Integrating Climate Change into State Hazard Mitigation Plans: A Five-year Follow-up Survey

Meg Hamele

A thesis
submitted in partial fulfillment of the
requirements for the degree of

Master of Urban Planning
Master of Public Health

University of Washington
2023

Committee:

Nicole Errett
Andrew Dannenberg
Bob Freitag

Program Authorized to Offer Degree:

Department of Environmental and Occupational Health Sciences
Department of Urban Design and Planning

University of Washington

Abstract

Integrating Climate Change into State Hazard Mitigation Plans: A Five-year Follow-up Survey

Meg Hamele

Co-Chairs of the Supervisory Committee:

Nicole Errett

Department of Environmental and Occupational Health Sciences

Andrew Dannenberg

Department of Urban Design and Planning

Climate change is increasing the frequency and intensity of disaster events globally, resulting in heightened risks to human life, economic security, ecosystem health, and overall well-being. Hazard Mitigation Planning, overseen by the Federal Emergency Management Agency (FEMA), is one tool used to reduce disaster risk by identifying potential hazards and taking action to reduce their impact. While FEMA policy requires states and territories to consider the risks of climate change in their plans, guidance remains broad, leading to different approaches of climate change integration in State Hazard Mitigation Plans (SHMPs). This study builds off a 2018 survey of State and Territorial Hazard Mitigation Officers (SHMOs); 56 SHMOs were invited to participate in an updated electronic survey to assess how the integration of climate change in SHMPs has evolved over the last five years. A majority of the 30 respondents (96.7%)

recognized their jurisdiction is vulnerable to climate change and with a similar proportion agreeing climate change is a threat to their jurisdiction both now and in the future. Leading motivating factors for integrating climate change into SHMPs included increased evidence for climate change projections, and disasters in their jurisdiction or a neighboring jurisdiction (73.3%). The most frequently reported barrier was the reliance on historical patterns of hazard exposure (46.7%). Furthermore, the majority (90%) of states are incorporating at least one climate change adaptation strategy into SHMPs. Despite this, most states reported having insufficient resources to plan for and implement climate-related mitigation activities. Findings suggest that state and territorial hazard mitigation planning programs are trending towards further integration of climate change into plans, or are more aware of risks climate change poses to their state, when compared to 2018. Further research is needed to illuminate how to best support state-level hazard mitigation program response to climate change.

Research Plan

Background and Significance

Disasters such as earthquakes, hurricanes, floods, and severe storms pose a significant threat to human life, ecosystem health, economic stability, and overall community well-being.[1] Disaster risk is increasing globally due to climate change, which is expected to increase the intensity, frequency, and magnitude of weather-related events. The consequences of this are unfolding in real time, as 2022 alone boasted eighteen weather and climate events with costs exceeding $1 billion USD.[2]

The U.S. Federal Emergency Management Agency (FEMA) plays a key role in disaster risk reduction and oversees the four phases of emergency management; mitigation, preparedness, response, and recovery. FEMA defines hazard mitigation as any sustainable action that reduces or eliminates long-term risk to people and property from future disasters.[3] Mitigation focuses on longer term structural and non-structural projects that have protective effects when compared to the more reactionary phases of preparedness, response, and recovery[4]. Given the nature of increasing risk, the importance of minimizing community vulnerability to hazards has continued to grow, with increased attention on the importance of hazard mitigation planning as a key protective strategy.[5] A 2019 study by FEMA highlights the financial benefits of mitigation planning, finding that every US $1 invested in mitigation projects prevents $6 in damage.[6]

The U.S. Disaster Mitigation Act of 2000 (DMA) provides guidelines and frameworks for state, local, tribal, and territorial government hazard mitigation planning. States, tribes, and territories must have a FEMA approved Hazard Mitigation Plan, which adheres to procedures and regulatory standards, in order to be eligible for federal financial assistance following a disaster. Local jurisdictions are eligible for funding only through sub-grants provided by the

state, incentivizing the adoption of state, tribal, and territorial level hazard mitigation plans.[3] State Hazard Mitigation Officers (SHMOs) act as the primary point of contact between state government and FEMA, and aid in the development of both state and local hazard mitigation planning activities.[6]

The effects of climate change on disaster management are complex, introducing new challenges for the hazard mitigation field.[7] At the center of the hazard mitigation planning process is risk assessment; state, tribal, and local governments first identify their unique disaster risks and vulnerabilities, then develop long-term strategies for protecting people and property from those risks.[3] The risk assessment process is typically done through analyzing the historic trends of a given jurisdiction. This presents a significant complicating factor, as climate change can be perceived as a risk in and of itself, or as a factor that influences the severity or frequency of other hazards.[7] These additional risks are thus difficult to plan for unless hazard mitigation planners incorporate projected climate data into the risk assessment process.

FEMA has updated its hazard mitigation policies to include climate change. In 2012, FEMA released their Climate Change Adaptation Policy, requiring all Agency programming, policies, and operations to integrate climate change adaptation planning.[8] FEMA's 2015 update of their State Mitigation Plan Review Guide furthermore includes the expectation that states will work with community partners and agencies to identify and incorporate appropriate and relevant climate data in their risk assessment process.[9] However, this updated guidance remains broad, resulting in vastly different approaches to integrating climate change into state and local hazard mitigation plans and policies.[10] A 2018 study of State Hazard Mitigation Officers (SHMOs) found that while 85.7% of respondents reported incorporating climate change into their state hazard mitigation plans, only 29% reported expanding hazard mitigation strategies related to

climate change.[10] This suggests that while many states are discussing the risk of climate change in state hazard mitigation plans, they are not necessarily working towards implementing solutions to decrease vulnerability to identified risks.

Since the initial survey in 2018, recent literature has largely focused on the relationship between HMP and climate change adaptation planning (CCAP). In response to the threat of climate change, some jurisdictions in the US are opting to create climate change adaptation plans (CCAPs), which can be defined as the adjustment of natural or human systems to a new or changing environment.[8] CCAP is distinct from climate mitigation, also referred to as greenhouse gas mitigation, which aims to reduce global carbon emissions.[8] CCAP and hazard mitigation share similarities; both ideally anticipate future risks and vulnerabilities, and provide a plan for mitigating those identified risks. However, while the two share overarching goals, they have several important differences. HMP does not strictly focus on climatological risks, and includes the assessment of seismic hazards such as earthquakes and volcanic eruptions, as well as security threats such as terrorism[11].

