Urban Garden Survival

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Abstract

Urban gardens are community led plots designated for agricultural purposes in residential and urban areas. Greenville County has seen a recent growth in urban gardens with the assistance of non-profit groups like Gardening for Good. The current total in Greenville County stands at 79 with new gardens added every year. While the growth is encouraging, some gardens have failed. This study uses GIS to explore the social and ecological factors that correlate with urban garden survival in an effort to provide garden managers with information that will help them develop gardens that thrive and persist.

Introduction / Lit Review

Within our local community, Greenville County has witnessed a growth in urban gardens. Gardening for Good is a central hub and resource center for urban gardens, serving to facilitate the "energy of the community garden movement to coordinate neighborhood redevelopment efforts, improve the health of residents and neighborhoods, and transform Greenville through gardening" (ggardeningforgood.com).

Golden (2013, 17) explains that there is a "sense of readiness," and an "institutional climate" for urban agriculture that did not exist 13 years ago. In addressing this energy, we can look at Bradford who argues the importance of an ecological perspective when understanding and applying human decisions to urban planning and green infrastructure (Bradford et al, 2013).

Denver Urban Gardens' Best Practices Handbook for Creating and Sustaining Community Gardens (2012, 14) states, "intentional planning promotes sustainability," summarizing that a community garden takes time to complete, the length often depending on available resources and "the energy, cohesiveness and readiness of the organizing community."

Grimm et. al (2000, 574) writes, "an ecosystem is a piece of earth of any size that contains interacting biotic and abiotic elements and that interacts with its surroundings." In applying this definition to urban areas, "a city is most certainly an ecosystem." Urban agriculture embodies these elements of interaction between social and ecological systems. The benefits of a shared space in which people come together to grow food are widespread through environmental, economic and social elements (Golden, 2013). Using Geographic Information Systems (GIS), we looked at attributes such as income, median age, land cover, and other spatial data to relay what correlates with increased survival rate.

Acknowledgements

Reece Lyerly from Gardening for Good and Dr. John Quinn from Furman University for mentoring and helping cultivate our initial hypothesis. Mike Winiski from Furman University for an exponential amount of help with GIS and many invaluable ideas for our hypothesis and research methods. Finally, fellow student Jordan Keesee for assistance with GIS questions and data retrieval.

References/ Data Sources

Online sources like NHGIS for census data (income and population), South Carolina Department of Natural Resources GAP (soil types), Furman University's online gisdata file and ArcMap for arranging the information.

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Grimm, Nancy B., Grove, Morgan J., Pickett, Steward T.A., Redman, Charles L., 2000, Integrated Approaches to Long-Term Studies of Urban Ecological Systems: BioScience, v. 50, no. 7, p. 571-584, d.o.i 10.1641/0006-3568(2000)050[0571:IATLTO]2.0.CO;2

2014, Gardening for Good: http://www.ggardeningforgood.com/ (accessed November 2014).

