The Future of Urban Food Production

Measuring the suitable land area in Cambridge for Farmbot

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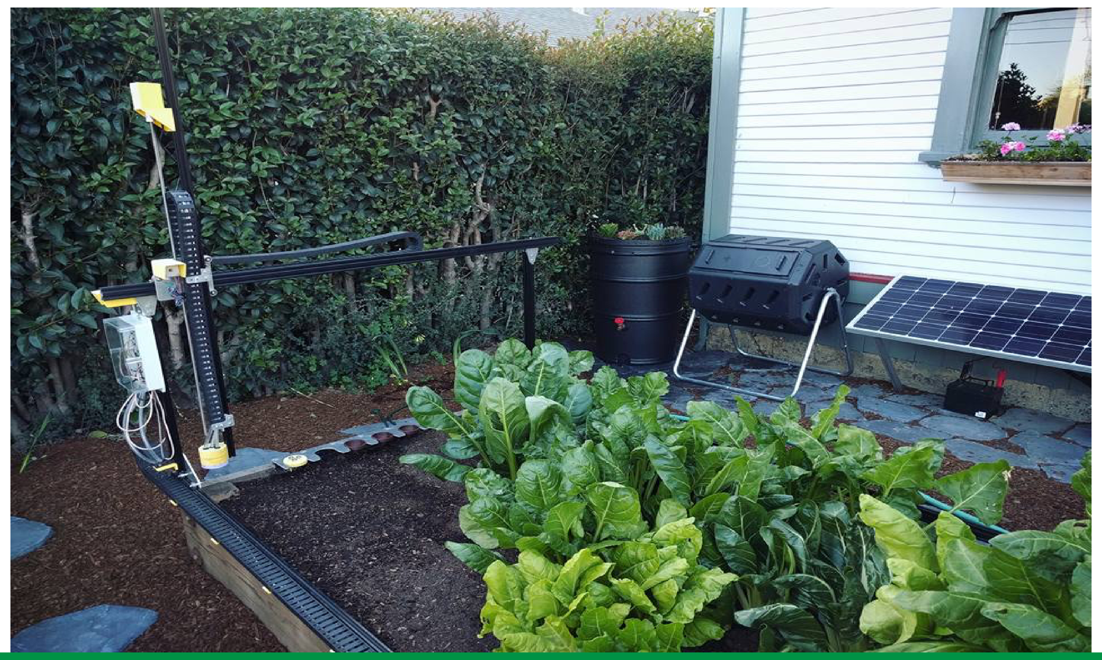


BACKGROUND

With recent investment and campaigning by both the State of Massachusetts and the City of Boston to improve food security it has become apparent that urban agriculture is an important component to improve food access in the state. A variety of initiatives, collaboratives, and governmental action plans have been put into action in recent years to improve food security such as: The Local Food Action Plan, and the Massachusetts Food System Plan. A new and innovative technology in food production which could improve food access is, Farmbot. Farmbot is a robotic, technology which allows individuals to grow food with nothing more than the touch of a button. As seen in the image above Farmbot can maintained a raised bed full of fruits and vegetables, from planting, weeding, watering, and soil testing. Farmbot handles everything up until harvest. This project works to determine what land areas in Cambridge would be suitable for Farmbot, monitoring land use, surfaces, and canopy cover to determine the suitable areas for Farmbot models Genesis(4.5 square meters) and Genesis XL (18 square meters).

