

# Distributive Equity in Flood Mitigation Spending by the Federal Emergency Management Agency: A Two-Decade Evaluation

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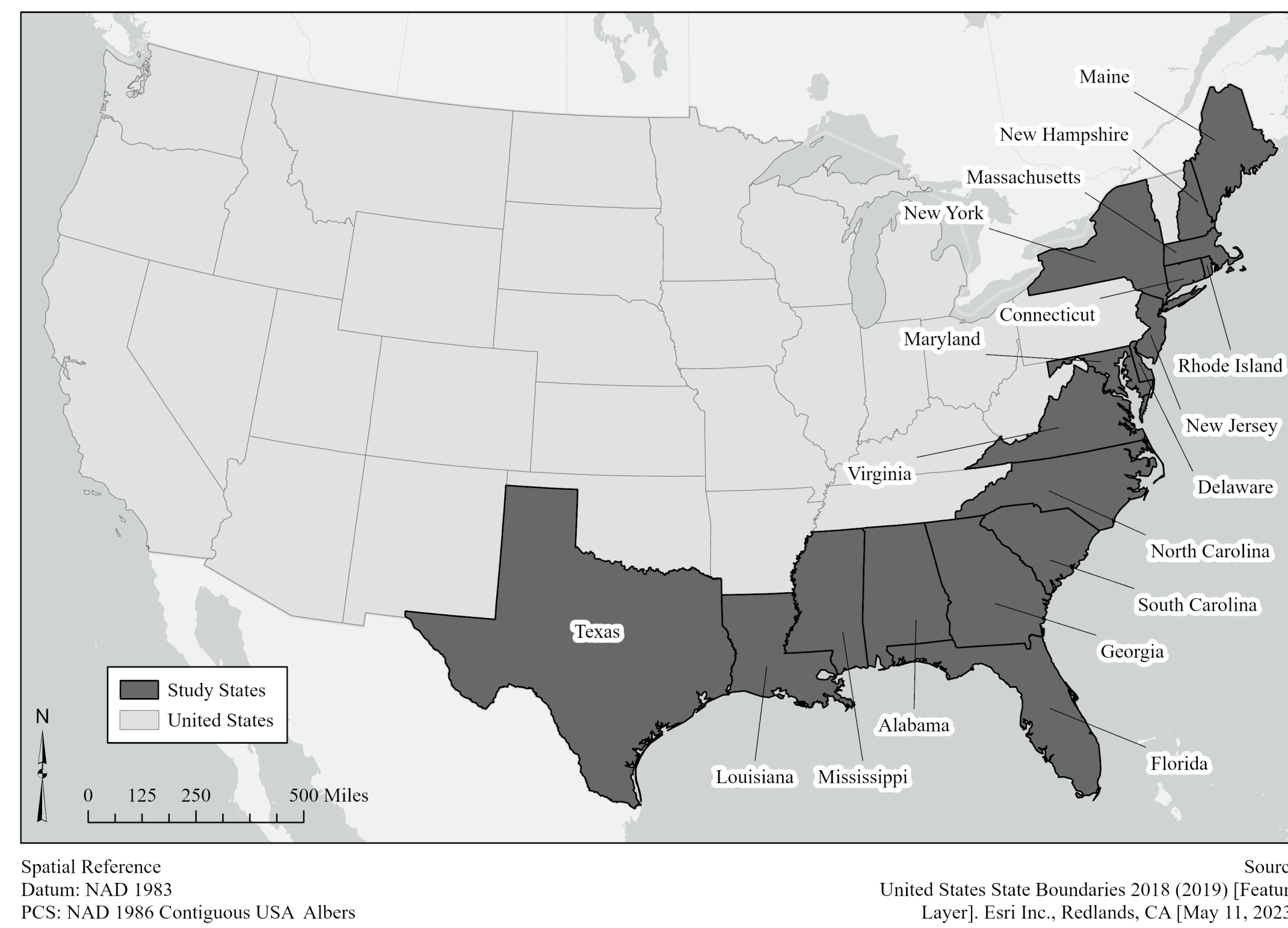
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## Introduction

Flood losses, and exposure continue to rise due to rapid population growth and accelerated development in flood-prone regions, particularly in low-lying coastal communities<sup>1,2</sup>. Mitigation activities can reduce or eliminate flood exposure, and mitigation spending must be equitably distributed to achieve fairness. Yet, mitigation funding programs sometimes increase social inequality<sup>3,4,5</sup>, as areas with higher percentages of affluent people and non-minority residents have been prioritized for hazard protection by governments<sup>6</sup>.

