Jennifer Obadia
Intro GIS

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Final Paper

# Assessing Access to Community Gardens in Boston

*Project Description*

For this project I chose to conduct an assessment of urban agriculture in Boston. This was a three part process. First I conducted a baseline assessment of community gardens, non-profit farms and school gardens within the city. Then I looked at the distribution of residents in Boston to ascertain how many people have access to gardens and how many do not. Finally, I looked for vacant lots, owned by the city that could be converted to agricultural use in order to increase access to community gardens in areas that do not currently have gardens. The primary questions included:

1) What is the spatial distribution of gardens within the City of Boston, ie. how many gardens are there and where are they located?
2) What is the total square footage of community garden space in Boston?
3) How many people have access to a community garden? (How many people in Boston live within 0.33 miles of a community garden?)
4) How many people in Boston do not have access to a community garden? (How many people live farther than 0.33 miles from a community garden?)
5) Is there City owned land that could be used to increase the number of community gardens in Boston?

*Data Sources*

| Data Layer | Agency | Online Metadata | Source Scale | Year |
|---|---|---|---|---|
| Community Gardens | Self created | n/a | Derived from Google Maps | 2008 |
| School Gardens | Self created | n/a | Derived from Google Maps | 2008 |
| Boston Parcels | City of Boston | n/a | unknown | uknown |
| Town Poly | MassGIS | http://www.mass.gov/mgis/towns.htm | 1:25,000 | 2002 |
| Boston Roads (EOTROADS_ARC) | MassGIS | http://www.mass.gov/mgis/eotroads.htm | 1:5,000 | 2005 |
| Hydro100K | MassGIS | http://www.mass.gov/mgis/hd100_.htm | 1:100,000 | 2002 |
| Hydro25K | MassGIS | http://www.mass.gov/mgis/hd.htm | 1:25,000 | 2004 |
| blockpop | MasGIS | http://www.mass.gov/mgis/cen2000_blocks.htm | 1:100,000 | 2003 |
| Boston OrthoPhoto | City of Boston | n/a | unknown | 2003 |

