Climate Equity on the Eastern Shore of Virginia

Quinby, VA

Final Report

May 6, 2024

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Acknowledgements

This report for the Eastern Shore of Virginia Climate Equity Project was prepared by Maya Claggett, Emilie Hoke, Rachel Kinzer, Jessie Rothfleisch, Holly Sims, & Marcela Zeballos during the Spring 2024 PLAN: 6020 Methods of Community Engagement and PLAN: 6040 Quantitative Methods for Planning Analysis courses taught by Prof. Barbara Brown Wilson and Prof. Andrew Mondschein. We thank our external partners, UVA's Environmental Institute and Eastern Shore community members, for supporting this report.

Section 1

Executive Summary

Painter, VA

This report describes three general analyses aimed at understanding how Eastern Shore officials address concepts related to climate equity: first, thematic content analysis of three long-range plans; second, descriptive and spatial analyses of transportation data; and third, descriptive and comparative analyses of municipal expenditures. The findings from these analyses are briefly outlined below. Methods, limitations, and further recommendations are described in the following sections of this report.

Thematic Content Analysis

- In analyzed plans, people are viewed and discussed as means for economic development longevity.
- Environmental impacts are heavily discussed, although there is little mention of how these impacts disproportionately affect come populations more than others.
- Although climate equity terms like "environmental justice" are defined in some of these plans, they are not used with intention. Environmental impacts and local populations are both discussed, but rarely are the two discussed together.

Transportation Analysis

- "Climate-Related" road closures between May and December 2023 were more frequent in September, midway through the general Atlantic Hurricane Season.
- The main evacuation routes, Lankford Highway (US 13) and Seaside Road, had the most "Climate-Related" road closures during the same time interval.

Financial Analysis

- Climate equity expenditures vary between Accomack County, Northampton County, and Virginia from 2003 to 2022.
- The expenditures for Environmental Management vary between the two counties on the Eastern Shore from 2003 to 2022.
- Accomack County's climate equity expenditures fluctuate from 2003 to 2022, whereas Northampton County and Virginia's climate equity expenditures are more stagnant from 2003 to 2022.

Section 2
Partner Summary & Issue Background

The Eastern Shore of Virginia Climate Equity Project is an initiative funded by the National Science Foundation and housed at the Environmental Institute at the University of Virginia (*Eastern Shore of Virginia Climate Equity Project*, n.d.). This project is led by Karen McGlathery, who also served as the primary contact for this research project. The overall goal of the project is to address inequalities and information gaps on the Eastern Shore of Virginia in order to improve localities' adaptation and resilience to climate change. For this project, the research team hopes to 1) provide an honest and useful assessment of the way climate, equity, and the combination of the two are discussed in key planning documents in the region, and 2) conduct an Eastern Shore case study to examine transportation-related impacts and financial responses to a changing climate. We also hope this report will highlight information gaps and future research potential with regard to climate equity on the Eastern Shore.

These findings will help the Environmental Insitute by informing them of where the biggest gaps of information lie in official county-level documents. With this information, the Environmental Institute can make informed decisions about where to invest resources to further climate equity goals at the local government level. This information, combined with input from residents in the area at climate equity workshops held in 2023, will contribute to the creation of clear, attainable, and productive climate equity goals in the region (Cater, 2023). With these goals, the Eastern Shore of Virginia will be better prepared to protect all its residents from the negative effects of climate change.

History of Eastern Shore

The Eastern Shore of Virginia is comprised of two counties, Accomack and Northampton. The area is home to just over 45,000 people (VA – Eastern Shore of Virginia, n.d.). The Eastern Shore is the furthest east point in the Commonwealth of Virginia, as it is a 70-mile completely detached island from the rest of mainland Virginia. The area's economy is traditionally based on agricultural and seafood production, although the area as a whole is diversifying its economy to grow into the tourism and manufacturing sectors (Eastern Shore, n.d.). Both counties have an African American population of roughly 30%, a Central / South American population of roughly 10%, and an Asian American population of roughly 1% (VA – Eastern Shore of Virginia, n.d.).

Because the area lies between the Chesapeake Bay and the Atlantic Ocean, the region is prone to dangerous climate-related weather events. The Eastern Shore of Virginia is, at its highest point, only 50 feet above sea level. This makes the region incredibly prone to climate events like sea level rise, flooding, storms, and shoreline erosion (Andrews et al., 2019). In the last decade alone, the region has faced seven intense storm events that resulted in dangerous high winds and flooding in the area (Accomack-Northampton Planning District Commission, 2021). As climate change worsens and weather events like storms, tides, and floods become more intense, the Eastern Shore must be prepared to take care of all its residents (Causes and Effects of

Climate Change, n.d.). This is especially true for communities that are more likely to experience the negative effects of climate change, namely low-income communities and communities of color (EPA, 2021). Municipalities must be prepared to protect and assist the most vulnerable member of their communities who are disproportionately impacted by the effects of climate change. It should be said, though, that it is no accident that these communities experience these effects more intensely than whiter, wealthier populations.

History of Climate Equity in Urban Planning

The field of urban planning has a history of systemically underserving and actively damaging some communities. Across municipalities in the United States, there is a historic pattern of undermining low-income communities and communities of color in many policymaking decisions. The tangible results of these decisions include limited and faulty physical infrastructure, service interruptions from extreme weather events related to climate change, and affordability challenges from consumers (Jessel et al., 2019). Because of this, roughly 60,000 U.S. citizens lack access to energy despite there being enough raw materials to provide them energy (Larson, 2020).

These causes of inequity are a result of practices that historically devalued property owned by people of color (Rothstein, 2018), such as "redlining" using Home Owners' Loan Corporation (HOLC) maps (Mitchell, 2018), discriminatory property assessments (Kelly, 2017), and urban renewal projects (Teaford, 2000) and subsequent displacement (Fullilove, 2001). The result of this was a huge loss of wealth for minority and often vulnerable populations, leading to a toxic spiral of lower incomes for these group, which leads to reduced revenues from property taxes, which ultimately results in a lack of funding for critical infrastructure, such as road networks, and investment to protect against climate impacts (Almagro et al., 2023). This history has ensured disinvestment of municipal resources from low-income communities and communities of color.

Although the field of urban planning has taken a turn to address these harms, many municipalities have not begun that journey. Most planning documents in the U.S. still do not talk about equity or set goals to advance equity tangibly in their communities (Loh & Kim, 2020). Planners in the field are more vocally calling for equity to be a forefront discussion in key planning documents in order to address some of these generational harms (Stromberg, 2023). As such, it is necessary to evaluate whether key planning documents from the Eastern Shore of Virginia prioritize equity in their plans in order to protect and assist their communities made vulnerable by climate change.

Section 3
Thematic Content Analysis

By articulating the priorities adopted by local governments, comprehensive plans serve as long-range planning documents that not only set the course for development and investment but also signal and promote a community's goals and objectives. Similarly, hazard mitigation plans outline and document historical and current hazards that pose the largest threat to communities, property, and industries (Accomack-Northampton Planning District Commission, 2021). Notably, up to date hazard mitigation plans are required in order to qualify for federal disaster assistance (FEMA, 2023). The research team analyzed current versions of the Northampton County Comprehensive Plan, the Accomack County Comprehensive Plan, and the Eastern Shore of Virginia Hazard Mitigation Plan (see Table 1) to understand 1) how local government authorities document the intersection of vulnerability and climate-change related impacts, and 2) if these official records capture and address the disproportionate exposure to the negative effects of climate change experienced among marginalized communities. Two county-level documents and one regional report were intentionally selected for this analysis in order to assess the context and language used to document events and interventions across two different scales.

Plan	**Date adopted**	**Overview**	**Pages**
Accomack County Comprehensive Plan	Adopted May 14, 2008 Amended 2018	"The overall purpose of the Comprehensive Plan is to guide the future social, economic and physical development of Accomack County so as to ensure the provision of adequate, quality, community facilities and services and the maintenance of a healthy, safe, orderly, and harmonious environment".	343 pages
Northampton County Comprehensive plan: *Your Northampton County 2040*	June 8, 2021	"This Comprehensive Plan is a statement of shared community values and a framework to advance those values. It articulates Northampton County's vision for the future and identifies specific steps to realize our vision. The Comprehensive Plan is not regulation. It is an adopted policy guide for County officials and a resource for community members. It is our guide to creating a more resilient and vibrant community - together".	344 pages
Eastern Shore of Virginia Hazard Mitigation Plan	2022	This plan identifies current and historical regional hazards, assess risk, analyzes potential impacts, describes stakeholder involvement in the preparation of the plan, and establishes regional goals and strategies to guide the implementation of mitigation projects.	582 pages

Table 1. Summary of regional plans analyzed for the thematic content analysis of planning documents.

Methodology

This report uses content analysis to systematically and objectively identify (Holsti, 1968) the occurrence of 1) specific descriptions of changes in the environment, 2) significant weather events, 3) documented impacts of these environmental changes and events, 4) locally experienced vulnerability, and 5) policy or strategy recommendations made in response to these environmental changes, impacts, and events. The research team developed a set of a priori codes

(see Table 2) before the in-depth review of the Northampton County Comprehensive Plan, the Accomack County Comprehensive Plan, and the Eastern Shore of Virginia Hazard Mitigation Plan to use across all three plans. These codes identify phrases that discuss specific events, vulnerability, and actions associated with climate-change related hazards within the three planning documents.

A Priori Codes	*Definitions*
Effect	Impacts and damages of a specific climate disaster.
Events	Specific climate disasters that occurred in an area (ex., hurricane, flood event, blizzard).
Frequency	How frequently general climate disasters occur (ex., annually, in concurrence with certain tidal conditions, etc.).
Minority Groups	Populations identified as having a specific shared and largely unchanging characteristic, including income status, race, languages spoken, disability.
Reaction	Response of a locality to a climate disaster (ex., policy, mitigation efforts).
Reason for Event	Cause of the event. With this term, we are looking to see if climate change is attributed as a root cause for any isolated climate disasters.
Vulnerability	General likelihood that a group will be exposed to the impacts of climate change without any specific attribution of any identity liked to that likelihood. Mentions of risk for individuals and communities.
Emerging Codes	*Definitions*
Common Environmental Descriptors	Specific words or phrases used in the document that indicate how local government and the community view and describe the natural landscape.
General Environmental Impacts of Concern	Common damages and outcomes the community experienced not associated with an acute weather event.
Reason for General Environmental Impacts of Concern	Common root causes identified by the community for the environment-effects they are experiencing not associated with an acute weather event.

Table 2. Coding Dictionary for Thematic Content Analysis

The research team used the "Events" code to understand the types of specific events impacting the region, the "Effect" code to understand impact and damages from these acute-weather events, the "Frequency" code to understand how often these acute-weather events took place, the "Reaction" code to understand official responses to these acute-weather events, and the "Reason" code to understand how the community and local government described the cause of the acute-weather event and looked specifically for connections to climate change. Additionally, the "Vulnerability" code was used to identify a heightened likelihood of exposure to the impacts of climate change and the "Minority groups" code was used to identify non-dominant groups or populations across different measures such as income, education level, and race.

Using Dedoose, a qualitative data analysis software, two team members independently reviewed one planning document and applied the a priori codes to descriptions that discussed specific events, vulnerability, and actions associated with climate-change. During this process, three emerging codes were identified (see Table 2). These codes identified descriptions of the environment, climate impacts felt by the community, and explanations of the causes of these impacts that were not associated with an acute weather event. We developed a second set of

terms (see Appendix 1 and 2) from a literature review and searched the planning documents for these equity-centered terms to understand if Northampton County's Comprehensive Plan and Accomack County's Comprehensive Plan identified or addressed elements of climate equity through their county-level action-based recommendations (Lieberknecht, 2023). For ease of interpretation, the research team used a template provided by the *Eastern Shore Land Change* research group to display the results (see Table 3). Both approaches allowed us to assess implicit and explicit discussions of climate equity in official planning documents.

	Selected Document	
Plan	**Accomack County Comprehensive Plan**	**Northampton County Comprehensive Plan**
Year	2018	2021
"Climate Change"	**8**	**26**
"Resilience"	**NOT USED**	**18**
"Resiliency"	**7**	**21**
"Environmental Justice"	**NOT USED**	**3**
"Threat"	**30**	**27**
"Equity"	**1**	**3**
"Equitable"	**2**	**NOT USED**
"Minority"	**NOT USED**	**8**
"Adaptation"	**5**	**2**
"Mitigation"	**19**	**20**

Table 3. Presence of climate-equity terms in county-level plans

Once the coding process of all three planning documents was completed, the research team used the "Analyze Workspace" function within Dedoose to visualize patterns and relationships between the applied codes such as frequency, co-occurrence, and presence. The Code Application Chart (see Appendix 3) displays the frequency of code applications and the Code Co-Occurrence Chart (see Appendix 4) is a matrix displaying the frequency at which two codes were used on the same excerpt which indicates a possible relationship between themes (Dedoose, n.d.). In order to show the most prominent codes, the Code Cloud (see Appendix 5) is included in this report because it displays the application of codes relative to their frequency, as indicated through the font size and intensity of color.

Findings

Accomack County Comprehensive Plan

Respecting the Past, Creating the Future: Accomack County Comprehensive Plan includes sections on the planning process, existing conditions of the natural environment, existing conditions of the development environment, including land use and transportation,

issues impacting the county, policies and actions, a Future Land Use Plan, and different supplemental materials, including a five-year update (Accomack-Northampton Planning District Commission, 2021). The plan described the existing conditions of the natural environment and development, presented issues to those resources, and then proposed responses to the issues that the county faces. The plan outlines the problems impacting the county as follows:

> The fundamental problem facing the County is that the demand for growth is coming from outside economic and demographic pressures that are beyond the County's direct control, yet the County has very fragile, finite and critical natural resources, and very limited fiscal and infrastructure resources, to accommodate those pressures. Thus, in order to support existing and new residents with adequate public services, the County also needs to expand its economy and employment base in a manner that supports its other goals. (Accomack-Northampton Planning District Commission, 2021, p. ii)

The plan described land and the environment as an asset, using words like "fragile," "productive," or "pristine." Generally, threats to Accomack County often included hazards and risks to infrastructure, resources, development, and the environment without mentioning who is affected by those threats.

The comprehensive plan, originally adopted in 2008, sparsely acknowledged climate change, sustainability, or resilience. These ideas were somewhat evident in the more recent amendments to the plan. Specifically, a 2018 amendment states, "***the County needs to be mindful of the impact of sea level rise on various facets of the county, including loss of developed land, loss of environmentally buffering land, loss of revenue from a tax base perspective as well as from an economy perspective***" (Accomack-Northampton Planning District Commission, p. C-18). Interestingly, despite being a recent addition, this section still contextualizes climate equity concepts in terms of economic production or revenue, leaving residents to be viewed as critical tax base members.

Northampton County Comprehensive Plan

"Your Northampton County 2040" incorporates findings from existing state and regional resources, including the Groundwater Resource Protection and Preservation Plan, the Eastern Shore of Virginia Hazard Mitigation Plan, the 2016 Virginia Working Waterfront Master Plan, the Chesapeake Bay Phase III Watershed Implementation Plan (WIP), and the Eastern Shore of Virginia Transportation Infrastructure Inundation Vulnerability Assessment, to inform the proposed recommendations and strategies (Northampton County, 2022) for county-level development and regional integration. The comprehensive plan clearly articulates an acknowledgement and strong value of the abundant natural resources that drive economic growth and "provide significant environmental economic value to the county" (Northampton County, p.15). The landscape is described as 'pristine' and 'beautiful' with 'breath-taking vistas' that bring 'inspiration' and push the growth of industries (Northampton County, p.16). There is documentation, across multiple sectors, that climate change is impacting the landscape,

ecosystems, and productivity of Northampton County and that similar changes are being felt by rural communities across the country.

Economic activity and output frame the articulation of recommendations aimed at protecting and enhancing communities and landscapes. Strategies for preserving community resources recommend against "inappropriate development and land use" that could impact water quality, which currently supports agriculture, aquaculture, fishing, and crabbing industries (Northampton County, 20). This prioritizes the protection of ecosystems and natural resources in order to preserve their maximum yields. The plan reiterates this point by communicating that ***"investments in quality-of-life improvements can also be viewed as investments in Northampton County's economy"*** (Northampton County, p.66). Additionally, investments in communities, including underserved minority and at-risk-communities, are framed in terms of opportunities for achieving economic growth by improving postsecondary education options, such as workforce training apprenticeships, to develop an educated, skilled workforce to fill employment gaps identified by local businesses (Northampton County, 2022). Social equity is discussed briefly, but not defined, in the county's future vision indicating implicit acknowledgement that not all communities of the Eastern Shore have achieved social equity. Additionally, descriptions of housing challenges acknowledge that not all residents have access to "clean, safe, and attractive residential areas" (Northampton County, p.72). This short discussion on equity is not connected explicitly or implicitly to climate equity or resilience.

