Abstract

Title of Thesis:	INVESTIGATING THE INTERSECTION OF FLOOD RISK AND ENVIRONMENTAL JUSTICE IN MARYLAND
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Considering the implications of environmental justice, we sought to identify areas of Maryland with high socio-economic vulnerability, flood risk, and environmental risk to assess whether emergency preparedness policies in these areas were effective. We characterized this disparity based on a review of hazard mitigation policies in areas of Maryland that were susceptible to flood risk and toxic release. Our first phase of research determined which counties met our criteria of containing low-income, minority populations and being subject to flood risk. With the use of GIS technology to visualize pollution risk factors, we chose various counties in Maryland to use as our focus of comparison. The second phase analyzed emergency management plans for flooding and hazard mitigation policies of the selected counties. In our third and final phase, we interviewed officials or related personnel in the emergency preparedness policies and practices to gain a better understanding of the reality of their implementation. We found that Baltimore City, Dorchester County, Anne Arundel County, and Prince George's County had high-risk factors for flooding and socioeconomic vulnerability and had less comprehensive emergency plans. Additionally, we found that the explicit mention of environmental justice was not a priority of most plans, creating space for future improvements and research.

INVESTIGATING THE INTERSECTION OF FLOOD RISK AND ENVIRONMENTAL JUSTICE IN MARYLAND

by

Gemstone Team E-JUSTICE

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List of Abbreviations

CEJSC: Maryland Commission on Environmental Justice and Sustainable Communities

CDC: Center for Disease Control and Prevention

EOP: Emergency Operations Plans

EPCRA: Emergency Planning and Community Right-to-Known Act

FEMA: Federal Emergency Management Administration

GIS: Geographic Information System

HMP: Hazard Mitigation Plans

LEPC: Local Emergency Planning Committee

MDE: Maryland Department of the Environment

MEMA: Maryland Emergency Management Agency

MEOW: Maximum Envelope of Water

MOM: Maximum of MEOWs

NHC: National Hurricane Center

NOAA: National Oceanographic and Atmospheric Administration

NPL: National Priorities List

OEM: Office of Emergency Management

RAFT: Resilience Adaptation Feasibility Tool

SLOSH: Sea, Lake and Overland Surges from Hurricanes

TRI: Toxic Release Inventory

U.S. EPA: United States Environmental Protection Agency

Chapter 1: Introduction

It is predicted that in the next century, sea levels in Maryland will rise between 16 inches and four feet (U.S. EPA, 2016). In addition to this sea level rise, the frequency and severity of storms are expected to increase, causing destructive erosion, loss of habitat, and soil and water contamination (U.S. EPA, 2016). These changes will impact all coastal communities, but low-income and minority populations are expected to be disproportionately impacted because of their proximity to environmental hazards, which may release toxic waste during and after flood events (Barrett et al., 2015). This differential exposure as a result of social status raises environmental justice concerns, a term the U.S. Environmental Protection Agency (U.S. EPA) defines as the fair treatment and meaningful involvement of a community in the development, implementation, and enforcement of environmental laws, regulations, and policies (U.S. EPA, 2014). Our team sought to research this disparity between social risk factors and environmental justice by studying the intersection of flood risk and environmental hazards.

Our research aimed to identify areas of Maryland with high socio-economic vulnerability, flood risk, and environmental risk and to assess whether emergency preparedness policies in these areas were effective in ensuring environmental justice as defined by the U.S. EPA, particularly with regards to meaningful involvement of vulnerable populations.

In order to fulfill our research goals, we used data obtained from Geographic Information System (GIS) analysis and from interviews with county emergency planners. In addition, to assess the effectiveness of emergency preparedness policies,

we conducted a comparative analysis of county plans, including plans required under the federal Emergency Planning and Community Right-to-Know Act (EPCRA) and other applicable laws. Our hypothesis was that, in a flood-prone county with a significant minority and low-income population, there would be a lack of rigorous planning and enforcement of emergency policies related to flood risk and associated environmental risks, raising environmental justice concerns.

Three phases of research were conducted, with the first determining which counties have minority populations, are vulnerable to flood events, and contain a large number of environmentally hazardous sites in the floodplain. With the use of GIS technology to visualize risk factors, we chose various counties in the state of Maryland to use as our focus for comparison. The second phase involved analyzing the emergency preparedness policies of the selected counties. We conducted our analysis using a framework we built to determine the effectiveness of development, implementation, and enforcement of each policy. We expected to find less complete policies in counties which had higher flooding and social vulnerability risk, and an overall disconnect between flood policy and environmental hazard policy. The third phase evaluated the effectiveness of the implementation of these policies by interviewing people associated with the policies and planning committees. In this phase, we conducted interviews with county government officials and used this information to draw conclusions on how effectively the plans have been implemented. We additionally used this phase to identify fragmentation between the written policy and the knowledge of policy makers.

After conducting our research, a cross-analysis of GIS data, qualitative policy analysis, and supplemental interview responses revealed that counties with high social vulnerability and flood risk had poor preventative planning and enforcement policies. Though there were some exceptions to this finding, overall, our research supported our hypothesis.

Chapter 2: Literature Review

Introduction

The following chapter covers the existing literature on fundamental aspects of our research, defines key terms, and explains how they relate to each other. It explores similar research on flooding risk and policy in Virginia that included a GIS component and examines the indicators they used in order to inform the creation of our own maps. It also contains an initial overview of the existing hazard mitigation policies that address emergency preparedness and flooding events in the state of Maryland as a basis for our policy analysis.

Background

Environmental Justice

Environmental justice is defined by the U.S. EPA as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (U.S. EPA, 2020). By "fair treatment," it is specified that "no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies" (U.S. EPA, 2020). By "meaningful involvement," it states that "all people deserve the same degree of protection from environmental and health hazards, and equal access to the decision-making process in order to have a healthy environment in which to live, learn, and work" (U.S. EPA, 2020). We used this definition for our research because similar

language was used in President Clinton's Executive Order 12898, which instructed all federal agencies to pursue actions to address environmental justice in minority and low-income populations (Huang, 2014). While this is a federal definition, it will be a useful guide to our study of state- and county-level policies. The concept of environmental justice encompasses issues related to public health, safety, and economic exploitation, and how these issues affect communities as a result of their geographic location, socioeconomic status, race, ethnicity, immigration status, education level, and age.

Awareness of environmental justice gained ground in the 1960s within the greater environmentalism wave, sparking both academic and public communities to document environmental inequalities in the physical landscape of their cities. Research has since found that racial minorities and socioeconomically-disadvantaged groups are exposed to environmental hazards at disproportionately higher frequencies and quantities when compared to their peers (Kruize et al., 2014). According to the aforementioned definition, this inequality constitutes an environmental justice issue (Barrett et al., 2015). Despite the fact that the environmental justice movement began over 50 years ago, communities across the United States continue to be differentially exposed to toxic pollutants that threaten their health and quality of life.

Pollution and Flooding

While all flooding events have environmental and social impacts, floods that occur in densely populated areas near environmental hazards can spread pollutants and hazardous materials more easily, exposing residents to serious health issues. Considering the aforementioned disproportionate proximity of vulnerable

communities to hazardous materials, floods amplify the potential for environmental justice concerns. This section explores pollution in relation to water and floods, as well as some of the main sources of hazardous materials.

Water pollution.

Water pollution is an overarching term describing the contamination of bodies of water and the resulting human and environmental health impacts. Water pollution can be made up of both chemical pollutants, such as heavy metals and pesticides, and biological pollutants, like animal and human waste (Moore, 2007). Chemical pollutants usually originate from industrial byproducts, and they negatively affect the environment by altering the chemical composition of waterways (Moore, 2007). Biological pollutants are often present in runoff from soil surfaces due to fertilizers used on agricultural lands, or from mismanaged wastewater treatment plants (Abu-Ashour & Lee, 2000). Over 100 types of pathogenic bacteria, viruses, and protozoa can be found in contaminated water, and they are responsible for causing as many as nine million cases of waterborne diseases every year in the United States (Rose et al., 2001). It is important to consider water pollution when looking at flood risk because communities are exposed to chemical and biological pollutants when an area is flooded with polluted water, which can impact human health. Water pollution can be measured by reviewing state water quality reports and monitoring reports issued by facilities to comply with the Clean Water Act. The Act regulates pollution discharge into bodies of water with control programs such as industrial wastewater standards and national water quality criteria (U.S. EPA, 2019).

