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EDITED BY
J. B. Ruhl,
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Tracy Lynn Kijewski-Correa,
University of Notre Dame, United States

*CORRESPONDENCE
Sadegh Eghdami
✉ me2ts@virginia.edu;
✉ sadegh.eghdami@gmail.com

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Gap analysis of climate adaptation policymaking in Coastal Virginia

Sadegh Eghdami[1]*, Valerie Michel[1], Majid Shafiee-Jood [1,2] and Garrick Louis[1]

[1]Department of Systems and Information Engineering, University of Virginia, Charlottesville, VA, United States, [2]Department of Civil and Environmental Engineering, University of Virginia, Charlottesville, VA, United States

Due to its inherent multidimensionality and complexities, successful climate adaptation policymaking requires a concerted effort among multiple governance levels. Discovering the challenges and governance gaps can provide insights for policymakers paving the way for more effective policies in the future. This paper intends to provide such analysis for Coastal Virginia, a strategic region in the United States receiving significant climate impacts, particularly sea-level rise (SLR) and flooding. Utilizing semi-structured interviews with the main stakeholders and building on the adaptation framework of Moser and Ekstrom, we identify, categorize, and relate main adaptation challenges to better understand the gaps and underlying institutional dynamics causing them. Intergovernmental coordination and comprehensive planning and prioritization are the main overarching challenges, with high emphasis in the literature, while the challenge of retreat and the private sector are less discussed. It is followed by recommendations for different levels of government, informing the path forward from the stakeholders' perspective. A discussion of findings provides several implications for local, state, and federal policymakers. This research could be extended to other coastal and non-coastal areas to help formulate national and sub-national adaptation policies that maintain a holistic vision for adaptation policymaking while pondering the context-specificities of states, regions, and localities. It would be an essential task as adapting to climate change is still in its infancy stages, with the prospect of staying with us for decades to come.

KEYWORDS

climate adaptation, Coastal Virginia, gap analysis, adaptation challenges, adaptation policymaking, intergovernmental coordination, comprehensive adaptation planning

1. Introduction

The impacts of climate change on the U.S. coastal areas, e.g., rising sea levels, storms and hurricanes, and threats to natural and human ecosystems, will intensify within the next several decades (Scavia et al., 2002). The increased risk, accompanied by the importance of coastal areas, has sparked policy responses at different governance levels (Olazabal et al., 2019). Climate adaptation policies and measures vary across regions due to institutional, economic, societal, and cultural differences. Successful adaptation policies require coordinated and comprehensive planning across different forms and levels of government (Füssel, 2007; Preston et al., 2011). Therefore, it is critical to analyze and explore the gaps and challenges of implementing policies across multiple governance levels to better understand the dependencies and intricacies of comprehensive planning for adaptation.

Several scholars have identified barriers and challenges of climate adaptation at either national, state, regional, or local levels using different methodologies, e.g., interviews,

document analysis, and surveys (Biesbroek et al., 2011; Hunt and Watkiss, 2011; Baker et al., 2012; Boateng, 2012; Bierbaum et al., 2013; Clar et al., 2013; Reckien et al., 2014; Waters et al., 2014; Ryan, 2015; Shi et al., 2015; Chen et al., 2016; Tangney, 2017; Woodruff, 2018; Miao, 2019; Molenveld et al., 2020; Rai, 2020; Valente and Veloso-Gomes, 2020; Bromley-Trujillo and Holman, 2021; Lee et al., 2021; Basseches et al., 2022). For instance, Biesbroek et al. (2011) categorize the barriers to development and implementation of climate adaptation strategies into seven clusters and, using a survey of 264 involved individuals in the Netherlands, find the ten highest-ranked barriers to adaptation, e.g., conflicting timescale, conflicting interests of actors, and lack of financial resources. Using a quantitative approach, Miao (2019) studies the underlying reasons a state plans for climate adaptation through logistic regression and finds that experiencing more extreme weather events, economic activity in Coastal regions, state income, and civic engagement partially explain the presence of a state adaptation plan. Lubell (2017) study the governance gap, which is the breach between the problem of SLR and the implementation of adaptation solutions in the San Francisco Bay Area, to understand climate adaptation barriers. He identifies six governance challenges followed by seven recommended actions to improve adaptive capacity in the near term. Through a survey of stakeholders, Yusuf and St. John (2017) identify barriers to adaptation readiness in Hampton Roads by asking them what part of the adaptation cycle they find to be the most challenging in this region. They find implementing and developing options the most challenging phases while funding for adaptation is the most significant barrier to adaptation readiness. In another case, Valente and Veloso-Gomes (2020) identify adaptation barriers by reviewing the adaptation projects in several port cities, e.g., Venice, Hamburg, London, Rotterdam, New York, and Tokyo. They identify governance, sociocultural, financial, political, and communicational barriers highlighting the need for adaptive planning to address them. Such studies provide tremendous insights into adaptation challenges by selecting a governance level (national, state, regional, or local) and evaluating the adaptation practices using a variety of qualitative and quantitative methodologies. However, it is imperative to include analyses of the relationship between these various governance levels regarding climate adaptation and policymaking to achieve a well-rounded, comprehensive synthesis of this subject matter.

Our study contributes to the current literature by identifying adaptation challenges at different governance levels and the interdependence of these challenges. We pursue a multi-governance analysis to capture decision-making interdependencies and mutual impacts at different governance levels. As adaptation is context-specific, we use a case study to critically analyze adaptation policymaking in a specific region, identify the challenges, and shed light on governance gaps (Preston et al., 2013; Wilson, 2022). We look at the Commonwealth of Virginia for state governance while supplementing our understanding with regional and local governance perspectives from the Hampton Roads region and the City of Norfolk, respectively. We chose Coastal Virginia as a case study as it has one of the highest levels of relative SLR in the United States; therefore, there is a need for adaptation policies to address the imminent climate change impacts (Boon, 2012; NOAA, 2022). We chose the City of Norfolk and the Hampton Roads region as our local and regional focal areas due to their pioneering role in Virginia's coastal climate adaptation policy and national strategic significance (Eghdami et al., 2023a). Hampton Roads region is one of the largest concentrations of armed forces in the U.S as it is home to 15 military installations, including Naval Station Norfolk, the world's largest naval base (Kleinosky et al., 2007; Sadler et al., 2017).

This paper aims to identify adaptation challenges and governance gaps in Coastal Virginia, providing insights for policymakers at different governance levels, ultimately leading to more effective adaptation policymaking (Shi, 2019; Hürlimann et al., 2022). Specifically, we address the following research questions in this paper:

1. What are the overarching challenges and gaps specific to each governance level?
2. How could these gaps influence policies moving forward?