CCAPs are typically developed separately from HMPs, and are often undertaken by environmental and sustainability departments rather than emergency management. CCAPs furthermore typically involve high participation of non-governmental organizations (NGOs), as well as the participation of academic and third party experts, which is uncommon in HMP.[12] HMP is federally regulated with specific mandates, policies, and guidelines, on which receiving hazard mitigation funding is contingent, whereas CCAP is done electively and has no specific set of funding to create nor implement plans.[12] Some planning scholars have proposed the integration of CCAP and HMP, as research has highlighted the complementary nature of both practices.[12] While existing CCAPs are largely being developed at the local level, research

suggests that state support, such as providing technical data and planning guidance, are likely to enhance and improve local CCAPs.[13]

In addition to an increased focus on CCAP, policy priorities in the United States have shifted and evolved significantly in the last five years with the election of president Joe Biden in 2020. The Trump Administration, beginning in 2016, dismantled several pieces of key climate policy, including withdrawal from the Paris Agreement.[14] Indeed, the 2018-2022 FEMA Strategic Plan omits discussion of climate change entirely.[15] Comparatively, the Biden administration has prioritized climate change response and preparation, including the development of a National Climate Task Force, expanding funding for HMP, and introducing new programs to spur infrastructure development in response to climate change.[16]

FEMA's newly released 2022-2026 Strategic Plan lies in stark contrast with its preceding edition, with a central focus of leveraging FEMA policies and tools to address the climate crisis.[17] Given the significant change in the political environment and FEMA priorities, a resurvey of SHMO's is warranted to gauge what impact this evolution in policy has had on state HMPs and climate change. While the relationship between federal and state policy is complex, we expect that increased federal climate initiates, including the expansion of funding and grant programs, will lead to more comprehensive and further integration of climate change risk and adaptation solutions at the state level.[18]

In response, this study aims to assess how climate change is being integrated into state hazard mitigation plans, as well as investigate if and how hazard mitigation is incorporating or collaborating with climate change adaptation planning in their efforts. Building on a 2018 study surveying State Hazard Mitigation Officers, we aim to examine if, how, and why climate change risk and climate adaptation solutions are being considered in state hazard mitigation planning,

and how this has changed in the last five years, given a significant change in federal policies under the Biden Administration that emphasize and prioritize climate action. Specifically this study responds to the following research questions:

1. How has state-level integration of climate change risk and adaptation solutions evolved over the past five years?
2. What factors influence the extent to which states are integrating climate change risks and adaptation solutions into their hazard mitigation plans?

Results of the proposed study may be used to help strategize more effective incorporation of climate change into hazard mitigation planning by creating a more streamlined planning process, potentially increasing resilience and minimizing loss in the face of both disaster events and climate change.

Methods

A RedCap electronic survey was sent to 56 state and territorial hazard mitigation officers to collect data. Survey results, including both 2018 and 2023 survey data, were analyzed via descriptive statistics. The UW Human Subjects Division determined this research to be exempt status (STUDY00017389).

Study sample and recruitment

State Hazard Mitigation Officers (SHMOs) from each of the fifty states, the District of Columbia, and five major territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and U.S. Virgin Islands) were sent an invitation to complete an electronic survey via email. We requested that SHMOs coordinate with their colleagues to ensure only one response per state is submitted.

Contact information was obtained from FEMA's publicly available list of SHMOs posted on their website. We monitored this list throughout the survey response period and reached out to any new state contacts that became available. The survey was open for approximately two months, with initial contact made by email in February 2023. If emails were returned due to an invalid email address, alternative contact information, including alternative email addresses and telephone numbers, were obtained on state government websites. All jurisdictions were contacted with three email messages, and, if necessary, up to two phone calls in the last week of March 2023.

Data collection

Survey questions aimed to assess changes since the 2018 survey, with updated questions around new FEMA hazard mitigation policies, division-level perceptions of climate change, as well as questions about state climate change adaptation efforts based on climate adaptation literature.[10]

Study data was collected and managed using REDCap electronic data capture tools[1] hosted at the Institute of Translational Health Sciences. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources.[19]

Data analysis

Responding jurisdictions were sorted into coastal and non-coastal jurisdictions, defined by having at least one contiguous boundary with the Atlantic Ocean, Pacific Ocean, or Gulf of

Mexico. Jurisdictions were also sorted by the political party of their governor to compare responses between democratic and republican leaning states. Basic summary statistics were performed using R statistical software to compare 2023 data with that of 2018, including reported facilitators and barriers to integration, have evolved over time, as well as between coastal and non-coastal jurisdictions and among jurisdictions with Republican and Democratic gubernatorial leadership. The denominator used to calculate proportions was determined by the number of jurisdictions who responded to each individual question, and was thus sometimes lower than N=30.

Results

2023 Survey Data

Respondents

Of 56 states and territorial SHMOs invited to participate, 30 completed the survey (53.5%), with 80% of respondents being SHMOs themselves. Alternative respondents included Planning Branch Chiefs, Mitigation Strategic Planners, and Emergency Management Planning Specialists. 50% of respondents had been in their role for three years or less, 23.3% for 3-6 years, 3.3% from 6-9 years, and 20% for 9 or more years. Of the 30 respondents, 40% (n=12) were from coastal states, 60% (n=18) were from non-coastal states, 46.7% (n=14) had democratic gubernatorial leadership, 50% (n=15) had republican gubernatorial leadership, and 3.3% (n=1) had independent gubernatorial leadership.

Perceptions of Climate Change

When asked if their division considers climate change to be a threat now, 80% of respondents agreed or strongly agreed, and 93.3% agreed or strongly agreed that climate change is a threat in the future. Over 96% responded that their division considers climate change to be a

factor that influences the frequency or severity of natural hazards, with just under half (46.67%) considering climate change to be a factor that influences the frequency or severity of technical hazards, such as industrial pollution, toxic waste spills, and dam failures. Just over half of respondents (53.3%, n=16) reported having employees funded specifically for climate change and hazard mitigation work. Of those sixteen, thirteen reported these employees to have specific training in climate and mitigation, with the average number of FTE employees dedicated to this work being 2.2 per division.

At least 80% of respondents reported being at risk for the following hazards: climate change, critical infrastructure damage, drought, earthquakes, extreme cold, extreme heat, extreme weather, flooding, infectious disease outbreaks, landslides, power outages, water contamination, water shortages, and wildfires. Despite 96% of respondents indicating their state or territory is at risk for climate change, only 30% reported their SHMP includes mitigation strategies that address human drivers of climate change.

Perceptions of Climate Change by Coastal Status

When divided by coastal status, a greater proportion of coastal states perceive climate change to be a threat now, with 91.7% agreeing or strongly agreeing, compared to 72.2% of non-coastal states. The same trend was seen when assessing the threat of climate change in the future, with 100% of coastal states agreeing or strongly agreeing, compared to 88.9% of non-coastal states. When asked if the division perceived climate change to be a factor that influences the severity or frequency of natural hazards in their state, 100% of coastal states agreed, compared to 88.9% of non-coastal states. Coastal states more frequently reported having employees dedicated to climate change work, with 66.7% of coastal states reporting having at least one FTE employee, compared to 44.4% of non-coastal states.