Eastern Shore of Virginia Hazard Mitigation Plan 2021

This plan is designed to detail the history of, the causes for, and how to better prepare for different climate disasters along the Eastern Shore of Virginia (Accomack-Northampton Planning District Commission, 2021). The top four hazards for the region that were identified in this plan were coastal flooding, wind, coastal erosion, and storm water flooding. These priorities were set by community input and based on data from climate disaster histories that showed these events to be frequent and intense in the region. The plan is separated by chapters describing the process of writing the plan, general categories of hazards, and how each hazard manifests in towns throughout the Eastern Shore. This plan is incredibly thorough in its detailing of hazards, their histories, and responses to them. In this way, it sets the region up for achieving its goal of creating safer communities with expedited recovery processes after disasters. Only chapters 1-8 and the introduction of this plan were analyzed up to this point in the analysis.

Discussion & Recommendation

Summary

The theme most frequently applied across the selected "network of plans" (Lieberknecht, 2023) is "reaction." This is due to the fact that all of these documents are county and regional planning documents, meaning that their intrinsic goal is to respond to previous events and set policies for how to move forward. The second most used theme is "Vulnerability", followed by

"Effect" and "Event". Notably, the "Reason" code that aims to capture the cause of events and source of vulnerability is the code that appears the least in both county-level comprehensive plans. This means that all three plans clearly document the types of specific events impacting the region and the impact and damages from these acute-weather events, but falls short of naming the cause(s) of the acute-weather event. "Vulnerability" appears almost three times as frequently as "minority groups" indicating that while these plans set out to ensure that damage is minimized in their communities, they do not address why this damage is more intense or more likely for some communities over others.

In analyzing the co-occurrence of codes, when two codes are applied to the same excerpt, we observed the following codes often appeared co-coded together: "general environmental impacts" + "vulnerability", "reason for general environmental impacts" + "vulnerability", "vulnerability" + "reaction", and "minority group" + "reaction" (see Appendix 4). The co-occurrence of "general environmental impacts" and "vulnerability" establishes that climate impacts felt by the community are well documented along with descriptions of manifestations of vulnerability, but without a direct attribution to a cause. The co-occurrence of "reason for general environmental impacts" and "vulnerability" shows that vulnerability is being discussed in relation to environmental impacts. The co-occurrence of "vulnerability" and "reaction" signals that official responses to these acute-weather events are well documented alongside vulnerability but without direct connections to the cause of acute-weather events. The co-occurrence of "minority group" and "reaction" discloses that the descriptions of policy and planning reactions to climate events frequently also named a minority group when doing so. This indicates that, in voicing intention to prevent harms from repeating them in the future, plan authors allude to minority populations in some capacity. This could mean that plan authors want to keep minority populations uniquely in mind when setting future policies.

Accomack County Comprehensive Plan

"Vulnerability" was prevalent in the Accomack County Comprehensive Plan and included many different hazards, threats, and risks to the environment, infrastructure, and development. There were many codes for "reaction" in the Accomack County Comprehensive Plan (see Appendix 3), mainly because there is an entire chapter dedicated to policies and actions. The codes for "reaction" included plans, recommendations, actions, and policies discussed in the plan. In the plan, the proposed policies and actions were listed and described, as well as listed in categorized tables for the Action Plan. Because of this, some policies and actions were likely coded twice. Other times, a "reaction" was not a specific response, but rather a recommendation for the county to address a given issue. When "minority groups" occurred in the plan, different demographic information related to race, income, and age was included, as well as discussions about affordable housing, to name a few. There was overlap between "minority groups" and "reaction" in the Accomack County Comprehensive Plan (see Appendix 4). This primarily occurred when affordable housing was mentioned as a policy response or recommendation. The "Affordable Housing Plan" was proposed as an objective, so phrases like

"affordable housing" and "Affordable Dwelling Unit ordinance" were coded as minority groups within codes for reactions (County of Accomack Virginia, 2018, pp. 5-22 - 5-23, 5-30).

We coded fourteen "Event[s]," or specific storms or weather events, in the comprehensive plan. We did not code any "Effect[s]" related to these specific events. Generally, the plan just acknowledged that the storm events occurred. However, we found three instances where the plan described a "Reason" for these events. In one instance, the plan states that "the frequency and intensity of major storm events and storm surges along the Atlantic is expected to increase as a result of sea level rise and global climate change" (County of Accomack Virginia, 2018, 2-71). This was a relatively unique instance of the plan directly acknowledging climate change through its language. More commonly, we coded our emerging themes of general environmental descriptors, impacts, and reasons. Common environmental impacts were salt water intrusion, shoreline erosion, and sea level rise, all of which are viewed as direct threats to the county's valuable landscape. Interestingly, the plan frequently described poor development practices, such as excessive residential zoning, shoreline development, and commercial activities, as drivers of these negative environmental effects.

Northampton County Comprehensive Plan

Because this plan incorporated recommendations from multiple regional documents that address the risks, threats, and challenges associated with climate-change, it includes several climate-equity centered terms. However, these terms are included only conceptually and without actionable steps or a clear roadmap for implementing and integrating equity into existing processes. The thematic content analysis shows that while Northampton's Comprehensive Plan includes each of the a priori and emerging codes at some point, it discusses "vulnerability" nearly three times as often as it does minority groups (see Appendix 3). Vulnerability was the most prevalent climate-change centered theme which articulates a high level of awareness of susceptibility to changes in the environment. This affirms that Northampton County recognizes the level of vulnerability present in its landscape and existing infrastructure as something it needs to plan for in the future. It also illustrates that county officials are concerned about the way that its residents experience this vulnerability via its infrastructure and facilities, yet the documentation of current challenges does not identify who exactly is most likely to be vulnerable to challenges that this plan addresses. We also see in matrix of Code Co-Occurrence (see Appendix 4) that across all three plans, minority groups and vulnerability occur concurrently fifteen times. This means that when vulnerability is discussed, it is done in a way that does not attribute a reason of vulnerability to a community's identity. This leads us to conclude that this plan does not do enough to address climate equity, as it does not couple vulnerability to the root cause of identity-based marginalization that has occurred in the area historically.

Eastern Shore of Virginia Hazard Mitigation Plan

The content analysis of this plan yielded results that show that this plan largely focuses on event descriptions and effects of those events. Many of the chapters in this plan were dedicated to describing the history of categories of events in the region, and these histories yielded many descriptions of specific climate disaster events that occurred throughout the last century. This explains why these two code categories were more frequent than the others by 100% at minimum.

Additionally, there is regular discussion of vulnerability throughout the chapters in this plan. Discussions of vulnerability regularly occurred when a chapter provided a broad overview of a category of hazard like flooding or heavy wind. Alongside this discussion, though, was very little mention of vulnerable populations. This implies that the authors of this plan acknowledge that these weather events make residents in the area vulnerable to negative impacts, but they do not acknowledge how certain populations are made more uniquely vulnerable than others to these effects. This indicates that while these hazard mitigations plans will be broadly useful for the region to prepare for disasters, they will not be useful to the people who most need unique assistance in preparing for and responding to crisis.

Overall Discussion & Recommendations

From the content analysis, the general takeaway we see is that climate impacts and people are discussed recurringly, although the direct impacts of environmental conditions on people are rarely directly raised in these plans. We see environmental disasters and impacts discussed at length, and we see people discussed as economic units of the tax base in the region. We do not, however, see these two topics discussed directly together in these plans.

In the comprehensive plans, the aspirational statements deal with the economic growth of the community and not the protection of its residents. This is clear from the Northampton Comprehensive Plan, where one of their most prominent aspirational statements is “Investments in quality of life improvements can also be viewed as investments in Northampton County’s economy” (Northampton County, 2022). This exemplifies a view from the county that any investments in people or their surrounding environment will be seen as beneficial only if they also yield some kind of economic return for the county. Viewing the residents here as a tax base is a necessary concern for the region, as Northampton County has seen a 4% decline in its population in the last decade (*Northampton County,* 2024). Yet, this concern is not mutually exclusive from a discussion of how to best protect the populations, physically and emotionally, from environmental disasters. If anything, a population that is well informed and provided for by its local government is one that will be productive for the economy in the future.

We also see in these Comprehensive Plans varying levels of acknowledgement of worsening environmental impacts, even if they don’t always acknowledge that climate change is the cause of these impacts. This is demonstrated in the fact that, in the Accomack County Comprehensive Plan, climate change is mentioned a quarter of the number of times as general threats are (see Table 3). This pattern differs from the Northampton Comprehensive Plan, where “climate change” and “threat” are mentioned almost an equal number of times.

Acknowledgement of climate change exists at varying levels in these documents, even as they are centered on preparing for the effects of it.

We also see in the Hazard Mitigation Plan that specific climate events, like hurricanes and floods, are identified and mentioned regularly. Reactions and vulnerability are alluded to regularly, as well. Yet, minority groups are not discussed hardly at all in this plan. This all demonstrates that the region has a detailed understanding of the impacts that have led to today, and they understand that these events have been and can continue to be extremely damaging to the general population and infrastructure. With so little mention of minority populations, though, the county does not demonstrate a detailed understanding of how these events impact some populations more than others. They wish to address future vulnerabilities, but they do not understand for whom these vulnerabilities are most intense. This means that while their plan generally prepares the region for hazard and responses to them, the plan likely will not ensure the county is helping those most in need of assistance following a climate disaster.

This theme of separation of climate harms from the people they harm is one that is only seen in these plans. The residents of the Eastern Shore of Virginia demonstrate a better understanding of the intrinsic connection between the changing climate and the people who live there. Even young people understand this, as shown in the art below in which residents of the Eastern Shore are surrounded by water from flooding (see Figure 1). Even young residents of the area understand that people and the impacts of climate change cannot be separated. They even understand the importance of sticking together and caring for one another through harrowing climate disasters. This is an understanding that none of the analyzed plans demonstrated.

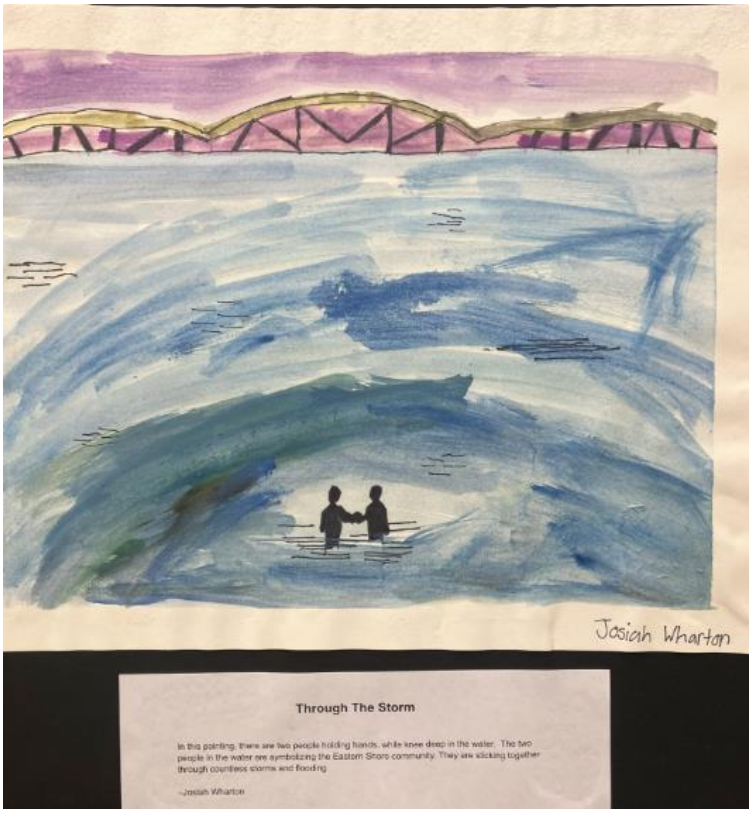

Figure 1. Artwork from a middle school resident of the Eastern Shore of Virginia. The caption reads "In this painting, there are two people holding hands, while knee deep in the water. The two people in the water are symbolizing the Eastern Shore community. They are sticking together through countless storms and flooding."

Therefore, our recommendation is to include an additional chapter that discusses climate change and its impacts on the most vulnerable community members in the Eastern Shore. Such chapters are not unprecedented in other coastal communities' comprehensive plans. In the City of Charleston, South Carolina, comprehensive plan, the final chapter is titled "Resilience and Equity." The entire final chapter of the plan discusses ways that the community can protect and specifically address potential harms to marginalized populations in Charleston (*Charleston City Plan 2021*, 2021). This includes protecting historic Black neighborhoods and burial sites, creating a special commission on the topic, creating a plan to access Federal Emergency Managment Agency funding for low-income communities, and more. Northampton and Accomack Counties should work to create their own resilience and equity sections within their comprehensive plans that detail how the counties will aid to aid their unique vulnerable populations, both in times of crisis and in times without. The discussion of preparation specifically for marginalized communities should also be more robustly detailed in the next iteration of the Hazard Mitigation Plan.

Economic stability and environmental impacts on humans are not mutually exclusive. The region can remain economically strong in ensuring that its marginalized populations are adequately resourced to withstand harsh climate conditions. In order to do so, though, Accomack and Northampton Counties must put in writing their commitment to protect and uplift their most vulnerable residents.

Limitations

We faced two main limitations with our thematic content analysis, one relating to content scope and the other relating to coding logistics. First, in terms of content, we opted to narrow our scope and only systematically analyze three long-range planning documents, excluding other opinion-informing mediums such as news or social media. We chose to investigate official documents over informal records to be able to assess how decision-makers and government entities are documenting climate equity. Furthermore, we identified several additional state, regional, and locality-specific planning documents with guidance and recommendations for long-term planning in the Eastern Shore, but we were unable to conduct a thematic content analysis on them due to time limitations. Future analysis could be conducted on those additional long-range planning documents to provide a greater understanding of the documentation around climate equity in the Eastern Shore.

Our second general limitation relates to the preparation of documents reviewed during the coding process. When working in Dedoose, we chose to upload printable document format (PDF) versions of the plans, as published by each county, in order to preserve their original

layouts instead of uploading them in modified Word Document format. When coding PDFs in Dedoose, the pages load individually so that when attempting to code an excerpt continuously from one page to the next, the codes were sometimes split into two different codes. This affected the number of codes registered across the various categories (see Appendix 3). Alternatively, coding on Word-formatted documents allows for continuous scrolling in a document. However, the drawback of using a Word Document format of plans that were originally published as PDFs is that figures and images were often misaligned and covered whole sections of text. Another limitation we faced was the inability to code text within figures and images in the documents.

Section 4
Transportation Analysis

To contextualize and further understand the intersection of vulnerability and climate change, we focused on the direct impact of regional climate change on the local transportation system. In an early meeting with members from the Eastern Shore Family YMCA, community members described how frequent inundations pose daily challenges to mobility, livelihoods, and access to services on the Eastern Shore.

Northampton County's Comprehensive plan summaries environmental constraints and explicitly identifies storm surges and sea-level rise as ongoing threats to the region (Northampton County, 2022). The Accomack-Northampton Planning District Commission references a 2015 Infrastructure Inundation Vulnerability Assessment that also identified the inundation of roads to be a "growing problem as sea levels are projected to rise and weather events become more severe" (Northampton County, 72). '*Road Inundation Improvements'* are recommended as short-term priority transportation projects which acknowledges the need for critical infrastructure investments to adapt to climate change (Northampton County, 2022).

We analyzed traffic, weather, and financial data to understand the frequency of severe weather events, the resulting impact of inundation-related road closures on community members, and climate-related expenditures in Northampton and Accomack since 2003. We aim to identify intersections or associations across events, impacts, and county-level investments related to climate-change to quantify and spatialize communities' lived experiences.

