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Article

Beyond the Seawall: Social Capital and Resilience Grants in Massachusetts Coastal Towns

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Abstract: As climate change intensifies, governments fund risk mitigation and recovery in vulnerable coastal communities. This study investigates the factors influencing grant acquisition using an original dataset of nearly 60 Massachusetts coastal towns, supplemented by 10 in-depth interviews with stakeholders in the field. Employing a mixed-methods approach, combining quantitative regression analysis and qualitative insights, we examine correlations with state-level climate grant activity. Controlling for geographic, demographic, bonding social capital, and voter turnout variables, our regression analysis reveals two significant predictors of grant acquisition: the demographic makeup of the community and bridging social capital. These findings suggest that having a greater proportion of minority population as well reduced access to external resources drive grant allocations. This research offers actionable recommendations for local communities, NGOs, and policymakers seeking to engage with residents facing the consequences of climate change.

Keywords: Vulnerability; Resilience; Coastal Community; Social Capital; Mixed Methods

1. Introduction

On January 4, 2018, Winter Storm Grayson arrived in New England with near hurricane force winds. Around the midday high tide, a massive coastal surge breached a seawall along Oceanside Drive in Scituate, collapsing part of it. Frigid water flowed through the streets, turning them into rivers that carried large chunks of ice, washing away a dumpster. The entire downtown and harbor areas became impassable. As water levels trapped people in their homes, the National Guard used high water rescue vehicles to extricate 20 people [1]. Similar scenes occurred in towns up and down the Massachusetts coast, as at least 26 towns reported coastal flooding [2]. Homes flooded and cars were trapped in ice, leading first responders to rescue people from cars and homes using boats and large trucks.

Massachusetts is no stranger to severe winter weather, but this storm was exceptional. A near-full moon and strong onshore winds caused record-breaking tides. In Boston, the water level surpassed the legendary Blizzard of ’78, setting a new high since measurements began in 1921. For many longtime coastal residents, it was unlike anything they had experienced [3]. As coastal communities in Massachusetts and around the world face increasingly frequent and intense meteorological hazards, the question of how they prepare and adapt is more urgent than ever.

In response to growing climate risks, Governor Charlie Baker launched the Massachusetts Municipal Vulnerability Preparedness (MVP) program in 2017. Administered by the Executive Office of Energy and Environmental Affairs, MVP provides funding and technical assistance to cities and towns to assess their climate vulnerabilities and develop resilience plans. The program operates in two phases: first, municipalities apply for funding to conduct community workshops and produce vulnerability assessments. Once certified, they become eligible for MVP Action Grants, which fund infrastructure improvements and other adaptation measures. The MVP program is also meant to be leveraged by communities when applying to other local, state, and national resiliency grants. Interviewees reported that being "MVP certified" was useful in applying for other grants as well, as it let communities identify their needs and signaled credibility to local, state, and federal agencies.

However, access to state level funding is uneven across coastal communities. The number of awarded grants vary across communities, with some towns and cities receiving no funding for coastal flood mitigation planning and others receiving more than a dozen grants. As one interviewee noted about the MVP in particular, "The MVP grant program is competitive and not all communities and non-profit organizations that apply are selected for an award…proposals that build on previous work do tend to be successful." This raises critical questions about equity and capacity: why do some vulnerable communities succeed in securing resilience funding while others do not?

This paper explores the factors that make it more or less likely for coastal Massachusetts communities to receive state-level climate resiliency grants, with a qualitative focus on the MVP Ideally, the most vulnerable towns, especially those with fewer financial resources and weaker institutional networks, would be prioritized for support. Yet existing research shows that politics, not need, often shapes disaster preparation and recovery [4]. Our study investigates whether this dynamic also applies to proactive climate adaptation funding.

This article contributes to our existing knowledge about climate change mitigation and disaster response in several ways. It is the first article, to our knowledge, to quantitatively analyze the factors correlating with greater grant acquisition among vulnerable, coastal communities in Massachusetts. Other papers have looked at grants for other threats and hazards such as fires in communities [5]. We build on scholarship on grant-winning at the local, regional, and state levels which has investigated parallel issues such as hazard mitigation grants [6] and climate change investments [7]. Like communities along the United States Gulf Coast, coastal Massachusetts localities face regular extreme weather events and decision makers have invested in disaster risk reduction (DRR) programs to help build resilience in the region. This research focuses on Massachusetts as it is an underexplored region in the literature. As the United States and countries around the world move into the Anthropocene era with the state and many cities of Massachusetts at the forefront of climate impact [8], these findings can encourage other scholars to tackle this question of funding availability for cities, towns, and villages.