Perceptions of Climate Change by Gubernatorial Leadership Party

A larger proportion of jurisdictions with democratic governors strongly agree that climate change is a threat both now and in the future (71.4%) compared to jurisdictions with republican governors (53.5%). However, the majority of jurisdictions with republican governors at least somewhat agree that climate change is a threat both now (93.3%) and in the future (86.7%). When analyzed by gubernatorial leadership, the category with the largest discrepancy between democratic and republican jurisdictions was having employee(s) funded specifically for climate change and hazard mitigation work, with 85.7% of democratic jurisdictions reporting yes compared to only 20% of republican jurisdictions.

Climate Adaptation

Of 11 common climate adaptation strategies, listed in Figure 4, at least half of respondents answered that their state is improving climate literacy and public awareness (80%), implementing the adoption of resilience standards in the siting and design of buildings (76.7%), using smart growth and development practices (70%), installing green and natural infrastructure (66.7%), restoring and conserving ecosystems (63.3%), promoting integrated watershed-based water resources management (63.3%), providing climate-related data, tools, and guidance for policy makers (63.3%), building a stronger culture of partnership/collaboration (60%), and promoting of natural hazard insurance coverage such as the National Flood Insurance Program (53.5%). 33% of respondents reported implementing clean energy programs, and 20% were pursuing relocation or retreat from vulnerable coastal areas.

Influencing and Impeding Factors

When asked about factors that have influenced their agency's decision to integrate climate change into their SHMP, nearly three quarters of respondents cited increased evidence

for climate change projections as well as recent disaster events in their jurisdiction or neighboring jurisdictions (73.3%). Two-thirds of respondents (66.7%) cited new state and/or federal guidance or rules , and 57% were influenced by increased grant funding for climate change-related projects.

Leading factors that were reported to impede climate change integration into SHMPs included reliance on historical patterns of hazard exposure instead of future projections (46.67%), a lack of funding to support climate change adaptation and mitigation activities (40.0%), other state agencies or commissions already addressing climate change adaptation (33.33%), and low prioritization of climate change compared to other hazard mitigation concerns (26.67%).

Table 1. Perceptions of climate risk by coastal status and by gubernatorial leadership.

Question	Overall % (n)	Coastal States % (n)	Non-Coastal States % (n)	Democratic Governors % (n)	Republican Governors % (n)
	N=30	N=12	N=18	N=14*	N=15*
The division perceived climate change to be a threat now					
Strongly agree	60.0 (18)	66.7 (8)	55.5 (10)	71.4 (10)	53.5 (8)
Agree	20.0 (6)	25.0 (3)	16.7 (3)	14.2 (2)	20.0 (3)
Somewhat agree*	16.6 (5)	8.3 (1)	22.2 (4)	14.2 (2)	20.0 (3)
Disagree	3.3 (1)	0 (0)	8.3 (1)	0 (0)	6.7 (1)
Strongly disagree	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
The division perceived climate change to be a threat in the future					
Strongly agree	60.0 (18)	66.7 (8)	55.6 (10)	71.4 (10)	53.5 (8)
Agree	33.3 (10)	33.3 (4)	33.3 (6)	28.6 (4)	33.3 (5)
Somewhat agree*	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Disagree	6.67 (2)	0 (0)	11.1 (2)	0 (0)	13.3 (2)
Strongly disagree	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

The division perceived climate change to be a factor that influences the severity or frequency of…					
Natural hazards					
Yes	95.6 (28)	100 (12)	88.9 (16)	92.9 (13)	93.3 (14)
Yes, but not within its state	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
No	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Unsure	3.45 (1)	0 (0)	5.6 (1)	0 (0)	6.7 (1)
Technological hazards					
Yes	46.7 (14)	41.7 (5)	50.0 (9)	42.9 (6)	46.7 (7)
Yes, but not within its state	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
No	6.7 (2)	8.3 (1)	5.6 (1)	7.1 (1)	6.7 (1)
Unsure	46.7 (14)	50.0 (6)	44.4 (8)	50.0 (7)	46.7 (7)
The division perceived its jurisdiction to be at risk for the hazard of climate change					
At risk	96.7 (29)	100.0 (12)	94.4 (17)	100.0 (14)	93.3 (14)
Not at risk	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Unsure	3.3 (1)	0 (0)	5.6 (1)	0 (0)	6.7 (1)
In SHMP, climate change is discussed as a…					
Hazard itself	23.3 (7)	33.3 (4)	16.7 (3)	35.7 (5)	13.3 (2)
Risk factor for other hazards	80.0 (24)	83.3 (10)	77.8 (14)	78.6 (11)	80.0 (12)
Neither	10.0 (3)	16.7 (2)	5.6 (1)	14.3 (2)	6.7 (1)
Unsure	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
The SHMP includes mitigation strategies that address human drivers of climate change					
Yes	30.0 (9)	16.7 (2)	38.9 (7)	35.7 (5)	26.7 (4)
No	40.0 (12)	41.7 (5)	38.9 (7)	28.6 (4)	53.3 (8)
Unsure	30.0 (9)	41.7 (5)	22.2 (4)	35.7 (5)	20.0 (3)
The state or territory has an employee(s) funded specifically for climate change and hazard mitigation work					

Yes	53.5 (16)	66.7 (8)	44.4 (8)	85.7 (12)	20.0 (3)
No	33.3 (10)	8.3 (1)	50.0 (9)	14.3 (2)	53.3 (8)
No, but are planning to in the next five years	3.3 (1)	8.3 (1)	0 (0)	0 (0)	6.7 (1)
Unsure	10.0 (3)	16.7 (2)	5.6 (1)	0 (0)	20.0 (3)

*Only democratic and republican political parties are shown in this table, which does not include the 1 jurisdiction with an Independent party leader. Total values between these two columns are n=29 instead of n=30.

Evolution of Integration from 2018 to 2023

35 jurisdictions completed the 2018 survey, 45.7% (n=16) of which were from coastal states or territories. 30 jurisdictions responded in 2023, with 40% (n=12) considered coastal. A total of 22 jurisdictions took the survey in both 2018 and 2023, with non-coastal states accounting for 63.4% (n=14) of paired respondents.

Table 2. Comparison of survey respondents by coastal and non-coastal groups between 2018 and 2023.

Jurisdictions who completed the survey in...	**Total**	**Coastal % (n)**	**Non-coastal % (n)**	**Democratic Governors % (n)**	**Republican Governors % (n)**
2018	35	45.7 (16)	55.3 (19)	N/A*	N/A*
2023	30	40 (12)	60 (18)	46.7 (14)	50.0 (15)
2018 and 2023	22	36.3 (8)	63.4 (14)	N/A*	N/A*

*due to changes in political leadership over time, this was not calculated for 2018 survey respondents

A higher percentage of surveyed states have incorporated climate change into their state or territorial hazard mitigation plan in 2023 (96.7%) compared to 2018 (85.7%). In both 2018 and 2023, the majority of respondents discuss climate change as a risk factor for natural hazards rather than a hazard itself in their HMPs. When asked in their most recent HMP update if additional hazards were identified that require mitigation because of climate change, 50% of 2023 respondents answered yes, compared to only 20% of respondents in 2018.