Methodology

To partly understand the impact of climate-change-related road closures on the Eastern Shore, we generated descriptive statistics using RStudio and spatialized road closure data using ArcGIS Pro. Our main data came from the Virginia Department of Transportation (VDOT)'s 511 System, a traffic information hotline. We gained access to eight months of data from the Eastern Shore (May through December 2023) through the Virginia Transportation Research Council (VTRC). The data was a spreadsheet with incomplete information related to the type of incident causing the road closure, the general location of the road closure, the duration of the closure, and number of lanes affected by the closure. The other main data used for our analysis was a road centerline shapefile available through the Virginia Geographic Information Network (VGIN).

The first step of our analysis was to sort and count the 511 road closure data by incident type category and month. Using RStudio coding software, we sorted data into "climate related" and "non-climate related" incidents. For "climate related" incidents our criterion was that the incident was directly related to climate conditions. We categorized "Fallen Tree," "Flood," and "Weather Condition" type incidents into "climate related" incidents. This left the "non-climate related" category to include the remaining incident types: "Bridge Maintenance Operations," "Collision," "Construction Work," "Disabled Vehicle," "Security Incident/Police Activity," "Paving Operations," "Road Maintenance Operations," "Special Event," and "Vehicle on Fire."

Table 4 shows the count of road closure incidents sorted by category of incident type. “Weather Condition” was the most commonly cited reason for climate-related closure incidents.

Incident Type	Count
Climate-Related	38
Fallen Tree	8
Flood	7
Weather Condition	23
Non-Climate-Related	228
Bridge Maintenance Operations	4
Collision	109
Construction Work	2
Disabled Vehicle	10
Security Incident/ Police Activity	2
Paving Operations	12
Road Maintenance Operations	82
Special Event	1
Vehicle on Fire	6

Table 4. Incident counts by type.

Next, we prepared our categorized 511 road closure data for spatialization using ArcGIS Pro. Notably, the original 511 road closure spreadsheet included a field identifying the nearest mile marker to the closure incident. Theoretically this field could be used to map the road closure data by spatially joining it to mile marker point data shapefile maintained on VDOT’s open data portal, Virginia Roads. However, the mile marker field in the 511 road closure data spreadsheet was often blank and VDOT only had readily available point data for mile markers specific to US Route 13 and not the Eastern Shore’s secondary roads.

Therefore, while less area-specific, we decided to join the tabular 511 road closure data to the spatialized road centerline data provided by VGIN. To do this, we created a new field in the 511 data spreadsheet and manually entered the road names that matched the existing road centerline data. We consulted county-specific road maps by VDOT and Google Maps to identify the road names of the specific route numbers available in the 511 data spreadsheet. Finally, we applied a graduated symbology in ArcGIS Pro to illustrate the roads most frequently affected by “climate-related closures” between May and December 2023.

Findings

Descriptive Analysis

Our descriptive analysis of VDOT's 511 road closure data showed that between May and December 2023, about 14% of closures were directly "climate-related." Furthermore, the majority of directly "climate-related" closures happened in September, midway through the Atlantic hurricane season (generally June to November). Table 5 shows the count of incidents in climate-related categories versus non-climate-related categories by month. The subsequent graphs, Figures 2 and 3, show incident counts over time for climate-related and non-climate-related incidents. Figure 2 shows spikes in climate-related events in June and September 2023.

Month	Number of Incidents (Total)	Climate-Related Incidents	Non-Climate-Related Incidents
May-23	3	3	37
Jun-23	38	5	33
Jul-23	31	2	29
Aug-23	31	2	28
Sep-23	43	13	28
Oct-23	30	3	27
Nov-23	22	0	22
Dec-23	31	3	18

Table 5. Climate- and non-climate-related incident counts by month.

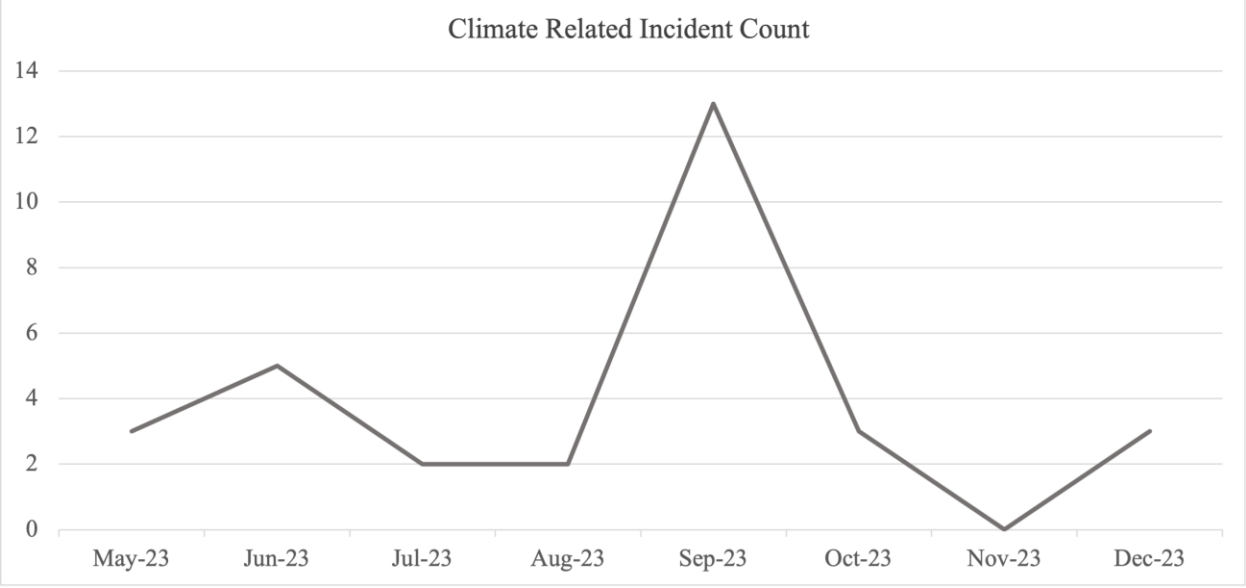

Figure 2. Climate-related incidents by month.

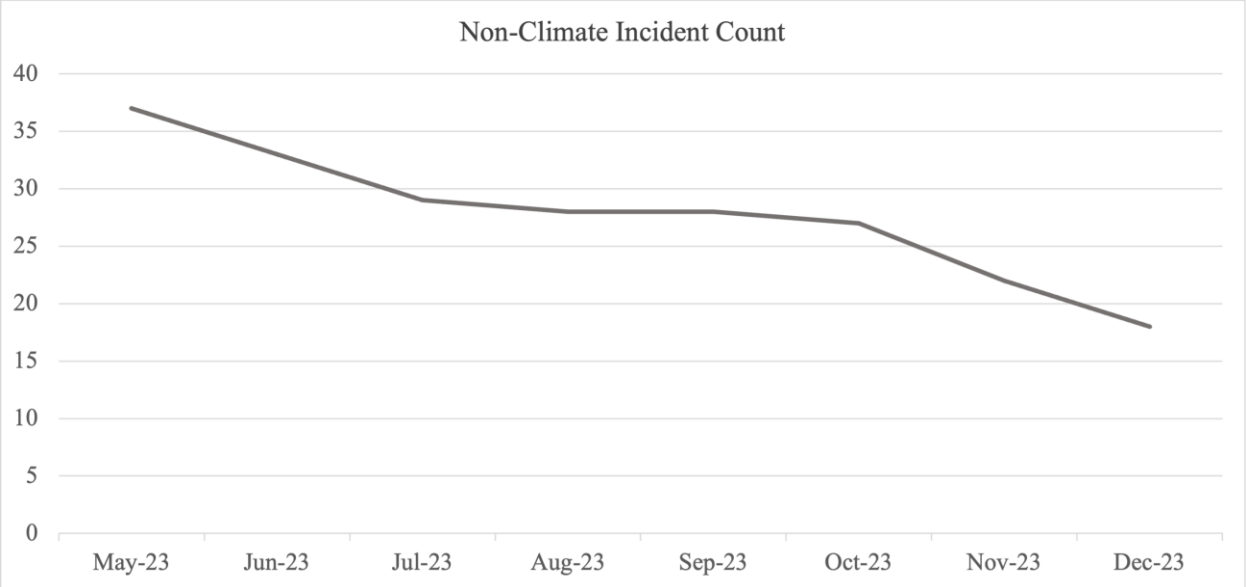

Figure 3. Non-climate-related incidents by month.

Spatial Analysis

Next, our spatial analysis of the 511 road closure data showed that the Eastern Shore's primary evacuation routes – Lankford Highway (US Route 13) and Seaside Road – had the most "climate-related" closure incidents between May and December 2023. This can be seen in Figure 4. Importantly, VDOT encourages a northward evacuation on the Eastern Shore, potentially leaving residents on the southern part of the peninsula vulnerable to compounding "climate-related" closures in the future. Because our data set was limited in time range and completeness, we decided against normalizing the incident counts by road length. This may be a more appropriate approach for future analyses. Additional limitations of these analyses are provided in the following section.

Painter, VA

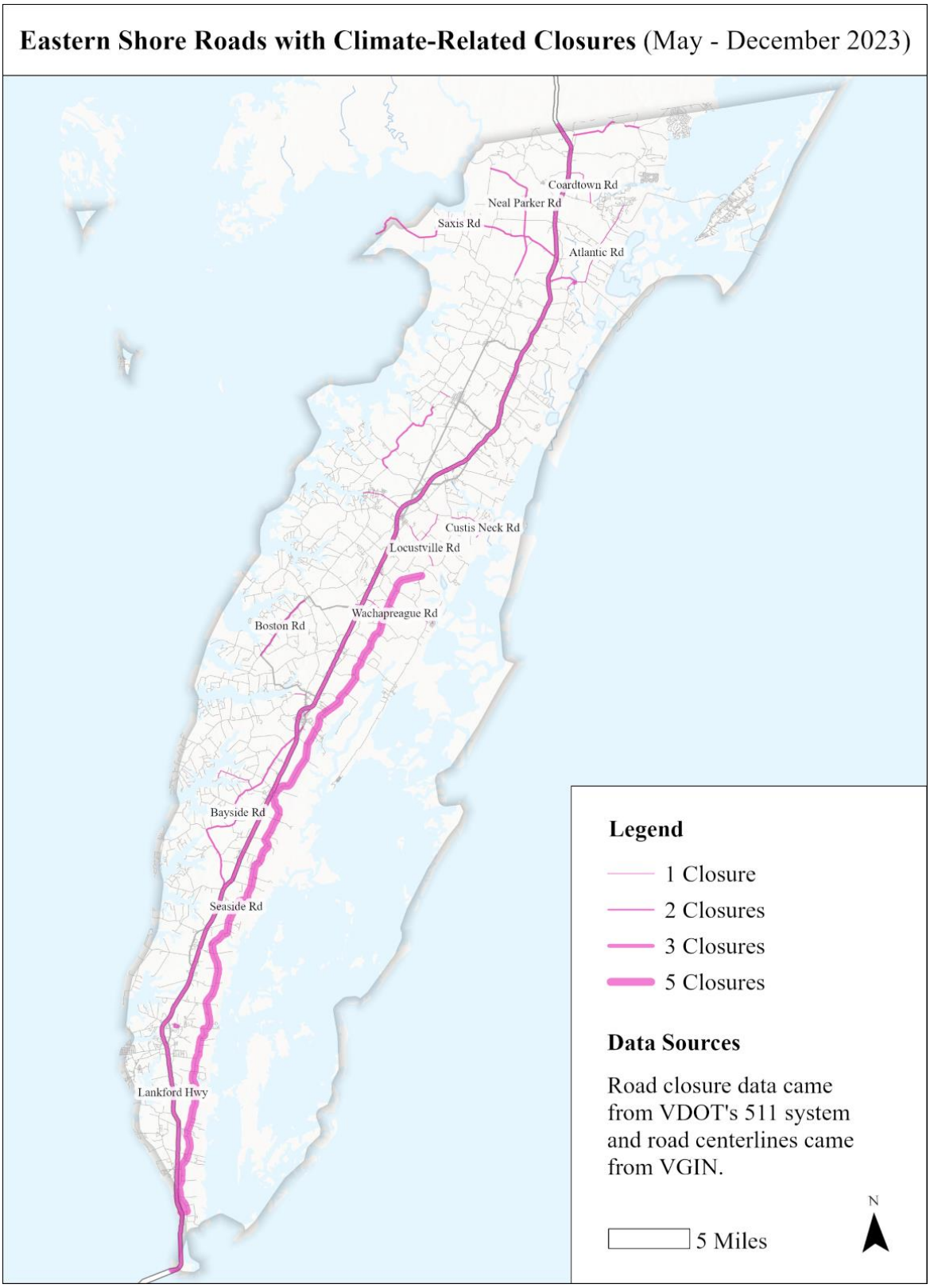

Figure 4. Map of Eastern Shore roads with climate related closures during May-December of 2023.

Discussion & Recommendation

While our analyses yielded some temporal and spatial findings, there are several caveats. First, the available VDOT 511 data only reported incidents that occurred between May and December of 2023, a relatively short time span. Furthermore, the data was incomplete and did not clearly report the location of each closure incident. Second, our categorization methodology of the 511 road closure data potentially misrepresents the impact of climate change on the Eastern Shore's transportation. We disaggregated the data into categories based on "incident type," but for some categories, it was unclear whether or not an incident was climate related. For example, we categorized "Road Maintenance Operations" as a non-climate-related category, however, it has been proven that there is a connection between climate change and increased road maintenance:

> "Climate stress on roads will likely change in the future, with various potential impacts and adaptation costs. For example, roads may experience more frequent buckling due to increased temperatures, more frequent washouts of unpaved surfaces from increases in intense precipitation, and changes in freeze-thaw cycles that cause cracking" (Environmental Protection Agency).

If this category in the 511 road closure spreadsheet was further defined, or better, disaggregated into more clear types of maintenance operations, we could more accurately sort incidents into climate-related versus non-climate-related categories. Finally, we were limited in publicly accessible and appropriate spatial data to help display the road closure information. Matching mile marker points rather than road segments could potentially allow for a hotspot analysis, which could lead to a more site-specific understanding of road closures.

While our ability to perform analysis was limited given the limitations of the data, these methods can still serve as a proof of concept that could be applied to more complete data. For example, if this data were available for a longer time span, it could be compared to road maintenance or environmental management investment data (see Section 5) to understand how climate related road closures impact local budgets. Road closure data over a longer period of time could also reveal seasonal trends of when closures are more likely to occur or if closures are becoming more frequent as a result of climate change and increased climate events. Once enough data has been collected over a long enough period of time, it could be used to project where or when future climate related closure incidents might occur, which can help counties allocate mitigation resources more effectively.

Section 5
Financial Analysis

The 2023 Atlantic Hurricane season ranked 4th for most named storms in a year (NOAA, 2023). In that year, Virginia experienced seven instances of billion-dollar severe storm events, compared to an average of 2.4 instances of billion-dollar events each year from 2010-2020 (NOAA, 2024). The most severe storm event in the 2023 season was Tropical Storm Ophelia, which hit the east coast, including Virginia's eastern shore, with heavy rain and high wind gusts.

Figure 5. Impacts of Tropical Storm Ophelia.
Image Source: CBS 6 News Richmond WTVR. September 22, 2023.

This financial analysis examines the relationship between these extreme storm events and expenditures for different categories in this region. Expenditures made in two areas of environmental equity concern, Environmental Management and Maintenance of Highways, Streets, Bridges, and Sidewalks on the county and state level, from 2003 to 2022 were examined. Tables and graphs are presented to visualize the data. This analysis was designed with the understanding that increasing financial burdens from severe storm events and climate-related hazards on the Eastern Shore of Virginia will continue to strain the resources of residing communities.

Methodology

To analyze climate-related expenditures on the Eastern Shore of Virginia we created a variety of descriptive statistics and visual analyses of two main expenditures: Environmental Management and Maintenance of Highways, Streets, Bridges, and Sidewalks. These two categories were chosen because they directly impact an area's ability to adopt to climate change related hazards and may also fluctuate depending on the amount of hazards that are experienced. These expenditures are directly related to climate equity as they control the distribution of

climate protection efforts and have the potential to alleviate unequal burdens created by climate change.