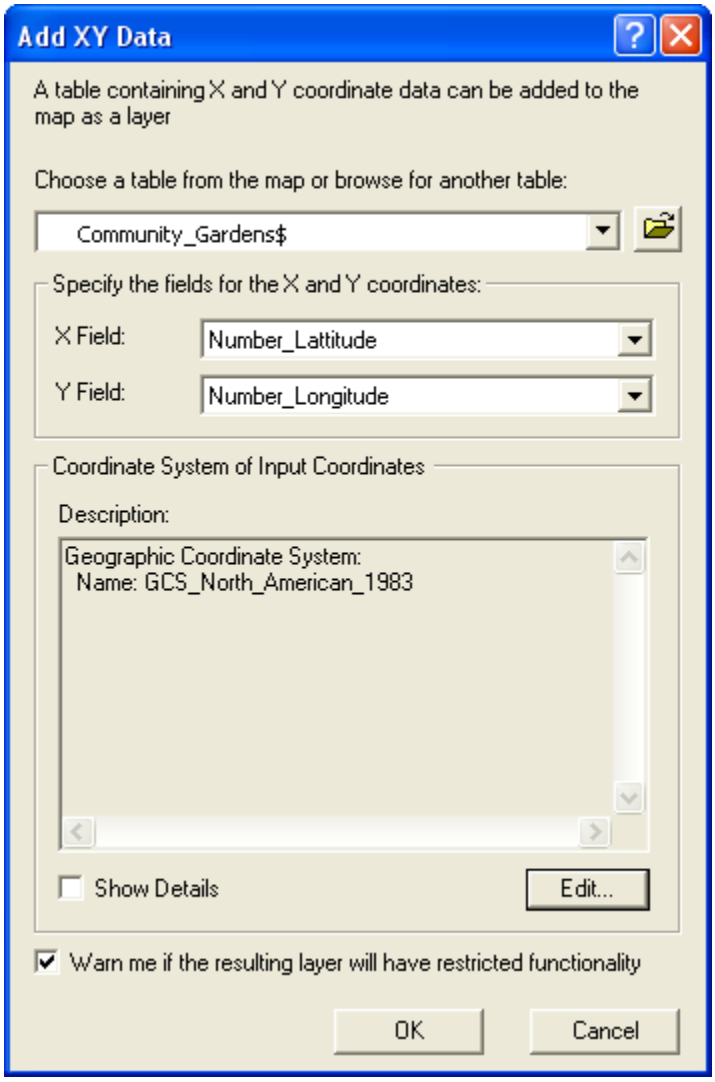
*Major Analysis Steps*

1. Gathering and Importing Garden Data Layers

A. I gathered data on community gardens, non-profit farms and school gardens in Boston. The Boston Natural Areas Network was my primary source of information. They shared maps and surveys that they had created within the past 3 years as well as additional information that they were currently gathering about the state of urban agriculture in Boston.

B. Once I had gathered all the information on urban agriculture sites I used Google Maps to find the XY coordinates for each site. This was necessary because the information that I was provided did not include proper mailing addresses, rather descriptive addresses, such as on the corner of streets X and Y. I input the descriptive information into Google Maps and then used the ortho imagery available to visually locate each garden. Once the gardens were located Google provided the XY coordinates. Finally, I input all of this information into an excel sheet.

C. Once the excel sheet was completed I used the "Add XY Data" function to import this information into ArcGIS.



D. Finally, I changed the coordinate system from GCS_North_American_1983 to NAD_1983_Stateplane_Mass_Mainland_FIPS_2001, so that it would match the other layers that I was using from Mass GIS.

E. The end result of this process was two data layers. One data layer was called "School Gardens" and provided information on all the schools in Boston that operate a school garden. The second layer was called "Community Gardens" and provided information on community gardens and non-profit farms in Boston.

2. Assessing Accuracy

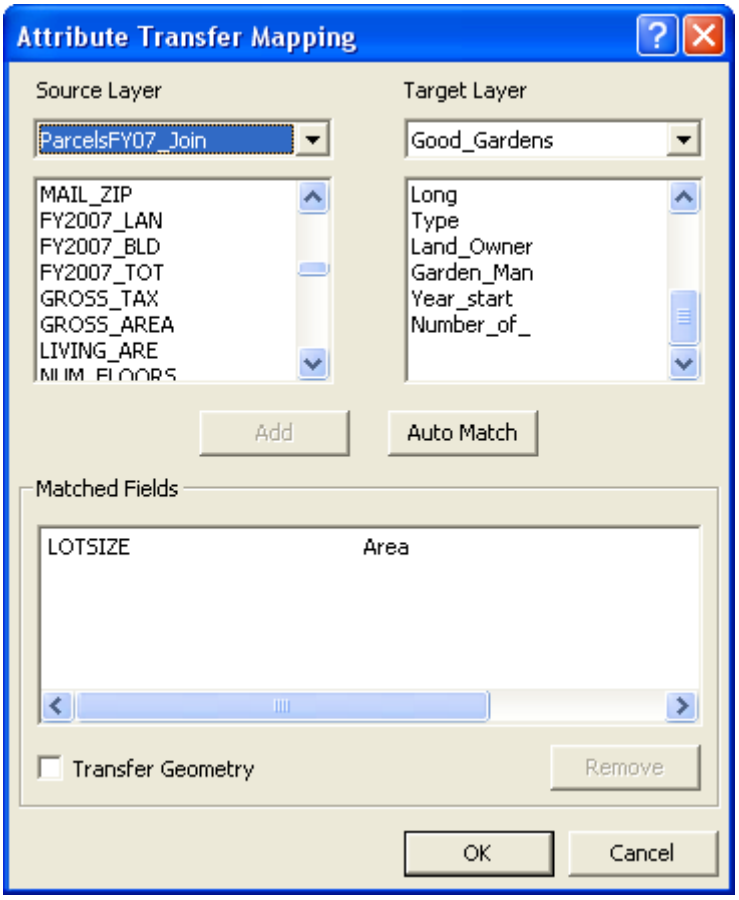
In order to assess whether or not the points draw to represent community gardens and non-profit farms were in accurate locations, I used the Ortho Imagery layer. As you can see from the picture below, the layer was highly accurate. All of the green squares are placed in parcels that are visibly garden plots.