Jurisdictions were asked to report on the sufficiency of SHMP resources to plan for and implement climate-related mitigation activities. In all categories aside from funding, more states

reported having insufficient or no resources for data/evidence (73.3%), staff capacity (73.3%), and staff expertise (56.7%) in 2023 compared to 2018 (36.4%, 54.6%, and 42.4%, respectively).

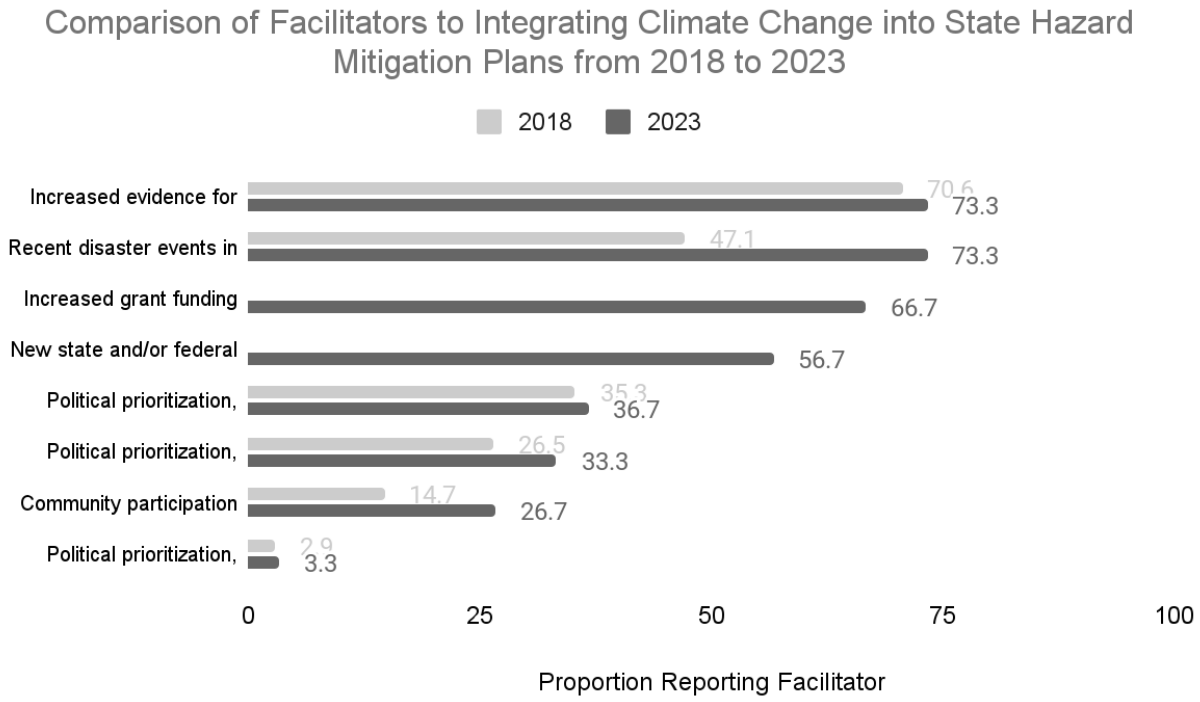
Table 3. Changes in hazard identification and reported resources from 2018 to 2023

Question	**2018 Percent**	**2023 Percent**
During the process of updating your current promulgated State Hazard Mitigation Plan, did you identify additional hazards that require mitigation because of climate change?	n=34	n=30
Yes	20	50
No	68.6	36.7
Unsure	11.4	13.3
Is your State Hazard Mitigation Plan the primary plan for mitigating climate-related hazards in your state?	n=35	n=30
Yes	28.6	33.3
No	20	30
Unsure	51.4	36.67
Sufficiency of State Hazard Mitigation Program resources to plan for and implement climate-related mitigation activities		
Data/evidence	n=33	n=30
Sufficient or abundant resources	48.5	26.7
Insufficient or no resources	36.4	73.3
Unsure	15.2	0
Funding	n=32	n=30
Sufficient or abundant resources	31.3	50
Insufficient or no resources	53.1	43.3
Unsure	15.6	6.7
Staffing: capacity	(n = 33)	n=30
Sufficient or abundant resources	33.3	23.3
Insufficient or no resources	54.6	73.3
Unsure	12.1	3.3
Staffing: expertise	(n = 33)	n=30
Sufficient or abundant resources	39.4	36.7
Insufficient or no resources	42.4	56.7

Unsure	18.2	6.6

Respondents were asked to identify whether or not the following factors facilitate climate change integration into their state or territorial HMP: Community participation, increased evidence for climate change projections, state-level political prioritization, national-level political prioritization, international-level political prioritization, recent disaster events in their jurisdiction or neighboring jurisdiction, new state and/or federal guidance or rules, and increased grant funding for climate change-related projects. Figure 1 shows changes in reported facilitating factors between 2018 and 2023. An increased proportion of respondents reported each of the factors identified as facilitators in 2023 compared to 2018. The highest proportion of respondents in both 2018 and 2023 reported increased evidence for climate change projections (70.6% and 73.3%, respectively) and recent disaster events in their jurisdiction or neighboring jurisdiction (47.1% and 73.3%, respectively) as facilitators. The 2023 survey was modified to include the facilitators of increased grant funding for climate change-related projects and new state and/or federal guidance or rules, which were the third and fourth leading facilitators reported (66.7% and 56.7%, respectively).

