IDENTIFYING OPPORTUNITIES TO INCREASE GREEN ROOFS IN NYC (WHERE THEY ARE MOST NEEDED)

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The Nature Conservancy and partners estimate that as of 2016 only about 736 of more than one million buildings in New York City (NYC) had green roofs, based on the first analysis of their distribution. Though not all buildings are suitable for green roofs, significant untapped potential remains. Furthermore, green roofs are not equitably distributed across the city – some areas with limited greenspace, higher exposure to the urban heat island effect, air pollution and stormwater challenges that do not have many green roofs can potentially benefit the most from local expansion of green roofs.

Recently, several new policies have been developed to increase the number and area of green roofs across NYC. Generally, these policies do not explicitly prioritize green roofs in areas of higher opportunity or need. To generate dialogue, The Nature Conservancy, with support from the mapping company, Azavea, and their Summer of Maps Fellowship Program, examined how green roofs could be prioritized across NYC, based on various types of need and at multiple spatial scales. This work can inform the development of relevant policies and programs.

POLICY BACKGROUND

The new policies and programs designed to help increase green roofs across NYC include mandates, tax incentives, and grants. For example, Local Laws 92 and 94 of 2019 require green roofs, solar, or a combination of the two on nearly all newly constructed buildings, building expansions, and full roof replacements. Though there are multiple incentive programs for solar panels, there are only two for green roofs. The NYC Department of Environmental Protection has a Green Infrastructure Grant Program, providing financial support for construction of green roofs above a certain size. There is also a tax abatement which was renewed and amended in 2019 for property owners who install green roofs on their buildings.

A key amendment to the tax abatement was an attempt to help address inequity in green roof distribution by providing a higher abatement rate ($15/sf) in "priority Community Districts," with a lower rate offered in non-priority areas ($5.23/sf). According to the legislation, priority areas would be determined based on "potential to minimize net stormwater runoff and increase green space." These criteria are a great start, but they are not comprehensive. Green roofs indeed can help manage stormwater – greatly needed in cities like New York where outdated Combined Sewer Overflow (CSO) systems discharge raw sewage directly into local waterways when overwhelmed by rainfall. Green roofs also function as wildlife habitat, and sometimes as places of respite, recreation, and education for local residents. However, they provide other benefits that address critical urban environmental issues that can also be considered in spatial prioritization, including mitigating urban heat and absorbing air pollution.

DATA AND METHODOLOGY

We explored four factors in potential prioritization of green roofs, based on relevance to NYC and data availability. We considered greenspace and need to manage stormwater, in part because these were specified in the tax abatement. For greenspace need, we calculated the percentage of land that was not covered in vegetation, based on recent land cover data for NYC (Figure 1 Map b). For

