

# THE ENVIRONMENTAL JUSTICE OF URBAN FLOOD RISK AND GREEN INFRASTRUCTURE SOLUTIONS

## SYRACUSE, NEW YORK

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This project aims to better understand the environmental justice implications of urban flooding and green infrastructure investments in vulnerable communities across 4 U.S. cities. This factsheet summarizes key takeaways for the city of **Syracuse, New York**. [Click here](#) to access the project's website, and the results obtained in other cities. This project is co-led by the Urban Systems Lab Research Fellow Pablo Herreros Cantis and Director Timon McPhearson with support from the Kresge CREWS Program, with additional input from Chris Kennedy, Chella Strong and Claudia Tomateo.

### INTRO

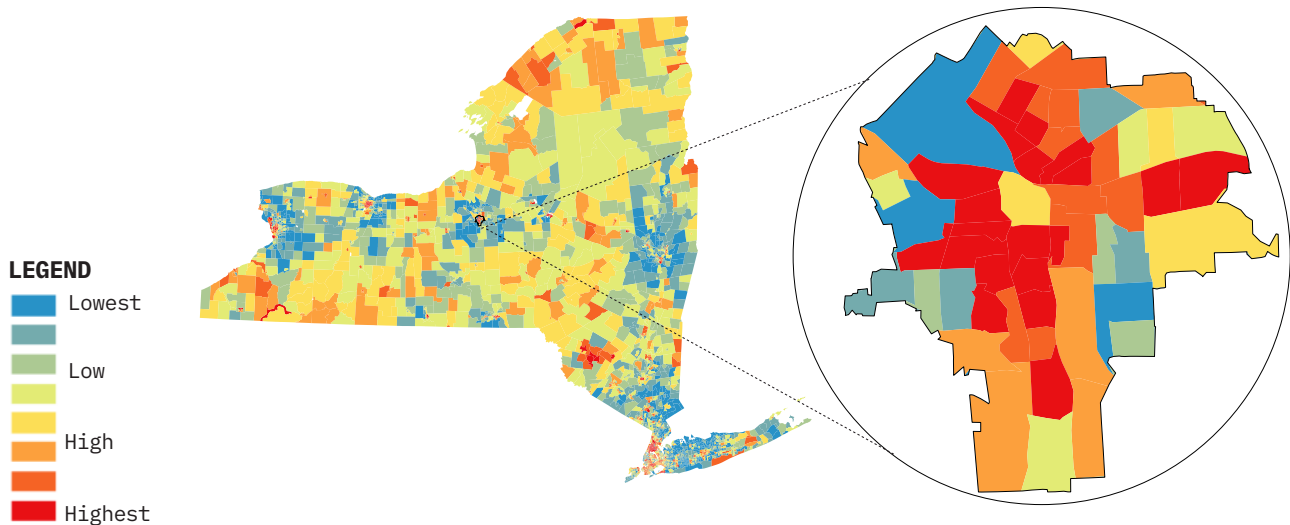
Severe and extreme precipitation have historically caused important problems in Syracuse related to water quality and flooding. The combined sewers of the city were releasing loads of untreated water into Onondaga Lake, while flash flood events caused by extreme precipitation flooded the streets of the city, requiring residents to evacuate their homes and leading to the loss of human life. During the decade of 2010, the Save the

Rain program supported the installation of hundreds of green infrastructure interventions aiming to reduce the impact of combined sewer overflow discharges. While the project was a huge success and milestone goals related to water retention were reached, the allocation and design of interventions focused on tackling water quality issues rather than flooding.

### DEMOGRAPHICS

NEW YORK SOCIAL VULNERABILITY INDEX

SYRACUSE SOCIAL VULNERABILITY INDEX



Total Area: 25.6 mi<sup>2</sup>  
 Total Pop: 148,620  
 Median HH income: \$38,276  
 % Black: 30.0  
 % Latinx: 9.4  
 % Asian: 6.5

% White: 50.0  
 % Below poverty: 31.0  
 % w/ a Disability: 12.8  
 % w/o Health Insurance: 5.6  
 No. of Buildings: 51,925  
 Miles of road: 536.9 (3.0 mi<sup>2</sup>)