3. Joining Parcel Size Information to Gardens

I made several attempts at a spatial join, but had no luck. Instead I used the spatial adjustment tool and followed the steps below.

A. Enabled the spatial adjustment tool.

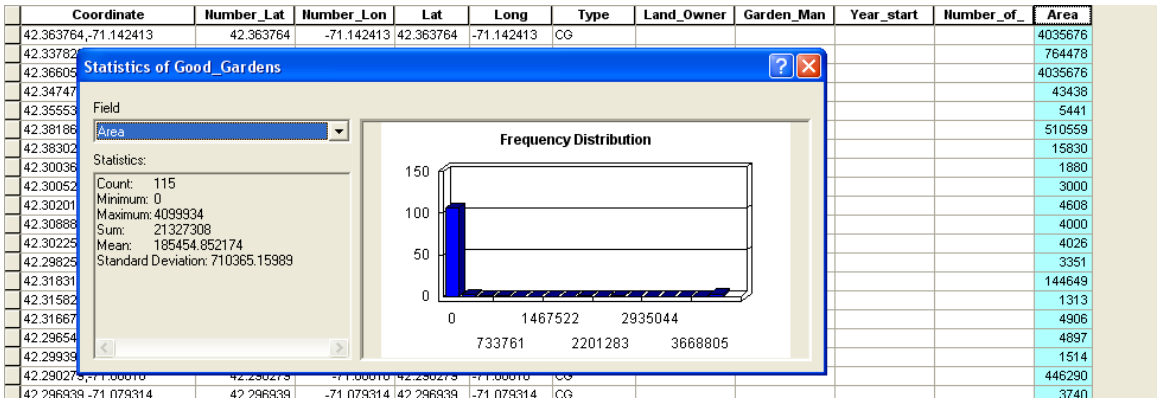
B. Used the “Attribute Transfer Mapping” function to transfer lot size information from the “ParcelFY07_Join” layer to the “Community Garden” layer.




C. Then I used the editor tool and clicked on the parcel and then clicked on the garden and the information was transferred, as you can see from the garden attribute table below.

| Type | Land_Owner | Garden_Man | Year_start | Number_of_ | Area |
|---|---|---|---|---|---|
| CG | | | | | 4035676 |
| CG | | | | | 764478 |
| CG | | | | | 4035676 |
| CG | | | | | 43438 |
| CG | | | | | 5441 |
| CG | | | | | 510559 |
| CG | | | | | 15830 |
| CG | | | | | 1880 |
| CG | | | | | 3000 |
| CG | | | | | 4608 |
| CG | | | | | 4000 |
| CG | | | | | 4026 |
| CG | | | | | 3351 |
| CG | | | | | 144649 |
| CG | | | | | 1313 |
| CG | | | | | 4906 |
| CG | | | | | 4897 |
| CG | | | | | 1514 |
| CG | | | | | 446290 |
| CG | | | | | 3740 |

D. Once the information was transferred from the parcel data layer to the garden data layer I was able to use the statistics tool to determine the total square footage of community gardens in Boston. I did this for non-profit farms and community gardens, not school gardens.




There is a total of 21,327,308 square feet of garden space in the city.

This number is just an estimate. There are several challenges that made it not possible to assess a more accurate number. Some of the gardens covered more than one parcel, and it was not possible to individually assess each garden plot and assess which parcels they occupied and then sum the lot size for all of the parcels. Additionally, some gardens encompassed only part of a parcel and it was not possible to divide the total lot size by the percentage of the lot occupied by the garden.