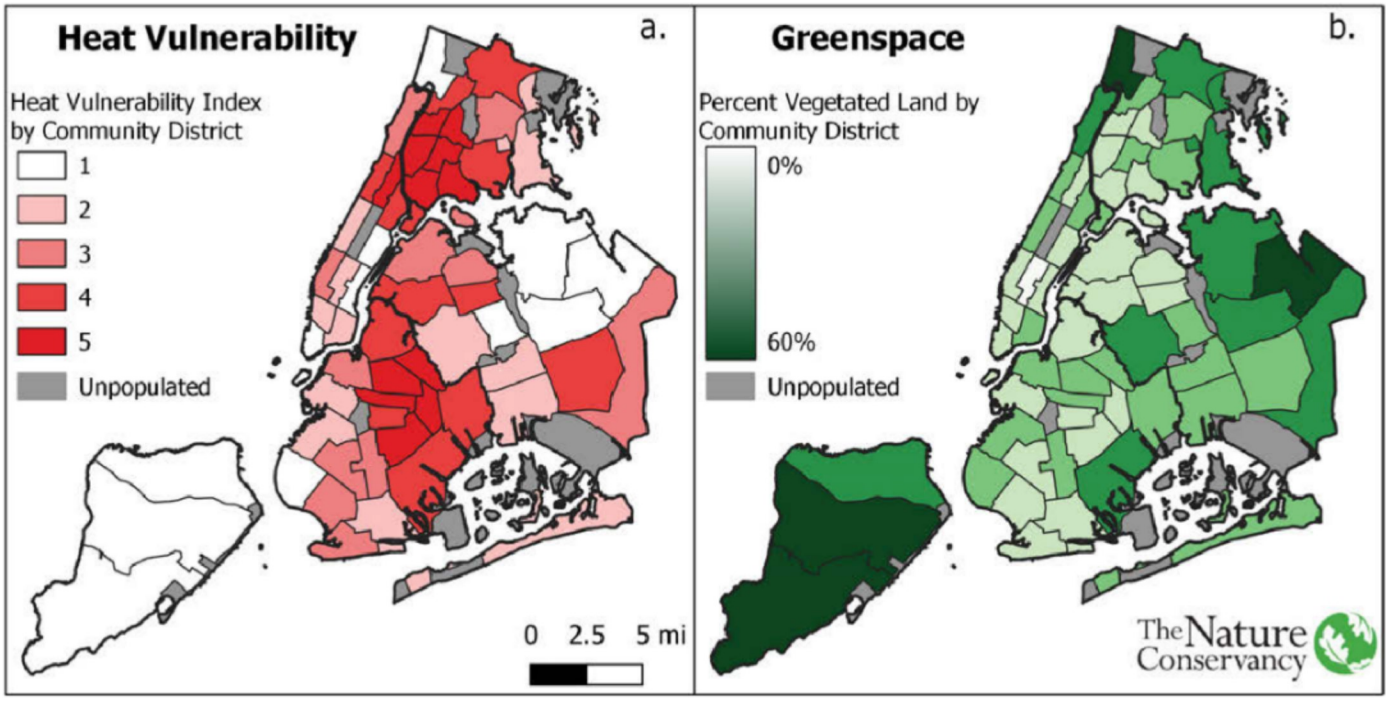

Figure I. Maps showing the Heat Vulnerability Index (panel a) and percentage of vegetated land cover as a metric of greenspace (panel b). Heat Vulnerability Index data are available from the NYC Dept. of Health and Mental Hygiene, and the greenspace data are derived from Land Cover data available on the NYC Open Data Portal.

stormwater, we estimated the amount of sewage discharge attributable to distinct areas based on data from Open Sewer Atlas NYC.

We also incorporated the Heat Vulnerability Index (Figure 1), developed by the NYC Department of Health and Mental Hygiene, which represents how vulnerable communities are to health consequences of heat waves based on demographic and environmental factors. Lastly, we used the Social Vulnerability Index, developed by the Center for Disease Control and Prevention, which generally reflects resilience of communities to external stresses.

We scored each factor in a standardized way, and combined them with equal weight into a single metric. Weights of different variables could be adjusted based on various considerations; we even explored omitting the Heat and Social Vulnerability Indices.

While combining these different factors, we considered how geographic scale influences the results. The tax abatement names Community Districts (CDs) - local administrative areas represented by boards of citizens – as the unit for prioritization. As a smaller alternative, we examined Neighborhood Tabulation Areas (NTAs), which are aggregations of census tracts that encompass 15,000 people in each. These were developed for planning purposes, but also serve as a practical scale for analyses such as this.

RESULTS AND TAKEAWAYS

We present a selection of maps to illustrate what prioritization could look like according to specific combinations of variables at both CD and NTA scales (Figure 2). Adding heat and social vulnerability as metrics shifts the areas of greatest need to include more of southern Bronx, northern Manhattan, and eastern Brooklyn. These areas are generally recognized as including

