, estimated to be under 50 acres.



Aerial imagery and ground truthing were invaluable in this assessment due to the limitations of software programs and data that may be flawed, or not up-to-date. These steps were important in determining the validity in the criteria application using GIS and provided extra steps in the confirmation of top-scoring sites. After the spatial analysis filtering process aerial scoring was performed which resulted in the selection of 52 highly scored publicly owned sites. The parcels in these sites totaled 28 acres, but due to the same clustering effect explained above, the actual acreage could range from 30 – 40 acres.

This study shows the level of detail and meticulousness employed to assess vacant land in Boston. Our profiles indicate the viability of parcels for the use of urban agriculture based on our criteria. Ultimately communities will need to decide how to use this data and if they in fact want to use land for urban agriculture. Making the data available at different levels of analysis allows maximum flexibility for interested parties to observe our results.



Recommendations

Private Land Analysis

It is recommended that work on developing this data continue, especially in regards to private land. For this report vacant private land includes private land without built structures but does not take into account if that land is actually available on the market. Due to time constraints private vacant land was not evaluated beyond the spatial analysis phase in GIS. It is important to note that a substantial amount of formerly private vacant land falls into the hands of public agencies, which is why this report focuses on publicly owned land. It could be useful to think of the private vacant land acreage as arable private land since there are no built structures, but much of that land may not actually be available for urban agriculture, but could still be grown on for personal use. When analyzing private land, aerial verification and ground truthing methods should be used in conjunction

with the various tools and techniques outlined in this report. The data sets of private land can be customized to suit different needs over time. A thorough private vacant land assessment could significantly contribute to the establishment and retention of urban agriculture throughout Boston.

Further Public Analysis

It is recommended that the “Public vacant no rail open space” data set be sorted for smaller size criteria, say 8,000 square feet. These smaller size plots could be viable if they are relatively close to other plots. In this way a cluster analysis could be performed going beyond the strict definition of contiguous parcels used in this report. It is important to note that in order to map the data it will need to be joined to the City of Boston Parcel data by the Parcel ID.

It is also recommended that the aerial scoring data be revisited, and the lower scoring parcels be examined using the “Public vacant with aerial

scores” data set. Low scoring parcels should be revisited and considered for urban agriculture, because in the quest to find the best sites for ground truthing and site profiles many sites were scored lower, but were still highly viable sites.



Transparency and Accessibility of Information

Boston is poised to expand urban agriculture throughout the city, but as policies and planning initiatives to support agriculture move forward it is essential that all information be transparent and accessible. Publicly available land data is often complicated and overly technical for stakeholders who do not have formal knowledge or experience in data assessment and spatial analysis. Identifying potentially productive land is only one piece of the urban farming equation and other relevant information for establishing an urban agricultural enterprise in Boston should be accessible for all. An easily navigable website with translations into other languages should be drafted and include the vacant land spatial analysis Google Fusion Tables, and sections on the following topics: financing, business planning, workforce development and labor, environmentally-friendly farming practices, community and city resources, leasing from public and private landowners. The site should

also enable stakeholders to interact and communicate with one another in a public forum – information and resource sharing will be an invaluable asset to Boston’s urban agriculture community.


Food Production Potential of Vacant Land Research

This vacant land assessment could be the foundations for a food production potential study, similar those performed Toronto and Oakland. To understand how food production will address public health, economic and environmental issues identified by the Mayor’s Office of Food Initiatives. The study could use Boston’s current and recommended vegetable intake and the amount of potentially productive land to quantify urban agriculture’s potential contribution to feeding residents with healthy, fresh and local food. Other forms of urban agriculture could be factored into the food production models including greenhouses, rooftop farms, hydroponics and many others. The Toronto food production study integrated rooftop farming into the

equation and identifying particular land-intensive crops that would be ideal for ground-based urban farming or rooftop farming.¹ It is recommended that an analysis of both public and private vacant land, along with other forms of urban agriculture be studied for their food production potential. Creative and innovative growing methods will continue only continue to flourish with the aid of such studies.