Waste facilities.

Sites that deal with municipal and industrial waste are potential sources of toxic releases. These facilities process solid waste, including non-hazardous commercial and residential matter, and hazardous agricultural and industrial waste (Moore, 2007). A hazardous waste management unit, as defined by the U.S. EPA, receives hazardous materials for storage, treatment, or disposal (U.S. EPA, 2019). In storage, materials are held until they are treated or disposed of, and must be stored through methods that comply with the regulations of the Resource Conservation and Recovery Act (U.S. EPA, 2019). In treatment, the composition of waste is altered through chemical reactions to reduce the amount or modify it such that it may be reused in an industrial setting. The most common units are ones that deal with disposal, and are usually landfills where hazardous materials are sectioned off into carefully designed units to protect groundwater and surface water resources (U.S. EPA, 2019).

In addition to solid waste facilities, there are also sites that manage sewage and wastewater. The materials go through stages of debris removal, filtration, and chemical treatment to reduce the concentration of pathogenic bacteria and nutrients, which if present may disrupt the ecological balance of natural bodies of water. The treated water is eventually released back into the environment (Moore, 2007). The remaining sludge is either stored on-site, used as fertilizer, or disposed of in a solid waste facility. These sites are regulated as point sources under the Clean Water Act.

Waste management facilities are critical for the safe storage and treatment of solid materials and wastewater, which helps protect water sources from pollution.

However, improperly managed waste can enter water sources, which may lead to serious human health issues, including waterborne diseases like cholera, typhoid, and skin diseases, and environmental impacts, such as reduced aquatic biodiversity and species richness (Makule, 2000). Studies have also pointed to elevated levels of antibiotic-resistance in residents of communities with sewage-tainted water containing higher levels of bacteria (Yu et al., 2018).

Superfund sites.

The Superfund program was created under the Comprehensive Environmental Response, Compensation, and Liability Act. This Act enacted requirements for uncontrolled or abandoned hazardous waste sites, enforced the liability of people responsible for releasing hazardous waste, and established a trust fund to aid cleanup when there is no evident responsible party. Short-term waste removals are initiated when an immediate response is required, but the long-term goal of the Superfund program is to permanently or significantly reduce the dangers of these polluted sites (U.S. EPA, 2019).

Superfund sites refer to disposal sites in the United States that have been identified by the U.S. EPA as being of high risk to public or environmental health due to the hazardous waste and contamination present (U.S. EPA, 2019). Some Superfund sites are placed on the National Priorities List (NPL) to initiate a long-term response to cleanup led, coordinated, organized, and managed by the U.S. EPA. There are 25 Superfund sites in the state of Maryland, 20 of which are currently on the NPL awaiting treatment (U.S. EPA, 2016).

The NPL is intended primarily to guide the U.S. EPA in determining what sites need further investigation and clean up (TOXMAP, 2017). When a site is proposed by the U.S. EPA, state, or community, the agency considers whether the site poses any risk to human or environmental health and if it should be put on the NPL. A site is withdrawn once the U.S. EPA decides that it does not pose a threat nor warrants further investigation, even though it may still require clean-up. If a site is deleted, the cleanup goals for the site have been met and no further action is necessary (TOXMAP, 2017). These methods of categorization, however, have been found to not prioritize the complaints of the community and do not provide a way of monitoring previous Superfund sites (Lioy & Burke, 2010). The lack of prioritization indicates no way of ensuring that there are no remaining environmental dangers and that the site will have their superfund status reviewed, leaving communities vulnerable if a flooding event were to occur and carry the contamination from the site into the water (Lioy & Burke, 2010).

Brownfields.

According to the U.S. EPA, a brownfield is "a property where the expansion, redevelopment, or reuse of which may be complicated by the presence of a hazardous substance, pollutant, or contaminant" (U.S. EPA, 2014). These properties are similar to Superfund sites because their flooding can cause leakage of hazardous substances. The U.S. EPA has a Brownfields Program to revitalize contaminated properties, but clean-up efforts are often a drawn-out process. The program has been criticized for numerous shortcomings: lack of federal oversight, limited funding for remediation initiatives, and bureaucratic processes that often complicate restoration (Golden,

Elmer, & Mooney, 2014). Many of these sites are still contaminated and therefore pose a risk to environmental and public health.

Health Care Facilities

Medical waste is classified by the U.S. EPA as "a subset of wastes generated at health care facilities, such as hospitals, physicians' offices, dental practices, blood banks, and veterinary hospitals/clinics, as well as medical research facilities and laboratories" (U.S. EPA, 2017). According to the world health organization 15% of the waste healthcare facilities produce is considered hazardous and may be classified as infectious, toxic or radioactive (World Health Organization, 2018). Medical waste can be further categorized into sub categories including but not limited to animal waste, cultures and stocks, and pathological waste (Cebe, Dursun, & Mankolli, 2013).

In 1988 congress enacted the Medical Waste Tracking Act or MWTA this was in response to increasing concerns about the disposal of medical waste in the 1980's. The MWTA was a two year program that was enforced in the states of New York, New Jersey, Connecticut, and Rhode Island and the U.S. territory Puerto Rico on June 24, 1989 and expired on June 21 1981 (U.S. EPA, 2017). MWTA worked to define the term medical waste and classify which wastes would be subjected to program regulations. The program also created standards and guidelines for the packing, storage, labeling and segregation of medical waste. Finally MWTA invented a tracking system for specific types of medical waste and established record keeping requirements as well as penalties for failure to comply with the requirements (U.S. EPA, 2016). Currently it is up to state governments to develop and or improve on similar programs guided by the results of the MWTAs investigation.

Climate Change and Flooding

Anthropogenic activities over the past century have exponentially increased the amount of heat-trapping greenhouse gases in the atmosphere, which has resulted in warming temperatures and an acceleration of Earth's hydrological systems. As a compounded effect of these changes, the intensity of rainfall and storms has grown as the rate of evaporation and snow and ice melt has increased (U.S. EPA, 2016). For every one-degree Fahrenheit increase in temperature, the atmosphere holds about four percent more water vapor (Poon, 2019). These rising temperatures have also caused ice sheets on Greenland and Antarctica to shrink, which paired with the decrease in density and consequent volume increase of the oceans' waters, has contributed to sea levels rising (van Aalst, 2006). High sea levels can have serious consequences, such as eroding beaches, submerging lowlands, exacerbating coastal and inland flooding, increasing the salinity of estuaries and aquifers through saltwater intrusion, harming all types of ecosystems, disrupting fishing and farming, and threatening the health of human residents (U.S. EPA, 2016).

We focused our research in the state of Maryland, where the effects of climate change are becoming increasingly concerning. According to a 2016 report by the U.S. EPA, the average annual precipitation in Maryland has increased by about five percent in the last century, and precipitation from extremely heavy storms has increased in the eastern United States by more than 25 percent since 1958 (U.S. EPA, 2016). Sea levels are rising in Maryland more rapidly than in other coastal areas because the land is characterized by low elevation and land subsidence, which is defined as a "gradual settling or sudden sinking of land surface" (Spanger-Siegfried et

al., 2017). As the lowest dry land is submerged, it becomes either tidal wetland or open water. In the next century, water levels along the state's coast are projected to rise between 16 inches to four feet. The Potomac, Patuxent, Choptank, and Nanticoke rivers are likely to keep pace with the rising sea during the next century due to their freshwater wetlands, which capture floating sediment and build more land (U.S. EPA, 2016). Furthermore, as urban areas expand and develop, the land covered by impervious surfaces will increase rapidly, reducing the land's potential to absorb the excess water (van Aalst, 2006).

