Mapping flower resources for pollinators using Google Streetview

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Introduction

Thousands of species of pollinators (like bees and butterflies) appear to be in decline around the world[1]. A leading cause of decline is a lack of habitat, which for these flower-visitors includes food obtained from nectar and pollen-providing plant species[1]. Urban landscapes, unlikely as it may seem, can provide crucial refuges for threatened pollinators, because humans can plant ideal flowers for the pollinators in gardens[2]. But conventional turf lawns, which are often barren of any pollinator-friendly resources, are the most common landscaping choice for homes in the US[3]. Previous work indicates that

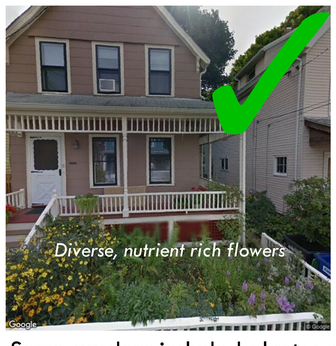
landscaping choices depend on what a person's neighbors plant, a social effect that would lead us to predict positive feedbacks, leading to spatial clustering of friendly gardens. In this project I ask whether pollinator plantings in Somerville, MA are in fact clustered in space – as we predict they are – and also test for the effect of income on landscaping.

Methods

OBJECTID	AddNum	Street
7855	0	ALBION ST
7980	0	ALBION ST
18	0	ALEWIFE BROOK PKWY
3330	0	ALEWIFE BROOK PKWY
13066	0	ALEWIFE BROOK PKWY
13426	0	ALSTON ST
3	0	ASSEMBLY ROW

We used the Google Streetview API to download pictures of every address in Somerville.

Then, we manually scored 13,000 images (>90% of Somerville) for presence of pollinator friendly flowers.



Some gardens included plants we know to be good for pollinators.

Many yards were lawns that had no flowers at all.

Some have purely ornamental flowers that are nutrient-poor.

Results

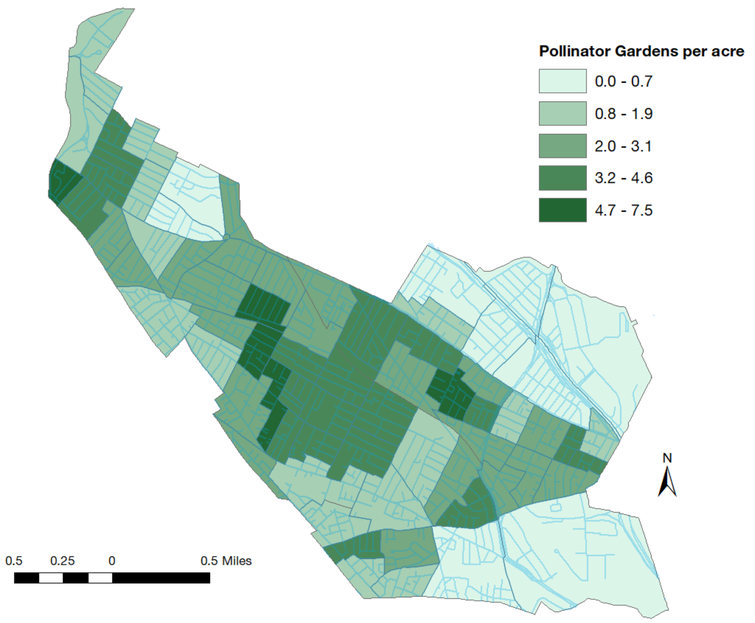


Fig. 1: Density of pollinator-friendly yards per census block group. Data derived by geocoding gardens as single points, then using kernel density and zonal statistics to calculate mean density per block group.

2% (268/13215) of addresses had pollinator friendly flowers.

Global Moran's I (a measure of clustering) indicates pollinator friendly plantings **are clustered together** ($I = 0.27$, $p < 0.001$).