Access to Capital and Technical Assistance

Starting and operating urban farming enterprises involves barriers similar to that of more traditional small local businesses – entrepreneurs are not always rich in their finances, business knowledge or abilities to navigate complex policies and planning processes. As identified through the interviews and background research, start upcosts and operational costs are major concerns for urban farmers. Five to ten year lease agreements for urban agricultural enterprises, as modeled through Boston’s Urban Agriculture Pilot



Program, do not encourage sufficient capital investments for parcels of land or ongoing expenditures. The Pilot Program assisted farmers with water and soil investments (two of the most costly inputs), but additional costs including land clearing, “capping” existing soils, hoop house or shed construction and equipment purchasing were not accounted for through the program. Water sharing with neighbors should be explored for urban farms, so that a second water meter may be installed using existing infrastructure, rather than paying for a separate water hookup.

Urban farms are triple bottom line local small businesses that contribute to the public good, and municipal governments should invest urban farms by providing access to capital consulting and technical assistance. Local governments can facilitate “seed” grants to urban farming enterprises. Redevelopment, economic development and small business agencies can integrate urban agriculture into micro-credit loan

programs to assist with startup costs.² Community and economic development can work directly with farmers, or contract with local nonprofits to provide small business consulting (including technical assistance and access to capital). Funding sources to consider for such initiatives include workforce development programs, state bond initiatives and federal grants from agencies including the USDA, HUD and EPA.³

Municipalities could explore tax and zoning incentives for urban agricultural enterprises, which could prove especially beneficial in redevelopment or underserved areas. Thus far such initiatives in other U.S. cities have focused on grocery stores or supermarkets in low-income neighborhoods, but the exploration of these models and how they can be translated to urban agricultural enterprises would be valuable. The Food Trust has piloted innovative supermarket grant and loan programs for low food

access neighborhoods in several cities throughout the United States.⁴ The New York City Food Retail Expansion to Support Health (FRESH) promotes the establishment and retention of grocery stores in underserved, low-income communities by offering tax and zoning incentives.⁵ City governments around the country are responding to emerging food systems issues with innovative and comprehensive solutions. Boston government and community leaders should explore such programs to assess how they can be adapted to suit the needs of local urban agricultural initiatives by offering tax and zoning incentives. City governments around the country are responding to emerging food systems issues with innovative and comprehensive solutions. Boston government and community leaders should explore such programs to assess how they can be adapted to suit the needs of local urban agricultural initiatives.



Section References

- 1 MacRae, Rod, et al., “Could Toronto Provide 10% of its Fresh Vegetable Requirements From Within its Own Boundaries? Matching Consumption Requirements with Growing Spaces,” *Journal of Agriculture, Food Systems, and Community Advance Online Publication*. Accessed March 18, 2013, doi:10.5304/jafscd.2010.012.008.
- 2 Flournoy, Rebecca, Allison Hagey and Solana Rice. 2012. “Urban Agriculture: Equitable Strategies and Policies for Improving Access to Healthy Food and Revitalizing Communities.” *Policy Link*. Accessed March 20, 2013. http://www.policylink.org/site/c.lkIXLbMNJrE/b.8370635/k.ADC3/Urban_Agriculture.htm#.UJ1xv4V9k7A.
- 3 *Ibid.*, 41
- 4 “What We Do with Supermarkets.” *The Food Trust*. Accessed May 1, 2013. <http://thefoodtrust.org/what-we-do/supermarkets>.
- 5 NYC Food Retail to Expand to Support Health. Accessed May 1, 2013. <http://www.nyc.gov/html/misc/html/2009/fresh.shtml>.

Appendices



I. Interview Appendix

Urban Farming in Boston: A Survey of Opportunities Exploratory Interviews

Briefing

Situation and Purpose

Currently there is no overall analysis of vacant land in Boston that would be suitable for urban agriculture, and the data is scattered among separate departments and organizations. The goal of our research is to unify this data and ascertain what is necessary for starting urban farming operations. Our team will be establishing criteria for evaluating land and feasibility for urban farms based on local stakeholder interviews, and informed by a review of relevant urban agriculture land assessment literature. From this, we will develop a rubric for land assessment and create site profiles for vacant lots that are suitable for future urban agriculture projects. We are interviewing local urban farmers and urban farming advocates. The timeline of our project corresponds to our semester schedule, and our final products will be completed by this May.


The interview questions consist of background information of your organization's involvement and interest in further developing urban agriculture in the city. I'll ask you about challenges faced and suggestions for a stronger food system in Boston. Others are more directly looking into specifics of your preferred attributes of an urban farm. These questions are ultimately aimed for us to analyze the needs and challenges faced in acquiring land for urban agriculture, in the hope that our final land inventory will be useful for stakeholders to develop new projects.