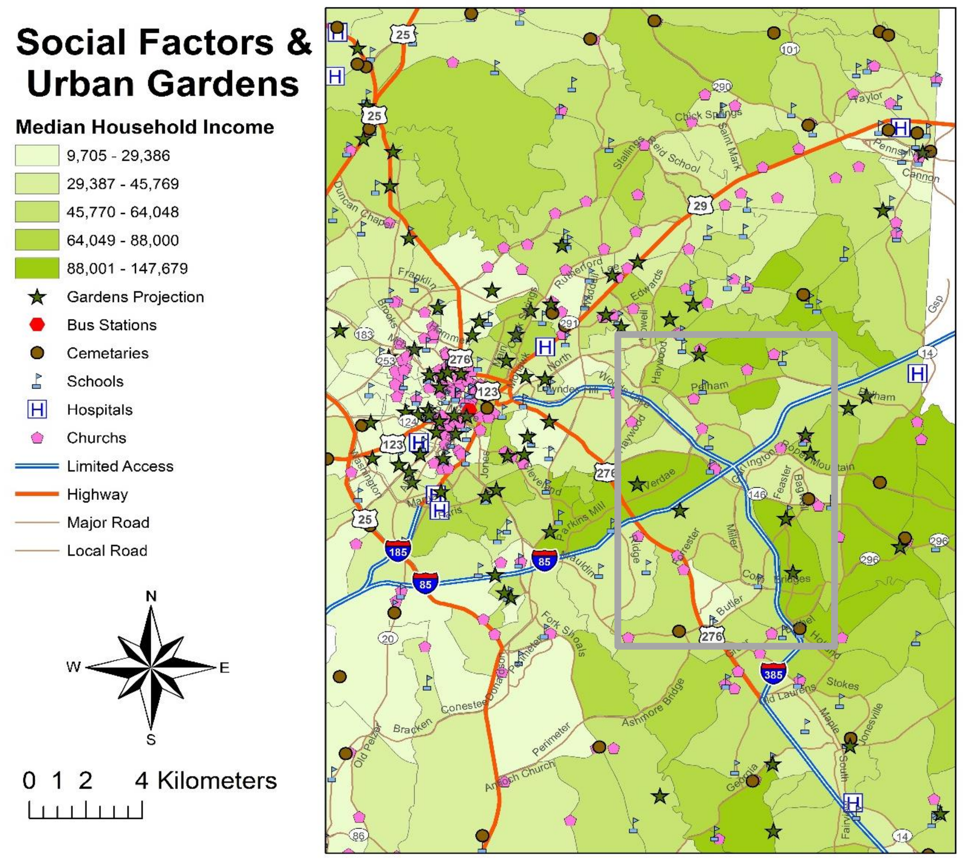

Figure 1. Greenville County social indicators related to the median household income.

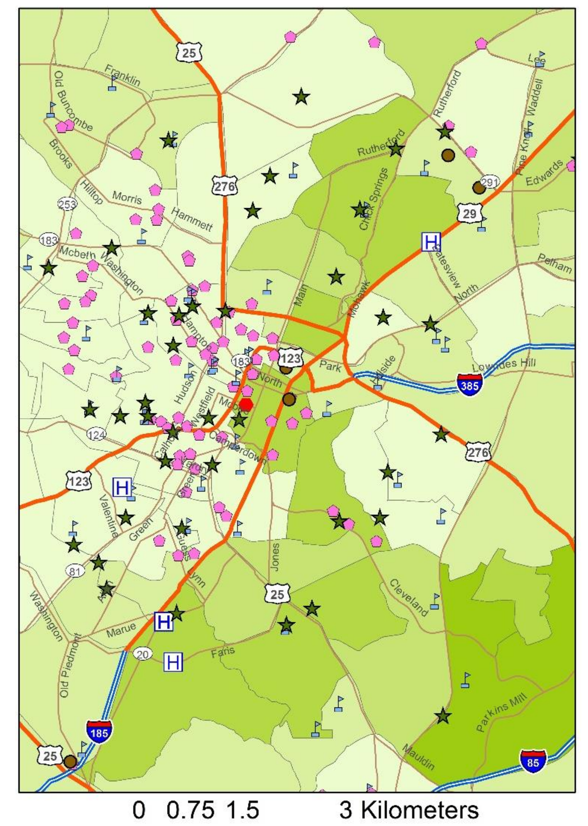

Figure 2. A subset map of Figure 1. centered on downtown Greenville.