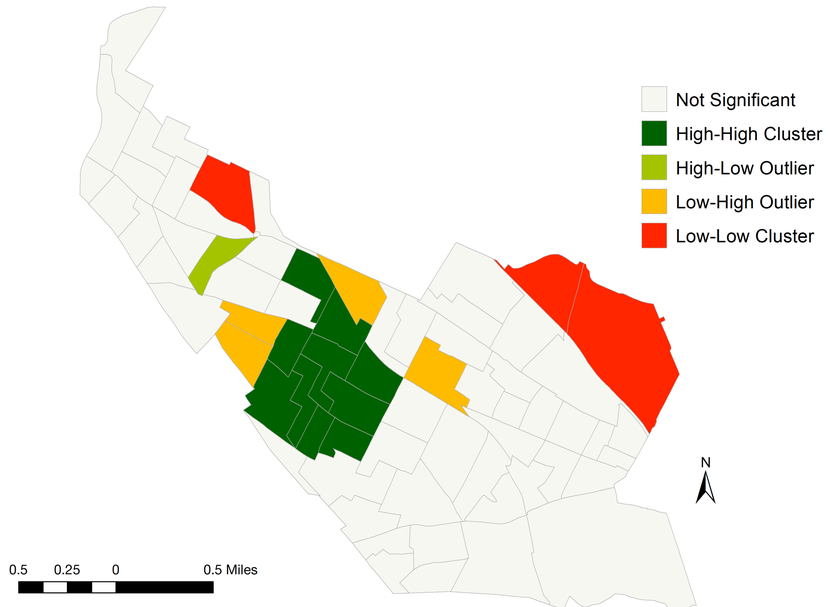


Fig. 2: Local Moran's I of pollinator-friendly yard densities. Clusters indicate sets of neighboring block groups with similar attributes., outliers indicate dissimilar neighbors. "High" here means higher friendly garden density.

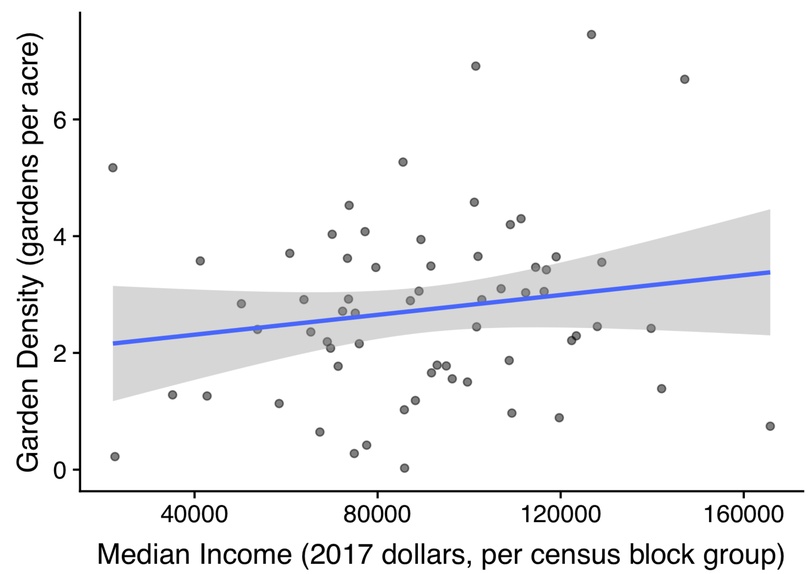


Fig. 3: Linear regression of friendly garden density vs. household income yielded **no significant relationship** at the census block group level ($r^2 = 0.03$, $p = 0.2$).

Discussion

Somerville varies in the density of pollinator-friendly plantings, and these plantings are significantly clustered, as expected under the "social contagion" framework in which people make landscaping decisions based on their neighbor's. This might benefit pollinators if these plantings become the enforced social norm, much like turf lawns are currently maintained. Income did not predict plantings. Somerville is also a "worst case scenario" in terms of yard space, with unusually small lots and very dense housing.

This method could be applied to any region covered by Google Streetview, and is effective at capturing fine grain trends in land usage.

References

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2. Baldock, K. C. R., M. A. Goddard, D. M. Hicks, W. E. Kunin, N. Mitschunas, H. Morse, L. M. Osgathorpe, S. G. Potts, K. M. Robertson, A. V. Scott, P. P. A. Staniczenko, G. N. Stone, I. P. Vaughan, and J. Memmott. 2019. A systems approach reveals urban pollinator hotspots and conservation opportunities. Nature Ecology & Evolution:1.
3. Nassauer, J. I., Z. Wang, and E. Dayrell. 2009. What will the neighbors think? Cultural norms and ecological design. Landscape and Urban Planning 92:282–292.

Projection: Lambert Conformal Conic; Data: MassGIS, Google Streetview, census.gov ACS 2013-17