4. Creating a Buffer

I used the Arc Toolbox → Analysis Tools → Proximity → Buffer to create a garden buffer shape file that was 0.33 miles around the gardens. I dissolved the buffers so that it would not show individual buffers around each garden, but rather an overall buffer of 0.33 miles around all gardens. I did this only for non-profit farms and community gardens, not school gardens.

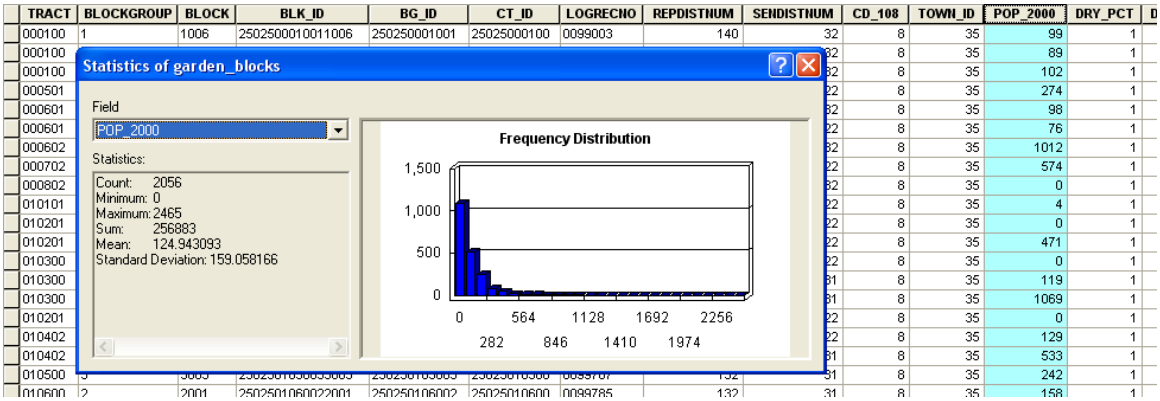
5. Determining Population Inside and Outside the Buffer

A. First I imported the popblock layer and reprojected it so that the layer was in the same coordinate system as all the other layers (NAD_1983_Stateplane_Mass_Mainland_FIPS_2001)

B. I used the select by location function on the census block layer (popblock) to create a new layer of only blocks inside the buffer zone.

C. Once the garden blocks layer was created I used the statistics tool to determine the total population inside the buffer zone.

There is a total of 256,883 people, or about half the population of Boston, within the garden buffer zone.

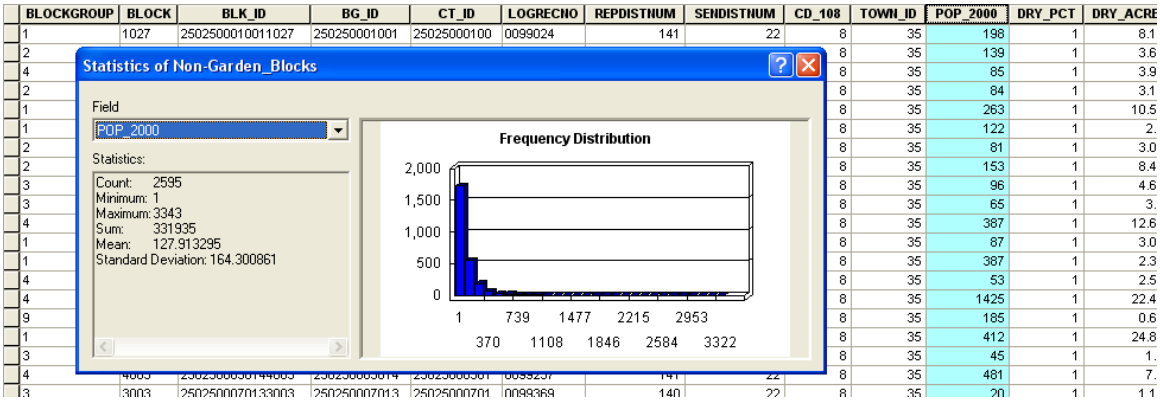



D. I created a new field called “pop_select” in the blocks layer. Then I selected only the garden blocks and used the geometry calculator to make “pop_select” equal to the original population field (pop2000). This gave me the real population for all blocks within the buffer zone and a value of zero for all others.

