Analyzing Managed Retreat Needs and Constraints: Insights from Historical MR Programs and FEMA Datasets

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Problem Statement

Climate change is intensifying flood risks, and traditional protective measures are proving insufficient for long-term resilience. Managed retreat (MR) presents a potential solution but is often applied reactively and without meaningful community engagement. There is an urgent need for decision-support tools that facilitate proactive, equitable, and context-specific MR planning.

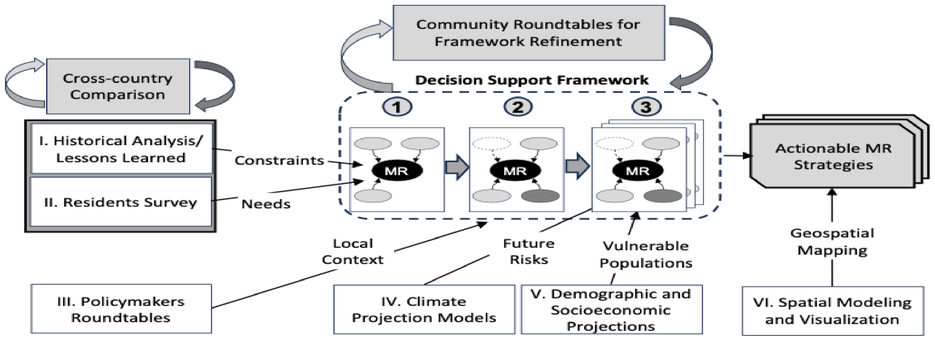


Figure 1: Proposed decision support framework for managed retreat

Background

Floods are among the most destructive and deadly natural hazards in the U.S., causing more fatalities than tornadoes and wildfires combined. Since 2001, floods have caused over 7,000 deaths, including 319 in 2024 alone. Despite improvements in forecasting, flood impacts continue to grow due to urban development and climate change. They account for 7.4% of total disaster losses since 1980, with damages exceeding $1 trillion and individual events costing up to $4.3 billion.

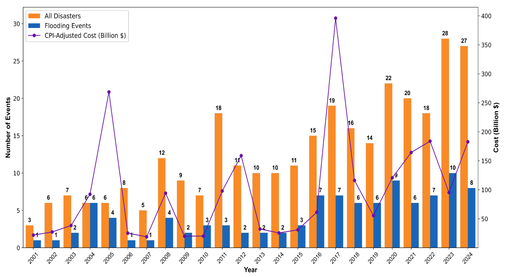


Figure 2: Billion Dollar Events to affect United States

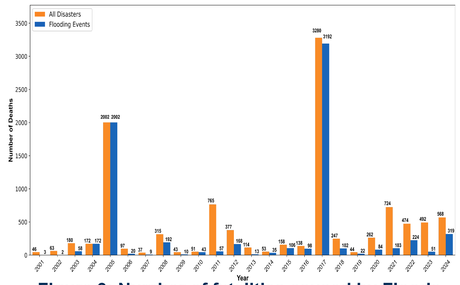


Figure 3: Number of fatalities caused by Floods

Study Objective

The objective of this research is to develop an equity-centered and community-informed framework that supports the use of managed retreat as a proactive strategy for reducing flood risks in vulnerable areas, particularly those affected by flooding, sea level rise and recurrent climate hazards. The project aims to shift retreat from a reactive, last-resort measure to a just and strategic adaptation tool that enhances long-term resilience.

Managed Retreat

Managed retreat (Figure 4) is strategic relocation of people and assets away from vulnerable areas to reduce risk from climate-related hazards and allow natural processes to occur. It includes strategies such as community resettlement, property buyouts, land conservation, rebuilding setbacks, infrastructure removal or relocation, and ecosystem restoration.