Financial data was analyzed for Accomack County, Northampton County, and the state of Virginia. The data is primarily from the Commonwealth of Virginia Auditor of Public Accounts (*Local Government Reports,* n.d.). Secondary figures were also calculated and inflation data from the US Bureau of Labor was used to adjust some figures for inflation. When possible, Amended Comparative Reports of Local Expenditures from the Commonwealth of Virginia Auditor of Public Accounts were selected to source the data. If an Amended Report was not provided for a given year, the Original Report was used. Northampton County did not report financial data for Maintenance of Highways, Streets, Bridges, and Sidewalks. We analyzed data for about a twenty-year period from 2003 to 2022; 2022 is the last year of published data available. An important consideration about the data used is that the Maintenance of Highways, Streets, Bridges, and Sidewalks category expresses the expenditures by the Virginia Department of Transportation made on behalf of each county. Therefore, this category reflects decisions of a state-wide entity, not the individual county. There was no indication what entities were responsible for the allocation of the Environmental Management expenditures in data provided by the Commonwealth of Virginia Auditor of Public Accounts.

The first step in our financial analysis was cleaning and exporting data from the individual yearly audits previously discussed. After data accumulation, each figure was adjusted to March 2024 dollars in order to normalize for inflation. Then, the percent of each expenditure's share of the respective total amount available for that year was calculated using the Total Amount Available category. Total Amount Available was a category in the reports and is described below in the findings section. Severe weather events that affected the area from 2003 to 2020 were compiled in a table (See Appendix 6) and were also summarized into events per year in Figure 11 to visualize the relationship between climate-related spending and the number of storm events. The graphs created are intended to show the changes in investments over time between the two counties. The financial data from Virginia is meant to provide comparative data.

Findings

Table 6 and Table 7 show financial data for environmental equity categories in Accomack County, Northampton County, and Virginia. This data is part of a larger collection used to create the graphs in this section of the report. The complete tables of data analyzed in this section can be found in the Appendix (see Appendix 7 and Appendix 8). In the financial categories in the tables, "adjusted" is used to describe categories that have been adjusted for inflation to March 2024 dollars. "Amount" describes the total expenditures for a specific category for a given area. For example, in 2022, the expenditures for Environmental Management for Accomack County were $539,602.00. The "Percent of Total" is a calculation of the total amount of a given category for an area divided by the "Total Amount Available." The "Total Amount Available" is a category in the reports that is the total amount of funds available, including local, state, and federal revenue, for a municipality in a given fiscal year. The Percent

of Average is the "percent of average per capita" for the locality (Commonwealth of Virginia Auditor of Public Accounts, 2022, p. 6). The colors in the tables correspond to the colors used in the graphs.

Maintenance of Highways, Streets, Bridges, and Sidewalks										
	Accomack County					Grand Total for the State				
Year	Amount	Adjusted Amount	Percent of Total	Per Capita	Adjusted Per Capita	Amount	Percent of Total	Per Capita	Adjusted Per Capita
2022	$ 169,516.00	$ 178,681.42	0.120060057	$ 5.07	$ 5.34	$ 846,139,789.00	2.010385143	$ 97.59	$ 102.87
2021	$ 212,211.00	$ 243,950.17	0.167205696	$ 6.35	$ 7.30	$ 783,582,579.00	1.921846654	$ 87.55	$ 100.64
2020	$ 273,122.00	$ 330,898.89	0.236206135	$ 8.39	$ 10.16	$ 795,777,922.00	2.137878457	$ 89.70	$ 108.68
2019	$ 201,970.00	$ 246,275.30	0.182342903	$ 6.16	$ 7.51	$ 767,476,761.00	2.118781185	$ 86.68	$ 105.69
2018	$ 367,756.00	$ 455,821.35	0.34114302	$ 11.13	$ 13.80	$ 734,968,771.00	2.111933362	$ 83.21	$ 103.14
2017	$ 147,695.00	$ 188,319.79	0.137749951	$ 4.43	$ 5.65	$ 719,583,459.00	2.129808491	$ 82.04	$ 104.61
2016	$ 155,349.00	$ 201,314.69	0.144079861	$ 4.64	$ 6.01	$ 687,207,279.00	2.12732658	$ 78.61	$ 101.87
2015	$ 93,194.00	$ 121,973.32	0.094181934	$ 2.75	$ 3.60	$ 633,400,453.00	2.024902826	$ 72.93	$ 95.45
2014	$ 123,197.00	$ 161,441.14	0.127869546	$ 3.67	$ 4.81	$ 630,874,326.00	2.076437761	$ 73.19	$ 95.91
2013	$ 93,916.00	$ 125,620.85	0.096644758	$ 2.80	$ 3.75	$ 582,099,745.00	1.95699894	$ 68.17	$ 91.18
2012	$ 108,503.00	$ 147,678.47	0.117119758	$ 3.25	$ 4.42	$ 611,836,226.00	2.089429312	$ 72.41	$ 98.55
2011	$ 164,689.00	$ 227,880.51	0.174615433	$ 4.97	$ 6.88	$ 578,999,477.00	2.004106297	$ 69.31	$ 95.90
2010	$ 133,250.00	$ 190,940.01	0.128106423	$ 3.37	$ 4.83	$ 594,508,191.00	2.064604479	$ 72.68	$ 104.15
2009	$ 158,096.00	$ 228,929.26	0.167129518	$ 3.99	$ 5.78	$ 581,944,265.00	1.987445635	$ 71.14	$ 103.01
2008	$ 188,623.00	$ 269,236.56	0.207119432	$ 4.84	$ 6.91	$ 570,279,742.00	2.009168832	$ 70.70	$ 100.92
2007	$ 124,201.00	$ 186,184.66	0.13786949	$ 3.19	$ 4.78	$ 527,122,590.00	1.942044926	$ 65.81	$ 98.65
2006	$ 148,898.00	$ 229,204.58	0.159160262	$ 3.77	$ 5.80	$ 495,820,298.00	1.96797832	$ 62.44	$ 96.12
2005	$ 174,985.00	$ 280,994.42	0.209923629	$ 4.48	$ 7.19	$ 451,546,709.00	1.94019834	$ 57.41	$ 92.19
2004	$ 214,727.00	$ 353,537.76	0.273342086	$ 5.55	$ 9.14	$ 464,907,179.00	2.180061925	$ 59.94	$ 98.69
2003	$ 183,958.00	$ 312,770.66	0.251087135	$ 4.72	$ 8.03	$ 410,861,988.00	2.078983963	$ 53.47	$ 90.91

Table 6. Financial data for Maintenance of Highways, Streets, Bridges, and Sidewalks for Accomack County and Virginia. This table is a smaller version of Appendix 7, as Table 6 just shows the data that was used in Figures 6-11.

Environmental Management															
	Accomack County					Northampton County					Grand Total for the State				
Year	Amount	Adjusted Amount	Percent of Total	Per Capita	Adjusted Per Capita	Amount	Adjusted Amount	Percent of Total	Per Capita	Adjusted Per Capita	Amount	Percent of Total	Per Capita	Adjusted Per Capita
2022	$ 539,602.00	$ 568,777.30	0.38217423	$ 16.15	$ 17.02	$ 33,504.00	$ 35,315.50	0.053096882	$ 2.73	$ 2.88	$ 38,443,383.00	0.091339525	$ 4.43	$ 4.67
2021	$ 321,503.00	$ 369,588.35	0.253319257	$ 9.62	$ 11.06	$ 33,232.00	$ 38,202.32	0.060301212	$ 2.71	$ 3.12	$ 39,343,109.00	0.096494517	$ 4.40	$ 5.06
2020	$ 209,797.00	$ 254,177.96	0.181440303	$ 6.44	$ 7.80	$ 31,283.00	$ 37,900.68	0.062998298	$ 2.65	$ 3.21	$ 37,666,932.00	0.10119321	$ 4.25	$ 5.15
2019	$ 281,570.00	$ 343,336.81	0.254207513	$ 8.59	$ 10.47	$ 31,283.00	$ 38,145.42	0.064802774	$ 2.64	$ 3.22	$ 35,368,848.00	0.097643152	$ 3.99	$ 4.87
2018	$ 192,093.00	$ 238,092.90	0.178192025	$ 5.81	$ 7.20	$ 31,283.00	$ 38,774.24	0.065889552	$ 2.61	$ 3.24	$ 32,706,990.00	0.093983562	$ 3.70	$ 4.59
2017	$ 246,474.00	$ 314,268.81	0.229877663	$ 7.39	$ 9.42	$ 28,783.00	$ 36,700.01	0.061515351	$ 2.37	$ 3.02	$ 32,717,249.00	0.096835848	$ 3.73	$ 4.76
2016	$ 233,583.00	$ 302,697.08	0.216638706	$ 6.97	$ 9.03	$ 28,783.00	$ 37,299.50	0.064497429	$ 2.36	$ 3.06	$ 41,132,686.00	0.127330805	$ 4.71	$ 6.10
2015	$ 179,953.00	$ 235,524.44	0.181860651	$ 5.31	$ 6.95	$ 28,783.00	$ 37,671.50	0.06514056	$ 2.36	$ 3.09	$ 36,633,678.00	0.117113333	$ 4.22	$ 5.52
2014	$ 62,760.00	$ 82,242.63	0.065140326	$ 1.87	$ 2.45	$ 28,783.00	$ 37,718.13	0.062355625	$ 2.38	$ 3.12	$ 27,041,456.00	0.089003305	$ 3.14	$ 4.11
2013	$ 62,284.00	$ 83,310.29	0.064093681	$ 1.86	$ 2.49	$ 28,783.00	$ 38,499.78	0.061923775	$ 2.31	$ 3.09	$ 27,317,525.00	0.091840562	$ 3.20	$ 4.28
2012	$ 60,441.00	$ 82,263.48	0.065240918	$ 1.81	$ 2.46	$ 28,508.00	$ 38,800.93	0.063070611	$ 2.29	$ 3.12	$ 25,341,858.00	0.086542801	$ 3.00	$ 4.08
2011	$ 81,376.00	$ 112,600.14	0.086280842	$ 2.45	$ 3.39	$ 28,508.00	$ 39,446.58	0.055184664	$ 2.30	$ 3.18	$ 19,403,908.00	0.067163263	$ 2.32	$ 3.21
2010	$ 583,421.00	$ 836,010.59	0.560900395	$ 14.74	$ 21.12	$ 25,813.00	$ 36,988.63	0.060086015	$ 1.93	$ 2.77	$ 21,576,668.00	0.074931323	$ 2.64	$ 3.78
2009	$ 1,609,262.00	$ 2,330,275.06	1.701214336	$ 40.66	$ 58.88	$ 35,241.00	$ 51,030.36	0.076074625	$ 2.63	$ 3.81	$ 23,567,938.00	0.0804888	$ 2.88	$ 4.17
2008	$ 602,462.00	$ 859,941.78	0.661539618	$ 15.46	$ 22.07	$ 30,262.00	$ 43,195.35	0.063401464	$ 2.28	$ 3.25	$ 24,800,614.00	0.087375751	$ 3.07	$ 4.38
2007	$ 143,884.00	$ 215,690.65	0.159718631	$ 3.70	$ 5.55	$ 30,262.00	$ 45,364.53	0.071699242	$ 2.29	$ 3.43	$ 23,581,033.00	0.086878131	$ 2.94	$ 4.41
2006	$ 119,403.00	$ 183,801.76	0.127632425	$ 3.03	$ 4.66	$ 30,262.00	$ 46,583.49	0.074053111	$ 2.29	$ 3.53	$ 20,680,974.00	0.082085604	$ 2.60	$ 4.00
2005	$ 240,447.00	$ 386,114.61	0.288456192	$ 6.15	$ 9.88	$ 27,262.00	$ 43,777.87	0.071149638	$ 2.07	$ 3.32	$ 19,731,886.00	0.084783637	$ 2.51	$ 4.03
2004	$ 304,585.00	$ 501,484.67	0.387729067	$ 7.87	$ 12.96	$ 26,262.00	$ 43,239.13	0.075727056	$ 2.04	$ 3.36	$ 19,896,190.00	0.093298035	$ 2.57	$ 4.23
2003	$ 468,866.00	$ 797,179.40	0.639962494	$ 12.02	$ 20.44	$ 20,012.00	$ 34,024.98	0.056630293	$ 1.59	$ 2.70	$ 18,665,455.00	0.094448216	$ 2.43	$ 4.13

Table 7. Financial data for Environmental Management for Accomack County, Northampton County, and Virginia. This table is a smaller version of Appendix 8, as Table 7 just shows the data that was used in Figures 6-11.

Figure 6 and Figure 7 show the percent of the total amount of available funds for different environmental expenditures for each county and Virginia from 2003 to 2022. Figure 6 shows the percent of the total amount of available funds for the expenditures of the Maintenance of Highways, Streets, Bridges, and Sidewalks for Accomack County and Virginia as a whole. Overall, less than 0.5 percent of the total amount of available funds for Accomack County was devoted to the Maintenance of Highways, Streets, Bridges, and Sidewalks expenditures from 2003 to 2022. About two percent of the total amount of available funds was allocated to the Maintenance of Highways, Streets, Bridges, and Sidewalks expenditures for Virginia from 2003 to 2022. No data for Northampton County was provided for the Maintenance of Highways, Streets, Bridges, and Sidewalks.

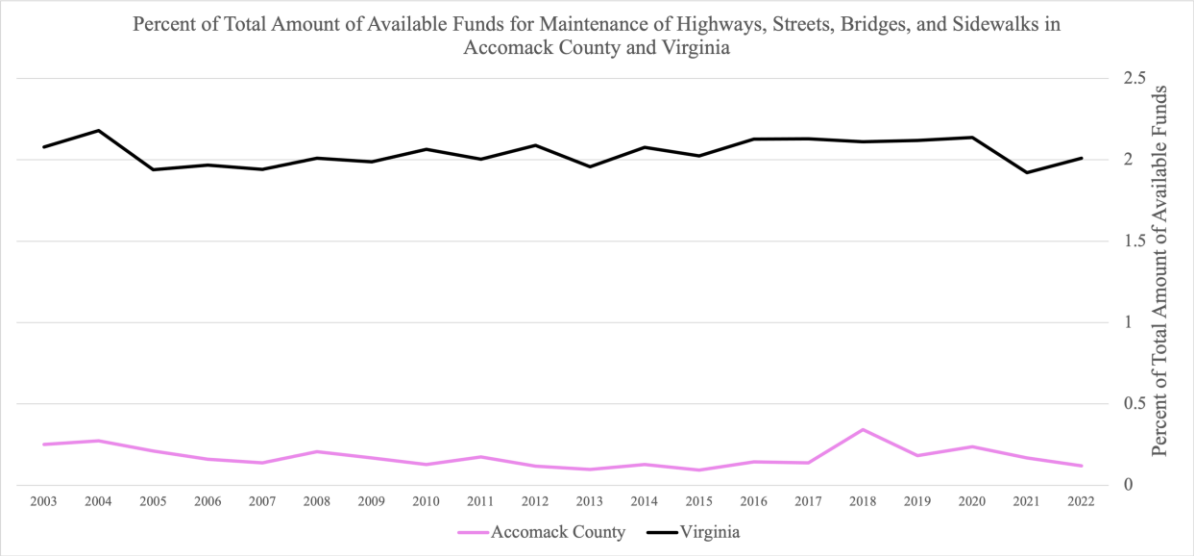

Figure 6. Percent of Total Amount of Available Funds for Maintenance of Highways, Streets, Bridges, and Sidewalks in Accomack County and Virginia from 2003 to 2022.

Figure 7 shows the percent of the total amount of available funds for Environmental Management expenditures for Accomack County, Northampton County, and Virginia from 2003 to 2022. The percent of the total amount of available funds for Environmental Management expenditures for Accomack County saw a steady drop from 2003 to 2006, a drastic spike between 2007 and 2011, then a slow increase from 2011 to 2022. The percent for Accomack County fluctuates much more than both Northampton County and Virginia from 2003 to 2022. The percent of the total amount of available funds for Environmental Management expenditures for both Northampton County and Virginia was less than 0.2 percent from 2003 to 2022. They were also relatively stagnant and show no trends of increasing or decreasing over the 20 years analyzed.