Figure 1

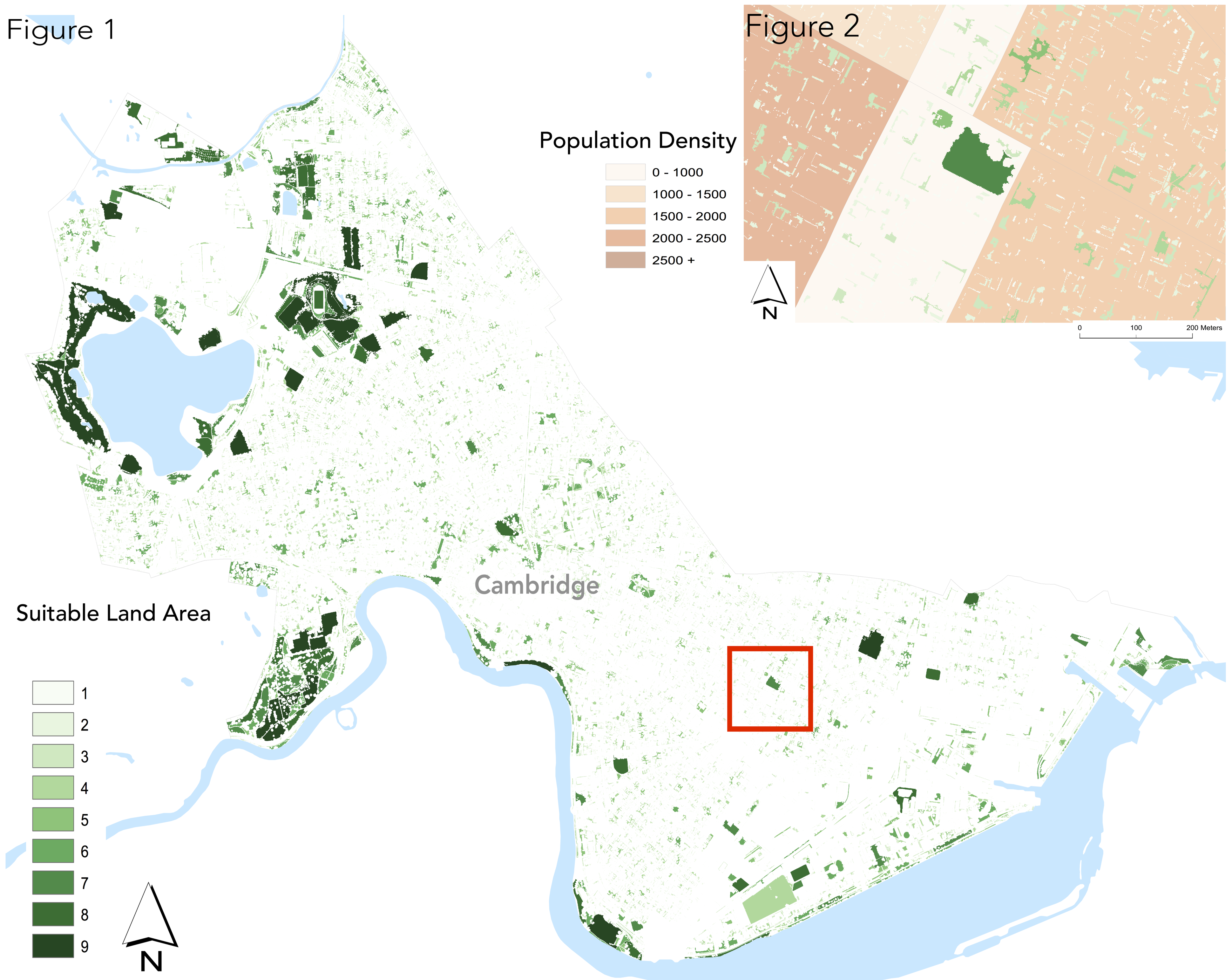
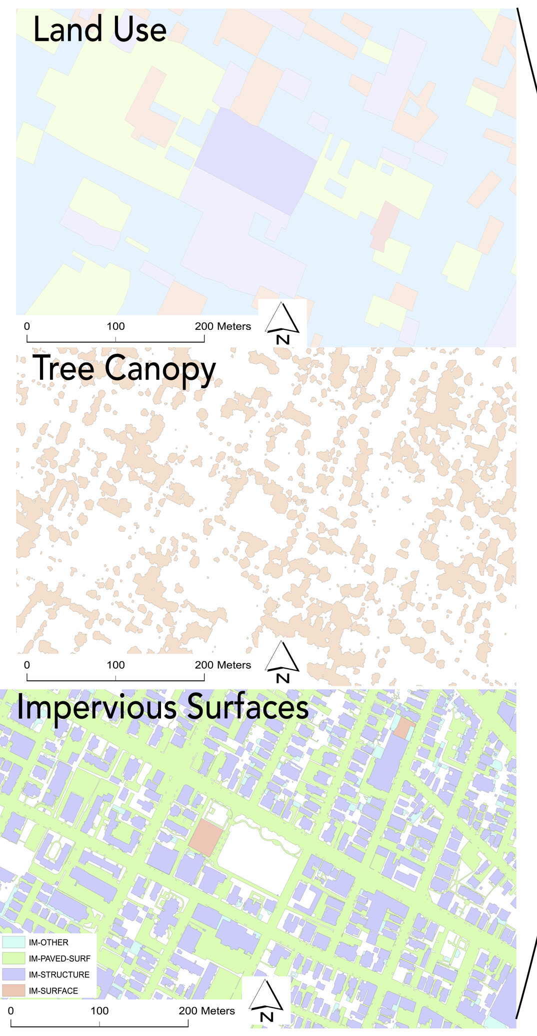