Next, our article draws on both quantitative and qualitative data to investigate the factors that contribute to grants distribution, and the extent to which social capital matters for funding allocations. We conducted an archival review of publicly available documentation on the MVP grant – including foundational and policy documents, community planning and action grant reports, and public outreach materials – as well as in-depth interviews with stakeholders to gain a deeper contextual understanding of the grant application and implementation process. Our regression analysis sheds light on the factors that are significantly correlated with grant distribution at the town level. Finally, this paper investigates the role of social infrastructure and social capital, using well tested measures to capture the degree to which these towns and cities are vertically and horizontally networked [9]. In doing so, we recognize that policy outcomes are influenced not only by characteristics of leaders but also by the information and resources from networked connections and institutions [10].

2. The Massachusetts Municipal Vulnerability Preparedness Program

The Massachusetts Municipal Vulnerability Preparedness (MVP) program stands out among state-level climate adaptation initiatives for its emphasis on community-driven resilience building. Launched in 2017 by the Executive Office of Energy and Environmental Affairs, the MVP provides funding and guidance to municipalities to assess climate vulnerabilities and implement adaptation strategies. The program prioritizes projects that advance nature-based solutions, incorporate climate data to develop proactive adaptation strategies, and provide broad public benefits through outreach and education. In addition, grant selection explicitly emphasizes increasing equitable outcomes by targeting Environmental Justice populations, integrating considerations of social vulnerability into project design and implementation [11]. A cornerstone of the program is its participatory framework, which actively involves local stakeholders in identifying risks and developing solutions.

Central to MVP's approach is the Community Resilience Building (CRB) workshop model, which convenes diverse groups to assess localities' biggest hazards, vulnerabilities, and strengths. The community workshop is not only encouraged, but a required step for localities to be eligible for project funding, called MVP Action Grants. These workshops often involve town officials, residents, business leaders, and community organizations. For instance, the town of Essex completed an MVP community workshop in 2018, which convened a diverse group of stakeholders, including representatives from a large national conservation non-profit, a local civil society organization, and local businesses operating in transportation, tourism, and hospitality [12]. Similarly, Plymouth's "Climate-Ready, Healthy Plymouth" initiative engaged residents, businesses, and civic groups through public fora and focus groups to inform their climate and health vulnerability assessment. The inclusion of diverse stakeholders allows for a comprehensive needs and vulnerabilities assessment. Among the vulnerabilities identified in Plymouth were social isolation, especially among the older population, and obstacles to communication during disasters [13]. Across towns, workshops are often held in community spaces, like schools, libraries, city halls, community centers, local museums, and historic venues.

Our review of MVP Action Grant reports indicates that public outreach and community engagement are integral components during the project stage. Funds have been used for educational activities, curriculum development, public art exhibits, and festivals, among other initiatives. For instance, the "Wicked Hot Mystic" project in Arlington included community workshops and educational materials to raise awareness about urban heat islands and climate resilience. Moreover, many infrastructure projects financed by MVP grants encompass elements of what scholars refer to as social infrastructure [14]. These projects often include the development or enhancement of community and recreational spaces such as parks, trails, playgrounds, and marinas. For example, the Mill Brook Corridor Improvements in Arlington involved environmental enhancements like invasive plant removal and improved public access, aligning with the town's resilience goals. Additionally, projects like the Lower Shawsheen Soccer Field flood resilience design in Andover not only address flood mitigation but also aim to enhance community recreational spaces.

Local governments, which tend to have fewer resources, often prioritize short term activities like clean-up and rebuilding after extreme weather events [15]. The MVP program looks to provide this funding before a coastal flood or other hazard event occurs. By institutionalizing participatory practices and centering social infrastructure, the MVP program not only addresses physical infrastructure vulnerabilities but also strengthens the social fabric essential for effective climate resilience.

3. Materials and Methods

3.1. Variables and Data

Our review of the literature and interviews with city resilience and planning officials helped us generate broad categories of factors that may influence the likelihood of communities getting municipal vulnerability preparedness grants. This section reviews how community and social resources, geography, and demographics might affect the likelihood of communities receiving grants.

Community resources

We are primarily interested in how grant distribution correlates with aspects of community-level resources that are thought to promote community resilience to natural hazards. We distinguish this category from elements of socioeconomic resilience, like median income and levels of education in a community.

Theory and empirical research show that communities with strong social capital - social networks, trust, and habits of civic engagement and cooperation - are more resilient to shocks. Social ties – different types of connections we have with other people – and social networks – the collection of these ties – are an important source of community resilience. Social ties have helped individuals during disasters by providing them with information on direct assistance in evacuation [16]. Social ties have also been found to improve community resilience by helping people return and rebuild after disasters [17-19].