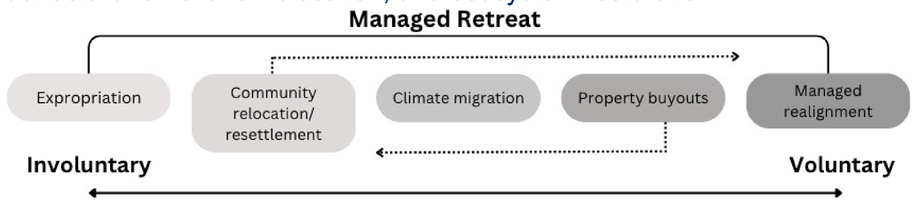


Figure 4: Managed retreat as a concept encompasses a range of tools from involuntary to voluntary

Managed Retreat in US

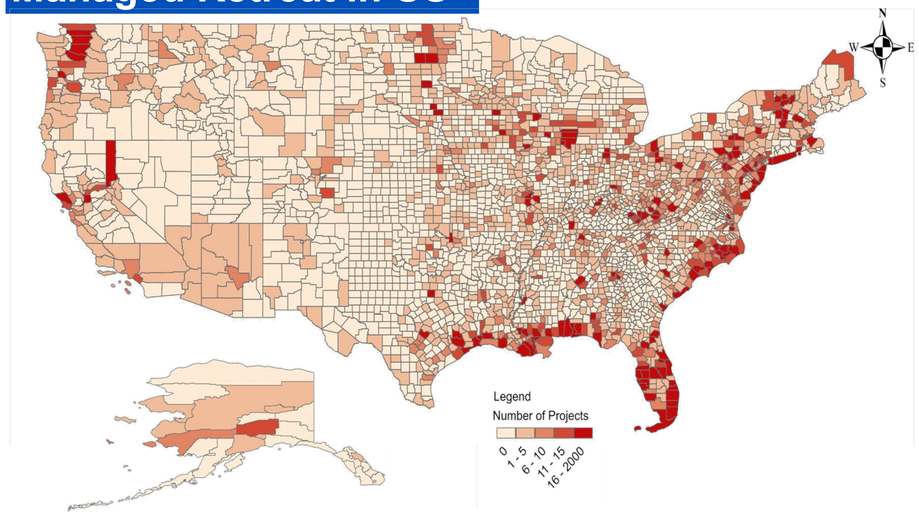


Figure 5: Buyouts of flood-prone properties across the United States. The number of FEMA-funded voluntary property buyouts in each county is shown for program years 1989–2025 (as cumulative no. of bought-out properties).

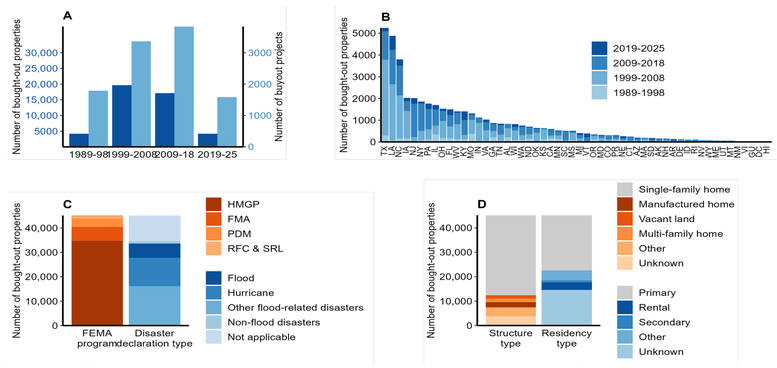


Figure 6: Trends in FEMA-funded buyouts of flood-prone properties, 1989–2025. (A) Buyout properties and projects by decade. (B) Properties bought out across U.S. states and territories by decade. (C) Buyout properties by FEMA grant program and disaster type. (D) Structure and residency types of bought-out properties (where specified).

Future Steps

The next steps in this research are to engage local stakeholders, including emergency managers, planners, community groups, to conduct semi-structured interviews to gather qualitative insights on MR implementation, funding, and community impacts. Findings will be used to refine the framework for optimal utility by real communities.

Acknowledgements

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