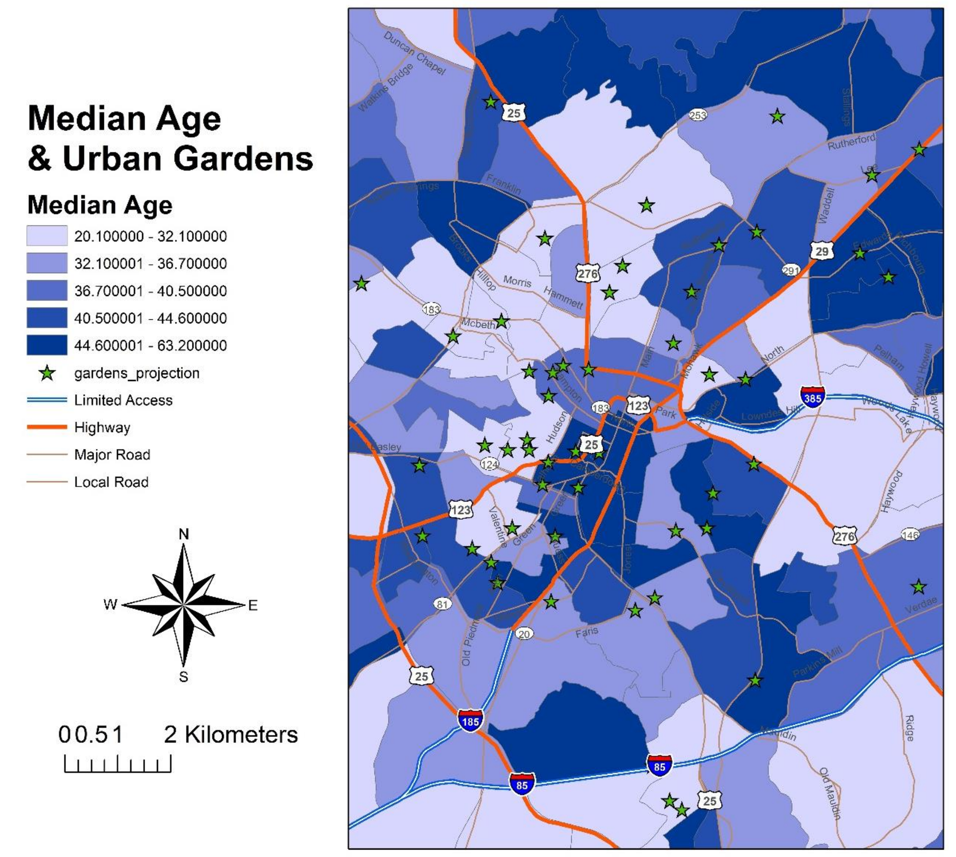

Figure 3. Greenville County social indicators related to the median age.

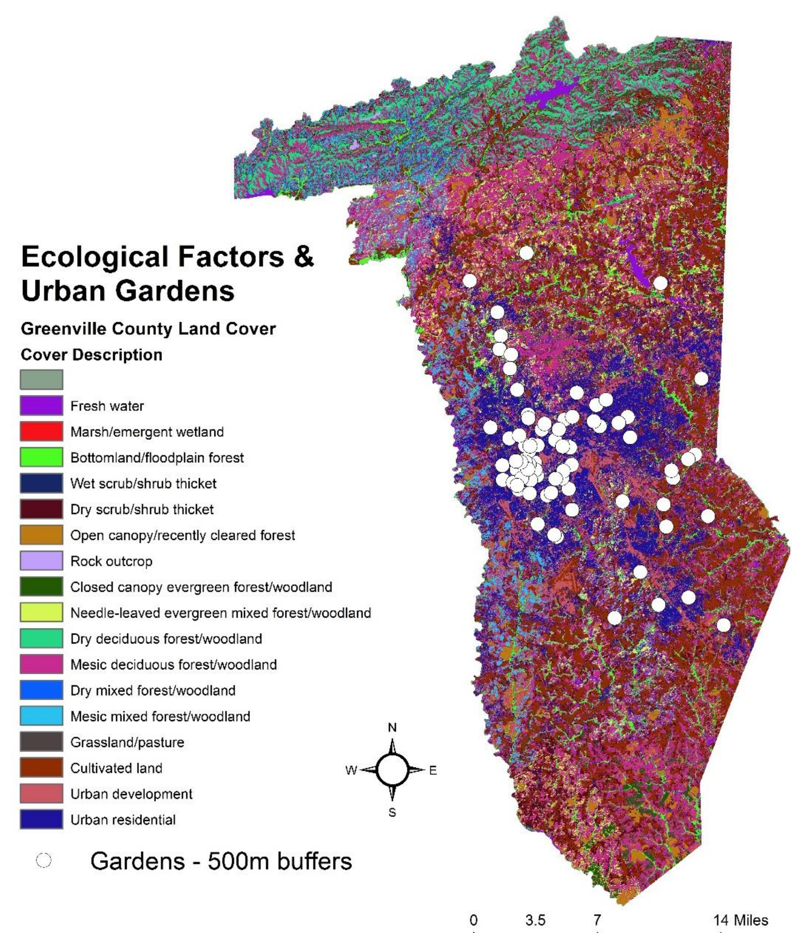

Figure 4. Greenville County land cover related to a 500 meter perimeter around each garden.