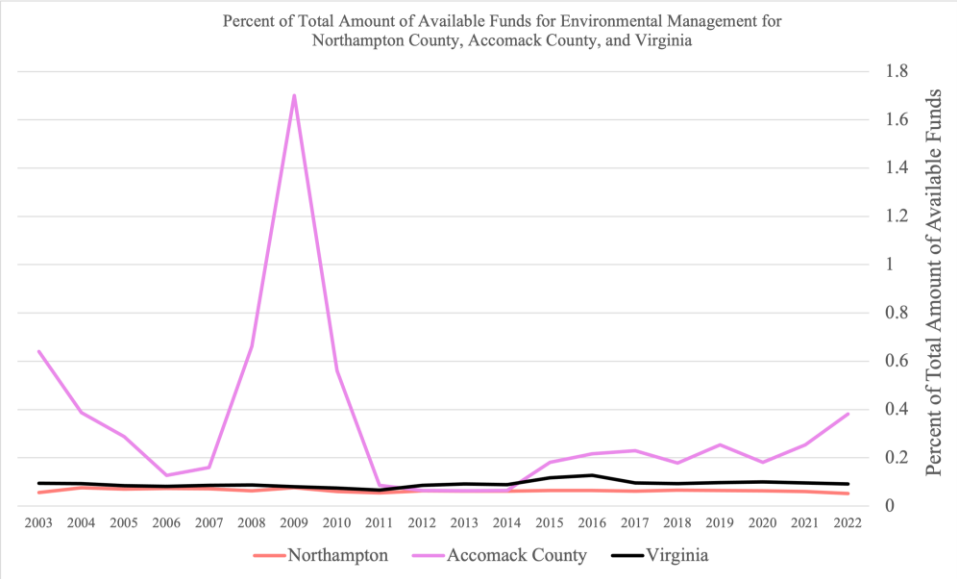

Figure 7. Percent of Total Amount of Available Funds for Environmental Management for Northampton County, Accomack County, and Virginia from 2003 to 2022.

Figure 8, Figure 9, and Figure 10 show climate equity expenditures as per capita spending and total expenditures for Accomack County, Northampton County, and Virginia from 2003 to 2022. Each of these data were then adjusted to 2024 dollars to account for inflation. Both the raw data and adjusted data are shown.

Figure 8 shows Accomack County's and Virginia's expenditures for Environmental Management from 2003 to 2022. The per capita amounts for Environmental Management, both adjusted and not adjusted for inflation, are shown for both Accomack County and the state of Virginia. The total expenditures of Environmental Management, both adjusted and not adjusted for inflation, for Accomack County are also graphed. Accomack County's expenditures and per capita amounts for Environmental Management vary from 2003 to 2022. This graph shows Environmental Management spending by Accomack County decreasing sharply from 2003 to 2006, then having a sharp increase and subsequent decrease, peaking in 2009. From 2011 to 2022 Environmental Management spending by Accomack County fluctuates slightly but increases steadily. Virginia's per capita amounts for Environmental Management are more stagnant from 2003 to 2022 compared to Accomack County's per capita amounts for Environmental Management.

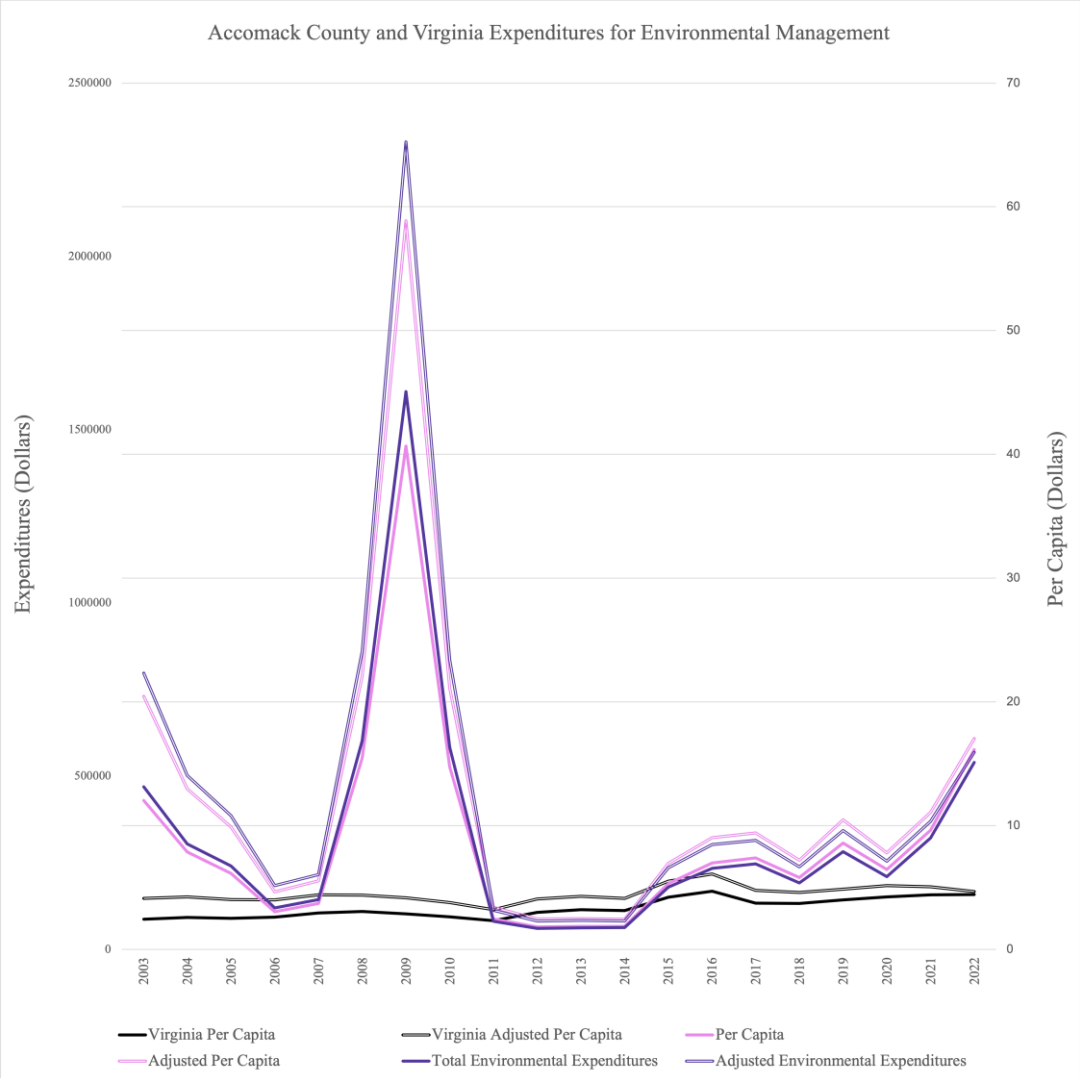

Figure 8. Accomack County and Virginia Expenditures for Environmental Management from 2003 to 2022.

Figure 9 shows the Environmental Management expenditures for Northampton County and Virginia from 2003 to 2022. The total Environmental Management expenditures, both adjusted and not adjusted for inflation, as well as the per capita amounts for Environmental Management, both adjusted and not adjusted for inflation, for Northampton County are graphed. In addition, Virginia's per capita amounts, both adjusted and not adjusted for inflation, for Environmental Management are graphed as a comparison. This graph depicts regular fluctuations in environmental spending by both Virginia and Northampton County. Generally, over the past twenty years per capita Environmental Management spending has slightly increased in Northampton County. Both Virginia and Northampton County have largely decreased in adjusted spending since 2016.

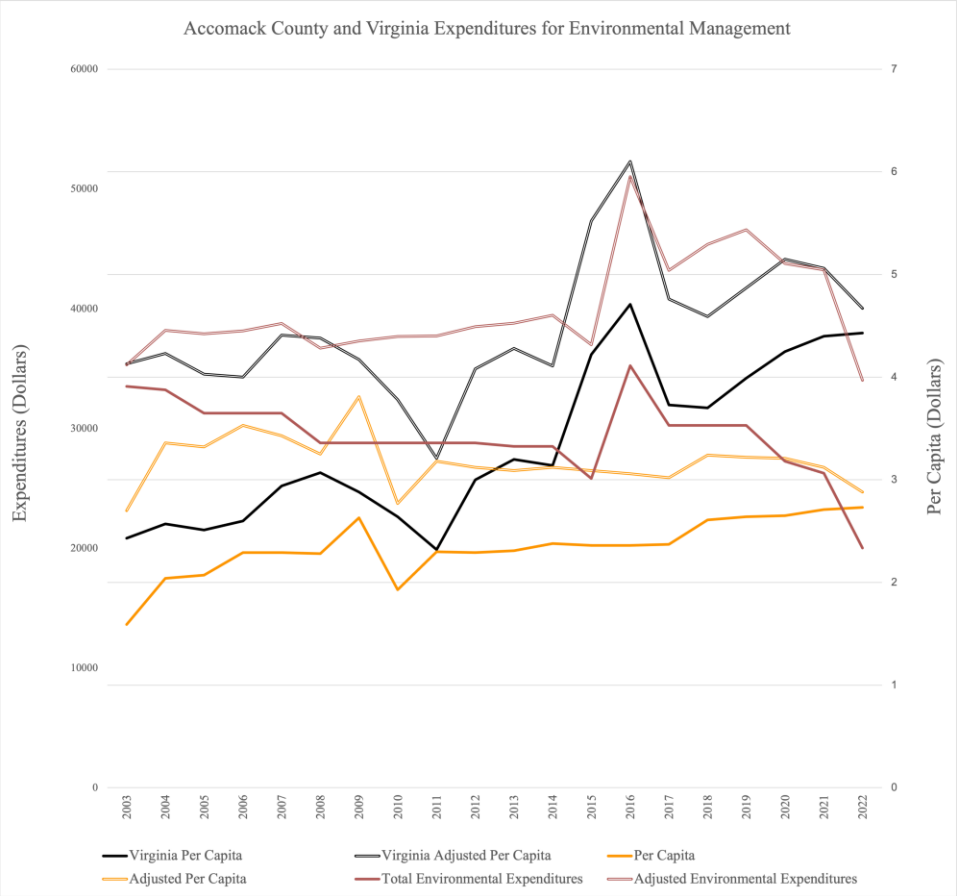

Figure 9. Northampton County and Virginia Expenditures for Environmental Management from 2003 to 2022.

Figure 10 shows the Accomack County and Virginia expenditures for the Maintenance of Highways, Streets, Bridges, and Sidewalks from 2003 to 2022. The per capita Maintenance of

Highways, Streets, Bridges, and Sidewalks amounts, both adjusted and not adjusted for inflation, are shown for both Accomack County and the state of Virginia. The total Maintenance of Highways, Streets, Bridges, and Sidewalks expenditures for Accomack County is also graphed. Virginia's Maintenance of Highways, Streets, Bridges, and Sidewalks per capita amounts have generally increased from 2003 to 2022. Accomack County's total expenditures for Maintenance of Highways, Streets, Bridges, and Sidewalks have fluctuated from 2003 to 2022. The per capita amount for the Maintenance of Highways, Streets, Bridges, and Sidewalks for Accomack County has been relatively stable, but there was a peak in 2018.

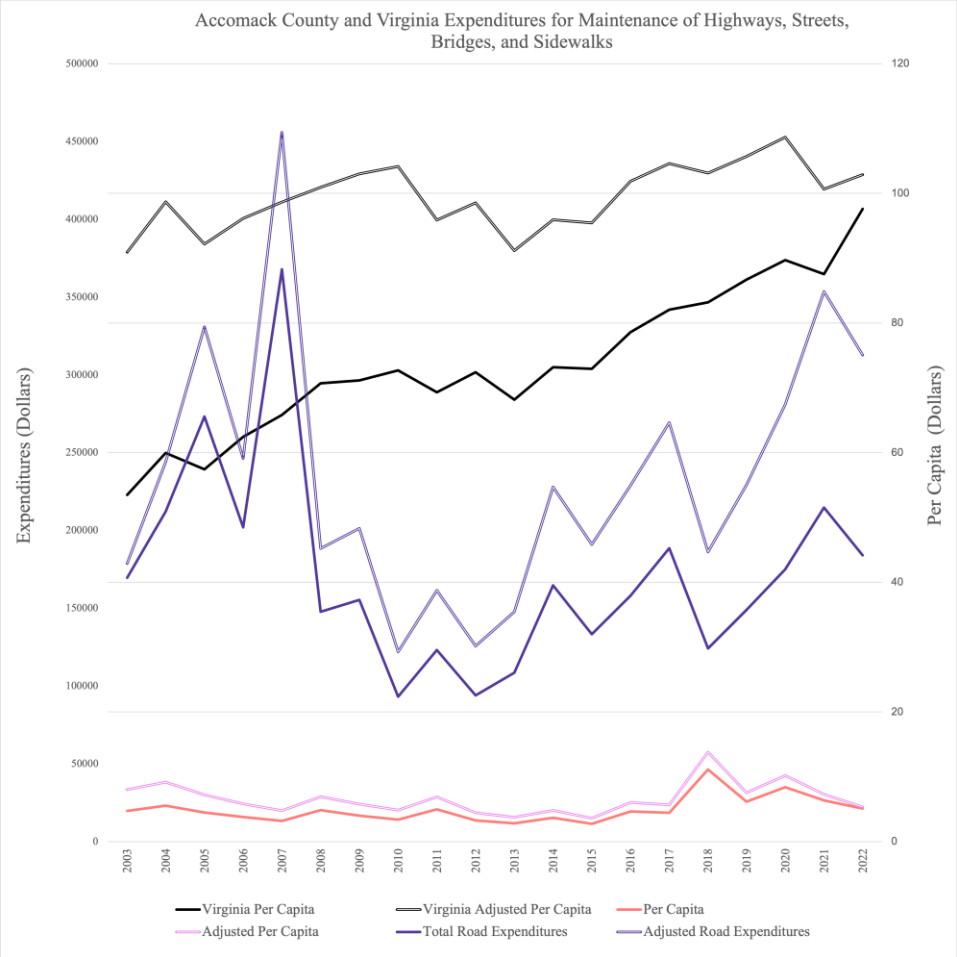

Figure 10. Accomack County and Virginia Expenditures for Maintenance of Highways, Streets, Bridges, and Sidewalks from 2003 to 2022.

Figure 11 shows the percent of the total amount of available funds for different environmental expenditures for Northampton County and Accomack County overlayed with the number of severe weather events that potentially affected and impacted the Eastern Shore. More information about these weather events can be found in Appendix 6, which shows storm events

that could have affected the Eastern Shore of Virginia from 2003 - 2020. In 2009, the percent of the total amount of available funds for Accomack County's Environmental Management expenditures spiked, and the number of possible storm events was around five. From 2007 to 2009 Accomack County spending on Environmental Management increased around 980%. Northampton County and Virginia do not experience large fluctuations in spending, and remain relatively stagnant in both equity expenditure categories.

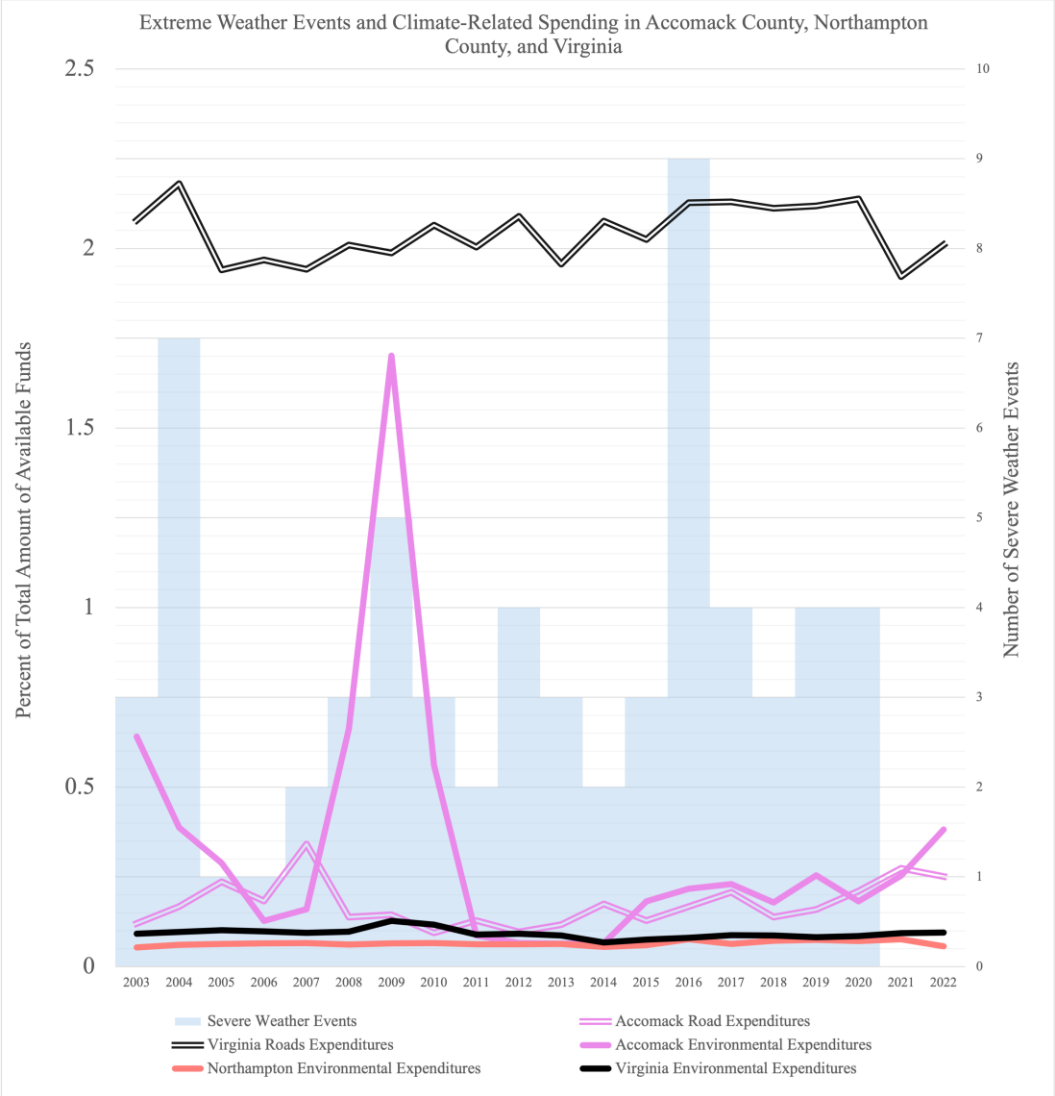

Figure 11. Extreme Weather Events and Climate-Related Spending in Accomack County, Northampton County, and Virginia from 2003 to 2022.