Figure 2

As costs of food continue to increase, and people continue to disconnect from farming, diets are beginning to degrade. In fact, researchers have found that individuals living in low-income or high-minority communities have low access to healthy foods which negatively impacts their diets. Farmbot could be a tool to offset this inequality.

METHODS



In order to identify the land area most suitable for Farmbot it was important to consider the areas which were most suitable for growing food. These areas required most importantly, direct sunlight and open space. Data was collected from the City of Cambridge and MassGIS on impervious surfaces, canopy coverage, and land use. Each dataset was rasterized and reclassified based on the suitability of Farmbot. The reclassification was based on a score from 0 to 2.

1. Tree Canopy Data from the City of Cambridge, was ranked either a 0 for full tree coverage (in pink) or a 2 as there is no tree coverage.
2. Land Use was collected from a dataset provided by MassGIS with a list of 37 different categories. The data was reclassified based on suitability for a raised bed. Therefore, areas with open space were categorized 2 while dense residential areas received a category of 1 as there could potentially be some open areas available for a small raised bed.
3. Impervious Surfaces were categorized by the City of Cambridge into 4 groups structure, surface, paved surface, other. The were reclassified for raised bed suitability thus sccoring roads and sidewalks a 0.

Once the data was categorized and classed the land area with suitability scores were averaged to find land areas with a suitability of 1 or 2.
All of the suitable land area was then grouped using a tool to develop a contiguous group of cells, instead of adding all the land area together this could pinpoint specific areas where a raised bed would fit. This Region Group tool allows for grouping of the land area as well as quantify the sizes of the suitable land areas for a Farmbot. The suitable land areas were then reclassified and ranked from 1 to 9 based on the land area and suitability of the land area.
Rankings from 2 to 9 are areas where various Farmbot could be installed. These ranking also factored in the earlier categorization thus land area with a suitability score of 1 but a large land area might not have ranked higher than a 3 or 4 on the final suitability scoring.

RESULTS

Based on the USDA Dietary Guide of America (USDA-DGA) the designer of Farmbot calculated how much the technology can truly produce facotring various growing models, calories from each crop, size of the Farmbot, etc. Using the USDA-DGAs recommend 3 cups of fruits and vegetables per person per day. When calculating the cups/m2/day for 33 different crops they estimated a Farmbot Genesis XL could provide the neceesary fruits and vegetables for a family of four.
As seen in the largest green land area in Figure 2, that land area could feasibly fit approximately 5 of 6 Farmbots, potentially feeding at least 20 people.
It is important to note, some land area which appears to be large in size and yet is classified as a lower ranking is due to its poor suitability for a Farmbot, the area could have received a score of a 1 instead of a 2 thus minimizing its capacity for more Farmbots.

LIMITATIONS

Listed are several of limitations and assumptions model for the simplicity of the model and overall scope of this project. This model likely provided an overestimated calculation of the realistic needs of Farmbot, this model assumed the availability of various elements needed for Farmbot but might not be realistic. A first set would be to conduct some ground-truthing and determing the suitability of some of these land areas.

Potential Future Studies/ Considerations:

- Collect data on shadow coverage to ensure suitability of growing crops.
- Consider access to electricity, this model is developed on the expectation that sustainability is a critical goal thus all Farmbot installed will be equipped with a solar-panel to power the technology, however that might not always be the case.
- Consider access to water, this model was developed without considering that element.
- Investigate elements of security, Farmbot is a sophisticated and expensive tool which might require security.

Additionally, this model is not accounting for realistic interest in Farmbot. Will people be interested in installing Farmbots' in open space which could be used for a playground or new developments? This model is built on the assumption that city and state actors are interested in employing unique methods to address concerns related to food access, security, and sustainability.

CITATIONS

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