To accomplish this, we first use semi-structured interviews with the main stakeholders involved in climate adaptation policymaking in Coastal Virginia to identify gaps and challenges at different governance levels. We then borrow the adaptation diagnosis framework proposed by Moser and Ekstrom (2010) to analyze how identified gaps impact different phases of the adaptation process. Finally, using the insights from the previous steps, we provide suggestions and guidelines for the future of climate adaptation in the region.

2. Materials and methods

2.1. Background on Coastal Virginia

Coastal Virginia has one of the highest rates of SLR in the United States, as the sea-level in some areas is 14 inches higher compared to 1950 (Boon, 2012; Kopp, 2013; NOAA, 2022). Moreover, Hampton Roads region is the second-largest population at risk of SLR in the U.S., after New Orleans (Eggleston and Pope, 2014). One-sixth of Coastal Virginia residents will be exposed to major coastal flooding by 2080, and about 300K acres of land will become unhabitable due to daily flooding. Extreme climate events will be a severe risk to the natural and built infrastructure, threatening an area that is responsible for 78% of Virginia's GDP (Commonwealth of Virginia—Office of the Governor, 2021). SLR and flooding, Figure 1, generate potential threats for military facilities, public and transportation infrastructure, ports and logistics, and tourism, in addition to private property damages (Van Houtven et al., 2016; Sadler et al., 2017; Commonwealth of Virginia—Office of the Governor, 2020; Yusuf et al., 2021). Adaptation practice in this area has been a bottom-up and fragmented process initiated by the most affected localities in Hampton Roads. As a Dillon Rule state[1], the state government has a critical role in shaping long-term policies toward adaptation addressing the most salient climate challenges in the

1 Under Dillon Rule, local governments are created by the state and exist to perform the tasks of the state at the local level. So, the local government's power is derived from the state while limited to what the state delegates to it.

state, i.e., sea-level rise and flooding, embodied in the most recent coordinated efforts through Virginia Coastal Resilience Master Plan and Community Flood Preparedness Fund (CFPF) as a funding mechanism (Eghdami et al., 2023a). The City of Norfolk has been a pioneer in this region, being able to obtain funding and technical resources through several cross-geographic initiatives, e.g., 100 Resilient Cities, Dutch Dialogues, and Norfolk Coastal Storm Risk Management Study (Eghdami et al., 2023a).

2.2. Methodology

We conducted 42 semi-structured interviews with climate adaptation policymaking stakeholders in Coastal Virginia from August 2021 to January 2022. We initiated our sampling from the decision-makers involved in coastal adaptation in the City of Norfolk, as it has been the locality of interest in our study. Then, we extended our reach to the involved stakeholders in regional and state governments, environmental nonprofits, academia, and economic development nonprofits through snowball sampling. We stopped sampling when the following two things occurred: firstly, the answers we were hearing from the interviewees did not add any new information to what we had already collected, and secondly, the suggestions we were receiving from an interviewee for whom to speak next were all people and organizations we had already contacted, both of which indicated a saturation point (Guest et al., 2006). We contacted 110 people within different stakeholder groups and conducted 42 interviews with people from local, regional, state, and federal governments, environmental and economic development nonprofits, and academia. We used email addresses, either available online or obtained from other interviewees, for contacting our potential participants and blocked 1.5 h of their time for the interview. We audio-recorded the interviews, following the University of Virginia's Institutional Review Board protocol, transcribed the interviews through an online artificial intelligence platform, Otter.ai, and used the transcripts in our analysis.

We used thematic analysis through conventional content analysis introduced by Hsieh and Shannon (Hsieh and Shannon, 2005). Thematic analysis is a general qualitative method to extract themes (codes) from qualitative data (i.e., transcribed interviews in our study). Coding, the process of extracting codes, was performed through a qualitative and mixed methods platform called "Dedoose."

For the coding, we reviewed the responses and specified the parts informing our research questions. For example, most codes addressing the recommendations came from the third segment of interviews. To accomplish thematic analysis, we first reached a preliminary codebook through consensus building after the first two interviews were individually analyzed (Saldaña, 2013; Roberts et al., 2019). We modified the codebook two additional times during the coding process as new codes emerged. The final codebook was discussed and translated to the challenges and recommendations.

Eventually, we leveraged the diagnostic framework by Moser and Ekstrom (2010) to associate identified challenges with adaptation phases. They develop the framework by considering a rational step-by-step approach and three structural components: actors, the context in which they interact, and the system of concern that is vulnerable to climate risk. Then, by asking the following questions, they identify potential barriers to adaptation at each stage: (1) what can damage the adaptation process? (2) how do the structural components contribute to the barriers to adaptation? We borrowed their framework to categorize the challenges we identified within our coding analysis. To adopt the framework, we compared our identified challenges with their barriers at each phase of the adaptation process and determined what phase is the most affected by each challenge. This helped us bring our findings into a theoretical context and create a holistic picture of adaptation policymaking in Coastal Virginia.

3. Results

This section summarizes our findings in three general categories. First, we present the overarching challenges of coastal adaptation policymaking. Then, we identify and discuss the challenges at each level of governance, i.e., local, regional, state, and federal. Finally, we highlight the recommendations that were discussed in our interviews with the stakeholders. We select and report some quotes from interviews in the Supplementary material for each challenge and recommendation to provide a more precise understanding.

3.1. Overarching challenges in the coastal adaptation policymaking

Our analysis has identified eight distinct challenges with the climate adaptation practice in Coastal Virginia: intergovernmental coordination, comprehensive planning and prioritization, political awareness and incentives, funding sources, social equity, the resilience of natural resources, a controversy around retreat, and conflicts with the private sector. We further explain each challenge by breaking it into its components, as shown in Table 1. To bring more clarity and relevance to adaptation frameworks, we borrow the Moser and Ekstrom diagnosis framework for adaptation barriers and associate each challenge component with the most impacted phase in the adaptation process. This analysis shows that six components (out of 19) mainly impact the understanding of climate risks, and 12 exert their influence through adaptation planning, while only one challenge component primarily impacts the execution and managing phase of adaptation. This shows that most adaptation challenges in Coastal Virginia pertain to the understanding and planning phases of adaptation, indicating that adaptation practice is mostly at its preliminary stages, with the implementation yet to come (Eghdami et al., 2023a). This section describes each overarching challenge through specifics from Coastal Virginia and interview quotes.

