Assessing the Socio-Economic Impacts of Coastal Flooding and Strategies for Sustainable Adaptation

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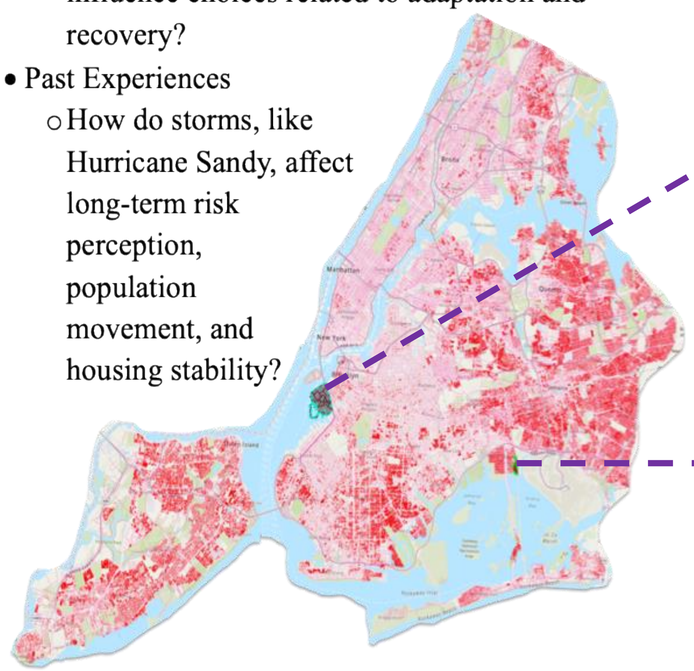
Background

CLIMA is an **interdisciplinary** research project that combines qualitative and quantitative methods to improve flood risk modeling for coastal communities, facing growing climate pressures. To improve **equitable** outcomes, the qualitative component centers on **structured interviews** with residents in flood-prone areas, capturing both **individual decision-making** and **community-level factors** that shape responses to flood events. This approach ensures the **inclusion** of **diverse** and often **marginalized perspectives**, contributing to a more comprehensive understanding of **vulnerability**, **mitigation**, and **adaptation**.

Qualitative Work

As part of the qualitative research, interviews were conducted with homeowners in flood-impacted coastal communities of NYC, including Red Hook and Hamilton Beach, to examine how social networks and individual-level dynamics shape housing decisions. Questions focused on:

- Close Social Ties
  - How do friends, family, and community leaders influence choices related to adaptation and recovery?
- Past Experiences
  - How do storms, like Hurricane Sandy, affect long-term risk perception, population movement, and housing stability?

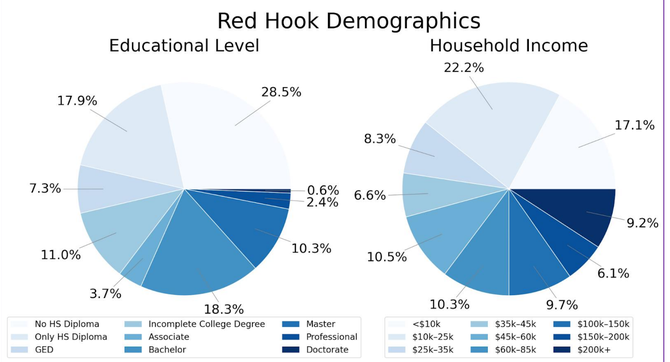


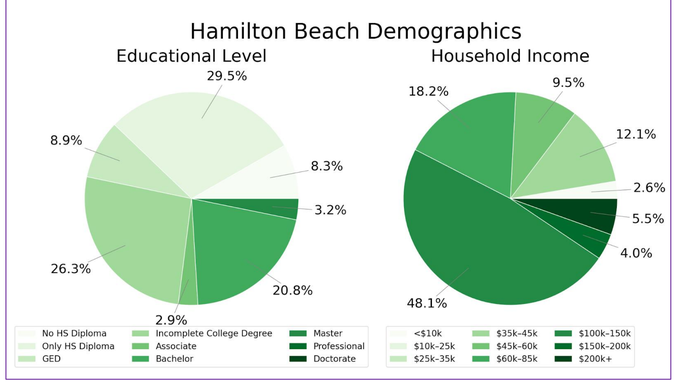
Legend:
(-----): Red Hook AOIs
(-----): Hamilton Beach AOIs
(■): Single-Family Homes
(■): FEMA 2% Annual Flood Zone
(■): FEMA .2% Annual Flood Zone
(—): Streets/Roads