Consent and Confidentiality

To reiterate, we are a student group working on a project sponsored by the Trust for Public Land. Participation in this interview is voluntary, and all responses will be kept confidential. While I will be using a recorder, we will respect any requests to keep information off the record. If our group wishes to use direct quotes in the final report, we will ask for written consent and provide you with the opportunity to review the quotes in context. Do you have any questions before we begin?

Script Introduction

1. How long have you worked for {your organization}?
 - a. Tell me about {the organizations'} mission.
 - b. Tell me about your role there.
2. Are you affiliated with other organizations/projects/initiatives in relation to urban agriculture or food systems?
3. How long has {the organization} been involved with urban agriculture?
4. How do you define urban agriculture?
5. What challenges does {your organization} face with regard to urban agriculture projects?
6. Does {your organization} foresee establishing an/other urban farm in Boston?
7. What is the role of community in your urban agriculture projects?
8. {IF not a member of the Working Group}What do you know about the Boston Urban Ag Zoning Initiative?



Urban Farming Physical and Operational Requirements

1. Tell me about your current farming operations.

- a. How much land do you currently farm on?
 - i. Originally, what did the land look like?
 1. Was it cleared? Vacant?
 - ii. Are you currently growing in raised beds? Directly in ground?
 - iii. Do you use a greenhouse to start seeds?
 - iv. Do you use season extension practices or storage?
 - b. How many part-time, full-time and volunteer staff do you have specifically for farming?
 - i. Does acreage determine the size of your staff or volunteer crew?
 - c. How much do you anticipate spending on a month's worth of utilities?
 - d. What current regulations do you face? (Run-off, nuisance, compost, etc)
 - e. What is the process for developing a farm design?
 - i. Did you complete a Comprehensive Farm Review?
 - f. In current operations has light exposure been an issue?

2. Tell me about the physical and operational requirements of land you

prefer to farm on.

- a. How would you strategically choose a plot of land for urban agriculture?
 - i. How much land do you think you need?
 - ii. What is the minimum size parcel you would want to farm on?
 - iii. Clustering
 1. Would you farm on multiple parcels?
 2. How far can plots be from each other?
 - iv. What is the optimal shape of a parcel?
 1. What do you consider a reasonable gradient for agriculture?
 - v. What do you think would be the maximum density of vegetation you would prefer before clearing the lot for agriculture?
 - b. What type of accessibility are you looking for in choosing a plot?
 - i. Bus? T? Cars?
 - ii. Proximity to schools?
 - iii. Dis/ability?
 - c. What kinds of security measures would you require for an urban plot?
 - i. Fencing? Visibility?
 - ii. Would street lighting factor in to your decision?
 - d. What are your top 5 requirements to make land farmable?

Land and Infrastructure

1. What do you know currently about

acquiring land in Boston?

- a. How would you expect to gain access to land?
- b. Who have you leased from in the past?
 - i. What are your current land arrangements?
 - ii. Is there a minimum or maximum length of time you would be interested in leasing land?
- c. What zoning districts have you farmed in?
 - i. Would you prefer to farm in a dense residential zone? Commercial? Industrial?

2. Tell me about funding sources for acquiring land.

- a. What do you think of the process?
 - i. Could you think of an alternate strategy for acquiring land in Boston for urban farming?
 3. What sort of infrastructure does the city currently provide to farmers?
 - a. Irrigation?
 - b. Electric?
 - c. Waste pick-up?
 - d. Suggestions for best practices (building sheds/ beds, drainage)?
 - i. What measures or barriers are necessary to prevent runoff into to waterways and/or streets?
 - e. What tools would you like to have made available to farmers?



Funding

1. How are urban agriculture endeavors funded in Boston?

- a. What are your current sources of funding?
- b. How do you factor leasing land into your business model?
- c. How do you plan to meet your labor needs?
- d. What infrastructure and capital investments are required to start and maintain an urban farm?
- e. (IF looking to acquire more land) How do you foresee funding another urban farm in your organization?
 - i. (IF planning another urban farm) Would you alter your business model with another urban farm?
 - ii. What are anticipated start-up costs?
 - iii. How many seasons does it take before a farmer can profit?

Sales

1. How does {your organization} handle any produce grown?
 - a. Donations, school kitchens, restaurants, food trucks, CSAs, etc?
 - b. {If they do sell produce} Where is produce sold or distributed?
 - c. Do you sell value-added products?
 - d. Are there adequate retail opportunities for selling produce?