Bonding social capital captures the connections among individuals who are similar and emotionally close, such as dear friends or family. These relationships are usually the first line of defense against shocks like environmental disasters [20] but may also fail to provide people with needed resources, as they are between homophilous individuals. Bonding ties may push a community to engage in grant seeking behavior more actively or, if many influencers in the area are against the idea, to do less. The correlation between bonding ties and grant seeking is unclear. Bridging social capital comprises horizontal ties among individuals across groups, like race, socioeconomic class, or ethnicity. Such connections often come through institutions such as clubs, schools, and workplaces [21] and are especially important for promoting civic engagement [20, 22]. Linking social capital instead captures relationships between residents and those with power and authority [23]. Relationships between residents and institutional actors, and between government officials at different levels of governance, can help secure aid for infrastructure because capacity, coordination, and communication are all needed to navigate complex governance systems [24-25]. Scholars have pointed out that it is crucial for local government officials to have resident input and understanding for defensive projects like seawalls [15]. We would expect higher levels of vertical ties to correlate positively with grant seeking.

This article's social capital indices employ the composite measures developed by Kyne and Aldrich [9], which can be constructed based on publicly available data in the continental United States. Bonding social capital is calculated based on attributes linked to homogeneity (e.g.: in race, ethnicity, income, education), communication capacity, language competencies, and the share of nonelderly members in a community. Bridging social capital is captured through the presence of, and community membership in, various civic organizations including religious organizations, charitable organizations, fraternal orders, and labor unions. Linking social capital is captured through indicators of linkages between citizens and their local, state, and federal government, as well as residents' participation in political activities, including political rallies, speeches, or organized protest. For each index, values can theoretically be anywhere between 0 and 1 (Table 1 below shows the actual minima and maxima for each index in our dataset). We used existing indices from early Social Capital Index (SoCI) work [9], engaging a commercial GIS platform to demarcate disaggregated US 2020 Census data from 2020 for each town.

Physical attributes

We control our analysis for several geographic and demographic factors that have been shown to significantly influence the distribution of climate resilience grants. Physical exposure to natural hazards has been found to drive overall risk and resilience to natural hazards [26-27] as well as grant distribution [28]. The proportion of a community's population that is exposed to flooding could influence how much a municipality will prioritize preparing, responding to, and responding to extreme weather events. A 2011 study of environmental justice movements in East Boston and Everett, for example, found that residents factored the threat of total loss of their homes and communities when establishing their preferences for climate adaptation measures [29]. Another study examining participation in the Cities for Climate Protection campaign found that cities with greater projected vulnerability to extreme weather events were more likely to take part in the campaign [30]. We capture physical exposure by measuring the share of a town's population exposed to flooding [27]. Using a commercial GIS platform and US Census data from 2020, we selected census blocks that fell wholly or partially within a NOAA hurricane inundation zone for each town and then calculated the ratio of the exposed population to the town's total population.

We also control the physical size of each locality. Lager municipalities may benefit from a larger and more diverse pool of residents, some of whom may advocate for funding and have the skills for successful grant acquisition. Past scholarship has argued that larger organizations with higher capacity to put together specific and thorough proposals were more likely to be awarded funding [5]. Physical size may also impact how officials in charge of allocating grant money perceive a community, much like having a large population does [31]. We measure size as the land area of each locality in square miles.

A variety of demographic conditions in coastal communities may alter how they perceive the risks involved in climate change and the benefits from investing time and energy in grants to reduce vulnerability. Studies have found meaningful correlations between population size and grant outcomes, although they may be mediated by other variables, including the source of funding, physical exposure, and social vulnerability. A large panel study of 3000 US counties found that federal-level disaster aid is disproportionately distributed to more populous communities [31]. Conversely, Jocoy [32] found that very small water systems in Pennsylvania (those serving 500 or fewer) applied for, and received, state-level funding less frequently than larger systems. We capture the population size of each town in 2020.

Demographic and Socioeconomic characteristics

Next, the construct of social vulnerability has been identified in the literature as an important factor in disaster aid distribution. Social vulnerability is characterized by the how individual demographic and socioeconomic characteristics can shape resilience at the community level. A large body of research has illuminated obstacles faced by socially vulnerable groups in applying for and receiving disaster assistance, including limited knowledge and information of application processes [33, 28]. Across 3,000 US counties, Miao, Davlasheridze, and Reilly [31] found that while individual-level aid may favor counties with worse socioeconomic conditions, the opposite relationship is found when it comes to aid given to state and local governments.