Figure 1. Influencing factors for integrating climate change into state hazard mitigation plans from 2018 to 2023



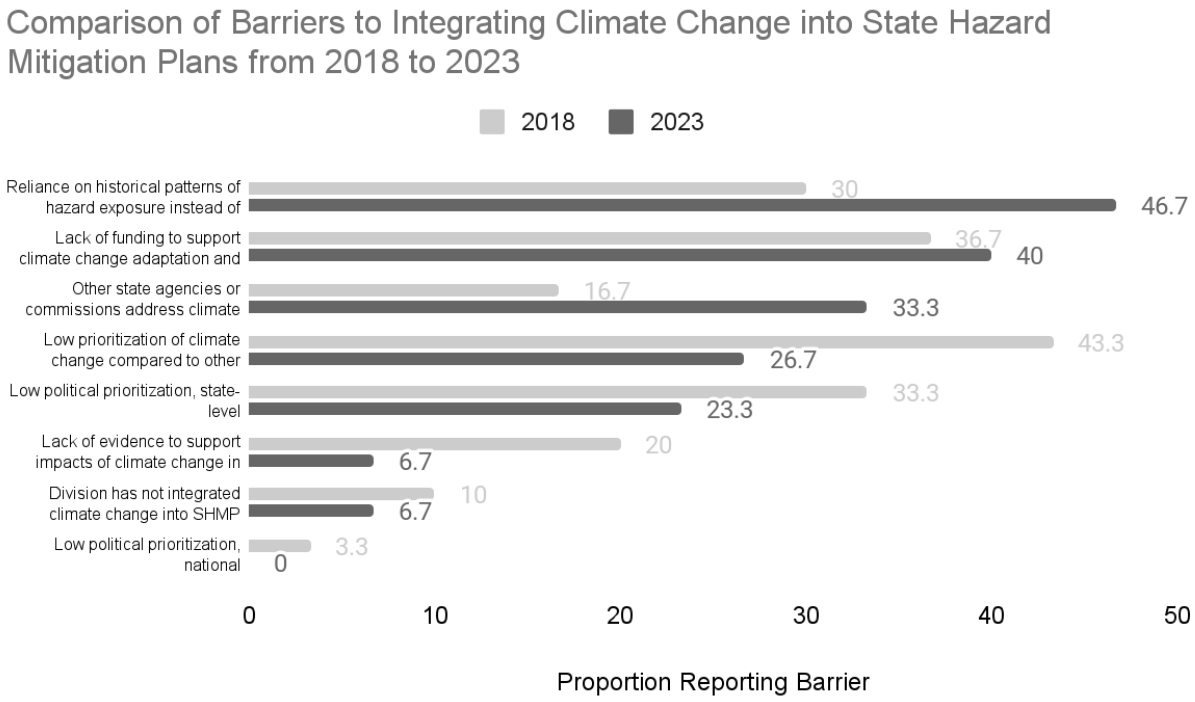
*Two facilitators (increased grant funding, new state and/or federal guidance or rules) were included only in the 2023 survey.

Respondents were then asked to identify whether or not the following factors were barriers to integrating climate change into their state or territorial HMP: a lack of evidence to support impacts of climate change in their jurisdiction, a lack of funding to support climate change adaptation and mitigation activities, low state-level political prioritization, low national-level prioritization, low prioritization of climate change compared to other hazard mitigation concerns, other state agencies or commissions address climate change adaptation (avoiding duplicating efforts), and a reliance on historical patterns of hazard exposure instead of future projections.

Figure 2 shows changes in reported barriers between 2018 and 2023. Change across barriers was mixed; a smaller percentage of 2023 respondents reported a lack of evidence to

support climate impacts in their jurisdictions, low state-level and national-level political prioritization, and low prioritization of climate change compared to other hazard mitigation concerns. A higher percentage of 2023 respondents reported a lack of funding to support climate change adaptation and mitigation activities, other agencies or commissions were already addressing climate change adaptation, and a reliance on historical patterns of hazard exposure instead of future projections.

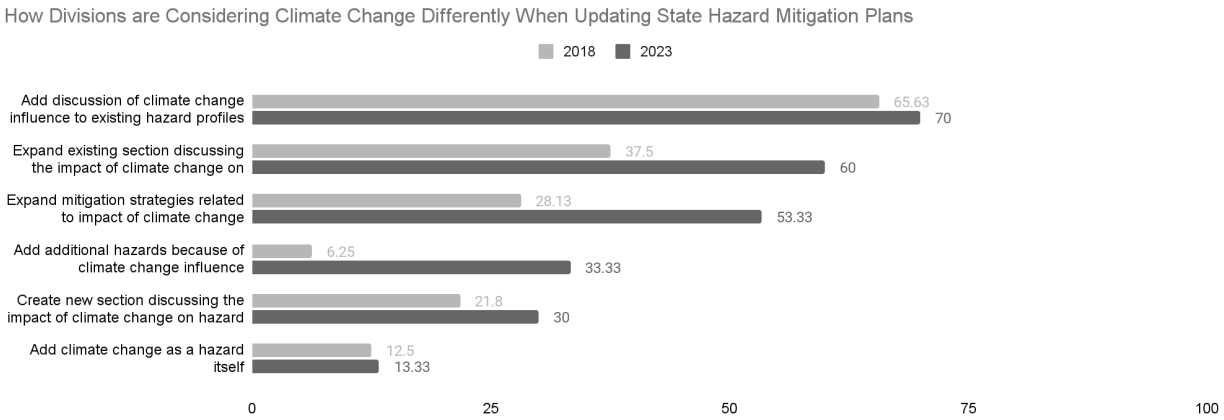
Figure 2. Changes to reported barriers to integrating climate change into state hazard mitigation plans from 2018 to 2023



Nearly all respondents reported they anticipate releasing an updated SHMP in 2023 or 2024 (93.3%). Jurisdictions were asked how they are considering climate change differently in upcoming plan revisions, and given a variety of options to select that describe further integration or deprioritization of climate change altogether. Across all categories that indicate further integration, the proportion of respondents from 2018 to 2023 increased. The largest increases

from 2018 to 2023 include adding additional hazards because of climate change influence (6.3% to 33.3%), expanding mitigation strategies related to impact of climate change (28.1% to 53.3%), and expanding their existing section discussing the impact of climate change on hazard mitigation (37.5% to 60.0%). Changes across all options can be visualized in Figure 3. Of note, no states in 2023 reported removal or decentering climate change in plan updates in 2023.

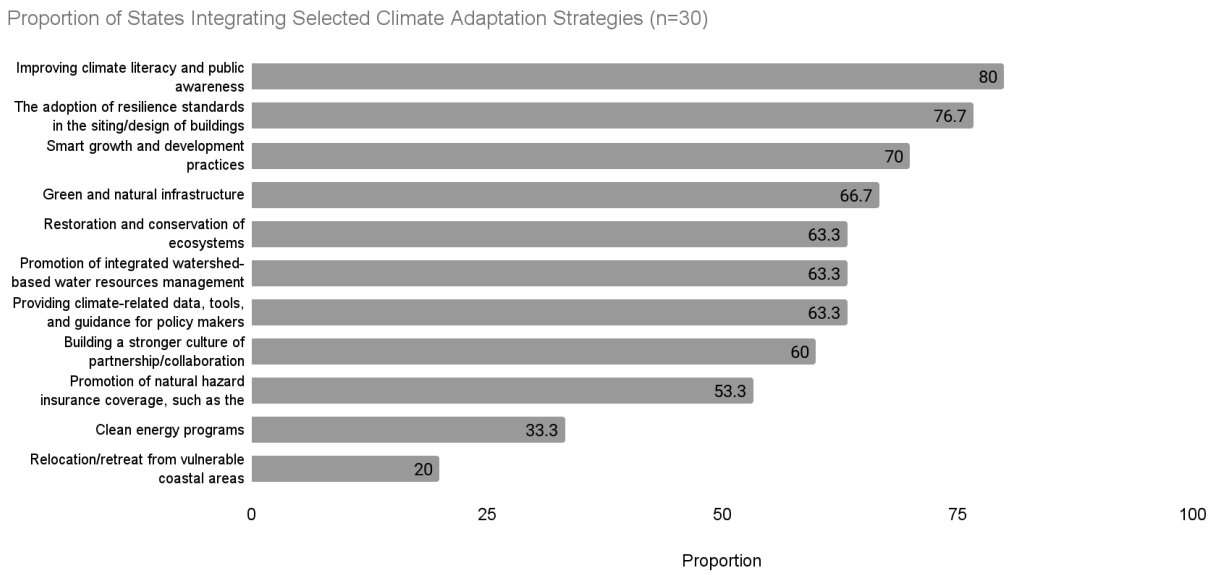
Figure 3. Changes in how climate change will be approached and discussed State Hazard Mitigation Plan updates from 2018 to 2023