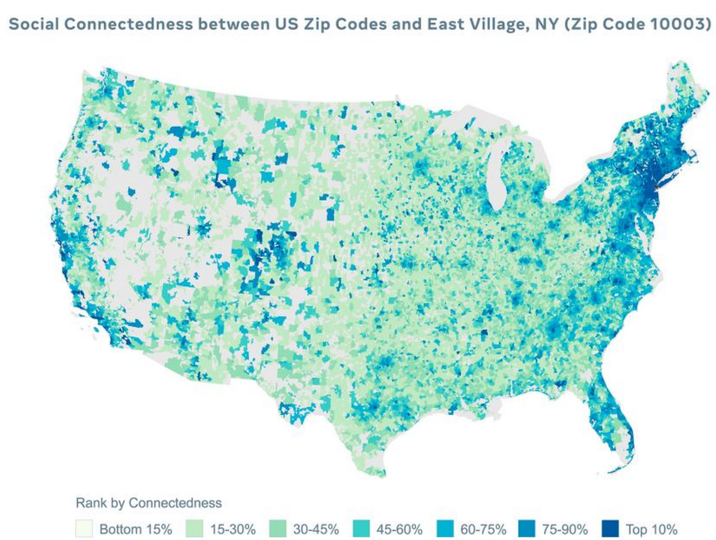
Demographic Breakdowns

Building directly on insights from qualitative interviews that reveal individual and community experiences, we can deepen our understanding through a detailed demographic analysis of the selected study areas, such that we:

- Highlight community voices by drawing on interviews that reflect lived experiences
- Deepen understanding through demographic analysis of study areas
- Examine age, race, and socioeconomic status to identify:
  - Vulnerable groups
  - Distinct social dynamics
- Recognize demographic differences to better interpret social connectivity
- Use qualitative findings to inform how social networks scale and influence resilience across regions







Social Networks

To analyze how social connections scale and evolve with population size, we use Meta's Social Connectedness Index (SCI), a measure of the likelihood that users from two locations are connected, based on internal data, such that we:

- Combine SCI with public Census data and Facebook user estimates
- Follow *Schläpfer et al.'s* methodology to estimate the power-law scaling exponent relating social connections to population across U.S. geographic scales
- Investigate how individual connectivity rates scale with population
- Provide insights into how social behavior interacts with built environments and natural hazards
- Support understanding of community resilience and recovery dynamics

References

[1] Kleiber, M. (1947). Body size and metabolic rate. *Physiological Reviews*, **27**(4), 511–541.

[2] Pérez-García, F., Etcheverry, M., & Muñoz, V. (2020). Emergence of collective phenomena in urban mobility. *Nature Physics*, **16**(12), 1232–1237.

[3] Schläpfer, M., Bettencourt, L. M. A., Grauwin, S., Raschke, M., Claxton, R., Smoreda, Z., West, G. B., & Ratti, C. (2014). The scaling of human interactions with city size. *Journal of the Royal Society Interface*, **11**(98), 20130789. https://doi.org/10.1098/rsif.2013.0789

[4] Kaplan, J., McCandlish, S. R., & Amodei, D. (2020). Scaling laws for neural language models. *arXiv preprint*, arXiv:2001.08361. https://arxiv.org/abs/2001.08361

[5] Facebook Data for Good. (n.d.). *Social Connectedness Index: Methodology*. Retrieved July 2025, from https://dataforgood.facebook.com/dfg/tools/social-connectedness-index#methodology