- i. What is most cost-effective?
2. How would you like to market/sell your products?
 - a. CSA, farm stand, retail, etc..)?
 - b. How will you incorporate zoning restrictions?
3. What is the cost to the farm for sales at farmers markets?

Debriefing

- {Reiterate main points you've learned from the interview- see if the interviewee offers any feedback}
- Now that you have a good understanding of the scope of our work, could you recommend others for us to interview?

[Turn recorder off]

I have no further questions. Is there anything else you would like to bring up, or ask about, before we finish the interview?

How did you feel about/ experience being interviewed about your farming experience and business models?

II. Data Appendix

Data is included at multiple levels of analysis to allow maximum flexibility in use. In this project stringent criteria were applied in order to narrow down the number of parcels to find only the most suitable parcels for ground truthing and site profiles. If an individual or organization wanted to apply less stringent criteria, or look at different size publicly owned parcels then they could choose to utilize the public vacant land without open space or rail parcels data set. Then they could apply their own size criteria and physical criteria. This could be done for private land as well.

Allvacant.txt, Allvacant.xls

All vacant land according to the definition and process set out in Section 4.

Privatevacantwithoutopenspace.txt, Privatevacantwithoutopenspace.xls

Private vacant land without privately owned parcels that intercepted the MASS GIS open space layer

Privatevacantbysize.xls,

Privatevacantbysize.txt

Private vacant land without privately owned parcels that intercepted the Mass GIS open space layer, and that are greater than 10,000 square feet
Privatefiltered.txt, Privatefiltered.xls
This data includes private vacant land greater than 10,000 square feet after filtration through GIS criteria.

Publicvacantnorailopenspace.txt,

Publicvacantnorailopenspace.xls

Public vacant land without publicly owned parcels that intercepted the Mass GIS open space layer or the City of Boston DOIT rail line data.

Publicvacantbysizewithdndclusters.txt,

Publicvacantbysizewithdndclusters.xls

Public vacant land without publicly owned parcels that intercepted the Mass GIS open space layer or the City

of Boston DOIT rail line data.

This data set was sorted by the size criteria, and includes DND owned parcels that are part of a contiguous cluster that is greater than 10,000 square feet.

Publicvacantwithaerialscores.xls

This data is the result of the spatial analysis process for public vacant land according to criteria set out in section 5. These parcels were scored through the use of aerial photography according to the scoring rubric that was developed and explained in section

The score is listed under the “aerial score” field, with a maximum score of 8.



MetaData

PID = Unique 10-digit parcel number. First 2 digits are the ward, digits 3 to 7 are the parcel, and digits 8 to 10 are the sub-parcel

ST_NUM = Street number of parcel

ST_NAME_SUF = Street name suffix of parcel

ZIPCODE = Zip code of parcel

PTYPE = Property Type (occupancy code)

LU = Land Use (type of property)

OWNER = Primary owner of property as of Jan 1, 2012

MAIL_ADDRE = Street address where tax bill is mailed

MAIL_CS = City and state where tax bill is mailed

MAIL_ZIP = Zip code where tax bill is mailed

AV_BLDG = Total assessed building value

AV_TOTAL = Total assessed value for property

LAND_SF = Parcel's total size in square feet

GROSS_AREA = Gross floor area

Private = "1" signifies a private property; "0" signifies a public property according to the definitions in this report

Other = This field is used for the purposes of mapping and labeling. "1" denotes a public vacant property for which the owner is not "DND", "BRA", "City of Boston", or "MBTA". "0" includes all private vacant land and the public land which is owned by the owners listed above.

DND Cluster = "1" denotes that the parcel is part of a group of contiguous DND owned parcels that collectively have an area \geq 10,000 square feet.

III. GIS Appendix

Data layers and database tables used:

FY 13' City of Boston Assessing Department's Property Parcel Data

Source: Assessing Department, City of Boston. Retrieved from Tufts GIS repository.

Public land is determined through tax exemptions, also known as PTYPE in the attribute table. AV_BLDG and GROSS_AREA that showed <NULL> values indicated vacant land. LAND_SF was the size of each parcel in square feet. Further detail on the vacant public and private parcel selection is explained in the Vacant Land Data Set Creation Section.