Integrating Climate Adaptation

The 2023 survey included new questions on whether or not jurisdictions are incorporating specific climate change adaptation strategies into their jurisdictional HMP. Of the eleven strategies listed, at least half of respondents reported integration of nine strategies into their HMP, with the most common strategies being improving literacy and climate awareness (80.0%), adopting resilience standards in the siting and design of buildings (76.7%), and implementing smart growth and development practices (70.0%). Figure 4 shows the full spectrum of strategies and respondents who reported they had included said strategy in their HMP.

Figure 4. Reported climate change adaptation strategies incorporated in State Hazard Mitigation Plans



When asked about climate change adaptation planning, only 30% indicated their jurisdiction has a statewide climate adaptation plan; 33.3% indicated no and 36.7% were unsure. However, 50% of respondents reported helping local jurisdictions create a climate change adaptation plan, and 33% of respondents reported their SHMP is the primary plan for mitigating climate-related hazards in their state. Of note, the largest proportion of respondents were unsure if their state has a statewide climate adaptation plan and unsure if their SHMP is the primary plan for mitigating climate-related hazards in their state.

Table 4. Comparison of states reporting having a statewide climate adaptation plan compared to states primary plan for mitigating climate-related hazards

	State has a statewide climate adaptation plan (n=30)		
SHMP is the primary plan for mitigating climate-related hazards in their state (n=30)	Yes (9)	No (10)	Unsure (11)
Yes (10)	10% (3)	16.7% (5)	6.7% (2)
No (9)	13.3% (4)	10% (3)	6.7% (2)
Unsure (11)	6.7% (2)	6.7% (2)	23.3% (7)

53.3% of respondents reported their state had additional plans for mitigating or adapting to climate-related hazards and vulnerability in their state beyond their HMP and primary state climate plan, including drought, water use, coastal, public health, transportation, and natural resource plans.

Discussion

Findings from this research suggest that state and territorial hazard mitigation planning programs are trending towards further integration of climate change into plans when compared to 2018. A vast majority of survey respondents (96.7%) recognize their jurisdiction is vulnerable to climate change, with a similar proportion agreeing climate change is a threat to their jurisdiction both now and in the future. Furthermore, a higher proportion of respondents reported being influenced to integrate climate change into SHMPs across all motivating factors in 2023 than 2018. As the impacts of climate change accelerate, this advancement in state and territorial climate preparedness is important in and of itself. Moreover, it may have cascading benefits to local jurisdictions in planning for climate change, as state preparedness helps bridge gaps in federal and local government policy.[20]

Results suggest that coastal states are overall taking a more proactive approach to climate change, with survey respondents from coastal states more often reporting that they are considering climate change a threat both now and in the future, and having staff dedicated to climate-related mitigation work. These results are consistent with literature, but a small sample size precluded advanced statistical analyses to confirm significance of observed differences.

While our findings indicate that states are dedicating resources towards climate-related hazard mitigation, more is necessary to meet the mounting demand. Over half of respondents reported having employees funded specifically for climate change and hazard mitigation work;

however, the majority also reported having insufficient or no resources in regard to staffing capacity (73.3%) and staff expertise (56.7%). Furthermore, fewer respondents reported insufficient or no resources related to staff capacity (54.6%) and staff expertise (42.4%) in 2018.

Increased reportage of insufficient resources to plan for and implement climate-related mitigation activities may be explained by newfound awareness of the breadth and magnitude of climate-related hazards. For example, the proportion of respondents who indicated identifying additional hazards that require mitigation because of climate change more than doubled from 2018 to 2023. Furthermore, the facilitating factor that saw the largest increase from 2018 to 2023 was recent disaster events in their jurisdiction or a neighboring jurisdiction. Additional research is necessary to better understand this potential correlation.

In addition to staff capacity and expertise, states require additional information and data to support their ability to understand and address climate risks. The most commonly reported barrier to climate change integration was a reliance on historical patterns of hazard exposure instead of future projections. Correspondingly, only a quarter of respondents (26.7%) reported sufficient or abundant data or evidence to plan for climate-related mitigation activities. Expanding partnerships or collaborative efforts with researchers or other agencies working on addressing climate change may provide an opportunity to supplement existing limited or strained resources.

Expanded federal funding was reported to have a positive impact on climate change integration into state-level hazard mitigation activities. Two-thirds of responding jurisdictions reported that increased grant funding for climate-change related projects was a motivating factor for integrating climate change into their HMPs. Additionally, states that reported having sufficient or abundant resources increased from 2018 to 2023, growing from 31.3% to 50%,

suggesting increased funding opportunities have played a significant role in helping states and territories integrate climate change into plans. Notably, funding was the only resource for which states reported increased sufficiency during this time period.

Results point to the impacts of federal prioritization of climate change on state level action. From 2018 to 2023, federal policy towards climate change changed significantly, leading to increased grant funding for climate preparedness projects and a significant change in FEMA's Strategic Plan to prioritize and emphasize climate change across FEMA programming. While small sample size precludes meaningful, in-depth statistical analysis of the potential influence that these federal changes in policy and political priorities have had on climate change integration in SHMPs, a greater proportion of respondents indicated state- and national-level political prioritization as motivating factors in 2023 compared to 2018. In addition, a smaller proportion of respondents reported state- and national-level prioritization as barriers when comparing 2018 and 2023 results. These findings emphasize the role of political influence on SHMP programming.