3.1.1. Intergovernmental coordination

It is believed that there is no institution or entity in Virginia with a mission solely dedicated to planning for climate risks and consistently overseeing various aspects of coastal adaptation. For example, a stakeholder with long engagement in Virginia's adaptation policymaking says, *"the depressing fact is that there is*

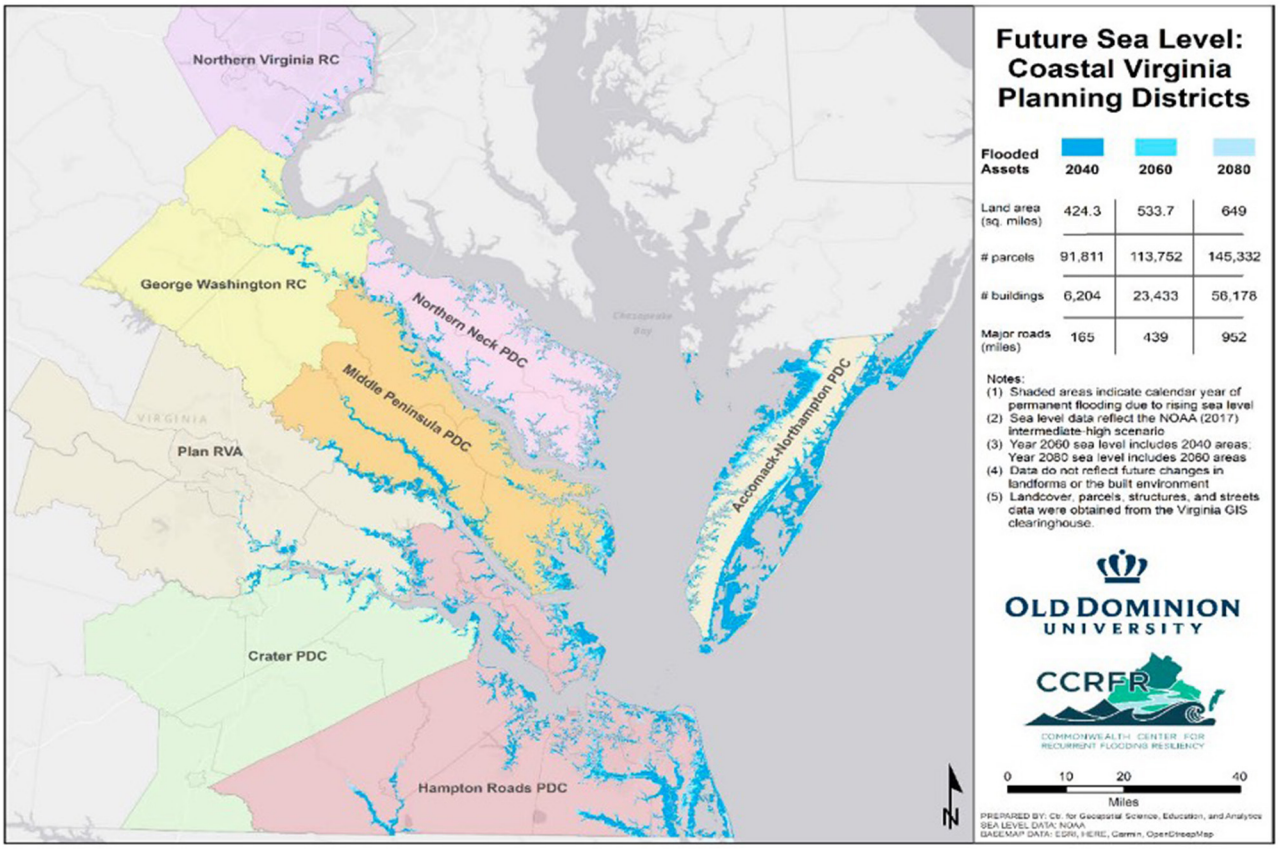

FIGURE 1
Coastal Virginia's regional planning districts with predicted flood vulnerability (Commonwealth of Virginia—Office of the Governor, 2020).

no entity within the state that is consistently and effectively focused on climate change issues." It is generally believed that mitigating the impacts of climate change, e.g., SLR, flooding, extreme heat, and drought, requires both horizontal coordination (i.e., in one governance level such as a locality) and vertical collaboration between the different layers of governance, and both levels have been missing in this practice. On the local level, the frontline of combatting climate impacts, there is little coordination between local departments to ensure that programs and projects are well aligned; this is mainly because various executive units are used to working in silos without a clearly defined path of coordination between them. An interviewee put it forward: "*there is still a lot of silos, and we have been working to tear some of that down informally, but we still definitely have a way to go."* The same story holds at the state level. Different state agencies have been partially tackling climate risks affecting their scope of work and mission; however, there is no mechanism or entity to mediate them, ensuring that a high-level vision is withheld for the state in this practice. Due to the diverse and significant impacts of climate on health, transportation, natural resources, environmental quality, land conservation, housing, and emergency management, it is necessary to define a coordination protocol to change this situation. Master Plan and the setting designed to achieve it, the Technical Advisory Committee (TAC), is the only statewide effort to address intergovernmental coordination challenges. This is considered a "good start"; however, the state legislature should engrain such a setting in the Code of Virginia to become solidified in the long term since climate impacts will remain and even aggravate in the years to come.

3.1.2. Comprehensive planning and prioritization

Our analysis has identified several key challenges that render planning in adaptation policymaking ineffective: lack of vision with a comprehensive approach, no agreement on solutions, not embracing all climate risks, and data deficiencies. First, it is believed among several stakeholders that there is still no identification and vision for critical assets, natural and built, even after the Master Plan. Such inventory of assets should be achieved through technical risk assessment and community inputs, paving the way for a long-term evaluation of options to protect them. A senior member of the environmental community expressed their concern *"what I plan to do is tee up priorities, whether that is on flood risk mitigation from the narrowest sense to community resilience at the broadest sense. If there is no plan, then it is just ad hoc. And we know what ad hoc investments are inefficient."* Moreover, disagreements exist on the best solutions to flooding and SLR challenges. For example, while some regional and local stakeholders in rural areas are trying to save the properties at risk for flooding, others believe that this poses severe consequences for water quality, health, and aquaculture.

TABLE 1 Summary of overall identified challenges.