Discussion

Our primary findings are as follows. First, climate equity expenditures vary between Accomack County and Northampton County and are different in comparison to the state's expenditures from 2003 to 2022. As seen in Table 6, the adjusted per capita amount for the Maintenance of Highways, Streets, Bridges, and Sidewalks for Accomack County ranges from $3.6 to $13.8. In contrast, the state's adjusted per capita amount for the Maintenance of Highways, Streets, Bridges, and Sidewalks ranges from $90.91 to $108.68. This could indicate that areas of the state vary in population and have different expenditures for the Maintenance of Highways, Streets, Bridges, and Sidewalks. Figure 6 further visualizes the difference in the Maintenance of Highways, Streets, Bridges, and Sidewalks expenditures, as it shows the percent of the total amount of available funds for the expenditures of the Maintenance of Highways, Streets, Bridges, and Sidewalks for Accomack County and Virginia. The percent of Accomack County's total amount of available funds for the expenditures of the Maintenance of Highways, Streets, Bridges, and Sidewalks is consistently less than 0.5 percent from 2003 to 2022, whereas the percent of Virginia's total amount of available funds for the expenditures of the Maintenance of Highways, Streets, Bridges, and Sidewalks from 2003 to 2022 is around 2 percent.

In terms of the Environmental Management expenditures (as shown in Table 7), the adjusted per capita amount for Environmental Management for Accomack County ranges from $2.45 to $58.88 ($58.88 can be attributed to the spike seen in Figure 8), and the average of the adjusted per capita amount for Environmental Management for Accomack County is $12.265. The adjusted per capita amount for Environmental Management for Northampton County ranges from $2.7 to $3.81, and the average for Northampton County is $3.176. The adjusted per capita amount for Environmental Management for Virginia ranges from $3.21 to $6.1, and the average for Virginia is $4.4765. Though the average adjusted per capita amount for Environmental Management for Accomack County is higher than Northampton County and Virginia, the average adjusted per capita amount for Environmental Management for Northampton County is less than Virginia's average adjusted per capita amount for Environmental Management. The spike in the amount of adjusted per capita in 2009, as well as relatively higher amounts of adjusted per capita in other years, can account for the higher average adjusted per capita amount for Environmental Management for Accomack County from 2003 to 2022. Additionally, Figure 7 visualizes the percent of the total amount of available funds for Environmental Management expenditures, and it shows how the percent of Accomack County's total amount of available funds for Environmental Management expenditures varies, whereas the percent of Northampton County's and Virginia's total amount of available funds for Environmental Management expenditures are relatively steady at less than 0.2 percent. Overall, these findings show that spending on road infrastructure and environmental management varies across Virginia.

Second, we found that Northampton County's expenditures on Environmental Management are less than Accomack County's expenditures on Environmental Management from 2003 to 2022. Table 7 shows the expenditures for Environmental Management across the two counties. The adjusted expenditures for Environmental Management for Northampton County range from $34,024.98 to $51,030.36. On the other hand, the adjusted expenditures for

Environmental Management for Accomack County range from $82,242.63 to $2,330,275.06. This shows that the amount being spent on Environmental Management varies between the two counties on the Eastern Shore.

As discussed previously in this report, the Eastern Shore of Virginia is facing rising sea levels, increasing storm frequency and intensity, shoreline erosion, and saltwater intrusion. These consequences of climate change have significant economic impacts on local communities. The ability of these communities to respond adequately to these challenges is directly tied to the amount of resources that is able to be deployed during times of need. Financial constraints and bureaucratic obstacles hinder municipalities' ability to take care of the most vulnerable and most impacted during times of stress while also hindering their ability to invest in mitigation strategies. Therefore, climate equity is largely tied to not only the size of expenditures made by government entities, as discussed previously, but also in the ability of governments to have a significant financial flexibility to respond to environment-related needs as they arise. This flexibility could be enacted over time as climate-related events and awareness of them increase, or on a short-term scale in response to severe weather events and sudden climate impacts.

In this analysis Figure 11, Extreme Weather Events and Climate-Related Spending in Accomack County, Northampton County, and Virginia from 2003 to 2022, best explores the relationship between climate-related spending and severe weather events. From 2007 to 2011 Accomack County's percent of total amount of available funds for Environmental Management expenditures sharply peaks with an increase in the number of severe weather events, and then decreases as the number of severe weather events decreases. In 2007 Accomack County spent $215,690.65 on Environmental Management and then $2,330,275.06 in 2009 (both figures adjusted for inflation using 2024 dollars). This is an increase of $2,114,584.41, around a 980% increase in just two years. Similarly, in 2007 Accomack County spent $186,184.66 on Maintenance of Highways, Streets, Bridges, and Sidewalks and then $269,236.56 in 2008 (both figures adjusted for inflation using 2024 dollars). This is an increase of $83,051.9, around a 140% increase in just one year. Accomack County, throughout the twenty-year period examined, regularly shows trends of noteworthy increases and decreases in each environmental equity expenditure category and across various units of analysis (per capita, percent spent, adjusted total, etc.). Northampton County and Virginia do not experience the same fluctuations in spending, and remain relatively stagnant in both equity expenditure categories. The sharpest change in Environmental Management for Northampton County was from 2009 to 2010, and it decreased by $14,041.73 (in 2024 dollars).

This framing of analysis could be used to further explore the relationship between environmental equity and financial adaptability within Eastern Shore communities. Achieving climate equity will require substantial financial investments and the ability to change the allocation of funds to meet these needs. Understanding historically low and stagnant budgets in areas of environmental equity expenditures may help frame conversations to take place around a community's resource allocation and policy responsiveness.

Additional financial analysis could be explored using the reports from the Commonwealth of Virginia Auditor of Public Accounts by selecting different expenditure

categories. Further financial analysis could be pursued by looking at financial information related to stormwater, green infrastructure, or other climate-related expenditures. Further analysis could also include population change for the Eastern Shore to visualize the relationship between population and climate equity expenditures. For the storm event data, additional analysis could include storms from 2021 and 2022, as well as include rain or storm events that have impacted residents of the Eastern Shore but are not listed in published storm lists.

Limitations

For the financial analysis, we encountered some limitations to our methods that impact our findings. In the reports from the Commonwealth of Virginia Auditor of Public Accounts, Northampton County did not have data for Maintenance of Highways, Streets, Bridges, and Sidewalks. In reviewing the notes documents for the 2022 report provided by the Commonwealth of Virginia Auditor of Public Accounts, we found that the spending for Maintenance of Highways, Streets, Bridges, and Sidewalks was from Virginia's department of transportation, but the source for the Environmental Management expenditures was not provided (Commonwealth of Virginia Auditor of Public Accounts, 2022). Additionally, in the reports from the Commonwealth of Virginia Auditor of Public Accounts there was some discrepancy between the sources of funding which may impact the value of comparisons between the two categories examined.

The different scales that some data existed on limited the extent that certain data comparisons were able to be visualized. For example, the per capita amounts for the state for Maintenance of Highways, Streets, Bridges, and Sidewalks (averaging $99.45 when adjusted for inflation) were not able to be effectively graphed with the same category for Accomack County (which averaged $6.58 when adjusted for inflation).

Additional limitations relate to the compilation of storm events. Effort was made to consolidate the storm list from multiple sources. Sometimes, storms were called by different names or described in different ways in the various sources. There is the possibility for some duplicate storm events, as indicated in the table, due to compiling from different sources. The list of storms is not exhaustive, as what is reported and considered a storm event could differ from the actual storm events experienced by the residents of the Eastern Shore.

Section 6
Conclusion

Painter, VA

The community of the Eastern Shore of Virginia is sure to face continuing worsening conditions as climate change intensifies globally and the severity of natural disasters increases locally. Government entities have an obligation to their communities to do everything within their power to uplift and protect all of their residents. To do this, they must account especially for those made most vulnerable climate change to ensure that no community member is left behind.

As our analysis finds, though, there is not sufficient attention paid to these marginalized populations or sufficient resources dedicated to ensuring their resilience to climate events. In our qualitative analysis of key local planning documents, we find that environmental impacts are described at length. Yet, the way in which these impacts will harm some more than others is not discussed. We see residents talked about as a means of economic development in the area, but we do not see an emphasis on how to prepare for their protection from further climate harms. In the transportation analysis we can see that more robust road closure data could reveal trends in road closures that may allow localities to allocate mitigation resources more efficiently and equitably. In the financial analysis, there was clearly disproportionate investments in infrastructure throughout Virginia and between counties. Additionally, Accomack County has historically shown its expenditures can fluctuate, while Northampton County's expenditures were significantly smaller and did not change as severe weather events worsened. With the findings from both parts of this project, we can expect that as climate damages worsen, Accomack and Northampton Counties will need additional resources to provide assistance to the residents who are made most vulnerable by climate change.

To prevent disproportionate climate harms from unfolding the Eastern Shore community, Accomack and Northampton Counties must better prepare to aid their most vulnerable residents. They can do so through building equity and resilience measures more thoroughly into their comprehensive plans, or by creating a climate equity plan separately from their comprehensive plans. They can also further explore the allocation of their funds, and make sure the fiscal

resources are going to those who are most impacted and least able to financially recover from disasters. By doing these things, local governments will be better prepared to protect *all* of their residents.

The effects of climate change are real and worsening. Local governments in this coastal community can no longer hope that continuous economic development will save the Eastern Shore from climate catastrophe. Instead, they must invest their resources into protecting the people who already live there. These current residents are not blind to real climate damages occurring around them (see Figure 1). It is now time for local governments to meaningfully address what residents there have known all along: although climate change will harm the Eastern Shore community, it can withstand these damages by staying strong together and protecting those who would otherwise be most impacted. If the community can, as Josiah put it, "stick together through countless storms and flooding," they will be equipped to continue as a thriving coastal community.

APPENDICES

Appendix 1: Context for Climate Equity Terms in the Accomack County Plan

Term	Count	Context
Climate change	8	"Climate change" is used as an indicator of both the intensity and frequency of storms and storm events (pp. 2-66, 2-71). It is also mentioned a section about sea level rise, and the plan links two sources for readers to seek more information about climate change (p. 2-67). Additionally, the plan acknowledges that Accomack County needs to "evaluate the impacts of climate change and sea level rise on groundwater and water quality and marshlands" (p. 2-67). "Climate change" is directly mentioned in Policy 1-g: "Collaborate with local, relation, and state agencies in planning for climate change" (p. 5-6). This policy notes how "planning for climate change" can respond to sea level rise, as well as "assess potential economic opportunities" (p. 5-6). It is also included in the name of a potential partner task force (p. B-17).
Resilience	0	"Resilience" does not appear in the plan.
Resiliency	7	"Resiliency," in the context of "Coastal Resiliency" appears as a finding and recommendation of the joint land use study (pp. B-3, B-11, B-17) and an impact to the Wallops Flight Facility (p. 3-36). "Coastal Resiliency" also appears as a section in the "Five Year Update Amendment" (Appendix C). Sections in this plan include "Coastal Resiliency" (p. C-17) and "Coastal Resiliency Planning & Next Steps" (p. C-20).
Environmental Justice	0	"Environmental justice" does not appear in the plan. "Justice" occurs once in plan as a part of the title, "U.S. Department of Justice" (p. 3-2).
Threat	30	There are fifteen occurrences of "threat" and fifteen occurrences of "threats." Other forms of the word include threatened, threaten, threatening, and threatens. Total of all of the forms of the word "threat" is fifty-four. Various forms of the word appear throughout the plan, including in relation to threats to the natural environment (Chapter Two) and the development environment (Chapter Three). They also appear in relation to various county concerns (Chapter Four), in policies and recommendations from the county to address the various issues (Chapter Five), and are included in the Future Land Use Plan (Chapter Six). Examples of the context of the use of "threat" or "threats" include "threats to water quality" (p. 2-9), "threat to groundwater quality" (pp. 2-23, 4-37), "threat of sea level rise" (p. 2-66), waterfront development as a threat to both "property and the environment" (p. 4-2), and "threat of saltwater intrusion" (p. 4-34), to name a few.
Equity	1	"Equity" occurs once in the text in the financial context: "Increase affordable and 'starter' housing so local people can have adequate housing and being to build equity" (p. A-2).
Equitable	2	"Equitable" appears twice in the plan. In one instance, it is used to describe the distribution of resources (p. 4-20). In the other instance, it is used in the description of a policy: "to create a prosperous, equitable, safe, and harmonious future for the citizens of Accomack County" (p. 5-8).
Minority	0	"Minority" does not appear in the plan.
Adaptation	5	"Adaptation" appears as a "strategy for erosion control" in the Comprehensive Coastal Resource Management Plan (p. 6-12). It also appears in the joint land use study in the titles of various resources (pp. B-17 - B-18).
Mitigation	19	"Mitigation" appears in the title, "Eastern Shore of Virginia Hazard Mitigation Plan" (both in the text and the bibliography) and is used in relation to this plan (pp. 2-71 - 2-72). It is

		also referred to as a criteria for development rezoning: “environmental impact mitigation — whether the environmental impacts of the proposed uses can be adequately mitigated by the applicant” (p. 6-25). It also appears in the joint land use study (pp. B-11 - B-13, B-17). Other forms of mitigation in the plan include “mitigate,” “mitigated,” and “mitigating.”

Appendix 2: Context for Climate Equity Terms in the Northampton Comprehensive Plan

Term	Count	Context
Climate change	26	“Climate change” is described as a growing “national and global force” (9) and is a source of the environmental impacts experienced in rural areas (12) and the Eastern Shore that threatens natural resources (20). “Adaptation”, “Mitigation” and “Planning” are used to describe the actions and strategies that must be incorporated in order to protect the environment, natural resources, and communities from the negative impacts of climate change.
Resilience	18	“Resilience” is used to describe both “economic resilience” (12) and “environmental resilience” (48). Both uses of the term refer to the county’s ability to meet economic growth needs and the county’s ability to protect natural resources and ecosystems that are at the core of economic productivity. “Community resilience” is not defined explicitly, it is only addressed in reference to an existing project, the “Advancing Ecosystem and Community Resilience” project, led by the Virginia Coastal Zone Management Program which aims to identify resilience priorities and conceptualize projects (55).
Resiliency	21	“Resiliency” appears in the comprehensive plan as an economic (10) and conservation (47) objective in the region. The plan directly refers to the county’s participation in a *Statewide Coastal Resiliency Master Plan* (100). “Community resiliency” is not defined explicitly, it is only acknowledged as a goal for which communities plan. The plan explicitly indicates that “adaptation” and “mitigation” will be necessary for achieving community resilience (55).
Environmental Justice	3	“Environmental Justice” is defined in the glossary of terms in the appendices and is listed as an on-going implementation strategy under the larger ‘Land Use’ category (97) to engage the community. By promoting environmental justice, the county aims to understand the ‘potential adverse effects of land use decisions and how they impact underserved and minority groups’ particularly (23).
Threat	27	The county’s vulnerability is documented through the identification of the number of threats that directly impact or are projected to impact the region. The term is found in conjunction with “threat of climate change” (47), “sea-level rise” (55), “water quality” (99), “flooding” (170) and “high wind events” (170).
Equity	3	“Equity” is mentioned two out of three times in the text boxes that summarize the plan vision where the county states that it will ‘pursue a thriving, resilient future that provides for social equity and opportunity for all residents’ (9). Equity is not defined but is listed as an issue that is best solved with a ‘regional perspective alongside transportation, education, tourism, job and workforce development among other areas’ (92).
Minority	8	“Minority” is included in descriptions around interventions aimed at supporting under-served and at-risk groups within the communities of Northampton County. Within the housing and community engagement sections, no explicitly connections made to their vulnerability in the face of the impacts of climate change, only references in relation to economic growth and investments.