City of Boston 2013 Parcel Data

Source: Assessing Department, City of Boston. Retrieved from Tufts GIS repository.

This data includes the shape data for the parcels in Boston. It was used to join to the parcel database tables to add spatial reference. The layer was then projected to:

NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001_Feet. The state plane projection is most suitable for city-level spatial analysis.

DND-owned vacant land

Source: Department of Neighborhood Development, February 2013

All DND vacant land is contained in this layer. SITETYPE attribute was useful to inform us on vacant land that was owned by the DND and available for use.

OpenSpace_Poly

Source: MassGIS. Retrieved from Tufts University GIS Repository

Used as to cross check vacant land and parks. Because parks fall as "vacant" in the Assessor database, this layer was used to overlay parcels with parks and open space. While some parks allow for community gardens, our project was interested in urban agriculture for the purposes of selling produce for commercial profit, which

is different from the purpose of a community garden.

Buildings

Source: City of Boston Dept. of Innovation and Technology 2012. Retrieved from Tufts GIS repository.

To operationalize light exposure, the proximity of parcels to tall buildings was considered. BLDG_HGT attribute was used to select buildings that were taller than 40ft.

Trees

Source: City of Boston Dept. of Innovation and Technology 2012. Retrieved from Tufts GIS repository.

Also used to operationalize light exposure, tree density was derived using this layer. Using the TYPE attribute, street trees were selected as opposed to park trees. This was chosen because street trees included trees contained in parcels.



Boston Digital Elevation Model

Source: Retrieved from Tufts GIS repository.

The slope for Boston was created using the slope tool. Output measurement was set to percentage rise. The Z factor was set to 3.28084 (feet to meters) because the Boston DEM was created by cell size in meters. The percentage slopes were reclassified in the properties table under the symbology tab. The slope was reclassified to 5, 10, 15, 20, 176.

To determine the slope for each parcel, a zonal statistics table was created, using the parcels layer as the input layer and selecting parcel ID for zone field. This layer was then joined to the parcel layer.

Wetlands

Source: MassGIS. Retrieved from Tufts GIS repository.

This layer was used to filter plots that intersected with wetlands.

Impervious Surface

Source: City of Boston Dept. of Innovation and Technology. Retrieved from Tufts GIS repository.

While most urban agriculture is possible on impervious surfaces, Downtown industrial sites and docks, while vacant, may not be suitable parcels for urban agriculture. Similarly, paved parks and parking lots were excluded. In pursuit to recommend the most suitable sites, we chose to filter out parcels with more than 80% imperviousness.

Maps included in digital attachment.

All Vacant

The All vacant folder contains an overall map of vacant parcels in Boston, both private and public in the city of Boston. Maps of vacant parcels by neighborhood are also provided. These maps have been filtered for open space and rail tracks, as detailed in Section 5 of the report.

Public

This folder contains maps of public parcels that have been filtered in our criteria assessment process. The Public_slope map shows parcels that have been pre-processed (filtered for open space, rails, wetlands and imperviousness) and filtered using our slope criteria. The Public_TreeDensity maps shows parcels that have been pre-processed (filtered for open space, rails, wetlands and imperviousness) and filtered using our tree density criteria. The Public_TreeDensity_Slope map shows parcels that have been pre-processed and have been filtered for both tree density and slope criteria. The criteria are explained in Section 5 of this report.

The After Aerial subfolder contains an overall map of parcels in Boston and neighborhoods that have been verified with aerial imagery.



Private

The Private folder contains maps of private parcels that have been pre-processed (filtered for open space, rails, wetlands and imperviousness) and filtered using our tree density and slope criteria.

Maps of private parcels sorted for our criteria by neighborhood are also included in this folder.



IV. Aerial and Groundtruthing: Forms and Site Profiles

A. Aerial Imagery Form, Valerie Oorthuys

B. Ground Truthing Forms, Valerie Oorthuys

C. Ground Truthing Profiles (alphabetical order)

Site profiles represent what a top site looks like on the ground, according to the criteria and methodology developed for this project. The profiles include information on other considerations identified in the interview process that required a site by site basis examination. Site profiles do not take into account competitive uses or existing plans for sites. The aerial photographs in this section show black outlined parcels, these parcels, when contiguous, should be considered a single site.