Overarching challenge		Challenge component		Most impacted phase in the adaptation process		
				Phase 1: understanding	Phase 2: planning	Phase 3: managing
1	Intergovernmental coordination	1.1	Lack of institutions to strategically address climate impacts and coordinate adaptation		☐	
		1.2	Lack of required collaboration in different governance layers		☐	
2	Comprehensive planning and prioritization	2.1	Lack of vision and prioritization		☐	
		2.2	Lack of long-term and comprehensive approach in planning		☐	
		2.3	No agreement on solutions		☐	
		2.4	No embracing of all climate risks in planning	☐		
		2.5	Data deficiencies impede comprehensive planning	☐		
3	Political awareness and incentives	3.1	Lack of observed severity hinders a call for action	☐		
		3.2	Lack of awareness and incentive in politicians and elected officials play an essential role		☐	
4	Funding sources	4.1	Critical need for funding and no agreement on who should pay			☐
		4.2	Insufficiency of funding at local and state levels		☐	
5	Social equity and underserved communities	5.1	Social equity is a significant challenge	☐		
		5.2	Challenges in the involvement of underserved communities in decision-making		☐	
6	Resilience of natural resources and environment	6.1	Resilience of natural resources does not receive enough attention in conversations around resilience	☐		
		6.2	Gray infrastructure is dominant in adaptation solutions		☐	
7	Retreat as a controversial issue	7.1	Need to think and plan for retreat		☐	
		7.2	Strong opposition to retreat from localities		☐	
8	Private sector	8.1	Economic development and resilience can be in conflict	☐		
		8.2	Conflicts with the private sector		☐	

Additionally, some planned projects are perceived to be addressing only one aspect of climate risk without due consideration of others. Even at a considerable financial cost, if such unilateral projects are implemented, they will not solve the multifaceted climate problem. The availability and sufficiency of data is another piece of the overarching gap in comprehensive planning in multiple ways. First, the deficiency of climate risk data and models impedes the effective identification of vulnerable areas in the planning process, which usually requires high-resolution data. For example, several areas of the state still do not have an appropriate hydrodynamic model to assess pluvial flooding, making any planning effort inadequate. Besides, accurate data on the projection of climate risks paves the way for greater attention in the affected localities, which are not proactively addressing such risks. A member of the regional government notes that *"we do not have a model that could tell us where we have deficiencies in our stormwater system capacity. Some*

of the other regions around the country have models that can show where it floods".

3.1.3. Political awareness and incentives

It is generally believed that the slow and long-term nature of climate impact, such as SLR, prevents climate issues from receiving the attention they deserve from the public. The absence of high-impact natural hazards in Virginia is considered another factor that precludes attention from the public and politicians, as posed by an academic stakeholder *"in emergency management, they say you want to take advantage of a good disaster. That is what a lot of places have done. They have hurricanes that have done a huge amount of damage"*. Politicians are generally known to be inattentive to climate-impact policymaking at the local and state levels. Due to the short-term political cycle, they do not have a strong incentive to bring such issues to the top of their agenda. The lack of incentive also results from the unpopularity of action for adaptation among constituents, as remarked by an interviewee, *"if you are going to do something as a political leader, it is really expensive. The propensity to push it down the road is really powerful. Nobody likes to have their taxes raised."* As adaptation decision-making is expected to be primarily local, this challenge is highly emphasized for local elected officials rather than the lawmakers in the General Assembly. Most changes and efforts in local government are made through agency staff rather than elected officials as they have a higher awareness of climate risks due to longer-term presence and higher experience with the challenges of climate risks. Most of the connections and collaborations of a locality with external stakeholders, e.g., environmental NGOs and academia, are established through their executive staff becoming more involved with the knowledge and practices of climate adaptation around the state and the nation.

3.1.4. Funding sources

Funding as a challenge came up in our interviews more than any other point, regardless of which stakeholder group the interviewee belonged to. There is no definite funding required to address coastal adaptation in Virginia since there has not been any comprehensive planning with a holistic perspective on the matter. Virginia Beach's adaptation strategy, Sea Level Wise, introduced projects whose costs are three billion dollars. Norfolk's study, done by the Army Corps of Engineers, introduced $1.4 billion worth of projects, which are believed not to consider the pluvial flooding (USACE, 2018). The Master Plan, published in December 2021, intentionally does not provide a final number on the cost of resilience projects inventory since they are aware of the lack of a comprehensive inventory; however, it is estimated to be between 5 and 10 billion dollars. Wetlands Watch, an NGO, estimates the flooding projects of Coastal Virginia to be at $40 billion without considering ongoing stormwater projects, private property, business expenses, and federal installations in this area (Wetlands Watch, 2021). Knowing that adaptation will be costly, there is an ongoing debate on who should pay for it. A stakeholder points this out by *"so, where are we going to come up with that money? If you ask local political leaders, they will say it is the state. If you ask the state, they say it is the feds. If you ask the feds, they will say, we do not know."* It has been a massive expectation of localities from the state to supplement financial resources to help them in this matter. The state has attempted to introduce federal sources as possibilities, e.g., in the Master Plan, while not allocating extensive State money to adaptation. The most significant initiative has been CFPF, sourced from the carbon auction proceedings of RGGI[2], which Virginia joined in 2021. CFPF can potentially bring an annual $100 million, which is not comparable to the required funding mentioned earlier (Virginia General Assembly, 2020; Eghdami et al., 2023a). On the federal level, the Army Corps and FEMA have been the primary funding sources, while both are perceived as insufficient, taking decades to afford the required investments in adaptation (Wetlands Watch, 2014, 2021).

3.1.5. Social equity and underserved communities

Underserved and socioeconomically vulnerable communities are at a significant disadvantage in climate adaptation. Most importantly, they have lower individual capacities to combat the impacts of climate change, which are in addition to their already present socio-economic challenges. Although there is a significant acknowledgment of this problem between stakeholder groups, particularly highlighted in NGOs and academia, the problem has not been practically addressed in adaptation policymaking for various reasons. For example, there is criticism of the Master Plan for insufficient engagement with such communities, while the leading team believes that this matter should be addressed more effectively in the future phases of the Master Plan. Getting the engagement of the socioeconomically vulnerable requires building a relationship of trust, which can be recognized in a long-term continuous process rather than a one-shot event for a specific project. An environmental nonprofit member explains, *"the nature of many of our boards and commissions is older residents, and it is not as diverse or inclusive as I would like it to be. But there is also a lot to be said about who has the time, the opportunity, and the willingness to talk about specific issues."* We should also mention that there are recent efforts at governance levels to address diversity, equity, and inclusion in light of the national movement started in 2020; however, there is a long way to accomplish equitable policies in a diverse and inclusive manner.

3.1.6. Resilience of natural resources and environment

There is an ongoing debate on prioritizing natural resources and nature-based solutions in adaptation projects and programs. The concern about the resilience of natural resources, e.g., wetlands, living shorelines, natural habitats, and fisheries, primarily stems from environmental non-profits, academia, and state agencies whose mission involves protecting the natural environment. A state official argues, *"There is no accounting for ecosystem services or ecosystems generally are not given any kind of parity with gray infrastructure and the project prioritization list. So, even though wetlands play an essential role in helping to mitigate water inundation in communities, the plan [Master Plan] does not really reflect that."* There has been some success in state legislation supporting nature-based solutions, e.g., making living shorelines

2 Regional Greenhouse Gas Initiative (RGGI).

the default option for shoreline management in 2020. However, there is still concern that conserving natural resources is not often prioritized in adaptation planning because protecting the already-built infrastructure, such as buildings, receives precedence in cost-benefit analysis. On the other hand, local governments and engineering designs such as the Army Corps' solutions usually argue for the necessity of sustainable designs if we want to protect our communities. This argument relates this challenge to the issue of "Retreat" to be discussed next.