Income is a key component of social vulnerability. Higher income communities have more expensive homes to protect than vulnerable, under-resourced communities and thus may more actively seek assistance with actual or potential flood problems. Moreover, in higher-income localities, residents may possess other resources, like time and knowledge, to dedicate to advocating for disaster funding. Waterfront homes are often more expensive than inland ones, creating incentives for communities with more wealth to mitigate coastal flooding. At the same time, income inequality in coastal communities can lead to both wealthier residents and those in poverty both living in affected areas [34]. Some coastal New England towns, like New Bedford, face the dual problems of overcoming decades of decline of once-prosperous industry while encountering the looming impacts of climate change [35]. We measure this feature through per capita income in each locality in 2020.

The share of residents that belong to racial minorities may also influence priorities for time and resource investment. Having higher concentrations of disadvantaged communities, including racial minorities, lower income residents, and seniors, was significantly associated with lower levels of resilience to shocks [36, 37]. The racial composition of a community may also affect the distribution of disaster aid, with studies finding that localities with greater shares of racial minorities have received lower levels of assistance [38, 31]. We measure the share of each municipality's population that identified as Black/African American, Hispanic, and of Asian descent in 2020.

Finally, education is a critical component of resilience (or vulnerability) Multiple empirical studies across diverse geographic, socioeconomic, cultural, and hazard contexts have found that formal education has a positive impact on the reduction of vulnerability to climate change [39]. Education also appears to influence disaster aid distribution [31]. Better educated populations are more likely to have the human capital and expertise to advocate for, and contribute to, grant writing. At the same time, more educated communities are also likely to benefit from higher incomes and social networks [39]. Different studies have used different educational attainment metrics. Some focus on low educational attainment (e.g.: having a high share of the adult population without a high school degree), while others examine the effects of high educational attainment. In the context of Massachusetts, where over 90 percent of the population has completed high school, we expect to find more meaningful variation in higher educational attainment. We capture education attainment through the percentage of residents who are 25 years of age or older with a bachelor's degree or higher.

3.2. Data Processing

This project gathered data on 58 Massachusetts cities and towns with open coastlines for analysis (see Figure 1). In doing so, we capture the entire universe of state-recognized coastal communities served by the Massachusetts Office of Coastal Zone Management (CZM). There are roughly 20 additional localities in Massachusetts that touch the Atlantic Ocean, yet they are located on inlets and lack fully open coastlines.

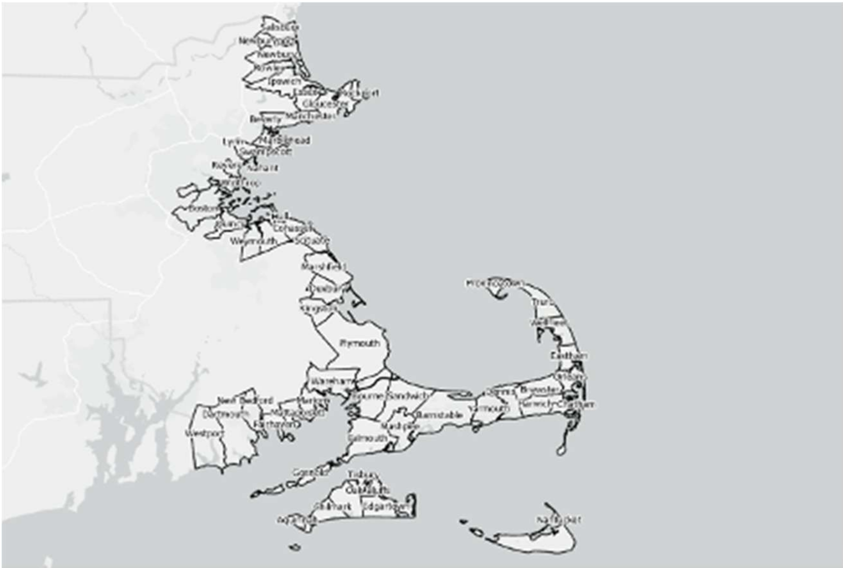

Figure 1. MA coastal communities in the dataset, Map generated by authors using GIS software.

While privacy concerns prevent us from accessing data about grant applications, state grants awarded to each town are publicly available on the Massachusetts Executive Office of Energy and Environmental Affairs website. We recorded the total number of grants and the total dollar amount from those grants received by each town between 2018 and 2024. The total amount of grant money received was only computed for grants awarded to a single town. There are several joint grants with two or more towns participating, and we were unable to estimate the proportion that went to each town.

