THE ENVIRONMENTAL JUSTICE OF URBAN FLOOD RISK AND GREEN INFRASTRUCTURE SOLUTIONS

MILWAUKEE, WISCONSIN

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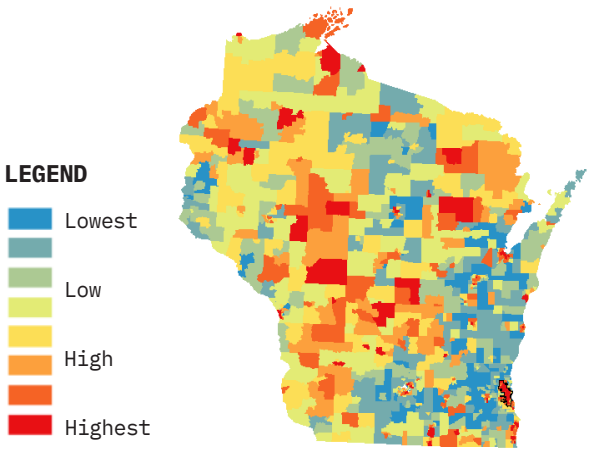
This project aims to better understand the environmental justice implications of urban flooding and green infrastructure investments in vulnerable communities across 4 U.S. cities. This factsheet summarizes key takeaways for the city of **Milwaukee, WI.** Click here to access the project's website, and 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.

IDENTIFYING THE CHALLENGES IN MILWAUKEE, WISCONSIN

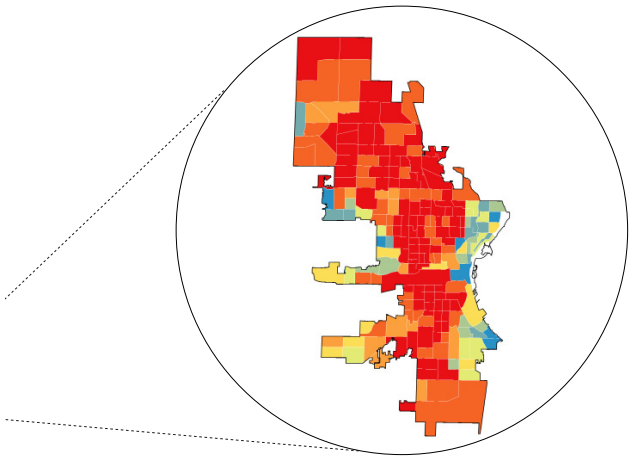
Flooding in Milwaukee is a common problem, with photographic records of flooding dating back to 1928. Several rivers (the Milwaukee, Menomonee, and Kinnickinnic rivers) and creeks converge in the city covering a vast area of urbanized, impervious surfaces. In addition, the city's downtown has a combined sewer system. Due to its close relationship with water through its rivers and lake Michigan, the city brands itself as a "water centric city". However, in July 2010, a series of storms in which more than 6 inches of rain fell in an hour led to flash flooding in parts of the city that caused millions of dollars in damages and thousands of homes flooded. To improve resiliency to such extreme precipitation, the city of Milwaukee launched its green infrastructure plan in 2019. In this plan, key priority areas are identified across the city to implement green infrastructure. Several indicators of potential success were used in this mapping (e.g. soil characteristics, distribution of public property, groundwater levels). And yet, the plan does not consider social factors such as social vulnerability or race, even though Milwaukee's history of racial segregation persists and may create disproportionate flood risks for Black and African Americans (39.2% of the city's population) among other marginalized groups.