3.1.7. Retreat as a controversial issue

Retreat, sometimes known as a forbidden "R" word in localities, is subject to a deep controversy among the stakeholders. While stakeholders representing environmental nonprofits, academia, and state agencies believe that managed retreat from some coastal regions in Virginia is inevitable and there is a need to initiate a conversation about it, there are several concerns over retreat from the localities' perspective (Commonwealth of Virginia—Office of the Governor, 2021). First, retreat threatens localities' fiscal stability, as it would decrease property taxes, which is the main revenue category for the local governments. This problem is more pronounced for smaller and rural localities, as sometimes a strip of expensive housing along the water shapes most of their revenue. Moreover, the acquisition and demolition of property, accompanied by the need to maintain the land in the future, is considerably costly for a locality. It is also politically not appealing for a local government to announce that they cannot save specific communities, and the only option is relocation. A member of the regional government comments, *"it [Master Plan Framework] talked about a relocation handbook. We talked to them [localities in Hampton Roads], and nobody wanted that. They said we are not ready for that. The state is going to write a relocation handbook?! We are not relocating people. That has not turned the corner and become a concept that many people who are in flood-prone areas are comfortable with."* The only locality with a long-term plan for retreat is the City of Norfolk, which identifies some areas of the city with high climate risks and low critical assets as potential retreat areas in its Vision 2100 document (City of Norfolk, 2016).

3.1.8. Private sector

Coastal adaptation is perceived to potentially conflict with economic development and the private sector because they follow two different time horizons. Adaptation planning involves long-term thinking, suggesting actions that are considered optimum in the long run, whereas in some segments of the private sector, real estate, for example, focuses on short-term profits. A non-profit member comments, *"In the real estate industry, the time horizon is to the point of sale. A real estate agent makes their money at the point of sale; they could not care less what happens in 20 years, generally speaking, because their money is when the contract closes, and they get 6% off the sale of this house. So, they necessarily have a shorter-term focus. I think we have difficulties with many people in the development community, and we are still trying to figure out how to get involved with them."* This fundamental difference can represent itself in different conflicts. For example, we heard stories of real estate associations lobbying against specific building codes and materials introduced to increase resilience because they increase building costs, negatively affecting their market. This conflict is mainly perceived as significant as the private sector is known to have the ability to influence political decisions on all governance levels.

TABLE 2 Summary of identified challenges at different governance levels.

Governance level	Main identified challenges	Underlying causal/institutional dynamics
Federal	• Measurement and prioritization • Need for military engagement	• Lack of a national adaptation policy
State	• Absence of leadership • Challenge of policy continuity	• Political atmosphere and ideologies
Regional	• Lack of regional planning	• Institutional formation of regional entities (Planning District Commissions)
Local	• Limited capacity • Hesitance to upper-level planning • Limited authority	• Emphasis on local autonomy in politicians and constituents • Varied resources of localities (smaller ones lacking institutional and financial capacity

3.2. Challenges at different governance levels

This section identifies the challenges specific to each governance level, i.e., local, regional, state, and federal, as outlined in Table 2. It summarizes the identified challenges at different governance levels to explain what institutional dynamics are bringing about the challenges at each level of governance. Identified gaps at the federal level generally stem from not having a comprehensive national adaptation policy because a process to devise such a plan would require precise evaluation of adaptation plans to ensure the reduction of social and ecological vulnerability as a critical step in the process (Preston et al., 2011; Shi and Moser, 2021). At the state level, political ideologies have caused abrupt changes in valuing climate-related issues within the political cycles in Virginia and several other geographies, diminishing the necessary leadership for driving climate adaptation policies (Selin and Vandeveer, 2011; Bierbaum et al., 2013; Shi et al., 2015; Eghdami et al., 2023a). Looking at regional governance, we observed a lack of regional planning that primarily stems from an emphasis on local autonomy and identity of localities and a regional institutional setting that does not provide sufficient finance and authority to drive regional collaboration in planning for adaptation (Shi et al., 2015; Stiller and Meijerink, 2016). Localities also face a varied level of financial and institutional resources, with other social and economic challenges taking priority over adaptation (Liu et al., 2016; Eghdami et al., 2023b).

3.2.1. Local government

We identified three main challenges at the local government level: limited capacity, hesitance toward upper-level planning, and limited authority. Limited capacity, most observable in small and rural areas, was the most highlighted challenge for local governments. This is addressed through limited staff, unfilled positions, lack of technical capability, and financial limitations, which put the smaller localities at a significant disadvantage compared to bigger cities like Virginia Beach and Norfolk. A stakeholder explained this, *"remember that we have this extensive range; Virginia Beach can afford to do almost any project themselves; Gloucester or Poquoson is so much smaller. They do not usually have the staff even to manage that contract if they have the money."* The state is expected to address this gap and provide a level playing field for all the localities. CFPF claims to consider this within its grant application process by conferring capacity building and planning awards. There were also several remarks on the hesitancy of local governments to regional and state planning, as they consider such planning efforts to hinder their autonomy. As effective intergovernmental coordination requires planning efforts beyond one governance level, financial incentives are known to encourage localities to engage in such efforts. Some stakeholders discussed that as Virginia is a Dillon Rule state, local governments are cautious in introducing new measures and policies for coastal adaptation, with the fear of that policy being challenged by the state. Under the Dillon Rule, local governments only have powers that are expressly granted by the State. So, localities would need further contemplation before introducing their policy, which acts as a barrier to new policies being introduced at the level of the local government, negatively impacting progress and change.

3.2.2. Regional government

We identified the absence of planning and decision-making on a regional level as a central gap. We have heard this narrative from several stakeholders, primarily nonprofits, academia, and even local government, arguing for the necessity of regional planning, as the water does not know political boundaries, and the benefits of planning regionally, e.g., more options, higher bargaining power for attaining federal financial resources, and sharing technical resources and expertise. An academic stakeholder commented, "*there has been a vacuum of regional leadership. That is the area I have focused on because I think, particularly flooding, does not know geopolitical boundaries. A floodplain does not just exist in one city or another. And so, to address flooding, we have to be looking at it on a regional basis, just as we do for transportation."* The Little Creek Watershed is an example of the necessity of having a regional approach in planning, as storm surges in the watershed make Virginia Beach, Norfolk, and the Naval base flood. However, the Army Corps' study design in Norfolk only included surge barriers to protect Norfolk, but it could protect all three if there were a regional approach.