To inform our quantitative analysis and discussion, we conducted in-depth interviews with ten city planners, resilience experts, and engineers in these coastal communities. Potential interviewees were identified through a systematic search of city government websites, where we identified the department(s) and team(s) most directly responsible for the management of coastal resilience grants. All the selected interviewees have deep experience with coastal resiliency grants, particularly the MVP. Interviews followed a semi-structured approach, where we started with a list of open-ended questions centered around core themes but allowed interviewees to introduce new lines of inquiry into the conversation. The list of questions was reviewed and exempted by the Northeastern University Institutional Review Board.

4. Results

Table 1 presents descriptive statistics for the outcome and explanatory variables. Across the 58 coastal municipalities in the sample, towns received an average of nearly five state-level climate resiliency grants, though there was considerable variation with one town receiving 0 grants, and

Boston receiving 15. Between 2018 and 2024, the average amount awarded has been $1.5 million per town, with totals varying from zero to just over $9 million.

Municipal characteristics reflect substantial heterogeneity. Land area ranges from just over one square mile to more than 100, while population size spans from fewer than 100 residents to over 675,000. These differences translate into variation in population density, from sparsely populated rural towns to dense urban centers with more than 13,000 residents per square mile. On average, about 42 percent of residents live along the coast.

Socioeconomic and demographic conditions also differ considerably. Average per capita income is $54,000, but the range extends from roughly $12,500 to nearly $180,000. Educational attainment varies as well, with the share of adults over the age of 25 who hold at least a college degree ranging from 17 to 86 percent. The population is on average predominantly white, though the shares of African American, Latino/Hispanic, and Asian residents vary across towns. The bonding social capital index ranges between 0.509 and 0.703, while bridging social capital ranges from 0.241 and 0.372, and linking social capital between 0.183 and 0.32. While these ranges are relatively small, they are in line with ranges at the county level nationwide [9].

Table 1. Descriptive Statistics.

	N	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Number of grants received	58	4.9	3.72	0	15
Cumulative $ amount of grants received	56	1,471,727	1,866,548	0	9,276,822
Land area (square miles)	58	22.5	18.1	1.25	107.8
Population density	58	1,855.2	2,815	5.21	13,512.9
Share of coastal population	58	0.4203	0.2131	0.1084	0.8926
Share African American	58	0.0257	0.0304	0.0013	0.1913
Share Latino/Hispanic	58	0.0571	0.0811	0.0149	0.44
Share Asian descent	58	0.0216	0.0421	0	0.307
Average annual income (in USD per capita)	58	54,085	28,983	12,557	179,745
Education (Share with BA or higher)	58	0.514	0.149	0.174	0.862
Bonding social capital	58	0.658	0.055	0.509	0.703
Bridging social capital	58	0.317	0.043	0.241	0.372
Linking social capital	58	0.266	0.044	0.183	0.32

Our main analysis is an OLS regression where the number of grants received is the dependent variable (Table 2). We tested for multicollinearity among predictors. Pearson correlation coefficients revealed high and statistically significant correlations between population density and the share of black residents in a town, as well as the level of bonding social capital. Variance inflation factors were moderate (mean VIF = 2.67, max = 7.01 for population density), suggesting no severe multicollinearity. Because population density had a moderate VIF we re-estimated the models excluding this variable.

To evaluate the potential influence of outliers, we employed interquartile range (IQR)-based outlier detection. For each continuous variable – geography, demographics, income, education, and three dimensions of social capital – we calculated the 25th and 75th percentiles, the IQR, and flagged observations falling more than 1.5×IQR outside this range. Towns with at least one such extreme value were classified as outliers. We also compared our model to a robust model, which downweighs influential observations, and one where towns classified as outliers were dropped from the analysis (Appendix Table 3). Bridging social capital was the only variable that remained significant across all three models. As an additional robustness check, we ran a model with the total dollar amount of grants received as the outcome (Appendix Table 4). The same variables that were significantly associated with the number of grants awarded were significantly associated with the total awarded amount in USD.

Table 2. Estimated Regression Coefficients for Number of Grants Awarded.