As warming temperatures have caused changes in climate variability and precipitation levels, the frequency and intensity of storms, specifically in the Atlantic Ocean, has been rising since 1995 (van Aalst, 2006). Flooding has become the most frequently occurring natural disaster in the United States, accounting for three-quarters of presidential disaster declarations in the last ten years (Poon, 2019). A storm can destroy homes, wash out infrastructure such as highways and rail lines, and damage communication, energy, and wastewater infrastructure.

A prominent local example is Ellicott City, Maryland. The mill town saw two major flooding events, both so severe that they are called 1,000-year storms: rain events so intense that, in any given year, it has a 1-in-1,000 chance of happening (Poon, 2019). In 2016, six inches of rain poured down on the town in just three hours, claiming two lives and causing 22 million dollars in damages and 42 million dollars in lost economic activity. In 2018, over eight inches of rain fell in three hours, amounting to 15 inches by evening and killing one person (Poon, 2019). Various regulations in Howard County, where the town is located, require new development

to withstand either 10- or 100-year storms, but experts do not expect the need to build to withstand 1,000-year storms. Furthermore, stormwater management regulations are designed to address water quality issues, not prevent floods (Poon, 2019).

Flooding and its Impacts on Environmental Justice

The differential exposure of specific populations to environmental disasters is observable in the context of natural disasters and flooding. A 2015 study found that extreme temperature and precipitation events were positively correlated with salmonella infections, and that coastal communities were more likely to become infected as a result of increased exposure to water infected by wastewater treatment plants, private septic systems, and animal feeding operations (Jiang et al., 2015). While the study did not examine race, ethnicity, education, income, or other social factors, it established that geographic location and proximity to waste facilities were factors that put populations at increased risk of public health issues (Jiang et al., 2015).

Another study found that environmental justice issues and disparities vary drastically from one location to another. In Miami, Latin populations have a higher risk of flooding and a lower risk of air toxicity exposure in comparison to other populations (Grineski et al., 2014). The reverse is true in Houston, where Latin populations face lower flood risks and greater air toxicity than other groups (Grineski et al., 2014). However, economic insecurity and neighborhood instability positively predicted risk in both cities. The histories and cultural developments of each location dictated the distribution of different minority groups and their exposure to risk, indicating the need for analyses on an individual and local basis (Grineski et al.,

2014). It is important to note, however, that while Grineski et al., 2014 found that Latin populations are at a lower flood risk in Houston, flooding and the resulting toxic releases from Hurricane Harvey did impact these populations (Bajak & Olsen, 2018).

Along with race and ethnicity, income level has been shown to be directly correlated with flood risk. According to the Federal Emergency Management Administration (FEMA), more affordable lands tend to be in low lying floodplains, resulting in low income communities living in areas of low elevation. This results in low-income minority communities being disproportionately affected by all flooding events, especially those following a storm (James, Hawkins, & Rowel, 2007). Additionally, people with lower incomes find it much more difficult to recover from a disaster due to having fewer savings, higher unemployment rates, and less access to communication channels and information. Having less access to resources means that even when lower-income groups are not directly affected by the damage of a natural disaster, there may still be environmental justice concerns because of their inability to take preventative measures and voice their concerns in decision making spaces (James, Hawkins, & Rowel, 2007).

These studies have shown how geographic location, economic insecurity, and neighborhood instability are all positively correlated with higher risk of exposure to flooding events and toxic materials. Given the significant variability of exposure, from one location to another, to flooding and associated risks and the established precedent of inquiry into this issue, we believe that there is substantial reason to study these climate change-related environmental justice issues in Maryland.

Case Studies: Hurricane Harvey in Texas and the Flint Water Crisis in Michigan.

Recent events can be examined to indicate the social impact flooding can have on vulnerable populations. Consider, for example, Hurricane Harvey, which flooded Houston, Texas in 2017. This storm brought devastating flooding to the area, displacing many of its residents. However, one of the major consequences from Hurricane Harvey was the pollution that was released into the flood waters.

The hurricane flooded 800 wastewater treatment facilities, 13 Superfund sites, and numerous refineries and rubber plants (Sherwin, 2019). According to an article by the Houston Chronicle, reports have cataloged over 100 Harvey-related toxic releases, but many of these reports have not been released to the public (Bajak & Olsen, 2018). Along with toxic releases, half a billion gallons of industrial wastewater was introduced to the environment after being mixed with storm surge water. As a result, several known carcinogens were brought into neighborhoods from stormwater (Bajak & Olsen, 2018). Residents in Crosby were exposed to a spillage from the chemical plant Arkema. Community members of Port Arthur were exposed to toxic pollution after an accidental release from a Valero Energy refinery (Flores, 2018). The Golden Triangle, also known as "The Cancer Belt," houses the world's largest concentration of petrochemical refineries, as well as numerous chemical and synthetic rubber plants. The state of Texas suspended reporting regulations for these companies in the aftermath of the storm, hiding crucial information that could have protected residents from exposure. Residents in this area continue to feel the impacts

of the toxic chemicals spilled during and after the storm, and are still not getting the help they need (Sherwin, 2019).

A survey conducted two years after the hurricane found that 27 percent of Latin Texans whose homes were damaged did not have safe living conditions compared to 20 percent of black residents and 11 percent of white residents. Similarly, 50 percent of lower income residents had not received the help that they needed compared to 32 percent of those earning higher incomes (Sherwin, 2019).

Unfortunately, situations such as this are not only relevant during natural disasters. Environmental justice issues exist at the federal, state, and local level, and government entities at all levels have been failing vulnerable communities for decades. Most famously in recent years was the water crisis in Flint, Michigan, which highlighted how all levels of government failed to protect the predominantly African American community from high levels of lead in their drinking water due to the corrosion of pipes. The state-appointed city manager chose to change the city's water source to save money, violating federal regulations that set minimum standards for drinking water. For the following two years, local and state officials refused to acknowledge the resulting Legionnaires outbreak that caused the death of 12 people and sickened at least 87 (Hersher, 2018). The levels of lead in the drinking water were so high that, at times, it rivaled those of a hazardous waste site (Sherwin, 2019). The median annual income of a Flint resident is approximately $24,000, which is 20,000 dollars below Michigan's state average, and the poverty rate is over 40 percent. Their income restricted them from moving to nearby cities such as Detroit, given the higher cost of living (Sherwin, 2019).

These situations are not unique, and while one cannot expect hazard planners to solve these deep-set injustices, emergency and flooding plans can take measures to mitigate them. Environmental justice is becoming a more prevalent issue as climate change increasingly introduces hazards that have the potential to affect vulnerable populations.

Hazard Mitigation Policies

There are multiple local, state, and federal policies associated with emergency preparedness and hazard mitigation, and while they address the same basic premises, there are differences in goals and subject matter. For our research, we focused on the EPCRA Emergency Response Plans, Emergency Operations Plans (EOP), and Hazard Mitigation Plans (HMP) for each of the counties we identified as having potential indicators of flood related environmental justice issues. EPCRA Emergency Response Plans outline roles and duties, emergency procedures, facilities and transportation routes with hazardous substances, affected areas, evacuation plans, training, and other relevant topics pertaining to the local emergency planning district (U.S. EPA, 2019). EOPs are documents that describe the plan of action before, during, and immediately after an emergency, including who is responsible for each action and what resources are available (FEMA, 1996). HMPs are documents that localities create to identify risks and vulnerabilities associated with natural disasters and include long-term strategies for protecting the population from future events (FEMA, 2019). While these policies are created and implemented at the local level, they must abide by national requirements and are understood in the broader framework of flooding policy in the United States. The overall goal of these plans is

to ensure that local communities are aware of and are able to appropriately respond to environmental and safety hazards surrounding them.

Emergency preparedness policies for toxic release.