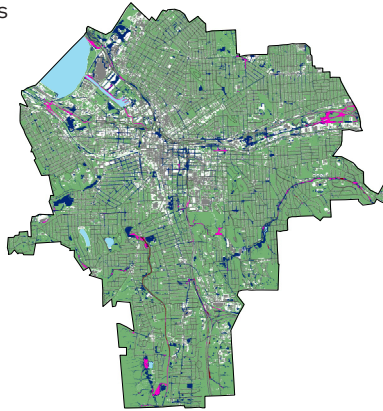
# SYRACUSE, NEW YORK

## BASELINE FLOODING RESULTS

### AGGREGATING RESULTS TO THE CENSUS BLOCK GROUP LEVEL

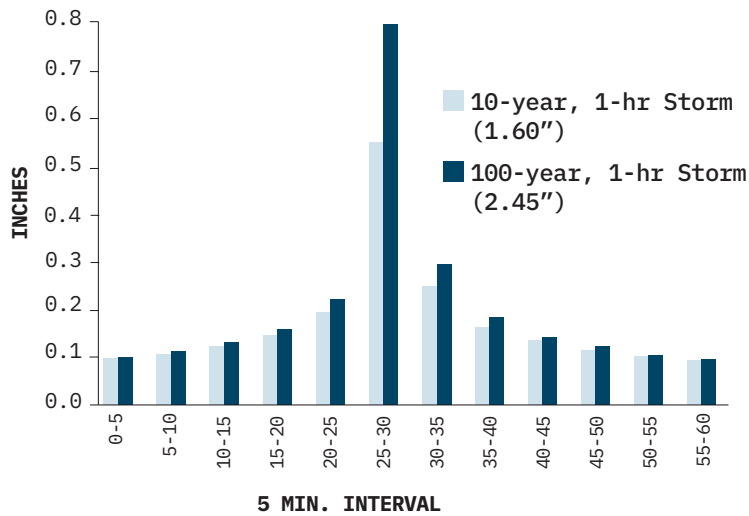
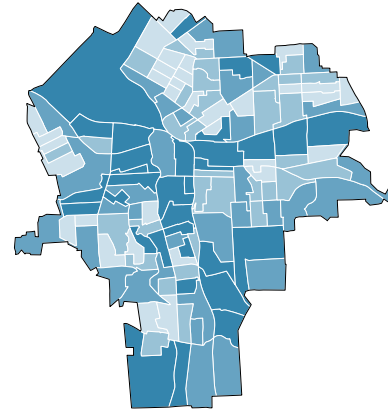
Max. Flood Depth

- Water Bodies
- Green Space
- d > 4"
- d > 1'
- d > 2'



Flood Risk

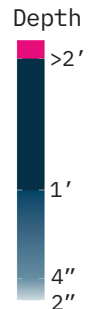
- Very Low
- Low
- High
- Very High



10 yr. storm



100 yr. storm



	10 YR. STORM	100 YR. STORM
Total Area Flooded > 4"	1.04mi <sup>2</sup>	1.89mi <sup>2</sup>
Road Area Flooded > 4"	0.30mi <sup>2</sup>	0.55mi <sup>2</sup>
Total Area Flooded > 1'	0.06mi <sup>2</sup>	0.22mi <sup>2</sup>
Buildings Flooded > 4"	1510	3110
Residential Prop. Flooded > 4"	1754	3400

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## RESEARCH QUESTION AND METHODOLOGY

To better understand how environmental justice issues play out in Syracuse, we ask the following question: “Are communities that are more exposed to flooding also more socially vulnerable than those that are less exposed?” To answer this, we simulated two baseline 1-hour storms - a 10 year storm and a 100 year storm. We then grouped census blocks and block groups in quartiles of percent area flooded with more than 4 inches in each scenario, to assess the

potential differences in flood exposure among different socioeconomic and racial groups. For more details about our methodology, visit our [project website](#).