3.2.3. State government

The main identified gaps at the state level are the absence of leadership and the challenge of policy continuity. The stakeholders expect the state to be a leader in climate adaptation by providing vision, standards, and resources for local governments; however, as it had not happened until recently under the Governor Northam administration, the state is known to lack this leadership. A local stakeholder mentioned, *"the state has not been a very strong leader in resiliency. They know that. Maybe Virginia is catching up. I do not know. There has certainly been a lot going on in the last two years, but it has not shaken out yet in terms of structure and funding."* It is also believed that the recent efforts have not been codified, and the next administration can quickly roll back the achievements by discontinuing the Master Plan process and RGGI participation, which is the primary source of state funding for climate adaptation. Lack of leadership and progressive adaptation policymaking is also observable in the legislative branch of the state, the General Assembly, except for a few bills within recent years, e.g., permitting the governor to join RGGI and modifications in the Chesapeake Bay Preservation and Tidal Wetlands Acts to include climate change.

3.2.4. Federal government

Although the stakeholders mainly addressed gaps and challenges in governance levels up to the state level, we identified two main gaps at the federal level: measurement and prioritization of problems and the need for military engagement and investment. The first gap addresses how measurement policies guiding federal funding and grant programs, e.g., FEMA and Army Corps, prevent the initiation of equitable and efficient projects by having an old and narrowly defined definition for the benefits of a project. A stakeholder long involved in adaptation within the US pointed out, *"I cannot say strongly enough how much we are missing in designing multiple benefit projects because the BCA [Benefit-Cost Analysis] processes were written 40 years ago, and we did not have the computing power that we have now; the knowledge to quantify those benefits, place them in a policy consideration and then value them. They are doing it in the international community, the World Bank, and the IDB."* The second gap reflects the significant presence of military installations in Virginia, particularly in Hampton Roads, arguing that DOD must allocate specific financial sources to combat flooding in the areas surrounding military installations. For instance, it is argued that if the roads to an installation are flooded, it will hinder the readiness mission of the military, so they should consider the surrounding areas. This argument has been the basis for two Joint Land Use Studies (JLUS) performed in Hampton Roads (Eghdami et al., 2023a). However, it is an incomplete discussion between regional and state authorities and the DOD to provide federal financial sources to design and implement resilience projects derived from the JLUS studies.

3.3. Recommendations on the path forward

This section summarizes the main recommendations our interviewed stakeholders suggested about the future of adaptation practice in Virginia (Figure 2). In general, it is believed that a multi-layered system is needed to address climate impacts effectively by leveraging the capabilities of different levels of governance and extending coastal adaptation to embrace the full range of

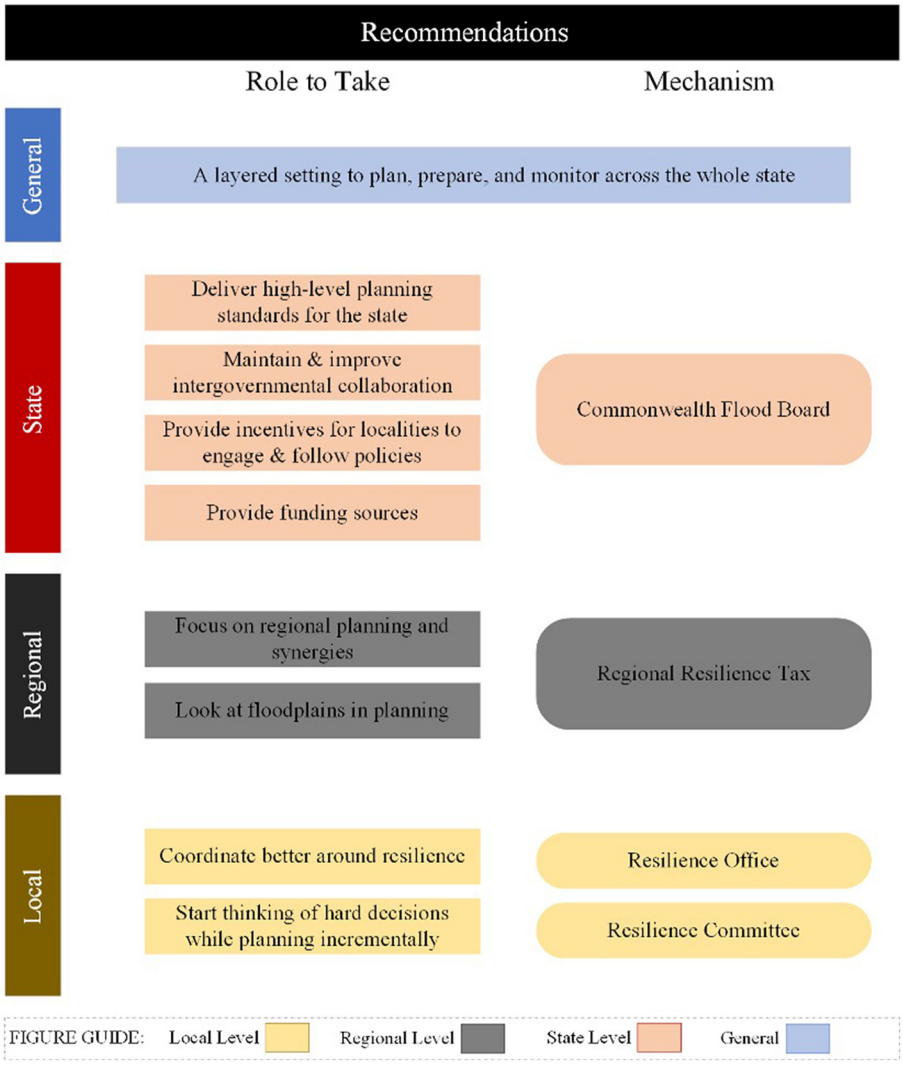

FIGURE 2
Recommendations for the future of climate adaptation policymaking in Coastal Virginia.

their jurisdictions. This is deemed necessary for technical and political reasons, as non-coastal areas are also experiencing climate impacts, mainly through more intense precipitation. Extending adaptation strategies to inland areas will broaden the political coalition and impact of climate legislation. On the local level, it was highly emphasized that localities should start thinking about the extent of the problem and how retreat will play a role in their comprehensive plans. This requires local governments to identify their critical assets collectively and determine what areas in their jurisdiction would be alternatives for retreat. While this is not a decision that should be implemented today, it is also essential for localities to take incremental steps toward resilience. This could happen by adopting zoning ordinances that leverage several tools to incentivize more thoughtful development. It is also suggested to use the resilience office and resilience committee as executive options to bring harmony and consistency to the ongoing efforts on the local level. Such measures, indeed, will address the intergovernmental coordination challenge on the local level.