1. 115 Bird St. 02125
2. 22 Bowdoin St, 02121
3. 7 Bonell Terrace, 02119
4. 1542 Columbus Ave, 02119
5. 483 Dudley St. 02119
6. 114 Floyd St. 02124
7. 273 Highland St., 02119
8. 68 Holworthy St. 02121
9. Melnea Cass Blvd., 02119

10. 30 Westville St., 02124

*PID listed may represent only one in a larger contiguous cluster of parcels, but in that instance the whole cluster was considered.

Photos: Tida Infahsaeng, Denise Chin

Aerial Photos: City of Boston Dept. of Innovation and Technology. Retrieved from Tufts GIS repository.

AERIAL IMAGERY EVALUATION

Parcel ID#: _____

Date of Map Version: _____

Date of Evaluation: _____

Parcel Address: _____

Name of Surveyor(s): _____

OBSERVATIONS OF PHYSICAL REQUIREMENTS

Attribute	Score Description	Score + Explanation
Light Exposure	<p>1: Over 50% shaded: large trees along all borders or scattered OR building obstruction on S facing side</p> <p>2: 25-50% shaded: large trees on Southern (S, SE, SW) borders/ scattered OR building obstruction on S facing side</p> <p>3: Up to 25% shaded: trees only along borders, at least 1 side with no/few trees, buildings on Northern (N, NE, NW) sides only</p> <p>4: Trees only along borders, with open Southern (S, SE, SW) sides, no building obstruction</p>	
Density of Vegetation + Debris	<p>1: Wooded plot OR would require contracting dumpster</p> <p>2: 25-50% covered in waist high growth, medium/large trees in center, rubbish removal would require mix of machinery and manual labor</p> <p>3: Up to 25% covered in waist high growth, 1+ medium trees in center, rubbish able to be removed manually</p> <p>4: Isolated patches of overgrowth, little to no debris</p>	

Total Score: _____

CONSIDERATION OF FARMER PREFERENCES

Existing Structure Inventory (fencing, concrete, etc):

Number, Type and Location of Abutters:

Description of Apparent Use:

Additional Observations: _____

Considerations for Ground Truthing: _____

Upload Aerial Photograph:



GROUND TRUTHING FORM

Parcel ID#: _____

Date of Visit: _____

Parcel Address: _____

Name of Surveyor(s): _____

Is Parcel Vacant? Y _____ N _____

OBSERVATIONS OF PHYSICAL REQUIREMENTS

Attribute	Score Description	Score + Explanation
Light Exposure	<p>1: Over 50% shaded: large trees along all borders/ scattered OR building obstruction on S facing side</p> <p>2: 25-50% shaded: large trees on Southern (S, SE, SW) sides OR building obstruction on Southern sides</p> <p>3: Up to 25% shaded: trees only along borders with at least 1 side with no/few trees OR buildings on Northern (N, NE, NW) sides only</p> <p>4: Trees only along borders, with open Southern sides AND little to no building obstruction</p>	
Slope	<p>1: Over 50% high slope; needs leveling with machinery</p> <p>2: 25-50% high slope; requires heavy investment/ terracing</p> <p>3: Up to 25% uneven slope, some may need to be leveled by machinery</p> <p>4: Easily leveled plot, likely little labor</p>	
Density of Vegetation + Debris	<p>1: Wooded plot OR requires contracting dumpster and removal service, use of machinery</p> <p>2: 25-50% covered in waist high growth, medium/large trees in center, rubbish removal requires mix of machinery and manual labor</p> <p>3: Up to 25% covered in waist high growth, 1+ medium trees in center, rubbish able to be removed manually</p> <p>4: Isolated patches of overgrowth, little to no debris</p>	

Total Score: _____

CONSIDERATION OF FARMER PREFERENCES

Existing Structure Inventory (fencing, concrete, etc):

Vehicle Access (Street parking restrictions, meters, curb cuts, ADA accessibility, etc):

Number, Type and Location of Abutters:

Number of Street Lights:

Visible On-site Water Access?