Adaptation	2	"Adaptation" is not defined within the comprehensive plan but is used to describe the types of strategies needed to 'protect infrastructure long term and the resiliency of critical services' (108) for communities.
Mitigation	20	"Mitigation" is largely used in reference to the Eastern Shore Mitigation plan and the best practices and recommendations established in that plan that was considered in the development of the Northampton Comprehensive plan (4). Mitigation is included within strategies for ensuring effective marine transportation as a means of dealing with coastal erosion and improving overall mobility in the county (105).

Appendix 3: Code Application Chart

Media \ Codes	I - Coding dictionary	Effect	Events	Frequency	Minority Groups	Reaction	Reason for Event	Vulnerability	II - Emerging codes	Common Environment	General Environmental Impacts	Reason for General	Totals
YourNorthampton2040_OnlineAcces		6	9	2	25	47	8	72		56	28	22	275
FEMA-Approved-2021-Eastern-		134	119	7	7	61	39	65		21	45	35	533
Accomack_Comprehensive_Plan.pd			14		65	438	3	192		18	24	12	766
Totals		140	142	9	97	546	50	329		95	97	69	

Appendix 4: Code Co-Occurrence Chart

Codes	I - Coding dictionary	Effect	Events	Frequency	Minority Groups	Reaction	Reason for Event	Vulnerability	II - Emerging codes	Common Environment Descriptors	General Environmental Impacts	Reason for General Environmental	Totals
I - Coding dictionary													
Effect			5	1		1	2	8			7		24
Events		5				2		1		1	1		10
Frequency		1					3	2					6
Minority Groups						21		15					36
Reaction		1	2		21			21		2	4	3	54
Reason for Event		2		3				7			1		13
Vulnerability		8	1	2	15	21	7			10	32	20	116
II - Emerging codes													
Common Environment Descriptors			1			2		10			4	4	21
General Environmental Impacts		7	1			4	1	32		4		11	60
Reason for General Environmental						3		20		4	11		38
Totals		24	10	6	36	54	13	116		21	60	38	

Appendix 5: Code Cloud

Appendix 6: Selection of storm events that were near to or affected the Eastern Shore from 2003 - 2020. Storm information sourced from *The Eastern Shore of Virginia Hazard Mitigation Plan 2021*, the

National Weather Service's Hurricane History of Central and Eastern Virginia list, the National Hurricane Center and Central Pacific Hurricane Center's Hurricanes in History list, and the Virginia Institute of Marine Science's Notable Storms list. Relevant storm information as well as relevant information related to transportation impacts were included in the table.

Date	**Storm Event**[*+]	**Storm Name (if applicable)**	**Notes on storms**	**Transportation information**
July 2003	Flash Flood			"Extensive flooding to secondary roads, as well as portions of Route 13" (Accomack-Northampton Planning District Commission, 2021, p. 78).
September 2003	Hurricane	Isabel		
September 2003	Flash Flood			"Several inches of water on Route 13 in the areas of Nelsonia and Mappsville. Some parts impassable. Many roads closed, under 6 to 8 inches of water" (Accomack-Northampton Planning District Commission, 2021, p. 78).
July 2004	Flash Flood			"One foot of water across Route 175 in town of Chincoteague. Six inches of water to 1.5 feet of water across northbound and southbound lanes of Route 13. Southbound lanes of Route 13 were closed for a time. Standing water of 1.5 feet alongside northbound Route 13 was threatening houses along the road" (Accomack-Northampton Planning District Commission, 2021, p. 78).
August 2004	Hurricane	Alex	Primarily heavy rain, with little damage or flooding (*The Hurricane History of Central and Eastern Virginia*, n.d.)	
August 2004	Tropical storm / extra-tropical	Charley	Category 1 hurricane near South Carolina before weakening to a tropical storm in North Carolina and then an extra-tropical storm near Virginia Beach (*Hurricanes in History*, n.d.)	
August 2004	Tropical Storm	Gaston	Category 1 hurricane near South Carolina	

			before weakening through North Carolina and producing heavy rain and storm activity in Virginia (*The Hurricane History of Central and Eastern Virginia*, n.d.)	
September 2004	Hurricane	Frances	Became a tropical depression after making landfall in the panhandle of Florida Though the track of the storm indicates it did not go through the Eastern Shore (*Hurricanes in History*, n.d.), The Hurricane History of Central and Eastern Virginia reported tornadoes in "central and eastern Virginia" (*The Hurricane History of Central and Eastern Virginia*, n.d.).	
September 2004	Tropical Depression	Ivan	Category 3 hurricane near Florida and Alabama before becoming a tropical depression in Virginia (*The Hurricane History of Central and Eastern Virginia*, n.d.)	
2004	Tropical Depression	Bonnie		
July 2005	Hurricane	Cindy	"Remnants of Hurricane Cindy" (*The Hurricane History of Central and Eastern Virginia*, n.d.)	
September 2006	Extra-Tropical	Ernesto	"Remnants of Tropical Storm Ernesto" combined with "unusually strong high pressure" (*The Hurricane History of Central and Eastern Virginia*, n.d.)	
2007	Extra-Tropical	Barry		
October 2007	Heavy Rain			
September 2008	Tropical Storm	Hanna		
September 2008	Nor-easter		"A disturbance related to Hurricane Kyle" (*Notable Storms*, n.d.)	
December 2008	Heavy Rain			
July 2009	Flash Flood			

September 2009	Nor-easter			
November 2009	*Nor-easter*		"Nor'easters of November and December 2009" (Accomack-Northampton Planning District Commission, 2021, p. 60)	
November 2009	*Nor-easter*	Nor-Ida	Also referred to as "Son of Ida" (*Notable Storms*, n.d.)	
December 2009	Nor-easter		"Nor'easters of November and December 2009" (Accomack-Northampton Planning District Commission, 2021, p. 60)	
March 2010	Heavy Rain			
March 2010	Heavy Rain			
March 2010	Nor-easter			
June 2011	Flash Flood			"High water was covering Routes 316 and 182" (Accomack-Northampton Planning District Commission, 2021, p. 79)
August 2011	Hurricane	Irene		
July 2012	Flash Flood			
August 2012	Heavy Rain			
October 2012	Hurricane	Sandy		
December 2012	Coastal Flood			
2013	Extra-tropical	Andrea		
March 2013	Coastal Flood			"The Chincoteague Causeway (Highway 175) was impassable due to two feet of water over the roadway" (Accomack-Northampton Planning District Commission, 2021, p. 79)
June 2013	Flash Flood		"The combination of the remnants from Tropical Storm Andrea and a frontal boundary" (Accomack-Northampton Planning District	"Several roads were impassable due to high water" (Accomack-Northampton Planning

			Commission, 2021 p. 79).	District Commission, 2021, p. 79).
August 2014	Flash Flood			" Flooding was reported on many streets in Cape Charles. Several cars were flooded by 2 to 3 feet of water" (Accomack-Northampton Planning District Commission, 2021, p. 79).
September 2014	Heavy Rain			
2015	Tropical Depression	Ana		
October 2015	Coastal Flood	Joaquin	"A combination of Hurricane Joaquin near the Bahamas and strong high pressure over New England produced strong onshore winds over the Mid-Atlantic" (Accomack-Northampton Planning District Commission, 2021, p. 56).	
November 2015	Heavy Rain			
January 2016	Coastal Flood			
February 2016	Coastal Flood			
July 2016	Heavy Rain			
July 2016	Heavy Rain			
September 2016	Tropical / post-Tropical Storm	Hermine		
September 2016	Heavy Rain		"The combination of a stalled frontal boundary and the remnant low pressure area that was Tropical Storm Julia" (Accomack-Northampton Planning District Commission, 2021, p. 80).	
September 2016	Heavy Rain			
October 2016	*Hurricane / Post tropical cyclone*	Matthew	"Post Tropical Cyclone Matthew, tracking northeast just off the North Carolina and Virginia coasts, produced very strong northeast or north winds over and the Virginia Eastern Shore"	

			(Accomack-Northampton Planning District Commission, 2021, p. 57).	
October 2016	*Heavy Rain*		"The combination of a cold front moving through the Mid Atlantic and Post Tropical Cyclone Matthew tracking northeast just off the North Carolina and Virginia coasts, produced heavy rain across the Virginia Eastern Shore" (Accomack-Northampton Planning District Commission, 2021, p. 80).	
June 2017	Heavy Rain			"Minor street flooding across portions of southeast Virginia" (Accomack-Northampton Planning District Commission, 2021, p. 80).
July 2017	Heavy Rain			
August 2017	Heavy Rain			
August 2017	Heavy Rain			
2018	Extra-Tropical	Michael		
September 2018	Heavy Rain		"Heavy rains related to Hurricane Florence" (Accomack-Northampton Planning District Commission, 2021, p. 85).	"Washed away a portion of Hillsborough Drive in Belle Haven and closed several other roads in Accomack and Northampton Counties" (Accomack-Northampton Planning District Commission, 2021, p. 85).
September 2018	Flash Flood			
September 2019	Hurricane	Dorian	Classified as a coastal flood event (Accomack-Northampton Planning District Commission) "Hurricane Dorian tracking northeast along the North Carolina coast and just off the Virginia coast" (Accomack-Northampton Planning District Commission, 2021, p. 57)	

October 2019	Coastal Flood			
October 2019	Heavy Rain		"Remnant low pressure of Tropical Storm Nestor tracked northeast across eastern North Carolina and off the southeast Virginia coast" (Accomack-Northampton Planning District Commission, 2021, p. 81)	
November 2019	Coastal Flood			
August 2020	Tropical Strom	Isaias		
September 2020	Post tropical cyclone	Sally	Classified as a Heavy Rain event (Accomack-Northampton Planning District Commission, 2021)	
October 2020	Post tropical cyclone	Delta	Classified as a Heavy Rain event (Accomack-Northampton Planning District Commission, 2021)	
2020	Tropical Storm	Fay		

[*] *Italicized* storm events indicate possible duplicate storm events.

[+] Some storm events were called different things. For instance, some events in the Eastern Shore of Virginia Hazard Mitigation Plan were categorized as Coastal Flood, Flash Flood, or Heavy Rain, but in the descriptions of the events, some were named. For example, the September 2020 storm was categorized as a Heavy Rain event, but then described as "Post Tropical Cyclone Sally" (Accomack-Northampton Planning District Commission, 2021, p. 81).

Appendix 7: Financial data for the Maintenance of Highways, Streets, Bridges, and Sidewalks for Accomack County and Virginia.

Maintenance of Highways, Streets, Bridges, and Sidewalks

	Accomack County							Grand Total for the State			
Year	Amount	Adjusted Amount	Total Amount Available	Percent of Total	Per Capita	Adjusted Per Capita	Percent of Average	Amount	Total Amount Available	Percent of Total	Per Capita	Adjusted Per Capita
2022	$ 169,516.00	$ 178,681.42	$ 141,192,670.00	0.120060057	$ 5.07	$ 5.34	12.38	$ 846,139,789.00	$ 42,088,442,195.00	2.010385143	$ 97.59	$ 102.87
2021	$ 212,211.00	$ 243,950.17	$ 126,916,131.00	0.167205696	$ 6.35	$ 7.30	18.93	$ 783,582,579.00	$ 40,772,377,831.00	1.921846654	$ 87.55	$ 100.64
2020	$ 273,122.00	$ 330,898.89	$ 115,628,665.00	0.236206135	$ 8.39	$ 10.16	23.46	$ 795,777,922.00	$ 37,222,785,848.00	2.137878457	$ 89.70	$ 108.68
2019	$ 201,970.00	$ 246,275.30	$ 110,763,839.00	0.182342903	$ 6.16	$ 7.51	17.65	$ 767,476,761.00	$ 36,222,558,823.00	2.118781185	$ 86.68	$ 105.69
2018	$ 367,756.00	$ 455,821.35	$ 107,801,121.00	0.341134302	$ 11.13	$ 13.80	30.83	$ 734,968,771.00	$ 34,800,755,759.00	2.111933362	$ 83.21	$ 103.14
2017	$ 147,695.00	$ 188,319.79	$ 107,219,639.00	0.137749951	$ 4.43	$ 5.65	12.85	$ 719,583,459.00	$ 32,786,298,722.00	2.129808491	$ 82.04	$ 104.61
2016	$ 155,349.00	$ 201,314.69	$ 107,821,453.00	0.144079861	$ 4.64	$ 6.01	14.33	$ 687,207,279.00	$ 32,303,797,889.00	2.12732658	$ 78.61	$ 101.87
2015	$ 93,194.00	$ 121,973.32	$ 98,951,037.00	0.094181934	$ 2.75	$ 3.60	9.44	$ 633,400,453.00	$ 31,280,535,782.00	2.024902826	$ 72.93	$ 95.45
2014	$ 123,197.00	$ 161,441.14	$ 96,345,849.00	0.127869546	$ 3.67	$ 4.81	13.07	$ 630,874,326.00	$ 30,382,530,000.00	2.076437761	$ 73.19	$ 95.91
2013	$ 93,916.00	$ 125,620.85	$ 97,176,507.00	0.096664758	$ 2.80	$ 3.75	11.38	$ 582,099,745.00	$ 29,744,509,982.00	1.95695894	$ 68.17	$ 91.18
2012	$ 108,503.00	$ 147,678.47	$ 92,642,780.00	0.117119758	$ 3.35	$ 4.42	11.7	$ 611,836,226.00	$ 29,282,456,335.00	2.089429312	$ 72.41	$ 98.55
2011	$ 164,689.00	$ 227,380.51	$ 94,315,260.00	0.174615433	$ 4.97	$ 6.88	19.5	$ 578,999,477.00	$ 28,890,657,044.00	2.004106297	$ 69.31	$ 95.90
2010	$ 133,250.00	$ 190,940.01	$ 104,015,081.00	0.128106423	$ 3.37	$ 4.83	11.38	$ 594,508,191.00	$ 28,795,258,217.00	2.06460479	$ 72.68	$ 104.15
2009	$ 158,096.00	$ 228,929.26	$ 94,594,900.00	0.167129518	$ 3.99	$ 5.78	14.68	$ 581,044,265.00	$ 29,281,015,528.00	1.98744563	$ 71.14	$ 103.01
2008	$ 188,623.00	$ 269,256.56	$ 91,069,678.00	0.207119432	$ 4.84	$ 6.91	17.76	$ 570,279,742.00	$ 28,383,863,657.00	2.009168832	$ 70.70	$ 100.92
2007	$ 124,201.00	$ 186,184.66	$ 90,085,921.00	0.13786949	$ 3.19	$ 4.78	13.22	$ 527,122,590.00	$ 27,142,656,846.00	1.942044926	$ 65.81	$ 98.65
2006	$ 148,898.00	$ 229,204.58	$ 93,552,246.00	0.159160262	$ 3.77	$ 5.80	16.53	$ 495,820,298.00	$ 25,194,398,385.00	1.96797832	$ 62.44	$ 96.12
2005	$ 174,985.00	$ 280,994.42	$ 83,356,595.00	0.209923629	$ 4.48	$ 7.19	20.75	$ 451,546,769.00	$ 23,273,224,169.00	1.94018934	$ 57.41	$ 92.19
2004	$ 214,727.00	$ 353,537.76	$ 78,556,143.00	0.273342086	$ 5.55	$ 9.14	25.48	$ 464,907,179.00	$ 21,325,411,620.00	2.180601925	$ 59.94	$ 98.69
2003	$ 183,958.00	$ 312,770.66	$ 73,264,696.00	0.251087135	$ 4.72	$ 8.03	21.97	$ 410,861,988.00	$ 19,762,633,826.00	2.079393963	$ 53.47	$ 90.91

Appendix 8: Financial data for Environmental Management for Accomack County, Northampton County, and Virginia.