E. Once the “pop_select” field was established I used the select by attribute field to create a non-garden blocks layer. I selected for all blocks where “pop2000” <> “pop_select”. This gave me all blocks outside the buffer zone for which the population is not zero. I then exported the data and created the new non-garden blocks layer.

F. I used the statistics tool to calculate the total population outside the buffer zone.

There are a total of 331,935 people outside the buffer zone.

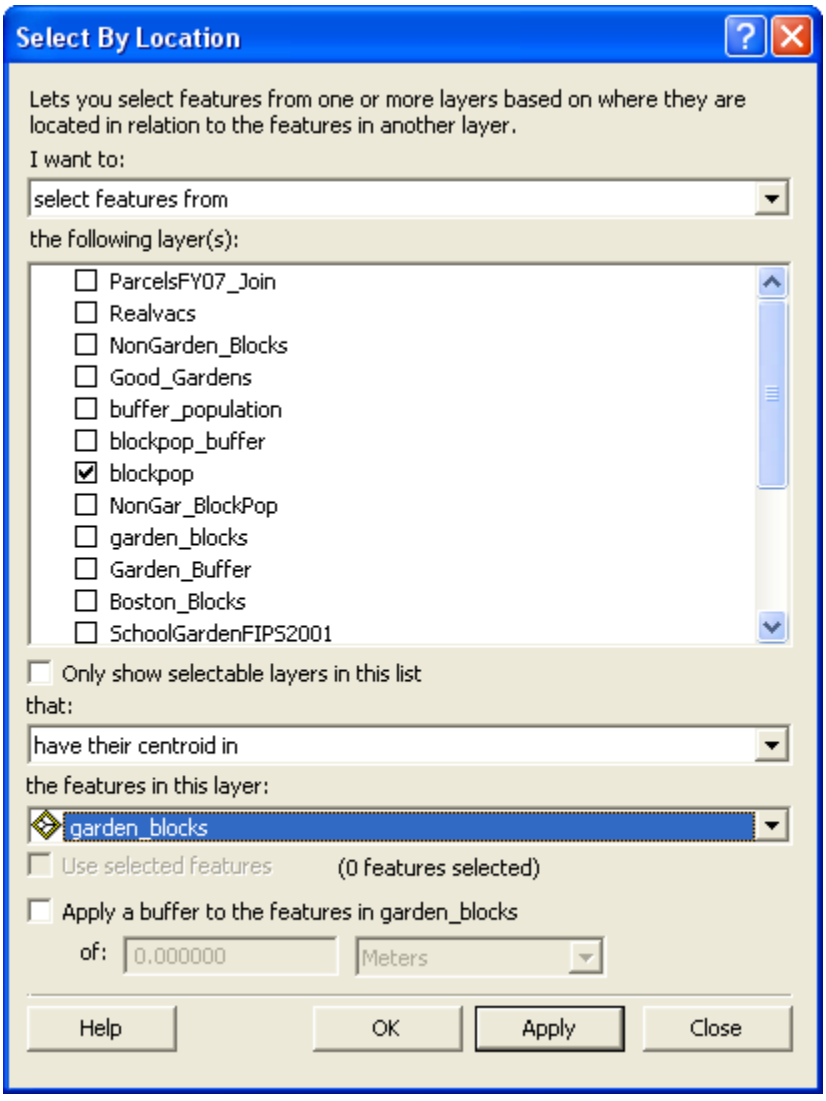


The one problem that arose from using this approach was that the blocks outside the buffer zone with a population of zero are excluded from this layer and therefore excluded from any further analysis.

6. Creating Density Maps

I created density maps for the region inside the buffer zone and outside the buffer zone to visually display the population distribution.