Future Research

All ecological and social numerical data collected could become their own layer on Arcmap. Each layer could demonstrate color variables that depict what gardens in what area have a high likelihood of survival based on the survival model predictions.

Information on the potential survival rate of urban gardens was not assembled prior to this compilation. Testing on which land cover types create the best survival environments and what social factors could help nurture urban gardens would create the ideal future research. More research on what social and ecological variables have the most impact on urban garden survival is paramount.

Methodology

The first hurdle was a compilation of gardens throughout Greenville County. With the assistance of Reece Lyerly at Gardening for Good, we collected basic information on seventy-nine gardens. All other garden information was received by direct contact with the urban gardeners through email. Once all our garden information was in an excel sheet, we uploaded it to Arcmap, geocoded it and displayed it as the garden layer.

Our first map (Figures 1 and 2) displays potential social and community indicators: bus stations, road-ways, hospitals, schools, churches, cemeteries, and the median household income (demonstrated via natural breaks) as the base layer. Through uploading each layer individually (gardens and social) and joining the Greenville County shapefile with the income's tables, the median household income was depicted for all Greenville counties. Next, the distance from every garden to the nearest social indicator (in all five categories) was measured using the near tool and placed in a spreadsheet for the survival model simulation by Dr. Quinn. We considered using the kernel tool to demonstrate garden clusters. However, it correlated high population density with more urban gardens.

Our second map, Figure 3, depicts the median age around the urban gardens (through varying colors of blue) to visualize any correlation between age and number of gardens. The third map (Figure 4) contains the ecological factors of Greenville County. We started by joining the land cover file (from GAP) with the Greenville County shapefile. On top of the new shapefile, we added the gardens layer and created a buffer of 500 meters around each garden. The extract by mask tool was used to determine what land cover was inside each buffer's 500 meters. The land cover inside each buffer was joined with the tabulate area tool to define what percentage of each land cover was in the 500 meters buffer of each garden.

Finally, a vibrancy score, rated by Gardening for Good, was given to all urban gardens with a scale of 1-5 (1 being the least "vibrant" and 5 being the most "vibrant). We defined vibrancy based on the perception of how well individual gardens are doing. Joining this tabular data to our garden shapefile, we looked for spatially related patterns but found that the more showing results were displayed in the model.

After all information and maps were created, we sent our final excel sheets to Dr. Quinn who ran the survival rate analysis on the gardens. Specifically, we looked at the proximity to churches and schools, running water, percent's of: close canopy evergreen forest/woodland, cultivated land, urban development and urban residential. All positive numbers in the analysis pertaining to categorical variables (running water) helps with the survival of the urban garden and all negative numbers could potentially lead to the downfall of the garden. All continuous data (all other variables) create either a positive or negative slope (via analysis on a probability scale) correspond to the potential of a successful garden.

Conclusion

According to the results from the first regression equation analysis, land cover has the greatest pull in the survival of an urban garden. Social factors like churches and schools assist in the probability of survival, but are not the biggest factors when considering survival. The median income and age both demonstrated a positive correlation to urban gardens. Higher income and age led to a higher survival rate depicted in the model. However, some of our data (compiling stage) contained gaps in information. For better success and a more accurate model we need a more comprehensive data set of urban gardens in Greenville County.

Our second regression equation analysis yielded polar results to our first simulation. To understand which results yield a better prediction will take more analyses with qualitative and quantitative variables. This project opens the door for further research on the survival rate of urban gardens.