Additional Observations:

115 Bird St. 02125

PARCEL ID#: 1301146000

**OWNER: Department of Neighborhood
Development**

CRITERIA QUALIFICATIONS

Size of Parcel: 10,718 sqft

Light Exposure: No South facing trees or buildings. Score:
4/4

Slope: Parcel needs investment to level; plot inclines to the
North. Score: 3/4

Density of Vegetation + Debris: 2 trees on the East border of
the plot, very little debris. Score: 4/4

Total Score: 11/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Within .4 mi of #15 bus stop, closest
T stop is Fields Corner station

Existing Structure Inventory: Chain link fencing surrounds

Vehicle Access: Street parking, unmetered, has curb cuts at
pedestrian crosswalk

Street Lighting: 5 Street Lights

Number and Type of Abutters: 4 residential abutters, shares
North border with a school



22 Bowdoin St, 02121
PARCEL ID#: 1401418000
**OWNER: Department of Neighborhood
Development**

CRITERIA QUALIFICATIONS

Size of Parcel: 25,642 sqft (clustered)

Light Exposure: Small street trees on South border, no trees in lot, no building shading. Score: 4/4

Slope: Very level parcel, except for the back wall that has a higher slope. Score: 3.5/4

Density of Vegetation + Debris: Grass kept short, however there is a concrete barrier and a tall pole. Score: 3.5/4

Total Score: 11/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Within .3 mi of #17 bus stop, closest T stop is Fields Corner Station

Existing Structure Inventory: Concrete barrier, metal pole, tall chain link fencing surrounds

Vehicle Access: Street parking, unmetered, has curb cuts

Street Lighting: 5 Street Lights

Number and Type of Abutters: 5 residential, 2 commercial



7 Bonell Terrace, 02119
PARCEL ID#: 0903174000
**OWNER: Department of Neighborhood
Development**

CRITERIA QUALIFICATIONS

Size of Parcel: 10,086 sqft (clustered)

Light Exposure: Open Southern exposure. Score: 4/4

Slope: Flat slope, leveling not needed. Score: 4/4

Density of Vegetation + Debris: Some clearing may be needed, little debris. Score: 4/4

Total Score: 12/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Within .2 mi of #42 and #44 bus stop, closest T stop is Roxbury Crossing Station

Existing Structure Inventory: Chain link fencing surrounds.

Vehicle Access: Street parking, unmetered, curb cuts are near plot

Street Lighting: 5 Street Lights

Number and Type of Abutters: Shipping + Receiving facility, Police Station, 3 residential abutters



1542 Columbus Ave, 02119
PARCEL ID#: 1100871000
**OWNER: Department of Neighborhood
Development**

CRITERIA QUALIFICATIONS

Size of Parcel: 53,886 sqft (cluster)

Light Exposure: Very open parcel, a few small trees on SE side of the plot. Score: 4/4

Slope: Flat parcel, except for multiple large piles of soil- could be leveled machinery Score: 3.5/4

Density of Vegetation + Debris: Limited growth, mostly open soil. Minimal debris. Removal of trees is unnecessary. Score: 4/4

Total Score: 11.5/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Across the street from Jackson Square Station

Existing Structure Inventory: Chain link fencing surrounds, some concrete barriers along inside borders of parcel

Vehicle Access: Parking here may be harder- available on Highland St., or potential for arrangement with Roxbury Public Works for use of driveway. No sidewalks.

Street Lighting: 4 Street Lights

Number and Type of Abutters: 3 commercial abutters.



483 Dudley St. 02119
PARCEL ID#: 0803128000
**OWNER: Department of Neighborhood
Development**

CRITERIA QUALIFICATIONS

Size of Parcel: 11,560 sqft (clustered)

Light Exposure: No trees on the parcel or surrounding, one building on the North border. Score: 4/4

Slope: Some manual leveling is needed. Score: 3/4

Density of Vegetation + Debris: Growth has been cut back, very little debris. Score: 4/4

Total Score: 11/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: #15 bus stop at parcel, closest T stop is JFK/UMASS Station

Existing Structure Inventory: Chain link fencing surrounds the parcel

Vehicle Access: Street parking, unmetered, no curb cuts

Street Lighting: 2 Street Lights

Number and Type of Abutters: 2 residences, a mixed use (commercial and residential) building, a school, and The Food Project and DSNI's greenhouses



114 Floyd St. 02124
PARCEL ID#: 1403081000
**OWNER: Department of Neighborhood
Development**

CRITERIA QUALIFICATIONS

Size of Parcel: 10,400 sqft

Light Exposure: Medium sized trees lining West border, no building interference. Score: 4/4

Slope: Majority of total space is easily leveled, yet the South-west corner (an area approximately 20'x20') would need machinery to level. Score: 4/4

Density of Vegetation + Debris: Slab of concrete (approximately 16'x6') by South border, tree stump. Trees along West and North borders, blocking path between parcels. Score: 3/4

Total Score: 11/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Within .3 mi of #28 bus stop, within .5 mi of Talbot Ave on the Fairmount Line, closest T stop is Shawmut Station

Existing Structure Inventory: Chain link fencing along South border, wood fencing on West and North.