Distributive equity is the central question of this poster. We explore the patterns in the timeline and amount of the Hazard Mitigation Assistance (HMA) program funds administered by the Federal Emergency Management Agency (FEMA). We also use OLS regression models to investigate how federal flood mitigation funds are allocated based on the percentage of vulnerable people in floodplains while controlling for flood severity and flood mitigation project characteristics.

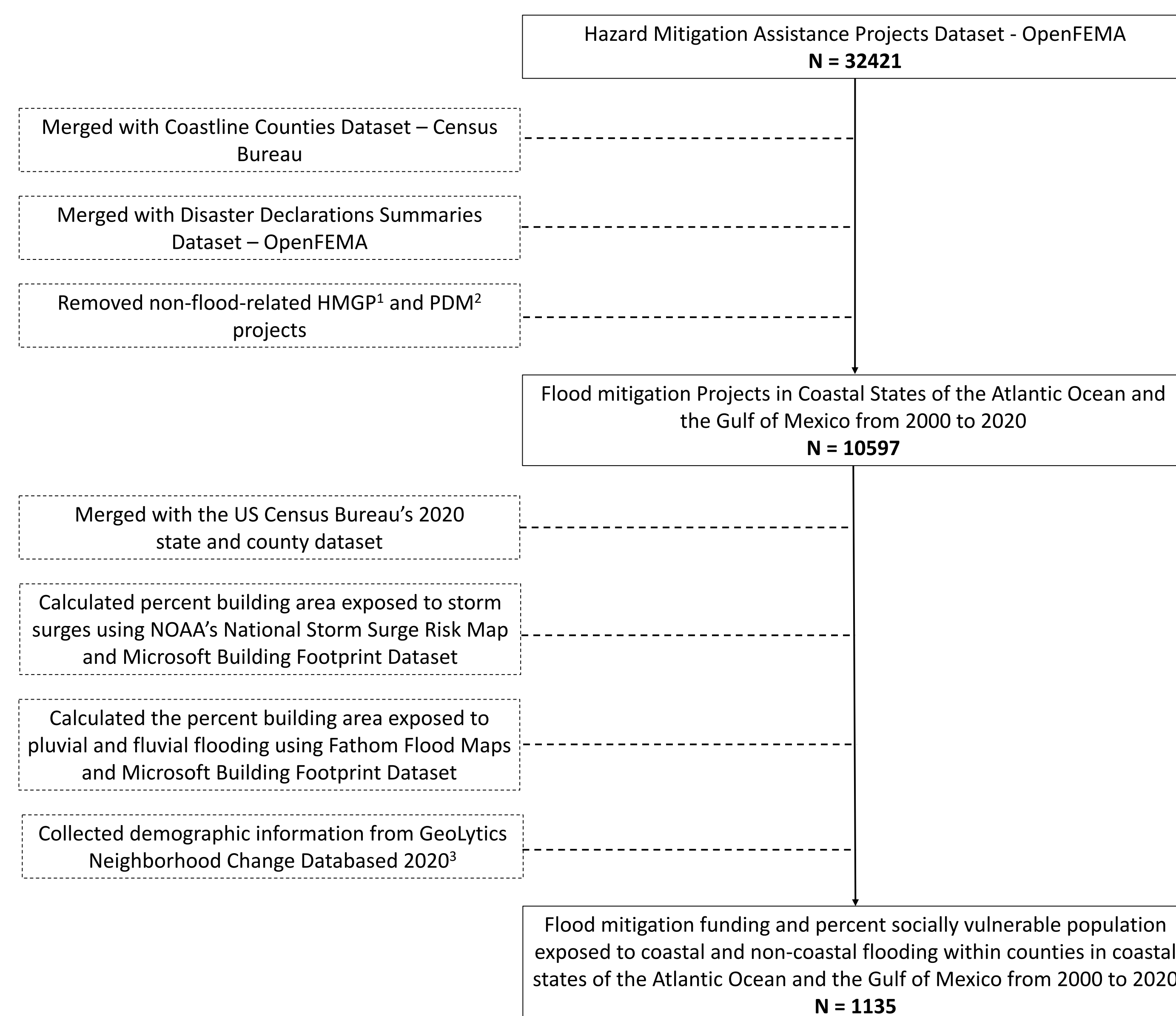
## Geographic Scope of the Analysis



The geographic scope of the analysis is the counties of the Atlantic Ocean and the Gulf of Mexico's coastal states.