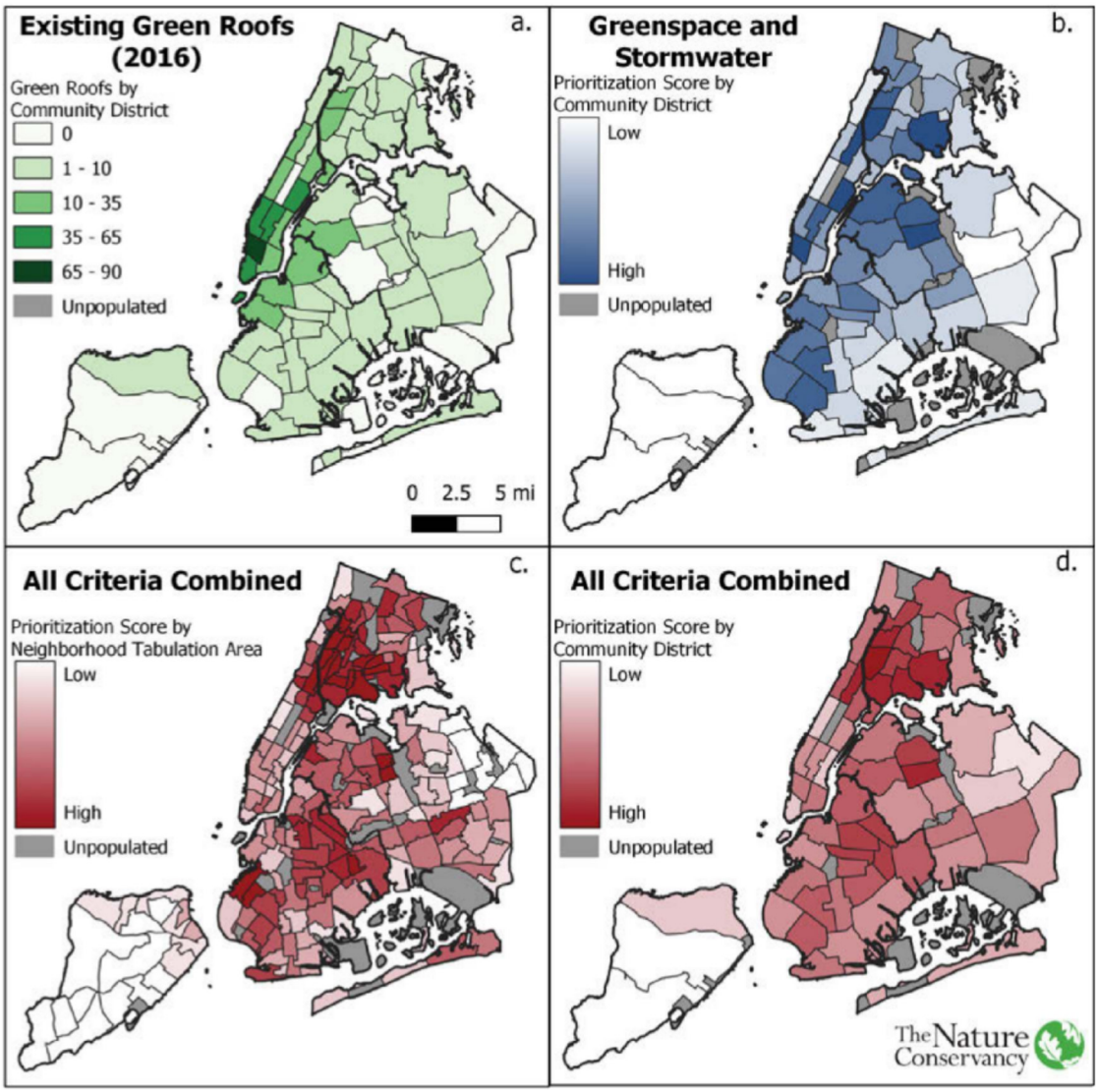

Figure 2. Maps showing distribution of existing green roofs in NYC (panel a), and potential prioritization schemes for green roofs (panels b, c, and d). Panel b depicts a prioritization at the scale of community districts based on lack of greenspace and an estimate of combined sewer system challenges; panel d adds metrics of Heat and Social Vulnerability; and panel c represents a prioritization with all four of these metrics at a smaller geographic unit, Neighborhood Tabulation Areas. See text for more details on methods.

environmental justice neighborhoods, where disproportionate environmental burdens have impacted communities of people of color and lower income households. Simply focusing on stormwater and greenspace could potentially further the disparity in green roof distribution based on the metrics we used, as greater need was identified for these variables in some areas that already have more green roofs, such as downtown and midtown Manhattan. Spatial scale of analysis also has a clear influence. With the smaller NTAs, prioritization can be conducted in a more targeted way, helping ensure that communities in areas of the city with the greatest need for green roof benefits can see them locally. Notably, CDs vary in population and area, and large ones in particular can have substantial environmental and demographic variation. Thus, policies enacted at this scale could be implemented in ways that don't benefit those whom they were designed to help.

Overall, the work described helps us explore some, but not all, of the options for prioritizing green roofs in NYC. This builds on previous examples of green infrastructure prioritization in both applied and academic settings. Other factors can be incorporated, and the factors we did include can be calculated in different ways to more holistically represent potential green roof benefits. Such work should leverage partnerships with local experts, including community-based organizations, relevant agencies, and academic researchers, to make the best use of available data and incorporate local perspectives. Furthermore, given that not all buildings can support a green roof, similar analyses will benefit from a rigorous understanding of feasibility of buildings to support green roofs. For NYC and other cities around the world, this is still a significant data gap.

As prioritization efforts are applied, it is also critical to consider how relevant policies may affect local residents. For example, if green roofs are incentivized, and seen as an amenity in needed areas, what approaches can be used to avoid potential green gentrification? And how can new green roofs be made accessible and usable for communities?

Green roofs are not a panacea for environmental and social problems, but they are part of the equation for making cities more livable and enjoyable in a climate-changing world. It is critical both that we increase them in number and area, and that their benefits be equitably distributed. We believe work like this can inform policy and incentive programs to make that happen.

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More information about The Nature Conservancy's work on green roofs in NYC is available at https://www.nature.org/content/dam/tnc/nature/en/documents/NYC_GreenRoofs_Summary.pdf.
Learn more about NYC's Sustainable Roof Laws at https://www.nature.org/content/dam/tnc/nature/en/documents/SustainableRoofLaws_12.12.pdf.