Vehicle Access: Street parking, unmetered, has curb cuts for vehicle entry

Street Lighting: 2 Street Lights

Number and Type of Abutters: 7 residential abutters



273 Highland St., 02119
PARCEL ID#: 1100840000
**OWNER: Department of Neighborhood
Development**

CRITERIA QUALIFICATIONS

Size of Parcel: 13,739 sqft (clustered)

Light Exposure: Highland St. parcels have an open Southern exposure. Fort Ave parcel has some trees on all borders.

Score: 3.5/4

Slope: Each parcel needs some leveling. Fort Ave slopes up towards South corner. Score: 3.5/4

Density of Vegetation + Debris: Highland St. parcels have a small impervious surface, a brick retaining wall, and some rocks and thick growth on the Northern border. Fort Ave has very little debris, yet does have a swing set. Score: 3.5/ 4

Total Score: 10.5/ 12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Within .1 mi of #14, #22, #29, #41, #9703 bus stops, closest T stop is Jackson Square Station

Existing Structure Inventory: Highland St. parcels have chain link fencing, Fort Ave has a swing set.

Vehicle Access: All parcels have limited, unmetered parking (some tow zones), and Highland St. has curb cuts. If a vehicle needed to enter Fort Ave parcel, a neighbor would need to grant access.

Street Lighting: 1 Street Light

Number and Type of Abutters: 6 residential abutters



68 Holworthy St. 02121
PARCEL ID#: 1203310000
OWNER: Boston Redevelopment Authority

CRITERIA QUALIFICATIONS

Size of Parcel: 38,767 sqft

Light Exposure: Trees along South and West borders, yet large enough that shade is not cast throughout plot. No building interference. Score: 3/4

Slope: Very even ground; likely little manual labor needed. Score: 4/4

Density of Vegetation + Debris: Scattered stones, concrete barriers, road bisecting plot. Numerous trees along South and West borders, growth has been kept short, very little debris. Score: 3.5/4

Total Score: 11.5/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Within .4 mi of #28 bus stop, closest T stop is Ruggles Station

Existing Structure Inventory: Concrete barriers block road access, chain link fencing surrounds plot

Vehicle Access: Street parking, unmetered, no curb cuts

Street Lighting: 7 Street Lights

Number and Type of Abutters: 7 residential abutters



Melnea Cass Blvd., 02119

PARCEL ID#: 0902100000

OWNER: BRA/Commonwealth/City of Boston

CRITERIA QUALIFICATIONS

Size of Parcel: 93,683 sqft (clustered)

Light Exposure: Buildings on Southern border, although plot is large enough to not be significantly affected. Score: 4/4

Slope: Very flat slope. Score: 4/4

Density of Vegetation + Debris: Trees along Northern border, little debris. Score: 4/4

Total Score: 12/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Within .3 mi of the #42, #44 and #15 bus stops, closest T stop is Ruggles Station

Existing Structure Inventory: Piping appears to be laid for housing, chain link fencing surrounds

Vehicle Access: Limited parking- would need to use Washington St. or Shawmut Ave.

Street Lighting: 8 Street Lights

Number and Type of Abutters: Numerous residential abutters, 1 grocery store



30 Westville St., 02124
PARCEL ID#: 1500796000
OWNER: Boston Redevelopment Authority

CRITERIA QUALIFICATIONS

Size of Parcel: 11,407 sqft

Light Exposure: Open Southern exposure, some shading from building along East border. Score: 4/4

Slope: Plot slopes downward, away from street. May need some leveling. Score: 3/4

Density of Vegetation + Debris: Some debris. Score: 4/4

Total Score: 11/12

CONSIDERATION OF FARMER PREFERENCE

Public Transit Options: Within .2 mi of #23 and #15 bus stop, closest T stop is Fields Corner Station

Existing Structure Inventory: Chain link fencing surrounds, concrete structure- potential for water access

Vehicle Access: One way street, some restrictions, unme-tered, has curb cuts.

Street Lighting: 3 Street Lights

Number and Type of Abutters: 3 Residential and 1 Elementary School