In 1986, Congress passed EPCRA to mitigate concerns about environmental and safety hazards pertaining to the storage and handling of dangerous chemicals. EPCRA is Title III of the Superfund Amendments and Reauthorization Act (SARA), which was passed in 1986 due to the Bhopal hazardous chemical spill in India that exposed around 550,000 people to more than 40 tons of methyl isocyanate gas (Choi, Dorner, Edell, Martin, & Patel, 2009). SARA sets requirements for industrial sites and federal, state, and local governments in an effort to protect the health, safety, and environment of local communities. These requirements include planning for chemical emergencies and increasing knowledge and access to hazardous release information from individual facilities, including the development and implementation of the Toxic Release Inventory (TRI) that will be discussed in more detail later in this literature review.

Moreover, EPCRA requires that each state assign a State Emergency Response Commission. The Commissions must divide their respective states into Emergency Planning Districts and name a Local Emergency Planning Committee (LEPC) for each district, which should be made up of community members and local officials such as firefighters, health officials, government and media representatives, community groups, industrial facilities, and emergency managers. Each LEPC must develop an annually-reviewed emergency response plan, which ensures that local communities are aware of and able to appropriately respond to environmental and

safety hazards surrounding them (U.S. EPA, 2019). Some elements of the plans include: reports of accidental hazardous substance releases, safety sheets for chemicals and the TRI, acknowledgement of hazardous facilities, evacuation routes, which officials are responsible for planning, and a list of required trainings that these officials carry out (U.S. EPA, 2018). Local facilities must also report to two inventories, Tier I for general hazard types and locations of hazardous chemicals, and Tier II for specific information on the location and quantity of potential hazards.

In 2008, the U.S. EPA conducted a national survey of LEPCs to assess their compliance with EPCRA. The goals of the survey were to track the progress of LEPC activity and determine the effectiveness of various communication and prevention efforts in the emergency plans (U.S. EPA, 2013). The survey was census-based and had a 39.8 percent response rate, with results indicating that two significant factors, dedicated membership and regularly scheduled meetings, contributed the most to the success of LEPCs (U.S. EPA, 2013. The survey also asked if environmental justice was included in plans, and it found that fewer than 40 percent of the participating LEPCs had addressed environmental justice (U.S. EPA, 2013). Due to the low response rate and consequently high level of uncertainty in the data, this survey should not be used as a baseline to determine the effectiveness of LEPCs. However, it can still be used as evidence that environmental justice is left out of many emergency plans.

Emergency management planning using an all-hazards approach.

In Maryland, emergency preparedness is regulated by the Maryland Emergency Management Agency (MEMA), the authority that implements emergency

preparedness policy and coordinates hazard mitigation, incident response, and recovery from disasters. In order to carry out these responsibilities, MEMA instituted the Maryland Emergency Preparedness Program to apply an all-hazards approach to preparing for emergencies (MEMA, 2015).

EOPs establish overall roles and responsibilities for emergency operations and organize county departments. They fulfill the MEMA requirement that each political subdivision create a local organization for the Office of Emergency Management (OEM) and develop and maintain a plan for disaster preparedness (Voss, 2013). EOPs also serve as the coordination point to access Maryland and federal assistance, specifically on the implementation of the hazard mitigation grant program (Voss, 2013). They can be developed at both the state and local level, but for our research we are focusing on county EOPs to understand differences in planning strategies and resources between jurisdictions (FEMA, 1996).

As a baseline, all EOPs must serve as a guide for an effective response to hazards that threaten a jurisdiction. This includes assigning responsibilities to organizations and individuals for carrying out specific actions and developing lines of authority and communication between government and nongovernment actors. The plans also have to identify the resources available to a county and describe how those resources will be used to protect people and property from a disaster. Local governments are the first to act to address the public's needs in an emergency, but EOPs are also important in coordinating assistance from other levels of government during a catastrophic disaster situation (FEMA, 1996).

EOPs are organized under the assumption that emergency management has four distinct categories: mitigation, preparedness, response, and recovery (FEMA, 1996). The mitigation section of the plan should focus on reducing the chances of a disaster. This section often involves zoning and building code requirements based on analysis of floodplains, which is important to consider for our research. Mitigation also involves educating the public on potential threats and how they can avoid disaster situations (FEMA, 1996). However, many disasters cannot be avoided, which warrants the preparedness section. This section establishes the authorities responsible for emergency action and coordinates the gathering of resources. Part of preparedness also involves conducting trainings and drills to ensure that emergency management personnel are ready to act. The response section of an EOP is focused on how to stabilize a situation and notify the public once a disaster does occur. This section can include implementing warnings and creating evacuation routes or shelters (FEMA, 1996). Lastly, the recovery section is focused on rebuilding and restoring physical and social spaces after a disaster. This includes short-term solutions such as restoring power and waste treatment and long-term solutions like rebuilding and restoring economic activity. While EOPs cover the entire process of a disaster, they are mostly focused on preparedness. EOPs are overall flexible plans that can theoretically be used as a guide in all emergencies (FEMA, 1996).

Some counties choose to embed their EPCRA Emergency Response Plans into a comprehensive emergency management plan called an Emergency Operations Plan (FEMA, 2010). While FEMA has regulations for the EOPs, the documents are mostly developed by local jurisdictions. EOPs provide information on how people

and property are protected in the event of a disaster, list available tools for recovery, and assign personnel to carry out the plan (FEMA, 2010). EOPs also outline measures for warning, emergency public information, evacuation, and shelter (FEMA, 1996).

Hazards mitigation policies that address flooding events.

In 1979, President Jimmy Carter created FEMA to coordinate the federal government's efforts in preparing, preventing, and mitigating natural and manmade disasters. The Robert T. Stafford Disaster Relief and Emergency Assistance Act signed in 1988 gave FEMA the statutory authority to coordinate disaster response activities (FEMA, 2019). The agency also oversees the Hazard Mitigation Plan, which is required of state and local governments in order to receive certain types of non-emergency disaster assistance through FEMA, including funding for mitigation projects (FEMA, 2019). In the case of a natural disaster, including a flood event, a governor is only able to request federal assistance in the form of a Disaster Relief Fund after the HMP is executed. This assistance can only be provided if there is a Presidential Declaration for major disasters and emergencies, which occurs when states are unable to adequately respond on their own, and the type of federal assistance is specified through the declaration. FEMA is then able to reimburse services provided through written mutual aid agreements in the form of individual assistance such as housing, grants for long-term hazard mitigation in predetermined areas, and public assistance for eligible facilities (ASTHO, 2012). With this Act, Congress intended to encourage state and local governments to create complete

disaster preparedness plans, provide federal assistance programs in case of damage caused by disaster, and coordinate federal, state, and local governments during crises.

To maintain eligibility for funding, local governments are required to update their plans and have them re-approved by FEMA every five years. The purpose of the plan is to increase awareness about different threats, hazards, and vulnerabilities, determine long-term strategies for risk reduction, and create partnerships for risk reduction involving the government, various organizations, businesses, and the general public (FEMA, 2019). Additionally, the plan should focus resources on the direct risks and vulnerabilities and communicate priorities to possible funding sources. Ultimately, hazard mitigation planning allows steps to reduce loss of life and property in order to lessen the impact of various disasters, including flooding.

Environmental justice policies.

The importance of including environmental justice in policy was validated by President Bill Clinton's signing of the historic Executive Order 12898 on Environmental Justice, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," in 1994. This marked one of the first major federal policies related to environmental justice in the United States and is one of the reasons why it is important to study how current policies address environmental justice. The landmark Order required that all federal agencies "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Huang, 2014). This requirement is often addressed through

Environmental Impact Assessments developed by federal agencies under the National Environmental Policy Act (NEPA) and by public participation in these assessments by vulnerable communities (Bullard et al., 2008). Furthermore, the Order brought validity and attention to the environmental justice movement, demonstrating that the federal government was aware of the disparity between environmental issues in low-income communities and middle-class or affluent areas.