Outcome = Number of grants awarded	**Unstandardized Coefficients**	**Standardized Coefficients**	**Standard Errors**
Land Area (square miles)	0.031	0.149	(0.029)
Share of coastal population	0.028	0.174	(2.204)
Share of African American / Black residents	40.34*	0.329*	(20.36)
Share of Hispanic residents	11.32	0.246	(8.446)
Share of residents of Asian descent	-9.32	-0.10.5	(11.21)
Per capita income	0.000	-0.091	(0.000)
Educational attainment	1.32	0.052	(4.859)
Bonding social capital	-1.789	-0.026	(9.66)
Bridging social capital	-24.39**	-0.28**	(11.24)
Linking social capital	-2.42	-0.074	(4.28)
Constant	12.32		(8.48)
Observations		58	
R^2		0.40	
P-value		0.0038	

Our regression demonstrated a good fit to the data. The p-value (Prob > F) is 0.0038, suggesting that the model is statistically significant. The R^2 value of 0.40 indicates that the model explained approximately 40 percent of the variance in the dependent variable. Diagnostic tests provided no evidence of heteroskedasticity or serious departures from normality: both the Breusch–Pagan / Cook–Weisberg test and White's IM-test failed to reject the null of constant variance, and the Cameron–Trivedi decomposition indicated no significant skewness or excess kurtosis. The residuals were approximately bell-shaped and centered near zero, suggesting no major systematic bias. However, the distribution displayed a modest right skew, driven by a small number of high-grant towns where the model underpredicted outcomes, indicating some influential observations. While these diagnostics supported the use of OLS inference, the mild skewness underscored the need for caution given the small sample size and potential sensitivity to influential cases.

Two variables were significantly associated with the number of grants a town receives. The share of African American/Black residents also showed a strong positive association: a one-unit increase corresponded to roughly 40.34 more grants awarded. By contrast, bridging social capital was negatively related to the outcome, with each unit increase associated with about 24.39 fewer grants.

Standardized coefficients (β) indicated that the share of African American/Black residents exerted the largest effect among the predictors ($\beta = 0.329$, $p < 0.05$), followed by bridging social capital ($\beta = -0.28$, $p < 0.01$) and the share of coastal population ($\beta = 0.174$, $p < 0.05$). Other variables, including land area, per capita income, educational attainment, and other measures of social capital, did not exhibit statistically significant effects in this model.

Overall, the results suggested that demographic factors and bridging social capital influenced grant allocation patterns across towns. On the other hand, bonding and linking capital, physical size, and socioeconomic aspects, though some exhibit large effects, were not statistically significant.

5. Discussion

The results suggest that state grant allocations are shaped less by general municipal capacity or affluence than by specific demographic and social characteristics that align with the program's stated equity and resilience priorities. Most notably, the strong positive association between the share of African American/Black residents and the number of grants awarded is consistent with MVP's explicit emphasis on advancing equitable outcomes for Environmental Justice (EJ) populations. Much research has shown that in the United States communities of color bear a disproportionate burden of environmental hazards (such as PCB smelters, waste dumps, and other often unwanted facilities). Because race is formally embedded in Massachusetts' EJ designation criteria, towns with larger black populations may be more likely to propose projects that qualify as serving EJ communities, or to be evaluated favorably under equity-focused scoring criteria.

When population density is introduced into the model (Appendix table A5), the estimated effect of the share of African American/Black residents becomes statistically insignificant, while coastal exposure and bonding social capital emerge as significant predictors alongside bridging social capital. This pattern suggests that the initially strong association between racial composition and grant allocation may partly reflect correlated structural characteristics of municipalities, most notably demographic composition, population density, and coastal exposure, rather than a direct effect of racial composition. Population density, coastal exposure, and social capital are closely intertwined in Massachusetts, and the elevated variance inflation factor for population density indicates potential multicollinearity that complicates the interpretation of individual coefficients.

Surprisingly, bridging social capital is negatively associated with grant distribution. Across model specifications, we found that higher levels of bridging social capital were associated with fewer grants received. Theoretically, communities with robust horizontal ties through civic organizations, religious associations, or unions are often seen as better equipped to organize collectively, disseminate information, and mobilize for funding opportunities. We would expect such communities to secure more grants, not fewer. However, since our data reflect grant distribution and not applications, we cannot determine whether this pattern reflects fewer applications or a higher rate of rejection. One possibility is that well-connected communities are less reliant on MVP grants because they have alternative sources of support. This possibility is not supported by our qualitative interviews. Across towns – including some that scored higher on bridging social capita – our respondents did not indicate their towns would forgo applying for the program. Another is that grant-making bodies may be intentionally directing funds toward less connected or more vulnerable communities, consistent with MVP's stated emphasis on equity and hazard exposure. This latter interpretation is supported by our qualitative interviews, where officials emphasized the importance of targeting under-resourced areas in resilience planning.

Several towns in our study had resilience projects underway, including community engagement initiatives, vulnerability assessments, and large-scale infrastructure projects like seawalls and elevated roads. Many of these towns relied on multiple funding sources, piecing together MVP grants with municipal funds, regional agency contributions, and federal programs. This fragmented funding landscape may advantage towns with stronger social or institutional networks, and disadvantage those with fewer connections or professional staff.