The main recommendations at the regional level were to use floodplains as the basis for regional planning and introduce regional resilience taxes to bolster regional efforts. It is argued that looking at the whole flood plain in planning and design will increase the efficiency and comprehensiveness of the outcomes. Some stakeholders argue that regional taxes are legally feasible and can become politically feasible because there is precedence in doing so for transportation projects. It is deemed critical to develop an institutional mechanism for leading the adaptation practice in Virginia at the state level. The Commonwealth Flood Board is the missing entity to ensure the sustainability of adaptation practice; on the one hand, it introduces statewide policies and standards that safeguard an intergovernmental conversation. It also encourages and supports local governments through incentives and funding sources. The recommendations at the state level correspond to several identified gaps in the previous sections showing how crucial it is for the stakeholders to see the state taking a leading role. We must note that although our gap identification included the federal

government, stakeholders, who were mostly from local, regional, and state agencies, did not provide governance recommendations at the federal level.

4. Discussion and policy implications

In Figure 3, we demonstrate how the identified challenges and governance-specific gaps influence each other, thereby threatening climate adaptation implementation and success in Coastal Virginia. For example, considering "Limited Capacity" as an identified local gap certainly affects "Comprehensive Planning," given that a capacity-deficient locality would not be able to perform adequate adaptation planning. On the other hand, our stakeholders deem the state responsible for this lack of capacity, attributing it, at least partially, to missing leadership at the state level, indicating that "Absence of Leadership" has a significant influence on "Limited Capacity." Policymakers need to understand such correlations and influences as they think about improving this practice in the future.

"Comprehensive Planning" and "Intergovernmental Coordination" are critical in this story. Comprehensive planning is crucial because it directly influences several overarching challenges, i.e., social equity, the resilience of natural resources, and the controversy on retreat. These three are highly influenced by the lack of a widely accepted adaptation vision, which should be attained through planning conversations among state, regional, and local stakeholders. Comprehensive planning is also crucial because the identified gaps at different governance levels open their way to this conversation by influencing planning. For example, the measurement gap identified in federal agencies affects the planning as it neglects full consideration of the socio-economic aspects in the design of an adaptation project.

Intergovernmental coordination is crucial in two ways: first, it is an essential requirement for comprehensive planning due to the multi-level and multi-sectoral nature of climate adaptation; moreover, it is influenced by several other gaps, as shown in Figure 3. "Funding sources" is another significant gap due to its influence on the comprehensive planning and implementation of adaptation projects. This multifaceted effect is the reason why funding sources have the highest frequency regarding challenges being mentioned by our stakeholders, thus aligning itself with the research previously mentioned by Yusuf et al., which is the main research conducted on adaptation barriers in Hampton Roads, concluding that funding is the most significant barrier to adaptation readiness (Yusuf and St. John, 2017).

Our analysis shows that although funding is mentioned the most in our talks with the stakeholders, comprehensive planning and intergovernmental coordination may play a more significant role in the planning and success of adaptation practice. We argue for the necessity of investment in building capacity, as the local capacity is essential for comprehensive planning and intergovernmental coordination. This could be realized by funding resilience officer positions, providing access to data sources, and consulting in design and engineering on the local and regional levels. The latter also brings harmony and consistency to the adaptation practice of the state. Such measures will provide practical incentives for local governments to engage and contribute to the state-led practice. It is also aligned with the success story and long-lasting effect of engagement in the "100 Resilient Cities" program in the City of Norfolk (Rockefeller Foundation, 2022).

Capacity building can increase funding sources in various ways. For example, by bringing consistency and collaboration through local and regional resilience offices, there will be opportunities to develop promising regional, even state-level, applications for federal grants. This will be exceptionally beneficial if the federal government continues the recent approach of planning for climate adaptation (Eghdami et al., 2023a). Increasing capacities will also result in the creation and expansion of local adaptation plans, with more programs and projects adding to the inventory of needed projects on the state level. This can support the need for financial sources as localities and the environmental community bargain with state-level policymakers. There is still no precise evaluation of financial requirements for climate adaptation in Virginia, mainly because the scope of risks and solutions is not clear yet; however, a clearer pecuniary understanding of the scope of the problem can pave the way for the allocation of new sources.

It is essential to note the challenges local governments face when recommending actions for the future. Some localities have had a stagnant economy; some have experienced a decrease in population; some have a high poverty rate while challenged with several other issues. So, climate impacts come as a new external shock, threatening their viability (Commonwealth of Virginia—Office of the Governor, 2021). However, it would still be possible to keep an eye on the problem and try to line up local efforts to understand the scope of climate impact on the locality, then identify their critical assets and learn about their options. Localities with limited capacity should be encouraged to introduce such actions into their agenda. Environmental nonprofits and academia can be extremely helpful in making this happen. For example, the Resilience Adaptation Feasibility Tool has been able to step into rural areas and initiate a conversation about adaptation. Such a model can be pursued in the future, even if the new administration terminates the state-level efforts in the short run (University of Virginia, 2022).

Finally, we would like to discuss how our findings compare to barriers and challenges found in other studies and regions. Among the overall challenges, intergovernmental coordination, comprehensive planning, and funding resources are the most common within the literature (Biesbroek et al., 2013; Clar et al., 2013). As argued earlier, we found the first two with higher importance as mitigating those challenges can give rise to more financial resources. The need for horizontal and vertical coordination and long-term planning across the board is fundamentally engrained in the nature of climate change impacts and the underlying factors that cause vulnerability to such impacts (Eisenack et al., 2014; Krishnaprabu, 2020). The insufficient political incentive is another identified challenge, directly impacting funding sources and comprehensive planning, well explored in the literature (Clar et al., 2013).

Two last overarching challenges, i.e., retreat and private sector, are less common among the identified barriers in literature. We find that retreat, usually discussed as managed retreat, has been getting more attention recently as it has become more apparent that certain areas are not habitable anymore (Hino et al., 2017; Siders, 2019; Lawrence et al., 2020); so, the need for it is not a mere projection now. Moreover, we observed this challenge as there were