The state of Maryland took its first step to address environmental justice in 1997 with the establishment of the Maryland Advisory Council on Environmental Justice (Barrett et al., 2015). By 1999, the Council had published a report on environmental concerns within minority and low-income communities. Furthermore, the Council sought to initiate a broad policy response to environmental justice issues by following a community-based planning model intended to encourage both environmental sustainability and economic growth (Barrett et al., 2015). Since its initial study in 1999, the Council has not issued any further reports.

In 2001, the Maryland Commission on Environmental Justice and Sustainable Communities (CEJSC) filed a report drafting an Environmental Justice Strategic Plan that recommended forming partnerships, understanding impacts, and strengthening public involvement in environmental justice concerns (CEJSC, 2001). CEJSC has since published annual reports detailing policy recommendations under the guidance of Maryland Department of the Environment (MDE) and the U.S. EPA.

Few actions have been taken to solve environmental justice problems at the state level. The CEJSC has consistently recommended policy changes, but it is not apparent whether the state has made any substantial progress towards meeting the

goals outlined by the body (Barrett et al., 2015). Maryland's environmental justice problem is systemic in nature; state officials continue to face resistance to environmental issues during decision-making, and there is a lack of overall support for environmental justice from government leadership. Given that environmental justice is not being taken into account while implementing policies, these measures are not sufficient to efficiently address such an expansive problem (Barrett et al., 2015).

Data Resources

Government Resources

Geographic Information System.

GIS is a computer system for capturing, storing, querying, analyzing, and displaying geospatial data (Chang, 2017). GIS is considered to be an indispensable tool in resource management, emergency planning, public health, land records management, and many other fields (Chang, 2017). It is used to manipulate datasets to reveal patterns, such as demographics and health trends in a particular area.

EJSCREEN.

The U.S. EPA has developed tools that use GIS to help decision-makers by providing relevant environmental data. EJSCREEN, an online mapping and screening tool, uses GIS technology to overlay environmental and demographic indicators across the country and draw conclusions (U.S. EPA, 2017). It allows users to choose a geographic area, then provides demographic and environmental data for that region. EJSCREEN can be used to measure water pollution by using the

database's information on stream proximity to treatment, storage and disposal facilities, Superfund sites, and the water's toxic concentration measurements (U.S. EPA, 2017). Proximity in this context is measured by the count of sites within a given number of kilometers from a body of water (U.S. EPA, 2017). It should be noted that there are limitations to EJSCREEN, as it is not a fully comprehensive list of issues relevant to environmental justice and there is some data uncertainty (U.S. EPA, 2017). For example, "data on environmental factors such as drinking water quality and indoor air quality are not available with adequate quality, coverage and/or resolution to be included in this national screening tool" (U.S. EPA, 2017).

Toxic Release Inventory.

Our research focused particularly on toxic releases as a source of water pollution, as flooding can allow toxic materials to be leaked into the environment. The Toxic Release Inventory (TRI) is an U.S. EPA program that tracks the management of chemicals known to endanger human health and the environment. Under EPCRA, sites that process or use certain toxic chemicals above a specific threshold are required to provide annual reports to the TRI about all releases and clean-up efforts (Flores, 2018). More specifically, the TRI identifies (a) industrial facilities that release toxic chemicals, (b) types of chemical being released from each facility, (c) quantity of a chemical being released, (d) pollution prevention activities for each facility, and (e) public health risks implicated by toxic releases (U.S. EPA, 2020).

The U.S. EPA compiles the data submitted by facilities to be used in a variety of tools, including the TRI National Analysis which has maps, charts, and tables

highlighting annual, national-level data, and detailed regional summaries. Users can search for information by facility, location, tribal communities, industrial sectors, and specific chemicals. TRI data overlaps with other U.S. EPA tools, allowing for comparative analysis. For instance, the EnviroMapper generates maps using TRI data and allows users to overlay contextual information, such as schools, streets, and waterways (U.S. EPA, 2013). This can be used, for example, to explore which facilities are located near a waterway with high-flood potential and which communities would be directly affected in case of a flood. A 2018 study by the Center for Progressive Reform found over 2,500 TRI facilities are located within FEMA's 100-year floodplains (Flores, 2018).

Non-Governmental Methods and Resources

The environmental justice movement emerged from communities coming together to incite policy changes to improve their livelihoods (Rootes & Leonard, 2009). These coalitions have proven most successful when they consulted environmental justice experts along with community representatives, allowing for crucial dialogue between experts and those directly impacted on how to approach policy and scientific data (Kreger et al., 2011). This insight is beneficial when used to educate the public, but the presence of academics or governmental agencies may also prove problematic in grassroots movements when there is a lack of representation of marginalized groups (Hesed & Ostergren, 2017).

Grassroots movements have served as a resource to inform residents about environmental justice. Tools that assess the injustices in different communities have emerged because of local resistance, such as EJAtlas, an interactive map of

environmental movements over time. The tool combines GIS mapping with input from both activists and academics, detailing the most common causes of conflict, social actors involved, strategies, and outcomes (Martinez-Alier, Temper, Del Bene, & Scheidel, 2016). Interactions with communities have also been used to assess vulnerability related to environmental justice (Jones, 2001). Flood risks vary across different communities because the capacity to react to flooding is unique to each demographic area. Direct communication with these communities is key to creating frameworks that encompass these variances (Ruth & Goodwin, 2009).

Summary

We found that there was a gap in the research regarding flood risk evaluation in low-income and minority communities in the state of Maryland. This has the potential to become a serious safety and health issue, as factors related to climate change are causing sea levels to rise and storms to become more frequent and intense. Given that the effects of flooding disasters vary from region to region, we found it to be essential to conduct research to determine which local areas are most vulnerable to flooding disasters and to evaluate the policies in these jurisdictions. From there, we determined that using governmental and non-governmental resources to develop recommendations to address flooding events and protect at-risk citizens could prove to be valuable in the continual effort towards promoting environmental justice in the state of Maryland.

Chapter 3: Methods

Introduction

Our research aimed to identify areas of Maryland with high socio-economic vulnerability, flood risk, and environmental risk, and to assess whether emergency preparedness policies in these areas are effective in ensuring the fair treatment and meaningful involvement of vulnerable populations. We hypothesized that, in counties with a significant minority, low-income, and high flood-risk populations, there would be a lack of rigorous planning and enforcement of emergency policies, resulting in a lack of environmental justice.

To test our hypothesis, we implemented three research phases. Our first phase used GIS technology to visualize data from all counties in the state of Maryland. We compared demographic and geographic data to identify counties with significant minority, low-income populations, high flood risk potential and proximity to environmental risks.

Our second phase focused on collecting and analyzing policy data from the counties highlighted in phase one. We created a criteria checklist using existing statutes regarding flood resilience, protection from toxic release, and community involvement. We also included criteria for emergency plans set by government agencies such as MEMA. The checklist was used to analyze and compare existing policies for flood emergency action and community preparedness and determine the level of effectiveness of these policies using a scorecard. These include the EPCRA Emergency Response Plans, EOPs, and HMPs.

In order to apply multi-method triangulation, our third and final phase consisted of interviews with signatories and contributors to local emergency plans. Signatories included leaders of local government agencies, such as the Police, Fire, and Health Departments. Contributors included members of Emergency Management offices who helped craft the plans. We established contacts using names provided in the plans themselves, starting with the contributors. We then employed snowball sampling by asking our initial contacts to connect us with other possible participants. The interviews were designed to fill gaps in our policy analysis and build more substance for the qualitative aspect of our data. We analyzed the results by finding trends in the interview responses through qualitative content analysis. Finally, we reviewed the intersection of the phases, finding trends in the results and how that answered our hypothesis.