Our interviews also revealed tensions between formal indicators of vulnerability and local realities. For instance, one official noted that coastal property values, which are often used as a proxy for individual wealth and may be factored into grant-making decisions, can obscure the real financial hardship of long-time homeowners. A retiree living on a now high-value plot may appear affluent on paper yet struggle to pay for climate adaptations. This underscores the need for more nuanced metrics of vulnerability that account for both asset ownership and liquidity or income levels. As one interviewee put it, "the points system can take a life of their own."

The match requirements of MVP grants were a recurrent theme in interviews. One under-resourced town described how the cost of permitting alone ($175,000) posed a major obstacle to a $78 million resilience project. Interviewees emphasized that the long-term economic risks of inaction far outweighed the cost of upgrades, but that identifying matching funds remained a serious barrier. These insights suggest that even communities with clear climate risks and planning capacity may be excluded from funding if upfront capital is unavailable.

Finally, our findings raise important questions about interaction effects. Income, education, and political support may interact with social and governmental capacity in complex ways. For instance, towns with strong bonding capital but lower socioeconomic resources may benefit most from targeted grant programs, while towns with higher education levels but weaker networks may struggle with local mobilization. Future work could test these relationships more explicitly, including how community characteristics shape not only access to grants but the effectiveness of resilience implementation over time.

This analysis faces some limitations, most notably regarding the availability of data to assess the counterfactual. While we can observe which towns received MVP Action Grants, we cannot directly observe the universe of applications submitted, particularly those that were unsuccessful. This makes it difficult to assess true success rates or to identify whether certain types of towns are systematically less successful despite applying. However, qualitative evidence from interviews with local officials indicates that the program is indeed competitive, with numerous applications not selected for funding each cycle. These accounts suggest that grant distribution does not simply reflect lack of interest or application from some communities, but rather a competitive selection process with variation in outcomes.

This analysis faces several other limitations that warrant caution in interpretation. First, the relatively small sample size of Massachusetts coastal municipalities limits statistical power and increases sensitivity to model specification, as reflected in coefficient instability across alternative regressions. While diagnostic tests indicate no evidence of heteroskedasticity or severe violations of normality, these tests do not mitigate concerns about limited precision or overfitting. Second, the results may be affected by omitted variable bias. The attenuation of the coefficient on the share of African American/Black residents after controlling for population density suggests that density, coastal exposure, and social capital may capture overlapping dimensions of vulnerability, administrative capacity, or project readiness that are not fully observed in the data. Finally, the analysis does not address potential endogeneity. Measures of social capital and grant receipt may be jointly determined, and unobserved municipal characteristics – such as bureaucratic capacity, prior experience with state programs, or informal state–local relationships – could influence both predictors and outcomes.

6. Conclusions

Our sample collected data on most of the communities recognized by the Office of Coastal Zone Management, and statistics indicate that they serve as a representative sample of the full universe of towns and cities. However, there is a larger potential sample – more than 300 – of coastal and near-coastal villages and towns in New England which future scholars could analyze for resilience grants behavior. Other studies could include coastal towns in other New England states such as Maine, New Hampshire, Rhode Island, and Connecticut. Additionally, we captured data on geographic, demographic, and communal resource levels in these towns and cities, but we likely missed potential confounding factors which may have biased our coefficient estimators.

Our study of coastal Massachusetts communities has demonstrated that towns and cities facing greater demographic vulnerability and fewer bridging social capital ties receive grants most often. Through interviews with local officials and a quantitative analysis of nearly 60 towns, we found demographic composition and heterogeneous ties to be most critical across multiple models. We interpret these results indicating that the state climate and resiliency grants may help to build community resilience in coastal Massachusetts. Areas along with the coast facing greater threats and municipalities with fewer heterogeneous ties received climate change and disaster risk reduction expertise and training.

While we do not know the impact of these grants, our interviews suggested that they have helped create several disaster risk reduction (DRR) tactics that are either ongoing or already completed. As other scholars have argued, decision makers often prioritize those with resources over those without. Instead, they should put resources into under-resourced communities rather than into those that already have the educational and financial resources and human and social capital reservoirs to carry out such DRR actions independent of aid.

We see several important recommendations emerging from our findings. First, state agencies with extremely limited funds should consider investing in building community-to- community ties across vulnerable areas. By strengthening bridging social ties across coastal towns under threat they may be able to reduce pressure for disaster risk reduction investments. Seaside communities that can draw on the expertise of other at-risk locales could pull horizontally on expertise and guidance rather than seeking state or national support. Communities in Japan, for example, regularly set up "sister city" connections to exchange expertise, personnel, and resources during and after shocks [40]. Further, by investing in social infrastructure such community centers, libraries, and other gathering places, localities are building up resilience against future shocks [41].