Environmental Management

Accomack County							
Year	Amount	Adjusted Amount	Total Amount Available	Percent of Total	Per Capita	Adjusted Per Capita	Percent of Average
2022	$ 539,602.00	$ 568,777.30	$ 141,192,670.00	0.38217423	$ 16.15	$ 17.02	311.57
2021	$ 321,503.00	$ 369,588.35	$ 126,916,131.00	0.253319257	$ 9.62	$ 11.06	198.68
2020	$ 209,797.00	$ 254,177.96	$ 115,628,665.00	0.181440303	$ 6.44	$ 7.80	131.57
2019	$ 281,570.00	$ 343,336.81	$ 110,763,839.00	0.254207513	$ 8.59	$ 10.47	188.66
2018	$ 192,093.00	$ 238,092.90	$ 107,801,121.00	0.178192025	$ 5.81	$ 7.20	137.61
2017	$ 246,474.00	$ 314,268.81	$ 107,219,639.00	0.229877663	$ 7.39	$ 9.42	179.3
2016	$ 233,583.00	$ 302,697.08	$ 107,821,453.00	0.216638706	$ 6.97	$ 9.03	168.1
2015	$ 179,953.00	$ 235,524.44	$ 98,951,037.00	0.181860651	$ 5.31	$ 6.95	139.19
2014	$ 62,760.00	$ 82,242.63	$ 96,345,849.00	0.065140326	$ 1.87	$ 2.45	51.08
2013	$ 62,284.00	$ 83,310.29	$ 97,176,507.00	0.064093681	$ 1.86	$ 2.49	49.91
2012	$ 60,441.00	$ 82,263.48	$ 92,642,780.00	0.065240918	$ 1.81	$ 2.46	47.78
2011	$ 81,376.00	$ 112,600.14	$ 94,315,260.00	0.086280842	$ 2.45	$ 3.39	79.05
2010	$ 583,421.00	$ 836,010.59	$ 104,015,081.00	0.560900395	$ 14.74	$ 21.12	409.2
2009	$ 1,609,262.00	$ 2,330,275.06	$ 94,594,900.00	1.701214336	$ 40.66	$ 58.88	1042.13
2008	$ 602,462.00	$ 859,941.78	$ 91,069,678.00	0.661539618	$ 15.46	$ 22.07	402.77
2007	$ 143,884.00	$ 215,690.65	$ 90,085,921.00	0.159718631	$ 3.70	$ 5.55	104.98
2006	$ 119,403.00	$ 183,801.76	$ 93,552,246.00	0.127632425	$ 3.03	$ 4.66	96.13
2005	$ 240,447.00	$ 386,114.61	$ 83,356,505.00	0.288456192	$ 6.15	$ 9.88	199.28
2004	$ 304,585.00	$ 501,484.67	$ 78,556,143.00	0.387729067	$ 7.87	$ 12.96	246.11
2003	$ 468,866.00	$ 797,179.40	$ 73,264,606.00	0.639962494	$ 12.02	$ 20.44	390.76

Northampton County							
Year	Amount	Adjusted Amount	Total Amount Available	Percent of Total	Per Capita	Adjusted Per Capita	Percent of Average
2022	$ 33,504.00	$ 35,315.50	$ 63,099,750.00	0.053096882	$ 2.73	$ 2.88	52.63
2021	$ 33,232.00	$ 38,202.32	$ 55,110,003.00	0.060301212	$ 2.71	$ 3.12	55.87
2020	$ 31,283.00	$ 37,900.68	$ 49,656,897.00	0.062998298	$ 2.65	$ 3.21	54.09
2019	$ 31,283.00	$ 38,145.42	$ 48,274,168.00	0.064802774	$ 2.64	$ 3.22	57.9
2018	$ 31,283.00	$ 38,774.24	$ 47,477,937.00	0.065889552	$ 2.61	$ 3.24	61.7
2017	$ 28,783.00	$ 36,700.01	$ 46,789,947.00	0.061515351	$ 2.37	$ 3.02	57.49
2016	$ 28,783.00	$ 37,299.50	$ 44,626,585.00	0.064497429	$ 2.36	$ 3.06	57.02
2015	$ 28,783.00	$ 37,671.50	$ 44,185,988.00	0.06514056	$ 2.36	$ 3.09	61.77
2014	$ 28,783.00	$ 37,718.13	$ 46,159,428.00	0.062355625	$ 2.38	$ 3.12	65.13
2013	$ 28,783.00	$ 38,499.78	$ 46,481,339.00	0.061923775	$ 2.31	$ 3.09	62.14
2012	$ 28,508.00	$ 38,800.93	$ 45,200,133.00	0.063070611	$ 2.29	$ 3.12	60.42
2011	$ 28,508.00	$ 39,446.58	$ 51,659,280.00	0.055184664	$ 2.30	$ 3.18	74.13
2010	$ 25,813.00	$ 36,988.63	$ 42,960,080.00	0.060086015	$ 1.93	$ 2.77	53.55
2009	$ 35,241.00	$ 51,030.36	$ 46,324,251.00	0.076074625	$ 2.63	$ 3.81	67.51
2008	$ 30,262.00	$ 43,195.35	$ 47,730,759.00	0.063401464	$ 2.28	$ 3.25	59.48
2007	$ 30,262.00	$ 45,364.53	$ 42,206,862.00	0.071699242	$ 2.29	$ 3.43	65.09
2006	$ 30,262.00	$ 46,583.49	$ 40,865,265.00	0.074053111	$ 2.29	$ 3.53	72.74
2005	$ 27,262.00	$ 43,777.87	$ 38,316,428.00	0.071149638	$ 2.07	$ 3.32	66.93
2004	$ 26,262.00	$ 43,239.13	$ 34,679,811.00	0.075727056	$ 2.04	$ 3.36	63.66
2003	$ 20,012.00	$ 34,024.98	$ 35,337,977.00	0.056630293	$ 1.59	$ 2.70	51.62

Grand Total for the State					
Year	Amount	Total State	Percent of Total	Per Capita	Adjusted Per Capita
2022	$ 38,443,383.00	$ 42,088,442,195.00	0.091339525	$ 4.43	$ 4.67
2021	$ 39,343,109.00	$ 40,772,377,831.00	0.096494517	$ 4.40	$ 5.06
2020	$ 37,666,932.00	$ 37,222,785,948.00	0.10119321	$ 4.25	$ 5.15
2019	$ 35,368,848.00	$ 36,222,558,823.00	0.097643152	$ 3.99	$ 4.87
2018	$ 32,706,990.00	$ 34,800,755,759.00	0.093983562	$ 3.70	$ 4.59
2017	$ 32,717,249.00	$ 33,786,298,722.00	0.096835848	$ 3.73	$ 4.76
2016	$ 41,132,686.00	$ 32,303,797,889.00	0.127330805	$ 4.71	$ 6.10
2015	$ 36,633,678.00	$ 31,280,535,782.00	0.117113333	$ 4.22	$ 5.52
2014	$ 27,041,456.00	$ 30,382,530,009.00	0.089003305	$ 3.14	$ 4.11
2013	$ 27,317,525.00	$ 29,744,509,982.00	0.091840562	$ 3.20	$ 4.28
2012	$ 25,341,858.00	$ 29,282,456,335.00	0.086542801	$ 3.00	$ 4.08
2011	$ 19,403,908.00	$ 28,890,657,044.00	0.067163263	$ 2.32	$ 3.21
2010	$ 21,576,668.00	$ 28,795,258,217.00	0.074931323	$ 2.64	$ 3.78
2009	$ 23,567,938.00	$ 29,281,015,528.00	0.0804888	$ 2.88	$ 4.17
2008	$ 24,800,614.00	$ 28,383,863,657.00	0.087375751	$ 3.07	$ 4.38
2007	$ 23,581,033.00	$ 27,142,656,846.00	0.086878131	$ 2.94	$ 4.41
2006	$ 20,680,974.00	$ 25,194,398,385.00	0.082085604	$ 2.60	$ 4.00
2005	$ 19,731,886.00	$ 23,273,224,169.00	0.084783637	$ 2.51	$ 4.03
2004	$ 19,896,190.00	$ 21,325,411,620.00	0.093298035	$ 2.57	$ 4.23
2003	$ 18,665,455.00	$ 19,762,633,826.00	0.094448216	$ 2.43	$ 4.13

BIBLIOGRAPHY

Accomack-Northampton Planning District Commission. (2021). Eastern Shore Hazard Mitigation Steering Committee. *The Eastern Shore of Virginia Hazard Mitigation Plan 2021*. Retrieved from https://cdnsm5-hosted.civiclive.com/UserFiles/Servers/Server_14877142/File/Government/Departments_Elected%20Offices/Planning,%20Permiting%20&%20Enforcement/FEMA-Approved-2021-Eastern-Shore-of-Virginia-Hazard-Mitigation-Plan.pdf/

Almagro, M., Chyn, E., & Stuart, B. A. (2023). *Urban Renewal and Inequality: Evidence from Chicago's Public Housing Demolitions* (Working Paper 30838). National Bureau of Economic Research. https://doi.org/10.3386/w30838

Andrews, E., King, A., Kraus, J., & West, A. (2019). *Flooding and Sea Level Rise on the Eastern Shore: Frequently Asked Questions*. https://raft.ien.virginia.edu/system/files/Flooding%20and%20Sea%20Level%20Rise%20on%20the%20Eastern%20Shore%20FAQs.pdf

Carter, A. (2023, February 15). *Climate Equity Workshop on the Eastern Shore Prompts Discussion*. Environmental Resilience Institute. https://environment.virginia.edu/about-esva-cep/news/climate-equity-workshop-eastern-shore-prompts-discussion

Causes and Effects of Climate Change. (2023). *United Nations Climate Action*. https://www.un.org/en/climatechange/science/causes-effects-climate-change

Charleston City Plan 2021. (2021). https://www.charleston-sc.gov/DocumentCenter/View/31227/Final-City-Plan-Adopted-October-12-2021

Commonwealth of Virginia Auditor of Public Accounts. (2022). *Notes to the Comparative Report of Local Government Revenues and Expenditures*. Retrieved from https://www.apa.virginia.gov/local-government/reports/comparative-reports/17874

County of Accomack Virginia. (2018). *Respecting the Past, Creating the Future: Accomack County Comprehensive Plan*. Retrieved from https://www.co.accomack.va.us/home/showpublisheddocument/10669/636761702081200000

County of Northampton Virginia. (2021). *Your Northampton County 2040: Creating a resilient and vibrant community. Together. Northampton County, Virginia Comprehensive Plan*. Retrieved from https://cdnsm5-hosted.civiclive.com/UserFiles/Servers/Server_14877142/File/Government/Departments_Elected%20Offices/Planning,%20Permiting%20&%20Enforcement/Comp%20Plan%202019/YourNorthampton2040_OnlineAccessible%20ADOPTED%206-8-21%20with%20visions.pdf

Data Visualization and Filtering - Dedoose. (n.d.). Dedoose.com. Retrieved April 30, 2024 from https://helpdesk.dedoose.com/hc/en-us/categories/12090894720269-Data-Visualization-and-Filtering

Eastern Shore. (n.d.). Virginia Economic Development Partnership. Retrieved April 17, 2024, from https://www.vedp.org/region/eastern-shore

Eastern Shore of Virginia Climate Equity Project. (n.d.). Environmental Resilience Institute. Retrieved April 17, 2024, from https://environment.virginia.edu/coastal-futures-hub

EPA. (2021). *CLIMATE CHANGE AND SOCIAL VULNERABILITY IN THE UNITED STATES* (430-R-21–003). U.S. Environmental Protection Agency.

EPA. (n.d.). Climate Change and Roads. https://19january2017snapshot.epa.gov/sites/production/files/2015-06/documents/roads.pdf.

FEMA. (2023). Mitigation Planning and Grants. *Hazard Mitigation Assistance Program and Policy Guide.* Www.fema.gov. https://www.fema.gov/emergency-managers/risk-management/hazard-mitigation-planning/requirements

Fullilove, M. T. (2001). Root shock: The consequences of African American dispossession. *Journal of Urban Health : Bulletin of the New York Academy of Medicine*, *78*(1), 72–80. https://doi.org/10.1093/jurban/78.1.72

Holsti, O. R. (1968). Content analysis. The handbook of social psychology, 2, 596-692.

"How Tropical Storm Ophelia Will Impact Virginia." 2023. CBS 6 News Richmond WTVR. September 22, 2023. https://www.wtvr.com/news/weather-news/here-is-how-tropical-storm-ophelia-will-impact-virginia.

Hurricanes in History. (n.d.). Retrieved from https://www.nhc.noaa.gov/outreach/history/

Jessel, S., Sawyer, S., & Hernández, D. (2019). Energy, Poverty, and Health in Climate Change: A Comprehensive Review of an Emerging Literature. *Frontiers in Public Health*. https://doi.org/10.3389%2Ffpubh.2019.00357

Larson, A. (2020, October 1). Did You Know There Are 60,000 U.S. Citizens Who Lack Access to Electricity? *Power*. https://www.powermag.com/did-you-know-there-are-60000-u-s-citizens-who-lack-access-to-electricity/#:~:text=%E2%80%9CWe%20have%20about%2015%2C000%20families,is%20a%20licensed%20professional%20engineer.

Lieberknecht, K. (2023). Leading with Local Knowledge: Climate Adaptation, Local Knowledge, and Participation in Austin, Texas' Network of Plans and the Co-Designed Climate Navigators' Tool and Process. Journal of Planning Education and Research, 0(0). https://doi.org/10.1177/0739456X221144610

Local Government Reports. (n.d.). Retrieved from https://www.apa.virginia.gov/local-government/reports?type=comparative-reports

Loh, C., & Kim, R. (2020). Are We Planning for Equity? Equity Goals and Recommendations in Local Comprehensive Plans. *Urban Studies and Planning Faculty Research Publications*. https://digitalcommons.wayne.edu/urbstud_frp/14

Mitchell, B. (2018, March 20). HOLC "Redlining" Maps: The Persistent Structure Of Segregation And Economic Inequality. *National Community Reinvestment Coalition*. https://ncrc.org/holc/

National Oceanic and Atmospheric Administration (2023). NOAA News & Features. https://www.noaa.gov/news-release/2023-atlantic-hurricane-season-ranks-4th-for-most-named-storms-in-year

NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2024). https://www.ncei.noaa.gov/access/billions/, DOI: 10.25921/stkw-7w73

Northampton County, VA population by year, race, & more. (2024, May 5). USAFacts. https://usafacts.org/data/topics/people-society/population-and-demographics/our-changing-population/state/virginia/county/northampton-county/

Notable Storms. (n.d.). Retrieved from https://www.vims.edu/bayinfo/tidewatch/notable_storms/

Commonwealth of Virginia Auditor of Public Accounts. (2022). *Notes to the Comparative Report of Local Government Revenues and Expenditures*. Retrieved from https://www.apa.virginia.gov/local-government/reports/comparative-reports/17874

Rothstein, R. (2018). *The Color of Law: A Forgotten History of How Our Government Segregated America*. Norton.

Stromberg, M. (2023, August 31). *Taiwo Jaiyeoba on Equity, Housing Choice, and the Power of Comprehensive Planning*. American Planning Association. https://www.planning.org/planning/2023/summer/taiwo-jaiyeoba-on-equity-housing-choice-and-the-power-of-comprehensive-planning/

Teaford, J. (2000). Urban Renewal and Its Aftermath. *Housing Policy Debate*. https://doi.org/10.1080/10511482.2000.9521373

The Hurricane History of Central and Eastern Virginia. (n.d.). Retrieved from https://www.weather.gov/media/akq/miscNEWS/hurricanehistory.pdf

US Bureau of Labor Statistics. 2024. *CPI Inflation Calculator*. Retrieved from https://www.bls.gov/data/inflation_calculator.htm

VA – Eastern Shore of Virginia. (2024, April 17). *Coming to the Table*. https://comingtothetable.org/organizer/eastern-shore-of-virginia/

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