DEMOGRAPHICS

WISCONSIN SOCIAL VULNERABILITY INDEX



MILWAUKEE SOCIAL VULNERABILITY INDEX



Total Area: 96.6 mi²
Total Pop: 577,222
Median HH income: $41,838
% Black: 38.7
% Latinx: 19.0
% Asian: 4.3
% White: 35.1
% Below poverty: 25.4
% With a disability: 10.0
% Without health insurance: 10.3
# Buildings: 254,689
# Miles road: 1,913.4 (25.9 mi²)

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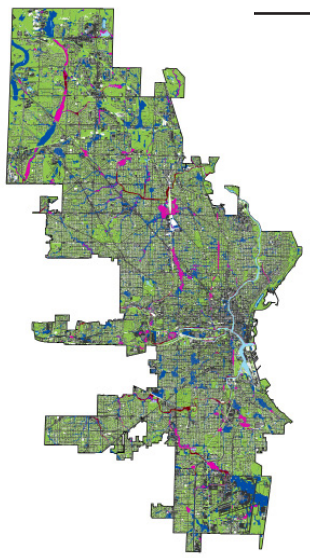
BASELINE FLOODING RESULTS

Aggregating Results to the Census Block Group Level

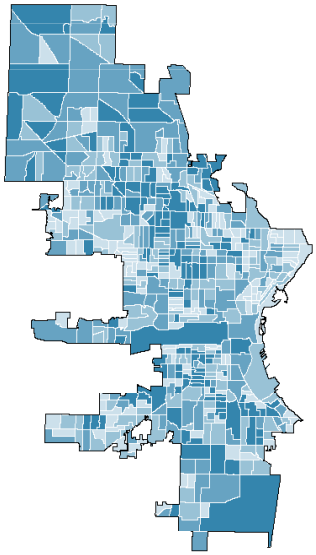
Max. Flood Depth

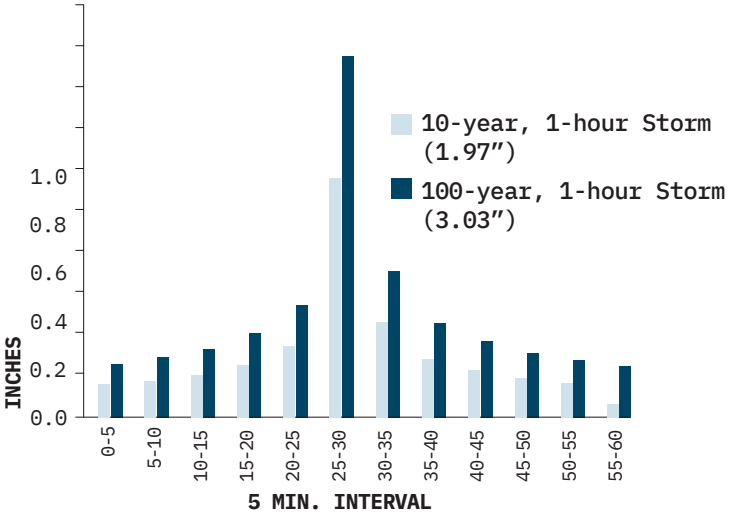
- Water Bodies
- Green Space
- d > 4″
- d > 1′
- d > 2′



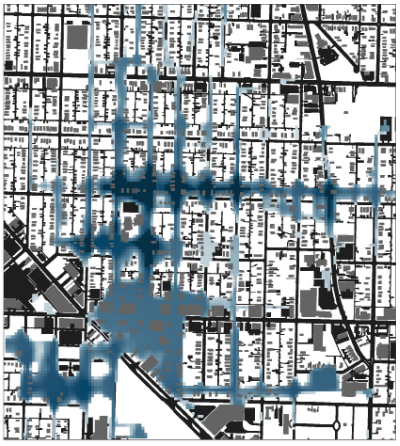
Flood Risk

- Very Low
- Low
- High
- Very High

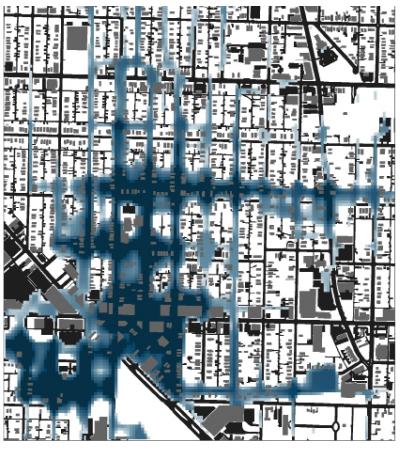




10 yr. storm



100 yr. storm



Areas Flooded	10 yr. storm	100 yr. storm
Total Area > 4″	12.5mi²	18.4mi²
Road Area > 4″	3.4mi²	5.0mi²
Total Area > 1′	3mi²	6.4mi²
Buildings > 4″	30428	43663
Residential Prop. > 4″	30363	42325