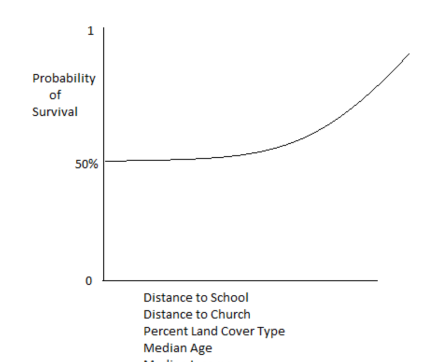

Figure 9.

Results and Discussion

The survival analysis was run using the regression equation. This analysis creates a prediction on what variables impact urban garden survival. The continuous variables: churches, schools, land cover, median household income (figure 5) and median age (figure 6) were analyzed by looking at the probability of survival (slopes up with a positive number and down for a negative number, displayed in figure 9). Schools and churches' probability was measured by the distance to each location. Land cover's probability was measured by the percentage of each type in proximity to the garden. Median household income and age are measured through blocks per unit. Corresponding, categorical variables like running water were determined as either a 1 or 0. Categorical variables either helped with the survival (positive number: 1) or could lead to garden's failure (negative number: 0).

Our first simulation, figure 7, demonstrated the survival analysis with quantitative data. Churches and schools showed a slightly positive probability with numbers in the thousandths place (a slight advantage, sloped up). Moreover, land cover was also a positive probability. Land covers urban residential (1.1539) and closed canopy evergreen forest/ woodland (0.7641) had a smaller positive probability. These land cover types aid in the success of an urban garden; however their probability steepness was not as high as cultivated land (2.0889) and urban development (3.4438). According to our survival analysis, gardens have a higher probability of survival next to a land cover with a higher number. Median household income and age showed with an increase in per unit (higher income/ age), the urban gardens had an increased survival. Lastly, running water contained a negative number. Meaning, it could potentially lead to the downfall of a community garden (categorical variable).

Our second simulation, figure 8, used a vibrancy survival analysis with qualitative data. Gardening for Good rated all the gardens with a scale from one to five (one symbolizing a garden will fail soon and five the garden is thriving). The survival analysis vibrancy data resulted in conclusions very different from our first analysis: churches(-.13), land covers(-.06 through -.21), median household income (-.22), and median age (-.08) all yielded negative results in this simulation. In the previous analysis, the same variables were thriving indicators of a successful urban garden. The land covers' results demonstrated an urban garden near any of these areas could potentially wither. Urban gardens near churches could fail, but schools are still a positive indicator (0.08). Lastly, median household income and age depicted a negative correlation. The higher the age and income, the lower the survivability. Corresponding, running water was negative in the first test but negative in the second test. We do not have conclusive knowledge as to why we have such discrepancies from our first to second analyses.

Median Income of Block Group	Perc. Of Total Gardens
9,705-29,386	37.97%
29,387-45,769	17.72%
45,769-64,048	20.25%
64,049-88,000	15.19%
88,000-147,679	8.86%

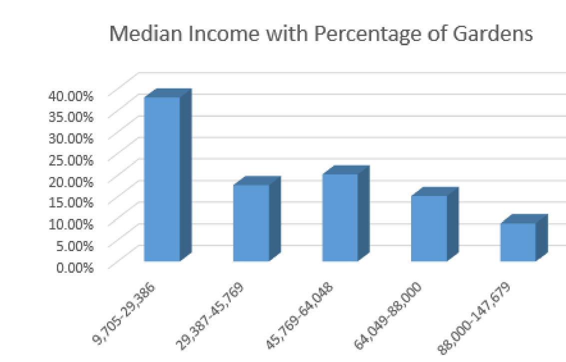

Figure 5. Income block group information from Figure 1 and the percentage of gardens in each group.