## Data Processing

This flow chart shows the steps we took to systematically clean our data.

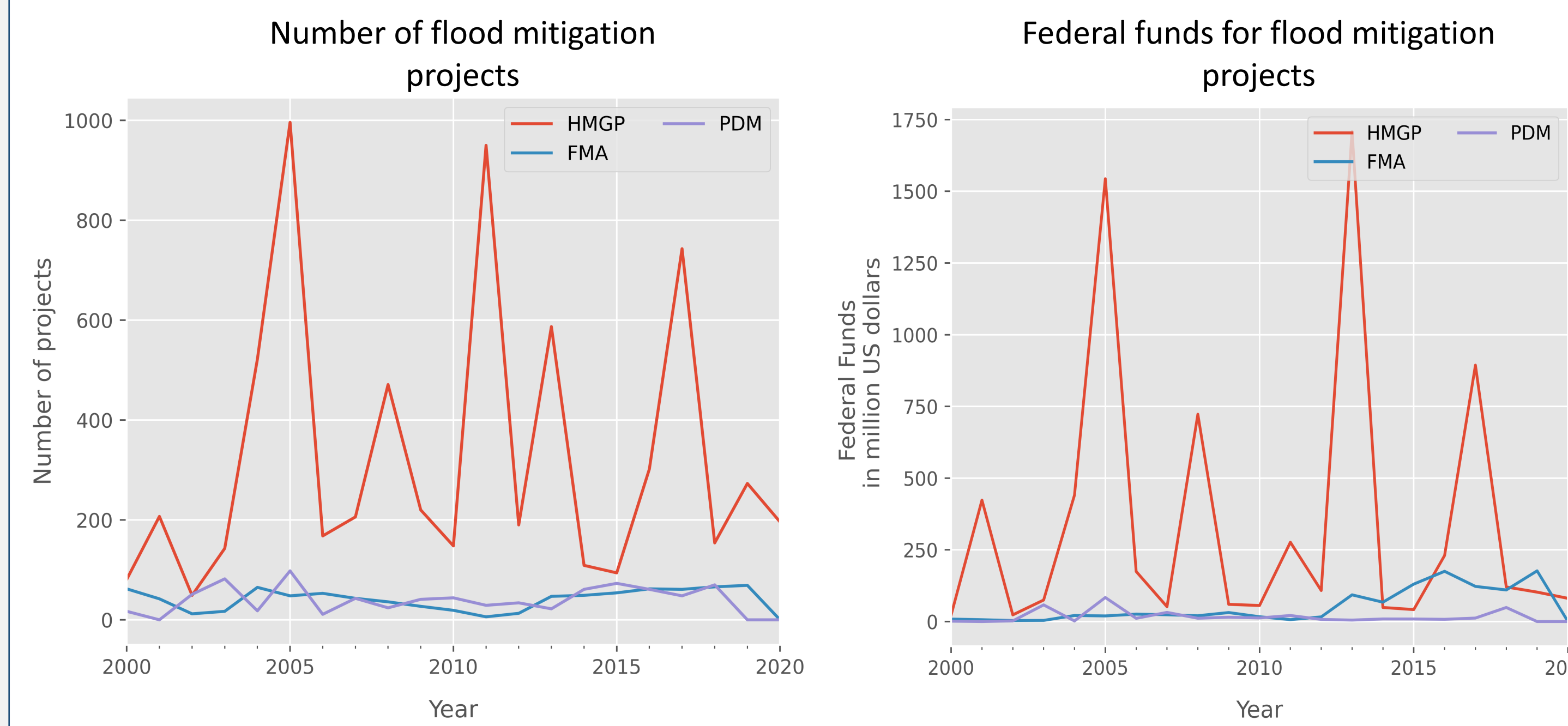


<sup>1</sup> Non-flood-related HMGP projects are tied to the following incidents: tsunami, human cause, terrorist, toxic substances, freezing, volcano, mud/landslide, severe ice storm, tornado, fire, biological, chemical, snow, dam break, earthquake, drought, and fishing losses  
<sup>2</sup> Non-flood-related PDM projects are acquisition of private real property due to landslides and structural retrofitting or rehabilitating public structures due to seismic  
<sup>3</sup> Collected demographic information: Total population, White alone, Black alone, other race alone, Hispanic/Latino, total persons below the poverty last year, and median household income last year, renters