At the same time, state-level political dynamics may prove more influential than those at the national-level; state-level priorities were more often reported as motivating factors and barriers to climate change integration into SHMPs, and there was a large difference in reported dedicated resources for climate change when jurisdictions were sorted by state-level political party leadership. These findings align with and emphasize the ongoing importance of local context and state-level political influence on climate-related policy; research suggests that even without strong national commitment, climate policy may defy the "race-to-the-bottom" argument, with states continuing to implement climate change policy regardless of federal stance.[18,21] This suggests that while federal leadership on climate policy may positively influence

the implementation of state-level climate policy, a lack of federal leadership may not necessarily impede climate action at the state-level. This overall underscores the collective power states have in mitigating the climate crisis.

Despite similar goals and purposes across the fields of hazard mitigation, climate adaptation, and disaster risk reduction, several barriers including varying terminology, scope of practice, and different contexts, hinder collaboration and coordination.[22] Our results echo these challenges. Over a third of the state hazard mitigation officers that responded to our survey were unsure if their state has a climate adaptation plan or unsure if their SHMP is the primary plan for climate-related hazards, and nearly a quarter of respondents unsure of both. These findings are consistent with a 2018 evaluation of state hazard mitigation plans for climate change adaptation efforts, which found low levels of state collaboration with other climate change leadership teams.[20] Increased collaboration and coordination between government agencies working on climate planning may help avoid duplicative efforts and streamline state climate change response.

Despite potential confusion around additional statewide climate adaptation planning efforts, 90% of jurisdictions reported implementing at least one of the listed climate change adaptation strategies in their SHMP, with responding jurisdictions on average reporting 6 of the 11 listed strategies. In addition, 7% of respondents indicated they were implementing an adaptation strategy not listed. These results reiterate the syncretic nature between HMP and CCAP described in the literature; while typically undertaken by different government agencies and varying scales, planning can and should be done in tandem to more effectively and efficiently build community resilience to climate-related disaster events.[12]

Limitations

Several limitations to this study exist. First and foremost, the inherently small sample size composed of state and territorial hazard mitigation officers, of which there are only 56, limits the meaningful statistical tests that can be performed on, and associated conclusions one can draw from, the data. With just over half of SHMOs responding (n=30), data provided by the remaining 26 SHMOs may be systematically different from what was captured by survey respondents. Only 22 states participated in both the 2018 and 2023 surveys, further limiting our sample size for direct or meaningful comparison.

Data collected was solely based on SHMO perceptions and recall, which inherently introduces bias into the data, especially on a topic as politically charged in the US as climate change. Respondents may have felt pressure to answer in a specific way, or may be unaware of climate change work happening both within or outside of their organization or division. Qualitative interviews with SHMOs may lead to a better understanding of the influence that factors such as political dynamics and access to resources including funding, staff capacity, staff expertise, and climate change data have on hazard mitigation planning. They may also reveal facilitators or barriers to climate change integration that were not captured in our survey, and illuminate more nuance related to if, how and why coastal status and state-level political leadership influences climate change integration.

This study did not analyze state hazard mitigation plans themselves to evaluate climate change integration directly, which may have provided more concrete conclusions around state-level climate change planning. To explore these findings more in depth, future work examining climate change integration into hazard mitigation plans should include content analysis of state hazard mitigation plans. With 60% of survey respondents reporting they

anticipate a release of their updated SHMP in 2023, analysis of updated plans may provide more conclusive information on the state of climate change integration into SHMPs.

Assessment of plans alone, without evaluation of implementation or effectiveness of specific strategies outlined, is not indicative of increased community resilience in the event of a disaster.[13] In other words, a SHMO reporting climate change integration into their SHMP or program does not explicitly translate into reduced risk to climate change on the ground. Additional research is necessary to assess the implementation and effectiveness of the specific strategies integrated into plans and programs on hazard mitigation and climate adaptation more broadly.

Lastly, we recognize that jargon across hazard mitigation planning, climate adaptation planning, and climate mitigation may be easily confused and misinterpreted by SHMOs within the survey itself. Mitigation in regard to climate change is often discussed as efforts to reduce greenhouse gas emissions, whereas in the context of the study mitigation applies to efforts to reduce the impacts of climate change related hazards.[8] Future survey research should consider integration of specific definitions into the survey instructions, or evaluate SHMO understanding of these terms as part of the survey itself.

Conclusion

The majority of surveyed jurisdictions are incorporating climate change into their state and territorial hazard mitigation plans. Findings suggest both further integration and a higher awareness of climate-related hazards when compared to 2018. A greater proportion of jurisdictions reported that several factors motivated them to integrate climate change into their plans in 2023 compared to 2018. The factors that motivated the largest proportion of

jurisdictions to integrate climate change in 2023 included an increased evidence for climate change projections and recent disaster events in their jurisdiction or neighboring jurisdiction. Furthermore, most responding jurisdictions reported inclusion of climate adaptation strategies into SHMPs. Despite this, they still reported insufficient resources in regard to data and evidence, staff capacity, and staff expertise. Future research should include analyses of SHMPs for quality of climate change integration and plans for implementation of specific strategies and approaches. Moreover, deeper engagement with SHMOs in the form of interviews may reveal themes not captured in this study.

Acknowledgements

REDCap at ITHS is supported by the National Center For Advancing Translational Sciences of the National Institutes of Health under Award Number UL1 TR002319.

The authors would like to thank Erika Lund, Recovery Coordinator, Seattle Office of Emergency Management, for piloting the updated survey and providing feedback.

Overall Conclusions

Several key findings around climate change and hazard mitigation planning emerged from this thesis work. We found that the majority (93.3%) of surveyed jurisdictions have integrated climate change into their state and territorial hazard mitigation plans, which is an increase from the initial survey in 2018 of 85.7%. When asked to report on factors that have influenced their agency's decision to integrate climate change into their SHMP, a higher proportion of respondents reported being influenced to integrate climate change into SHMPs across all motivating factors in 2023 than 2018. Furthermore, when asked how their jurisdiction

is considering climate change differently in their next SHMP update, 90% of jurisdictions reported they will be adding or expanding upon climate change, indicating deeper integration of climate change into plans when compared to 2018. Findings also point to an increased awareness of climate-related hazards when compared to 2018, with the proportion of jurisdictions who identified additional hazards requiring mitigation due to climate change in their most recent SHMP update increasing from 20% in 2018 to 50% in 2023. Despite this, states still reported insufficient resources in regard to data and evidence, staff capacity, and staff expertise.

When participating jurisdictions were broken down by coastal and gubernatorial political party status, key differences emerged across a few specific questions. A larger proportion of coastal jurisdictions and those with Democratic governors consider climate change a threat to their jurisdiction both now and in the future than non-coastal jurisdictions and those with Republican governors. More coastal jurisdictions and those with Democratic governors also reported having hazard mitigation staff specifically dedicated to climate change work. However, despite these differences, participants on the whole were concerned about the impacts of climate change on their jurisdiction. This suggests that while there may be subtle differences in approaches and resources, states are actively thinking about climate change regardless of coastal status and state-level political leadership.