Phase 1: Identifying and Selecting Areas in Maryland

The first step in our project was to identify which counties in the state of Maryland would be the focus of our research. We decided to focus on communities in this state because the projected 100-year flood zone mapping created by MDE shows a portion of Maryland will be underwater in 100 years (MDE, 2017). Additionally, the proximity of these communities to the University of Maryland allowed us to personally conduct interviews with lawmakers and community members involved. Our mentor, Professor Joanna Goger, also has experience working in this area under the subject of environmental law and has connections with community members and academics who have knowledge about environmental justice issues in Maryland.

Initial GIS Process

To determine which Maryland counties our team would study, we created a map using GIS because of the technology's ability to visualize, question, analyze, and interpret data to understand relationships, patterns, and trends (Esri, n.d.). Furthermore, GIS allowed us to customize parameters to best fit our working definition of environmental justice and create buffers around different points of interest to show relevant information within a specific radius.

The GIS subgroup's first step was to collect relevant data sets from each county to display on the map, including demographics, income distribution, elevation, bodies of water, and locations of facilities that hold, store, or release toxic waste. Different types of data files with key information on our chosen parameters were available to the public for free on government websites. The team's GIS Librarian, Kelley O'Neal, Ph.D., was a key resource in this phase to ensure that the data obtained was accurate and up-to-date. We primarily used ArcMap 10.6 and ArcMap Online to create maps.

Key Parameters

In order to determine what areas are at risk, we considered population density, social vulnerability, and geographic exposure probability.

Population density is an important metric to consider because it is directly tied to urbanization, as larger populations require increased development. This results in an increase in area covered by impervious surfaces, exacerbating runoff and reducing the possibility of excess water absorbing into soil (Howe & White, 2003).

Social vulnerability is a multidimensional construct defined as the sensitivity of a population to natural hazards and its ability to respond to and recover from the impacts of hazards (Cutter & Finch, 2008). The Centers for Disease Control and Prevention (CDC) has created a comprehensive Sociability Vulnerability Index that offers a county-level comparative metric of certain data sets to natural hazards. The Index defines several factors that have been determined to make populations more vulnerable to natural hazards. For example, both ends of the age spectrum, the youth below 17 years of age and the elderly residents of 65 years and over, have physical and cognitive limitations that influence their ability or willingness to comply with evacuation orders (Cutter & Finch, 2008). Populations may also face unique difficulties with evacuating such as not owning a personal vehicle or having a physical or mental disability that requires special help. Households that live below the poverty line, $23,850 per year for a family of four in the state of Maryland, have fewer economic resources to make emergency plans or recover from natural disasters. Residents that are non-proficient English speakers may have trouble understanding government directions. Lastly, racial minorities have been proven to be disproportionately impacted by risk exposure (Cutter & Finch, 2008). The index does not have one layer for social vulnerability but multiple factors, so we chose communities of color as an indicator of social vulnerability from this index. This is because the Toxic Wastes and Race study, that initiated the environmental justice movement, found that race was the strongest variable that predicted that location of waste facilities. In 1994, people of color were 47% more likely to live near a hazardous waste facility compared to white Americans (Bullard et al., 2008). While

this study is over 25 years old, researchers have been documenting that race is the most significant variable in predicting exposure to environmental hazards. Furthermore, the social vulnerability index defines "minority populations" as all persons except white, non-Hispanic, which also matches this definition of race.

Exposure probability can be measured by the geographic area that is at risk of flooding, and it is expanded upon in the GIS mapping section below.

Selecting Pollution Sources

Numerous existing maps using GIS technology show the location of diverse sources of pollution, both for research and to bring these sources to the attention of those that may be affected by toxic releases. However, these maps are not comprehensive enough, as they often only consider a handful of pollution sources (Flores, 2018). Focusing on just a small number of sites does not account for the full, compounded damage that may occur in the case of a disaster. To account for this gap in the information provided by existing maps, we chose to combine the data in existing maps with data from additional facilities not previously considered by groups conducting similar research.

We further concluded that attempting to plot every pollution threat in a single map was not feasible. We thus decided to narrow our research down to what we determined to be the largest threats to public health and largest causes of toxic flooding. We included pollution sources that are commonly included in other pollution analyses, such as Superfund sites and TRI facilities (see Figure 2 in Chapter 4). Some less common sites, such as hospitals, brownfields, and wastewater

treatment facilities were also included because of their potential relationship with environmental justice concerns. Less common sites may also indicate the presence of a compound risk. For example, hospitals and other related healthcare facilities are at risk to inadvertently become pollutants if flooded but their patients are also at risk for becoming victims of a flooding event. After compiling all of our data, we ranked each county (out of all 24 in Maryland), and created an index for environmental injustice due to flooding based on flooding risk, exposure to toxic release sites, and "minority". A comprehensive list of all the data points included in the GIS maps can be found in Appendix A.

Employing the SLOSH Model

The Sea, Lake and Overland Surges from Hurricanes (SLOSH) model is a computerized model created by the National Oceanographic and Atmospheric Administration (NOAA) that allows users to determine the potential storm surge heights for specific locations as a result of historical, hypothetical, or predicted hurricanes. The tool is used as the basis for the hazard analysis portion of coastal hurricane evacuation plans by the National Hurricane Center (NHC), National Weather Service, U.S. Army Corps of Engineers, and emergency management personnel to determine what populations are at risk, the evacuation zones and routes, and to estimate the percentage of people that need to evacuate and when (NOAA, 2003).

Post-storm analyses conducted to show the model's accuracy determined that it is within ±20 percent of actual peak storm surge (NOAA, 2003). The model covers the coastlines in the United States' East Coast, the Gulf of Mexico, parts of

Hawaii, Guam, Puerto Rico, the Virgin Islands, China, and India. SLOSH accounts for astronomical tides, given that they can add significantly to the water height, and the storm's pressure, location, direction, radius of maximum winds, forward speed, topography, and bathymetry. It does not include rainfall amounts, river flow, or wind-driven waves. The latter data points are combined by emergency management personnel with the model's results in the final analysis of at-risk areas (NOAA, 2003).

The model has three different storm files, but only two are available for the Chesapeake Bay Basin: Maximum Envelope of Water (MEOW) and a composite of the Maximum of MEOWs (MOM). MEOW is a composite of maximum storm surge heights at each grid cell. The data is generated by running hypothetical hurricanes with the same category, forward speed, landfall direction, and initial tide levels. With seven landfall directions, four to five categories, and six tide levels, there are around 200 available MEOWs per basin. MOM, on the other hand, is a composite of the maximum storm surge height for all hurricanes of the same category, disregarding the other factors included in the MEOW. Only five MOMs are available per basin, one per storm category (NOAA, 2003).

Some generalizations can be drawn from SLOSH models. Fast moving storms cause higher storm surges along open coasts and lower surges in sheltered bays and estuaries, while the opposite is true with slow moving storms (NOAA, 2003). The direction from which the storm approaches drastically impacts the extent of flooding, so storms of the same magnitude may produce different results. The slope of the continental shelf also impacts floods, with areas with shallow continental

shelves allowing greater storm surge but smaller waves, and areas with deep waters just offshore experiencing little storm surge but large waves (NOAA, 2003).

Several other storm surge models exist and are used, but we incorporated data from SLOSH because it is the primary model used by federal government agencies such as FEMA, NOAA, and the Army Corps (NHC, 2018). Similar to the FEMA floodplain map, one must consider the data used and any faults found in the tool in the analysis. Furthermore, rather than adding over 200 layers of flood risk, we decided to use the four MOMs available for the Chesapeake Bay Basin, given that category 5 storms were not included in NOAA's National Storm Surge Maps (NHC, 2018). Hurricane Evacuation Studies by NOAA use the high tide option to see a more conservative estimate, so we did the same despite having the option of using the mean tide.

ArcGIS Mapping

Using pre-existing data found on government websites such as social parameters, pollution sources, and storm models, we created maps using ArcGIS. More specifically, we utilized a buffer analysis, which is a methodology that creates a zonal area of a selected distance around its boundary (see Figure 1 below; Dong et al., 2003). Buffer analysis is an effective tool for visualizing spatiotemporal dynamics in environmental systems, and is a commonly used technique in environmental justice research (Li et al., 2010).