## Trends and Patterns in the Hazard Mitigation Assistance Program

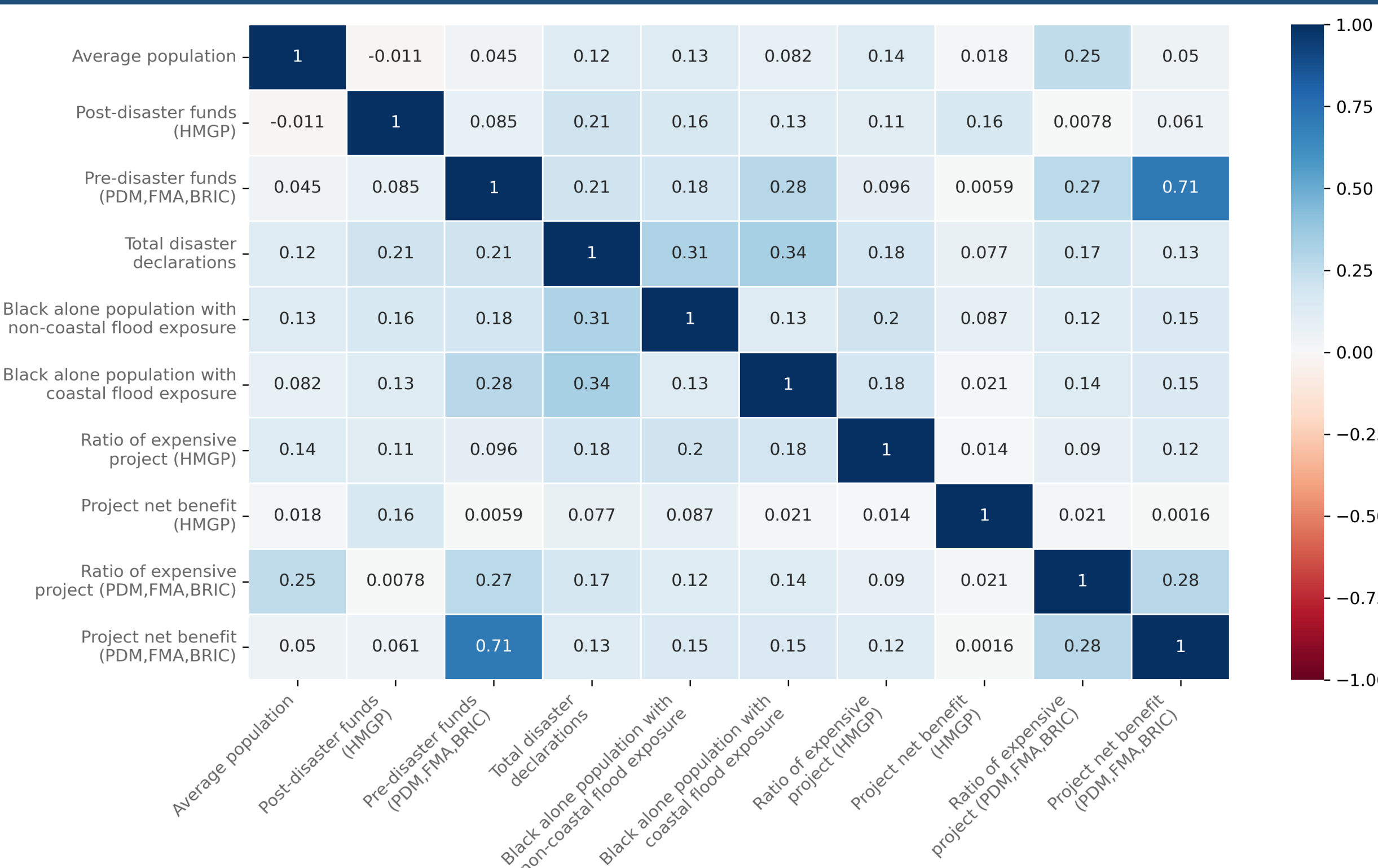
In the United States, a considerable proportion of flood mitigation programs are funded by FEMA through three Hazard Mitigation Assistance grant programs:

- The Pre-Disaster Mitigation (PDM) program (discontinued)
- The Flood Mitigation Assistance (FMA) program
- The Hazard Mitigation Grant Program (HMGP)<sup>7</sup>



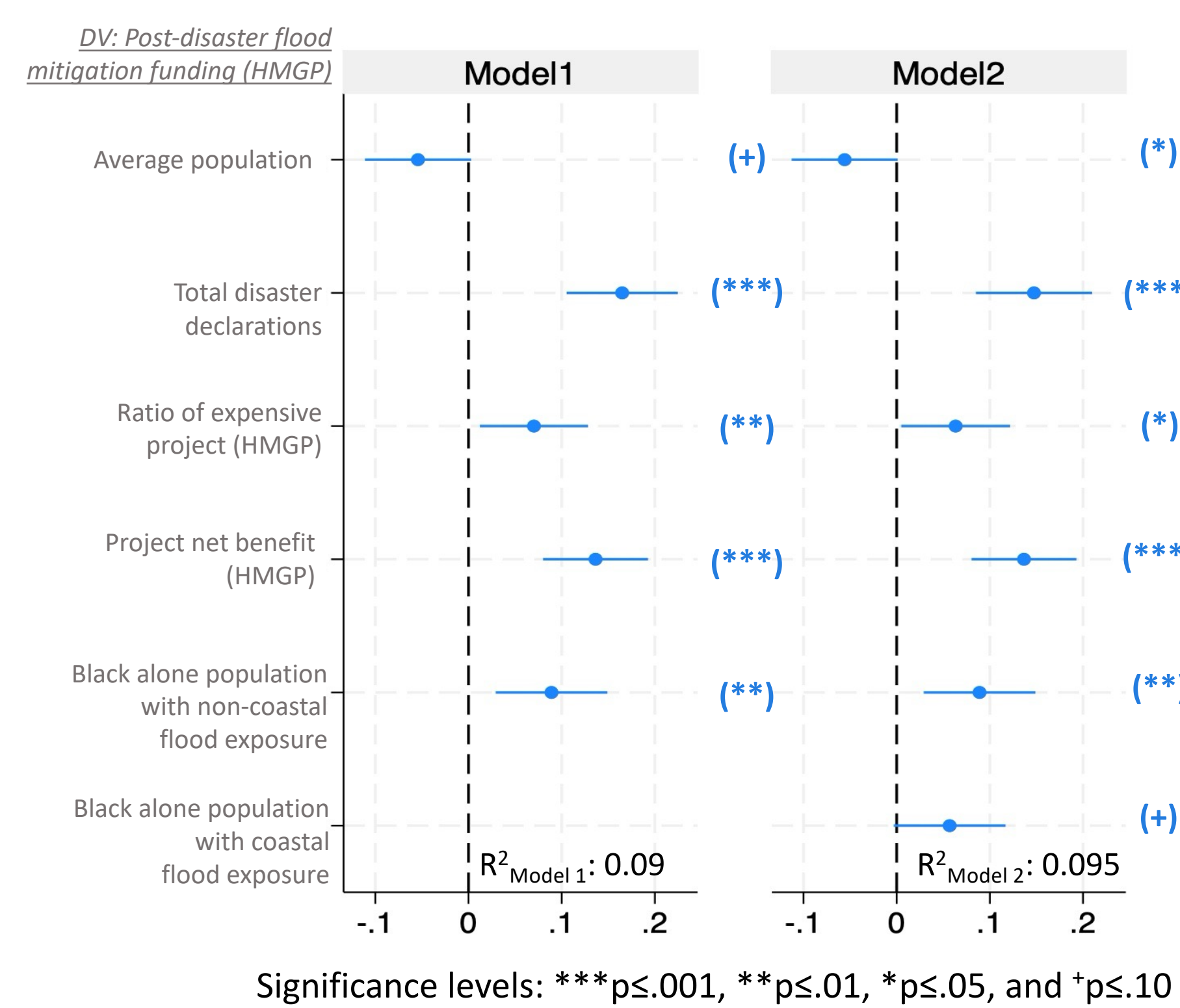
The Hazard Mitigation Grant Program accounts for 80% of flood mitigation projects and 82% of flood mitigation funds over two decades.