Findings also suggest a lack of coordination at the state level between climate change adaptation planning (CCAP) efforts and hazard mitigation planning, despite having similar goals and purposes across fields. However, although there may be potential confusion around additional statewide climate adaptation planning efforts, 90% of jurisdictions reported implementing at least one of the listed climate change adaptation strategies in their SHMP, with states on average reporting 6 of the 11 listed strategies.

This thesis project contributed to a greater understanding of how US states and territories are approaching climate change and climate change adaptation strategies within state-level hazard mitigation planning programs. However, there remains an opportunity to expand upon the knowledge captured in this project. Future research on climate change and hazard mitigation could be approached in several different ways. Two strategies that may be particularly fruitful include qualitative interviews with state hazard mitigation officers, as well as conducting a thorough analysis of the content of state and territorial hazard mitigation plans.

Qualitative interviews with SHMOs may lead to a better understanding of the influence that factors such as political dynamics and access to resources including funding, staff capacity, staff expertise, and climate change data have on hazard mitigation planning. They may also reveal facilitators or barriers to climate change integration that were not captured in our survey, and illuminate more nuance related to if, how and why coastal status and state-level political leadership influences climate change integration. While our survey offered a handful of opportunities to provide open-ended answers, the majority of questions had pre-filled responses, overall limiting the variety of responses. It would be valuable to give SHMOs an opportunity to speak openly about their experiences in integrating climate change into hazard mitigation planning at the state-level.

Data for this project came directly from SHMO perceptions, making it inherently subjective in nature and susceptible to bias. For a more objective approach, future research should include a thorough evaluation of SHMP content to assess how climate change is discussed and how proposed climate-related mitigation strategies will be implemented. This would be an especially rich avenue to explore, as 60% of participating jurisdictions reported they

expect an update of their SHMP to be released in 2023, providing a plethora of novel content for analysis.

Finally, these findings have important implications for state and federal agencies responsible for implementing and supporting SHMPs. For example, SHMOs in states with low levels of climate integration may benefit from recruiting staff with specific climate change expertise, or choose to pursue participating in interdisciplinary collaboration with other state agencies focused on climate change work. Increased collaboration may furthermore help reduce duplicative jurisdictional efforts. HMP divisions may also benefit from partnering with academic institutions to support their efforts to gather data and evidence for future climate conditions within their jurisdiction. SHMOs may also use findings to persuade policy makers to prioritize climate action, or to encourage the evaluation of plans to find best practices for climate integration that can be shared with colleagues and in professional settings. Federal agencies, including FEMA, may use gaps identified to inform future guidance development. Together, they can continue to help foster community resilience in the face of a changing climate.

Work Cited

1. Solecki W, Leichenko R, O'Brien K. Climate change adaptation strategies and disaster risk reduction in cities: connections, contentions, and synergies. *Curr Opin Environ Sustain*. 2011;3(3):135-141. doi:10.1016/j.cosust.2011.03.001
2. Smith AB. U.S. Billion-dollar Weather and Climate Disasters, 1980 - present (NCEI Accession 0209268). Published online 2020. doi:10.25921/STKW-7W73
3. Hazard Mitigation Assistance Grants | FEMA.gov. Accessed May 7, 2022. https://www.fema.gov/grants/mitigation
4. Hazard Mitigation Planning | FEMA.gov. Accessed May 8, 2022. https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning
5. Ji H, Lee D. Disaster risk reduction, community resilience, and policy effectiveness: the case of the Hazard Mitigation Grant Program in the United States. *Disasters*. 2021;45(2):378-402. doi:10.1111/disa.12424
6. Subpart M-- Hazard Mitigation Planning. Government Publishing Office. Accessed January 9, 2023. https://www.govinfo.gov/content/pkg/CFR-1996-title44-vol1/html/CFR-1996-title44-vol1-part206-subpartM.htm
7. O'Brien G, O'Keefe P, Rose J, Wisner B. Climate change and disaster management. *Disasters*. 2006;30(1):64-80. doi:10.1111/j.1467-9523.2006.00307.x
8. Horn DP. FEMA Hazard Mitigation: A First Step toward Climate Adaptation. *FEMA Hazard Mitig First Step Clim Adapt*. 2022;1:1-32.
9. State Mitigation Plan Review Guide. Published online 2015.
10. Gonick SA, Errett NA. Integrating Climate Change into Hazard Mitigation Planning: A Survey of State Hazard Mitigation Officers. *Sustainability*. 2018;10(11):4150. doi:10.3390/su10114150
11. Enhancing plan quality: Evaluating the role of state planning mandates for ...: EBSCOhost. Accessed December 20, 2022. https://web-p-ebscohost-com.offcampus.lib.washington.edu/ehost/detail/detail?vid=0&sid=b6a080a6-fc6a-47d8-8629-b13fe99485a7%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d
12. Matos M, Gilbertson P, Woodruff S, Meerow S, Roy M, Hannibal B. Comparing hazard mitigation and climate change adaptation planning approaches. *J Environ Plan Manag*. Published online July 8, 2022:1-21. doi:10.1080/09640568.2022.2093171
13. Woodruff SC, Stults M. Numerous strategies but limited implementation guidance in US local adaptation plans. *Nat Clim Change*. 2016;6(8):796-802. doi:10.1038/nclimate3012
14. Asadnabizadeh M. Climate Change in the Foreign Policy of the Trump Administration. *Environ Policy Law*. 2019;49(2/3):195-202. doi:10.3233/EPL-190157
15. Long B. 2018-2022 FEMA Strategic Plan.
16. Biden-Harris Administration Announces Funding Opportunity for New Community Resilience Program | FEMA.gov. Accessed December 21, 2022. https://www.fema.gov/press-release/20221220/biden-harris-administration-announces-funding-opportunity-new-community
17. 2022-2026 FEMA Strategic Plan: Building the FEMA our Nation Needs and Deserves.
18. Jordaan SM, Davidson A, Nazari JA, Herremans IM. The dynamics of advancing climate policy in federal political systems. *Environ Policy Gov*. 2019;29(3):220-234.

doi:10.1002/eet.1849
19. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42(2):377-381. doi:10.1016/j.jbi.2008.08.010
20. Hu Q, Tang Z, Zhang L, Xu Y, Wu X, Zhang L. Evaluating climate change adaptation efforts on the US 50 states' hazard mitigation plans. *Nat Hazards*. 2018;92(2):783-804. doi:10.1007/s11069-018-3225-z
21. Harrison K. Federalism and Climate Policy Innovation: A Critical Reassessment. *Can Public Policy Anal Polit*. 2013;39:S95-S108.
22. Klima K, Jerolleman A. Bridging the Gap: Hazard Mitigation in the Global Context. *J Homel Secur Emerg Manag*. 2014;11(2):209-216. doi:10.1515/jhsem-2013-0095