For the purposes of our project, we created a five-mile radius in order to add onto a "worse-case scenario" of a category 5 hurricane. SLOSH, as discussed

previously, does not map a category 5 hurricane impact north of the North Carolina and Virginia border. To model this, it is assumed that the impact will be between 5-10 miles inland (NHC, 2018). We chose five miles, the lower end of the spectrum, because although category 5 hurricanes are likely everywhere, they are unlikely in Maryland.

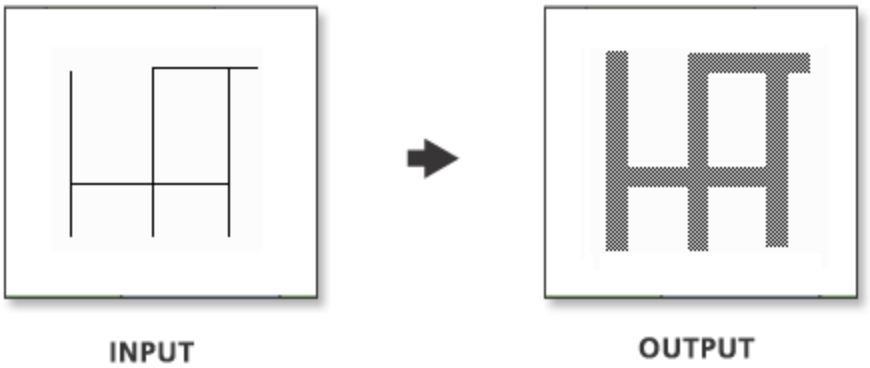

Figure 1: Fixed buffer around lines (Esri, n.d.).

The buffer was placed around the impact from a category 4 hurricane impact from the SLOSH data. The buffer zone, illustrated in Figure 1, allowed us to see sources of pollution including superfund sites, brownfields, point source discharges, methane emissions from landfills and more, that can be impacted due to a major flooding or natural disaster occurrence. A comprehensive list of datasets we included in our maps can be found in Appendix A.

County Selection

In order to find what areas are most vulnerable we looked at three factors: number of hazardous facilities in each county, social vulnerability, and the flooding risk for each county. We hypothesized that the intersection of these three factors would lead us to identify the most vulnerable counties. For the number of facilities in

each county, we counted the amount in each county from the given data sources mentioned in Appendix A.

Using the CDC's Social Vulnerability Index, we found the population density of minorities, which is the minority population from the census data in number of people, divided by the census tract area, in square miles. The areas with the highest minority population density are represented with a dark red, while areas with the lowest minority population density are represented by a light yellow. The areas that are more socially vulnerable will be darker in color. We visualized the results by looking for areas that have a higher minority population density.

For flooding, we mapped out the Maryland FEMA Floodplain Data and the SLOSH category 4 hurricane impact with the 5-mile buffer. We visualized the results by looking for areas that are heavily impacted by any of these three data sources.

The intersection of these three factors gave us areas that are at risk for environmental injustice. For the three factors, we gave a ranking from 1 to 24, with 1 being at high risk (highest amount of facilities, highest minority populations, highest flood risk) to 24 being at low risk (lowest amount of facilities, the lowest minority populations, lowest flood risk). We then took the average of all three values and the counties with the highest average rank are the counties that are at risk.

Informed by the risk factors and rankings generated in our GIS analysis, we narrowed the focus of our research from the 24 total counties in Maryland to eight counties and Baltimore City. We chose to focus on the five areas that were most at-risk due to their flooding risk, social vulnerability index, and polluting facilities. To

provide a point of contrast, we then selected four additional counties that had relatively high or midrange rankings for one of the aforementioned categories. The results of our findings are elaborated in our Results Section, but Phases 2 and 3 of our research were performed on counties selected during Phase 1.

Phase 2: Analyzing Existing Policies

During the second phase of our research, we analyzed existing policies for flood emergency action and community involvement. This assessment was conducted at the county level to compare effectiveness, public accessibility, and components in each policy. The analysis primarily focused on emergency response plans, as they present parameters to evaluate how each county plans to address the potential for and consequences of floods and other hazards.

Obtaining Local Emergency Plans

We first obtained the resources that the counties have available to the public, primarily LEPC plans that were standalone documents or embedded in an EOP, along with HMPs. EPCRA requires that the LEPC plans be made available to the public (EPCRA, 42 U.S.C. Sec. 11044). Generally, because a large facet of emergency action planning involves educating the community, these resources are often readily available online or by contacting the county government. Alternatively, if the county does not wish to share it electronically, EPCRA requires that a physical copy of the county LEPC plan is made available at specified locations (EPCRA, 42 U.S.C. Sec. 11044). There are not clear requirements for the accessibility of EOPs and HMPs. Opting to not share the information electronically may be merely a copyright or

security concern, but it may also be an indicator of a lack of transparency due to insufficient emergency planning.

Creating a Framework for Analysis of Plans

Once we located the emergency action plans from the counties that we identified, we developed a standardized policy analysis framework to analyze the effectiveness of the aforementioned county plans with regard to environmental justice, using a series of tools.

We primarily based our analysis on the EPCRA statute for LEPCs, EOP criteria from MEMA, and HMP criteria from FEMA. These laws and criteria serve as a basis for what plans require and are a starting point to ensure that plans are adequate. We also used questions from the U.S. EPA's Flood Resilience Checklist, which was created to assess whether localities are positioned to prevent flood damage and recover from floods. The Checklist also allows these communities to access regulatory tools to improve their flood resilience (U.S. EPA, 2014). Additionally, it identifies opportunities and provides strategies for flood resilience (U.S. EPA, 2014).

Another tool that we used was the Resilience Adaptation Feasibility Tool (RAFT), which was created with collaborative efforts of the University of Virginia Institute for Environmental Negotiation, the Virginia Coastal Policy Center at William & Mary Law School, and Old Dominion University/Virginia Sea Grant to assess and assist localities in enhancing coastal resilience to storm hazards in Virginia (University of Virginia, 2019). The process for each locality's participation included an independent assessment of their resilience, a community leadership workshop with

a commitment to resilience action, and support from the collaborative. The independent assessment utilized the RAFT Scorecard, which evaluates five categories on a scale of 0 to 4. The categories were the following: policy, leadership, and collaboration; risk assessment and emergency management; infrastructure resilience; planning for resilience; and community engagement, health and well-being (University of Virginia, 2019). This tool evaluated Virginia localities' various emergency management plans and other online resources in the independent assessment, and we used it to supplement our analysis checklist.

Our framework also included a select few questions that we asked emergency management planners in the third phase of our data collection. There were additional questions to reveal any resources with similar emergency management information and determine the level of community involvement in planning. The questions on the checklist and their sources are outlined in Table 1, Appendix B. The categories that we assessed were based on the four main categories that were similar to the RAFT (policy, leadership, and collaboration; risk assessment and emergency management; flooding risk and appropriate planning; and community engagement, health, and well-being), in addition to a separate section for environmental justice.

A list of the selected criteria questions that are relevant to emergency preparedness for toxic release and flooding can be found in Appendix B. Three team members independently reviewed the presence or absence of each of the criteria for each plan for every county identified, noting the exact page number and location of each found criteria. One consolidated answer for each criterion on the checklist was made after collective discussion among the three reviewers. The answers were

consolidated into a scorecard, with each of our 33 criteria having the value of one point. This list of 33 questions was tallied for each jurisdiction identified for evaluation as a total score and individual score for the categories from the RAFT Scorecard. A higher score indicated more robust emergency plans and supporting documents in protecting vulnerable communities from the threat of hazardous substance release as a direct result of a large flooding risk. The scores were measured using the median as a cutoff for a low and high score since there is no baseline county that we used as a point of comparison. A score that was above average, as defined by the median, will be considered a high score. Scores less than or equal to the median will be considered as low scores.