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RESEARCH QUESTION AND METHODOLOGY

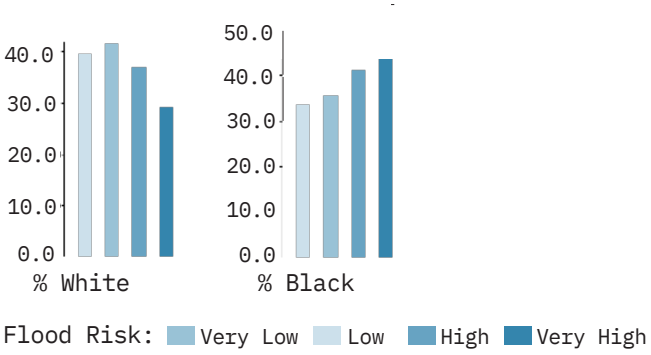
To better understand how environmental justice issues play out in Milwaukee, we ask the following question: "Are communities that are more exposed to flooding also more socially vulnerable than those that are less exposed?" To answer this, we simulated two baseline 1-hour storms - a 10 year storm and 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's website.**

Data Resolution:

Resolution of the simulation: 10m
Computed infiltration in Green Areas: Yes
Accounted for buildings: No
Accounted for soil textures: Yes

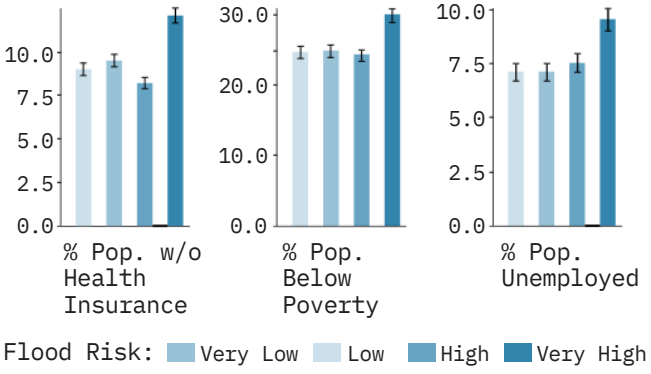
KEY TAKEAWAY 1: BLACK COMMUNITIES ARE DISPROPORTIONATELY EXPOSED TO FLOODING.

In a city where 38.7% of its population is Black or African American according to the Census, the census blocks that experience most flooding according to their area flooded (top 25%, or top quartile) are ~45% Black. On the other hand, while the city's White population comprises 35.1%, the communities living in the most exposed locations are ~30% White.



KEY TAKEAWAY 2: THE MOST EXPOSED COMMUNITIES SHOW HIGHER SOCIAL VULNERABILITY ACCORDING TO SEVERAL INDICATORS

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 and unemployment rates. Residents in these areas also have a higher lack of access to healthcare through health insurance. Other indicators that show higher social vulnerability in the most exposed areas are language isolation and the percentage of people living in mobile homes, though this percentage is low.



DISCUSSION/CONCLUSION

Based on our modeling results, we conclude that flooding in Milwaukee is likely to disproportionately impact vulnerable communities and Black residents. Unless Milwaukee incorporates social vulnerability variables into their GI and other flood resiliency planning, they risk exacerbating current inequalities. We modeled flood risk at a coarser resolution than the rest of the cities (10m) included in our study due to Milwaukee's size and our computational limitations. Future work should model at finer resolutions and incorporate public input in order to increase the accuracy of the mapping.

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