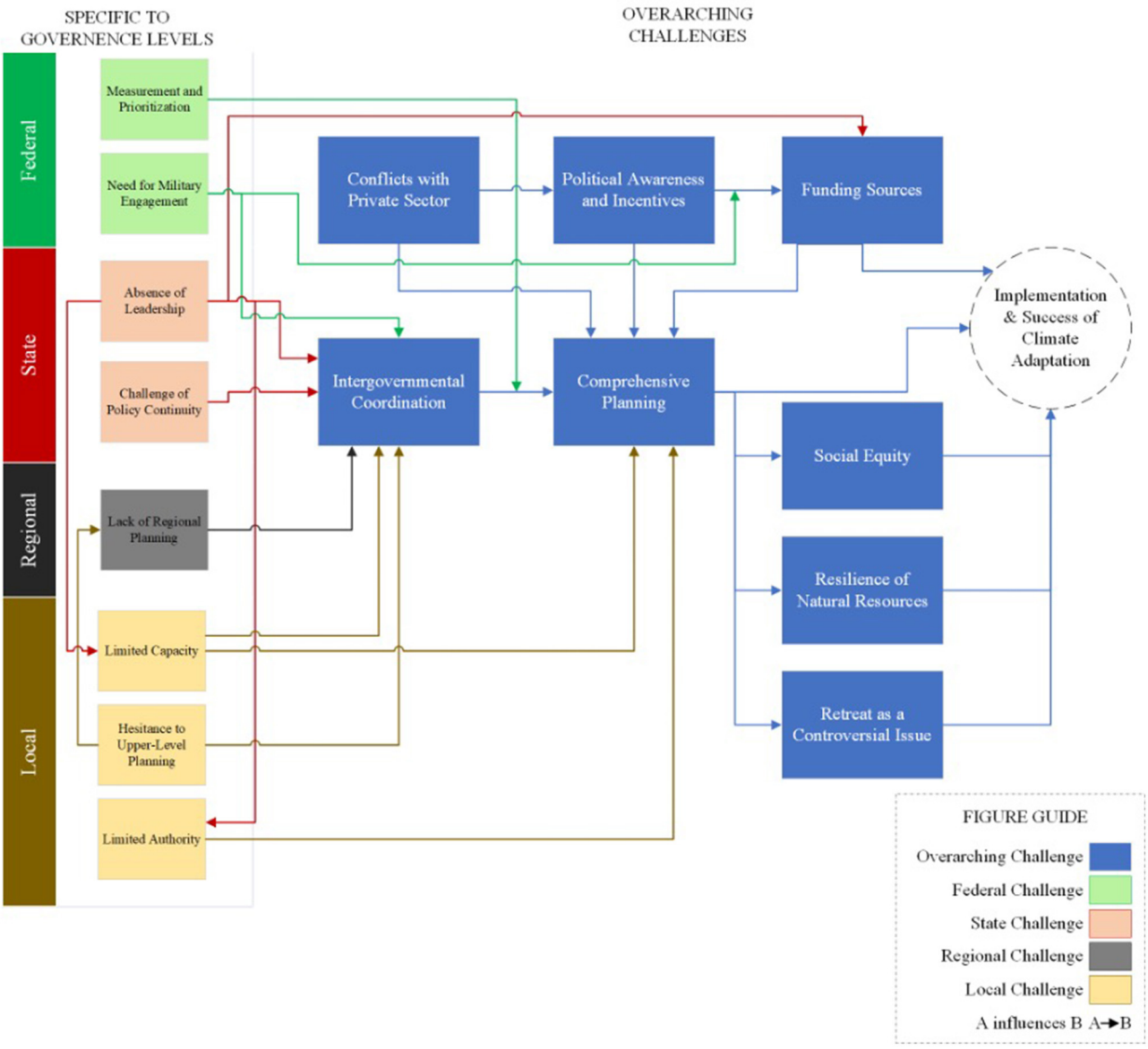

FIGURE 3
Climate adaptation challenges at different governance levels in Coastal Virginia.

opposite solid views between governance layers in our study, which was embodied in local government being hesitant to discuss retreat for several financial and reputation reasons. In contrast, the state government advocated for that discussion because flooding is to become more frequent impeding habitation in certain areas. The challenge of the private sector was emphasized as stakeholders have realized that an extensive implementation of adaptation measures requires private sector involvement, whereas the private sector has been historically absent from conversations around adaptation. The emphasis on private sector engagement also stemmed from the belief that the private sector can drive adaptation forward; a belief partially pertinent to the neoliberal perspective engrained in Virginia's political climate and fiscal conservatism (Lowry et al., 1998).

5. Conclusion and future research

We identified climate adaptation challenges in Coastal Virginia with two broad categories: the overarching challenges that impede adaptation in different governance levels or arise as the outcome of interactions between them; and the gaps that mainly present in one layer of governance. The analysis showed that adaptation challenges in Coastal Virginia are primiparity related to understanding and planning phases of adaptation according to the Moser and Ekstrom framework.

Our second category of findings addresses specific governance levels. The lack of a national adaptation policy at the federal level introduces significant challenges impacting intergovernmental coordination, comprehensive planning, and funding sources. With

the lack of federal initiatives in adaptation policymaking, the state of Virginia has taken policymaking initiatives (Rai, 2020; Bromley-Trujillo and Holman, 2021). However, the state has not been able to maintain leadership primarily due to the political ideologies that have brought about abrupt changes in climate-related policies. The absence of leadership contrasts with the studies that identify Virginia as a leading state in climate adaptation planning based on the Climate Action Plan (Miao, 2019). The continuity of statewide adaptation efforts in the new administration will be tested by observing whether the new governor continues or ceases the statewide adaptation efforts of the previous administration. Studying how a state's role might be seen and interpreted differently in a Home Rule coastal state such as Florida would be interesting for future research.

Lack of regional planning for adaptation is another identified challenge mainly caused by the institutional formation of regional entities. Regional partnerships can catalyze innovation in climate adaptation, potentially leading to more efficient floodplain-based governance systems (Zhu et al., 2007; Bauer and Steurer, 2014). Studying how a state or federal government can encourage regional planning could be an exciting avenue for future research. Such a study should include a modeling framework to account for local incentives, based on strategic interactions, and characterize win-win scenarios for local governments to initiate regional partnerships. Local governments are the main drivers of climate adaptation in Coastal Virginia while hesitant to upper-level adaptation planning. Moreover, smaller and rural localities substantially lack institutional, technical, and financial capacity. From a policy perspective, the identified local challenges point to the need for state and federal government interventions. It would be interesting to design and evaluate pilot interventions and identify essential requirements for effective interventions.

Our analysis identified the overarching adaptation challenges and the policy gaps on a multitude of governance levels. We discerned the most salient gaps to inform a discussion on the policy implications of our findings. We found some challenges that are less discussed in the literature, e.g., challenges of retreat and private sector, and explained them in the context of adaptation in Coastal Virginia; however, it would be essential to assess them further within the theoretical and practical studies. Implementing our approach to other coastal and non-coastal areas can inform local, regional, state, and federal policymakers about their influence, helping them establish adaptation policies. Such practice would be critical in formulating national and sub-national adaptation policies that can address climate impacts with a holistic vision without the risk of losing specific insights influencing policies on a local, regional, and state basis.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by University of Virginia Institutional Review Board for the Social and Behavioral Sciences (Protocol number: 4396). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SE: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Visualization, Writing—original draft. VM: Conceptualization, Data curation, Resources, Software, Writing—review and editing. MS-J: Supervision, Validation, Writing—review and editing. GL: Conceptualization, Supervision, Validation, Writing—review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fclim.2023.1259337/full#supplementary-material

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