## Pearson Correlations Across County Characteristics and Mitigation Funds



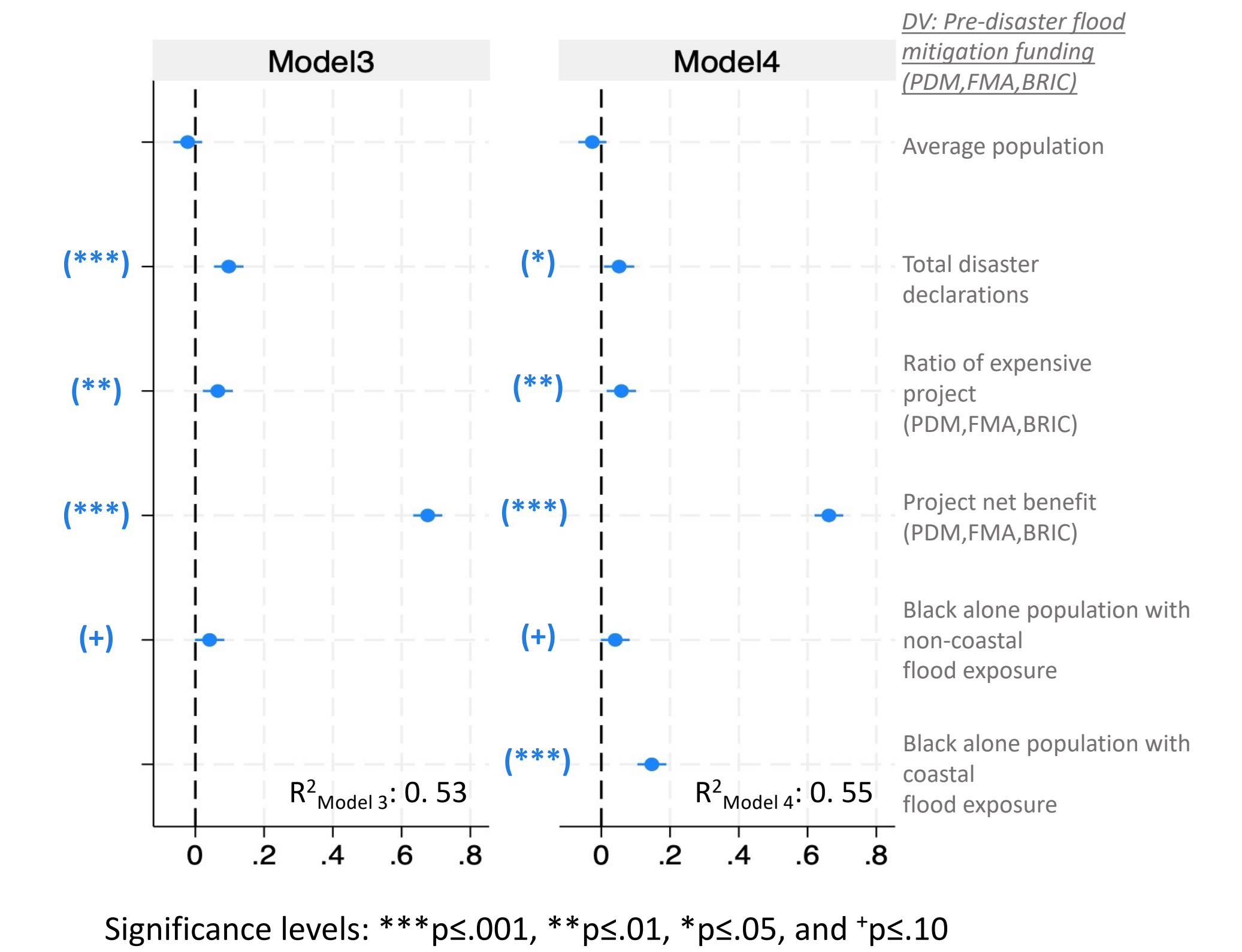
- Ratio of expensive projects is correlated with population and project benefits.
- Amount of HMGP funds is correlated with number of disaster declarations.
- Strongest correlations are between project benefits and pre-disaster mitigation funds.