A. I used the select by location tool to create a garden blockpop layer by selecting for all blockpops that have their centroid in the garden blocks layer.

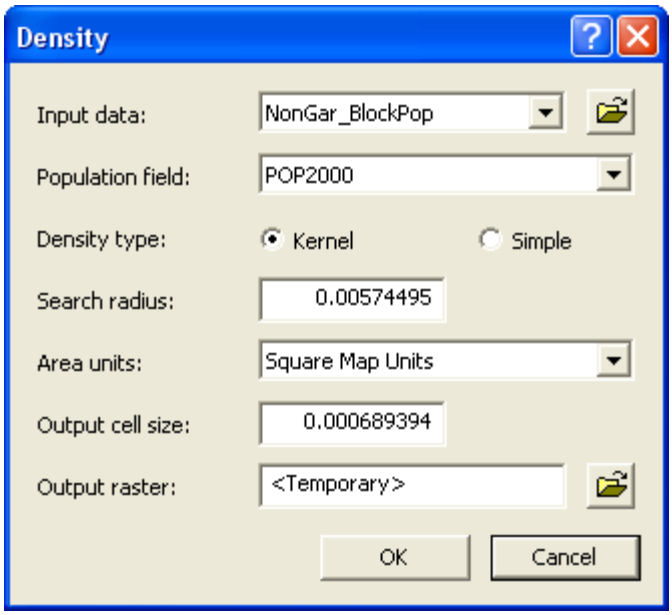



B. Then I enable the spatial analyst tool (tools → extensions → spatial analyst)

C. I turned on the spatial analyst toolbar and under options I set the extent to within the garden blocks layer.

D. I used the Density too and set input data to the newly created garden blockpop layer. This gave me a raster of the population density within the buffer zone.

E. I repeated the above mentioned steps creating a non-garden blockpop layer, resetting the extent to the non-garden blocks and then setting the input data to non-garden blockpop.




F. Finally, in order to ensure that the density maps inside and outside the buffer have the same categories as each other I saved one as a layer file and imported it to the other.

This was particularly interesting, because prior to doing so it looked as if the majority of the population was within the buffer zone and had access to gardens, but afterwards it became clearer (visually) that more of the population lives outside the buffer and lacks access to gardens.

7. Finding Vacant Parcels Outside the Buffer Zone

A. I used the select by location field to find parcels that have their centroid in non-garden blocks.

B. Then I used the select by attribute field to select parcels where the building value equals zero, the living area equals zero and the owner is the City of Boston.

C. Once I had limited my selection to only the parcels that fit all of the above mentioned criteria I created a new data layer called vacant parcels.

D. In this new layer I created a field called really vacant. I used the ortho photo layer to assess whether or not each of these parcels was actually vacant and used the editor to select all the parcels that were really vacant and then used the "Attributes" table to fill in "Yes" in the really vacant field for the selected parcels. Lastly, I created a new data layer called Vacants for only the really vacant parcels and then deleted the old vacant parcel layer.

*Difficulties*

I touched on the difficulties of this project as I was explaining my analysis steps. One of the biggest problems was the inaccuracy of the garden size due to the inability to properly align gardens with their parcels. Additionally, I had a hard time with the very act of joining parcel data with garden data and instead hard to use the much more laborious process of using the Spatial Adjustment tool to transfer this information one garden at a time. Lastly, I also encountered some difficulty creating the non-garden block layer, although I found a suitable work around.

*Conclusion*

Overall I was happy with this project. I enjoyed the process and was happy with the results. I found it interesting and satisfying to create the first map, which was just a simple visual representation of the distribution of gardens within Boston. It was also exciting to assess the physical distribution of gardens in relationship the population distribution of Boston. There appears to be a central area where there is a high density of gardens and population, but there are other areas where there is high population and relatively few gardens. Had I had more time I would like to look at the relationship between average household income and garden distribution. I would hypothesize that those areas with high population density and few gardens are also of lower average income.