Community outreach and education can strengthen the ability of residents to draw from their existing social bonds to be resilient against environmental impacts. By focusing on public outreach and public participation, the MVP grants may help to build or strengthen these bonds among individuals in the community. Similarly, vulnerable coastal communities need to develop better communication with decision makers and build vertical relationships of trust. Cultivating linking social capital during preparedness activities such as resilience and disaster planning brings the positive externality of improving recovery outcomes from future shocks.

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Appendix A

Table A1. List of interviewees.

Interview Number	Position
1	Coastal Resiliency Specialist
2	City Planner
3	Engineering Technician
4	Town Planner
5	Senior Climate Resiliency Specialist, environmental consultancy
6	City Planning Specialist

7	Climate Resiliency Planner
8	Massachusetts Emergency Management Agency member
9	Director of Natural Resources
10	Senior Project Manager

Table A2. Data sources.

Type of Data	**Sources**
Income data	MA Department of Revenue, https://dlsgateway.dor.state.ma.us/reports/rdPage.aspx?rdReport=DOR_Income_EQV_Per_Capita&rdDataCache=8755535155&rdShowModes=&rdSort=&rdNewPageNr=True1&rdRequestForwarding=Form
Social capital data	2020 US Census Data, using the indicators recommended by Kyne and Aldrich (2019).
Education	US Census Data, 2020
Voting	MA Secretary of State
Coastline Length	MA Coastal Zone Management
Population size	US Census Data, 2020
Town Area	Mass GIS Towns
Coastal Population, demographics	US Census Data, 2020

Table A3. Additional regression analysis results.

Outcome = Number of grants received	**(1)** **Full Sample**	**(2)** **No Outliers**	**(3)** **Robust Regression**
Land Area (sq miles)	0.031	0.064	0.029
	(0.029)	(0.056)	(0.026)
Coastal Population %	0.028	0.015	0.026
	(0.020)	(0.022)	(0.018)
Black Population %	40.340*	92.202	46.810**
	(20.363)	(51.919)	(18.396)
Hispanic Population %	11.320	-15.085	5.469
	(8.446)	(54.500)	(7.630)
Asian Population %	-9.328	142.258	-8.295
	(11.211)	(159.137)	(10.128)
Income Per Capita	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
% with Bachelor'	1.324	2.208	-2.770
	(4.859)	(5.880)	(4.389)
Bonding Social Capital	-1.789	3.270	-2.735
	(9.660)	(15.582)	(8.727)
Bridging Social Capital	-24.393**	-35.891*	-25.182**

	(11.241)	(16.510)	(10.155)
Linking Social Capital	-2.425	-10.601	-2.655
	(4.284)	(12.079)	(3.870)
Constant	12.323	14.065	14.645*
	(8.488)	(13.706)	(7.668)
Observations	58	41	58
R-squared	0.401	0.329	0.460

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A4. Regression results with alternative dependent variable.

Outcome = Amount of grants awarded (USD)	**Unstandardized Coefficients**	**Standardized Coefficients**	**Standard Errors**
Land Area (square miles)	23879.4	0.235	14776.78
Share of coastal population	606,479.5	0.0689	1,152,493
Share of African American / Black residents	26,700,000*	.441*	10,400,000
Share of Hispanic residents	311,158.4	.013	4,315,913
Share of residents of Asian descent	-3,786,990	-.086	5,727,434
Per capita income	-9.104	-.143	12.36
Education (percentage w BA)	2,053,655	.166	2,481,485
Bonding social capital	480292.8	.014	4951102
Bridging social capital	19,100,000**	-.442**	5,821,698
Linking social capital	-10214.29	-.0006317	2195711
Constant	5231047		4382344
Observations		56	
R^2		0.383	
P-value		0.0089	

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A5. Regression results including population density as control variable.

Outcome = Number of grants received	**(1)** **Full Sample**
Land Area (sq miles)	0.050**
	(0.024)
Population Density	0.001*
	(0.000)
Coastal Population %	0.032*

	(0.016)
Black Population %	19.439
	(18.769)
Hispanic Population %	-7.546
	(6.964)
Asian Population %	-19.089*
	(10.061)
Income Per Capita	-0.000
	(0.000)
Bonding Social Capital	19.091*
	(10.029)
Bridging Social Capital	-22.579**
	(9.662)
Linking Social Capital	-1.130
	(3.378)
Constant	-2.960
	(8.807)
Observations	58
R-squared	0.411
p-value	0.0027

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

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