Median Age of Block Group	Perc. Containing Garden
20.1-32.1	26.58%
32.1-36.7	18.99%
36.7-40.5	17.72%
40.5-44.6	17.72%
44.6-63.2	22.78%

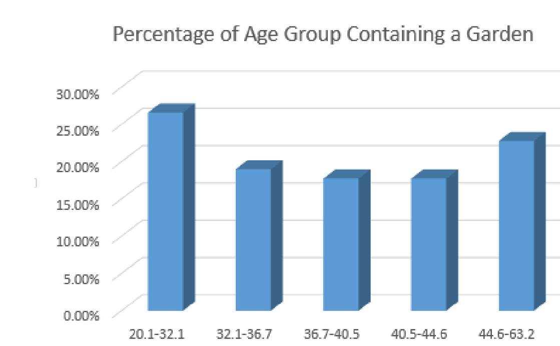

Figure 6. Median Age block group information from Figure 3. Percentages pertained to how many of the gardens were in each age block.

Variable	Estimate
Intercept	11.9193
Churches	0.0012
Schools	0.0006
Running Water	-0.8783
Per Closed Canopy Evergreen forest/ woodland	0.7641
Per Cultivated Land	2.0889
Per Urban Development	3.4438
Per Urban Residential	1.1539
Median Household Income	0.0000
Median Age	0.2976

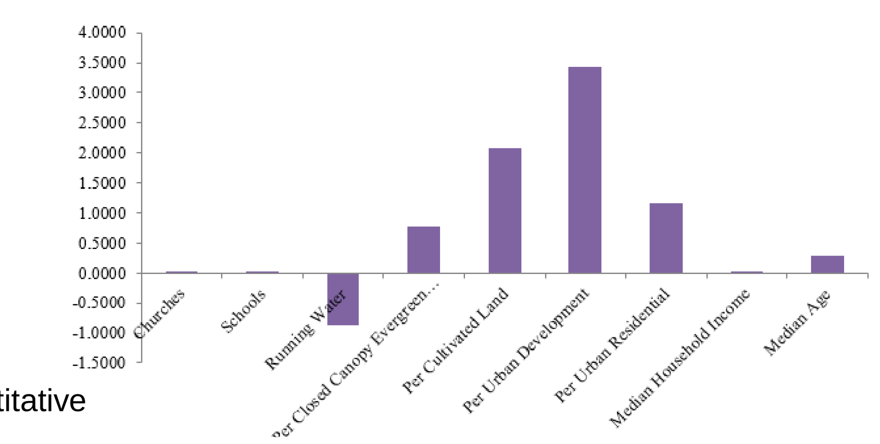

Figure 7. Results from first survival analysis: quantitative

Variable	Estimate
Intercept	0.00
Churches	-0.13
Schools	0.08
Running Water	0.01
Per Closed Canopy Evergreen forest/woodland	-0.06
Per Cultivated Land	-0.19
Per Urban Development	-0.21
Per Urban Residential	-0.14
Median Household Income	-0.22
Median Age	-0.08

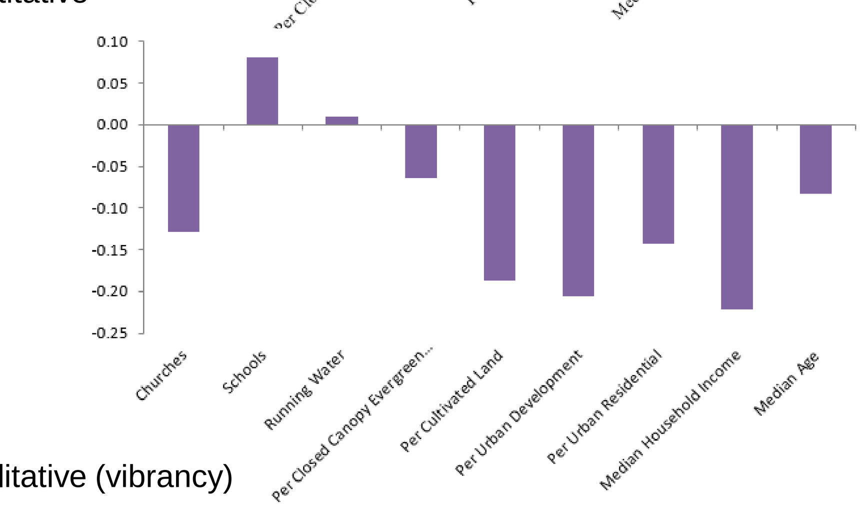

Figure 8. Results from second survival analysis: qualitative (vibrancy)