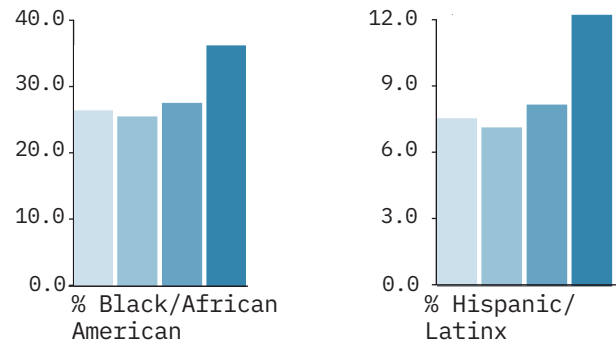
### Data Resolution:

- Resolution of the simulation: 2m
- Computed infiltration in Green Areas: Yes
- Accounted for buildings: Yes
- Accounted for soil textures: No

## KEY TAKEAWAY 1:

### BLACK AND HISPANIC COMMUNITIES ARE DISPROPORTIONATELY EXPOSED TO FLOODING

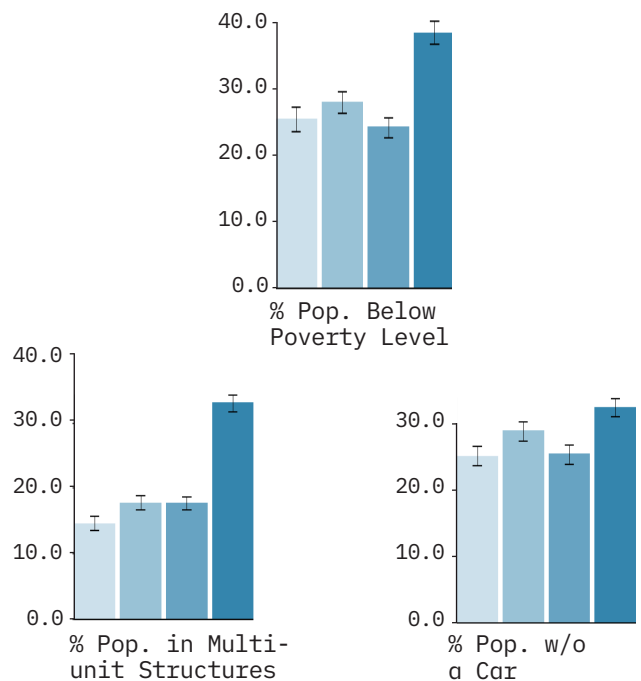
In a city where 30% of its population is Black or African American, the census blocks that experience most flooding according to their area flooded (top 25%, or top quartile) are ~36% Black. The same observation can be made for Hispanic residents (9.4% city-wide VS ~12% in the most flooded areas of the city). On the other hand, while the city’s White population comprises 50%, the communities most exposed to flooding are 41% White.



## KEY TAKEAWAY 2:

### DISPROPORTIONATELY EXPOSED COMMUNITIES ARE ALSO DISPROPORTIONATELY LOW-INCOME

Census block groups that are more exposed to flooding (a higher proportion of their area experiences flooding higher than 4 inches), also show higher poverty rates. Residents in these areas also have a higher lack of access to a car than less exposed locations, impacting their mobility when flooding takes place. In addition, exposed populations have a much higher proportion of their population living in multi-unit residential buildings, which tend to be harder to evacuate in case of emergency.



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## KEY TAKEAWAY 3: GREEN INFRASTRUCTURE IS NOT NEW IN SYRACUSE

The Save the Rain program has been running for more than 10 years in Onondaga County, funding hundreds of green infrastructure projects in the city. By engaging in conversations with county officials, engineers involved in the program and local scholars developed an understanding of Save the Rain's strengths and opportunities for improvement regarding flood risk mitigation and environmental justice. To learn about this part of our work in Syracuse, [click here](#) to access our Story-Map that explores ways to incorporate justice considerations and flood risk mitigation in green infrastructure planning.



## DISCUSSION/CONCLUSION

Based on our modeling results, we conclude that flooding in Syracuse is likely to disproportionately impact low-income communities and communities of color. While green infrastructure has been implemented successfully throughout the last decade, the City of Syracuse's program would benefit from incorporating social vulnerability and flood risk variables into their prioritization criteria, currently focused on reducing CSOs. For this, we proposed a methodology (see takeaway 3) that we hope serves as inspiration not only for Syracuse and Onondaga County, but for many other American cities that may currently face challenges posed by city-wide green infrastructure planning.