## Distributive Equity in Post-Disaster Flood Mitigation Spending



- In both models, counties with a higher number of disaster declarations, received more HMGP funding.
- Counties with higher percentage of Black population exposed to flooding (coastal and non-coastal), received more HMGP funding. This might reflect the efforts in addressing environmental justice concerns.

## Distributive Equity in Pre-Disaster Flood Mitigation Spending



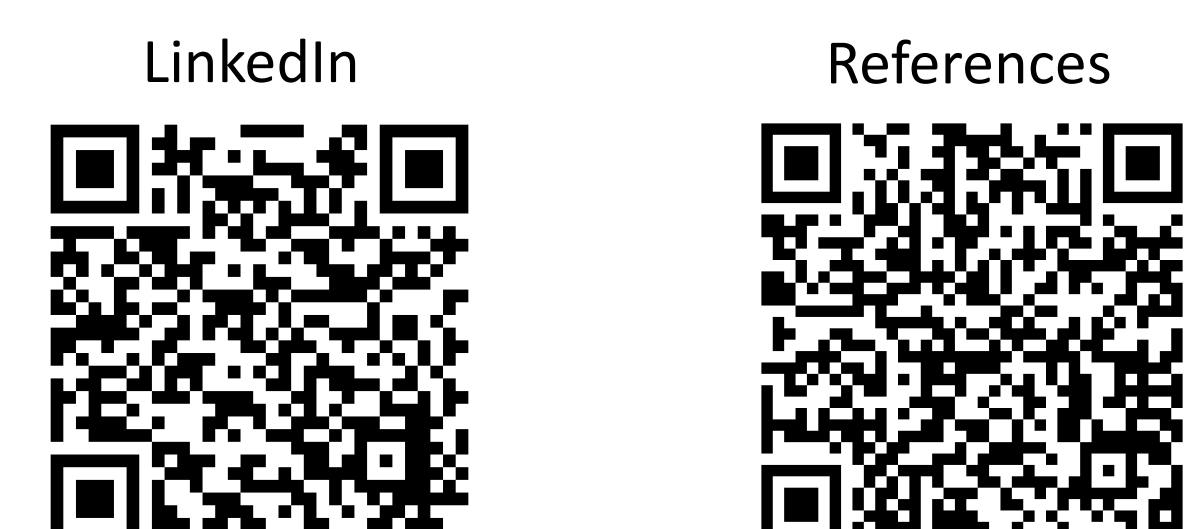
- Both models show that counties with more disaster declarations also received more pre-disaster flood mitigation funding.
- Compared to HMGP funding, a stronger effect emerged between the percentage of Black population exposed to coastal flooding and receiving more pre-disaster HMA funding.
- Though the effect was weaker compared to models 1 and 2, counties with higher percentage of Black population with non-coastal flood exposure received more pre-disaster funding.

## Conclusion

- From the descriptive analysis of the Hazard Mitigation Assistance program funds over two-decade, we observed that on average, the HMA program is allocating \$254 million each year to flood mitigation projects **after disasters rather than before**. The reactive approach to hazard mitigation limits the ability of local communities to use these mitigation resources effectively and the benefits of federal hazard mitigation assistance.
- Federal flood mitigation programs can promote distributive equity by prioritizing areas with high flood exposure and social vulnerability. Race (among other) is one example of social vulnerability characteristic associated with more harm and losses following a disaster<sup>8</sup>. OLS regression analysis suggests HMA's pre- and post-disaster flood mitigation funds are directed towards areas with greater flood exposure and social vulnerability (considering exposure of non-Hispanic Black population only). This allocation reflects a commitment to distributive equity.
- However, for a more comprehensive understanding of disparities in federal flood mitigation spending, we must consider a broader range of social vulnerability characteristics and examine how they intersect and compound, creating unique vulnerabilities for different populations.

## Acknowledgement

- This study was funded by the Mitigation Matters Research Award program, based on work supported by the Federal Emergency Management Agency through supplemental funding to the National Science Foundation (NSF Award #1635593), as well as the NSF Grant No. 1534976.
- Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of FEMA, NSF, or the Natural Hazards Center.



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