Phase 3: Interviewing Policymakers

After selecting the counties to study and subsequently analyzing their policies, we carried out our final phase to obtain additional information regarding county emergency planning. In this final stage, we conducted interviews with personnel involved with emergency preparedness to clarify questions about the contents of the planning documents and learn more about implementation of these plans. After we cross-analyzed interview responses with results found in our policy framework, we determined whether the emergency plans are effective in ensuring the fair treatment and meaningful involvement of vulnerable populations.

Establishing Contacts

We first contacted personnel involved with emergency preparedness planning for interviews. From there, we asked subjects to refer us to other relevant sources to

employ a snowball sampling technique. To begin the process, we created a standard script to establish contact with persons of interest. The recruitment script is below:

> "Dear [Potential Participant],
>
> My name is [name], and I am a member of a student research team in the Gemstone Honors Program at the University of Maryland, College Park. We are conducting a study that examines emergency preparedness in Maryland counties with vulnerable populations that face disproportionate risk from flooding events. We are combining GIS technology, policy analysis, and interviews of personnel working on various emergency plans, including the Hazard Mitigation, Disaster Preparedness, and Emergency Operation Plans. We would like to ask for your participation in our study. If you agree, you will be asked to participate in an interview to discuss your perception of your county's level of preparedness.
>
> The interview will be conducted in your preferred method, be it in person, over the phone, or in a video call. It should not take more than an hour of your time. These interviews will be audio recorded for transcription purposes and deleted afterwards.
>
> Your participation in this study is voluntary. Your identity as a participant will remain confidential during and after the study. Only the members of our research team will have access to the information, which will be stored in a password-protected drive.

If you would like to participate or have any questions, please contact teamejustice@gmail.com.

Thank you for your time,

[Name]

Undergraduate Researcher

Gemstone Honors Program

University of Maryland, College Park"

The team first reached out to contacts listed on the emergency plans and the LEPCs websites contact list of the counties being reviewed. If we were referred to a different person or were informed of some discrepancies in communication, we recorded that referral and/or discrepancy into our data, which we included as part of our results. If they agreed to allow us to conduct an interview, we administered a consent form which can be found in Appendix C.

If we did not receive a response from a county after numerous emails or the office responsible for the emergency plan in the county did not wish to participate, we recorded it in our data, as refusal to participate may reflect that community members are not allowed to be "meaningfully involved" in preparedness of their communities. We recorded the audio of interviews and transcribed them before deleting the audio files, as per our consent form. The interview questions can be found in Appendix D.

Analysis of Responses

Once interviews were complete, we followed a qualitative content analysis with guidance from Dr. Caroline Boules, an interdisciplinary social scientist who teaches the subject in the Environmental Science & Policy Program at the University of Maryland, College Park. The objective of the process is to "systematically transform a large amount of text into a highly organized and concise summary of key results" (Erlingsson & Brysiewicz, 2017). Six reviewers coded each interview individually, then discussed and consolidated the results.

Content analysis is not a linear process. By the nature of qualitative analysis, the process is reflective, requiring the revision of the fit of the six resulting codes after each interview. However, there is a hierarchy to follow when analyzing interviews, which we adapted from Erlingsson & Brysiewicz (2017). First, we went through condensation, which is the shortening of important text from the interview transcription while preserving the core meaning, to create what is called "condensed meaning units." For example, if the interviewee said, "the emergency operations plan is reviewed and updated every two years," it was condensed to "EOP is revised biennially." The next step was to develop the codes, which were compiled in a codebook. These are descriptive labels for the condensed meaning units, and they are usually one or two words long, making it easier to identify connections between meaning units. For the same example, the code would be "biennial revision." The next step involved developing categories or grouping together codes that are related through content or context. Following the example, codes related to the frequency of revisions were grouped into a category called "revision frequency." If needed, the analysis could go further and develop themes. Themes express an underlying

meaning found in two or more categories. They answer: why, how, in what way, or by what means. Concluding the example, everything related to policies was nested under “policy logistics”.

Upon completion of the coding process, we determined seven general categories to use in our analysis : “Mitigation” covered what the county has in place to reduce the risk of emergencies; “Response” covered how the county reacts to the emergencies; “Policy Logistics” covered improvements, frequency of meetings, updates; “Government Cohesiveness” covered inter-departmental cooperation, such as fragmentation and cooperation; “Agency Awareness” covered intra-agency cooperation, like staff knowing what they, both the person and the agency, do; “Outreach” covered communication with the population and any mention of environmental justice; and finally, “Commentary” was a catch-all for statements made by the interviewee about the agency, policies, plans, future improvements or other factors that did not comfortably fit in any other theme, but were noteworthy.

The interview transcripts were reviewed again through the lens of our seven categories and condensed into individual summaries of each county. The categories served to make the county summaries consistent in content and more easily comparable. The interview analysis concluded with the development of trends. Trends express an underlying meaning found in similarities and differences between counties. Upon comparison of county summaries and consideration of our research question, we developed five trends: “LEPCs” compared how counties used their LEPCs in the development of plans and how often they updated their plans concerning LEPCS; “Collaboration between agencies” compared how counties

communicated across agencies and exposed instances of fragmentation within each county; “Flooding mitigation and response” compared counties’ strategies for preparing for and responding to flooding events, including infrastructure, flood predictions, supplemental flood plans, emergency warning systems, and protection from environmental contamination; “Community involvement” compared how counties communicated with communities regarding emergency preparedness; “Environmental justice” compared interviewees’ knowledge of the concept and what measures counties took to represent communities of color in their plans.

After our qualitative content analysis was complete, we compared the results to our policy evaluation scorecards. Comparing the two was integral in determining compliance with requirements for the plans themselves and gaining insight into if and how they are being implemented. The combination of the two results allowed us to create holistic profiles of policy compliance from the counties we studied.

Chapter 4: Results

Introduction

This section covers the results of our three research phases, including a summary of the intersection between the three. Our first phase resulted in a map that visualized the flood, pollution, and social vulnerability in all counties in the state of Maryland. The intersection of these factors highlighted the five counties deemed to be the most at-risk. Our second phase yielded a scorecard of the effectiveness of existing policies for flood emergency action and community preparedness. Out of the 24 counties in Maryland, the analysis for phases two and three was narrowed down to eight counties and Baltimore City, including the ones found most at risk from phase one and four additional counties to provide a point of contrast. These additional counties had relatively high or mid-range rankings for one of the studied categories: flooding risk, social vulnerability, and polluting facilities. Our third phase qualitatively analyzed the interviews conducted with signatories and contributors to local emergency plans. Results from phase three revealed trends of similarities and/or differences between county emergency plans, based solely on the knowledge of the personnel involved in emergency management. After concluding all three phases, we reviewed the three datasets together to identify key intersections to inform our discussion and recommendations.

GIS Results

Flood, Pollution, and Social Vulnerability Maps

Using the databases in Appendix A and discussed in the methods, we created a map showing pollution, flooding risk, and the demographics related to social vulnerability present across the state of Maryland. The interactive map can be found at ter.ps/ejustice via ArcGIS Online, where users can toggle the individual layers. Below is a map of the entire state of Maryland, as well as maps for Baltimore City, Anne Arundel County, Prince George's County and Dorchester County. We chose to showcase these counties in particular, because they provide a sample of the varying situations found across the state of Maryland. The first map shows the overall amount of toxic release sites, the widespread flooding risk, and a glimpse of the social vulnerability index state-wide. The county maps then provide more detailed views of the intersections we found in particular counties we studied. Baltimore City is a prime example of the intersection between high social vulnerability, high flood risk, and a high amount of toxic release sites. Anne Arundel County represents more of a mid-range example across all three categories. Prince George's County represents an example of a county where two of the categories were high, toxic release facilities and social vulnerability, but flooding risk was low. Inversely, Dorchester has two low risk categories, toxic release facilities and social vulnerability, but the highest-ranked flood risk.

In order to review other counties in the state, we recommend viewing the map on the website.

State of Maryland map

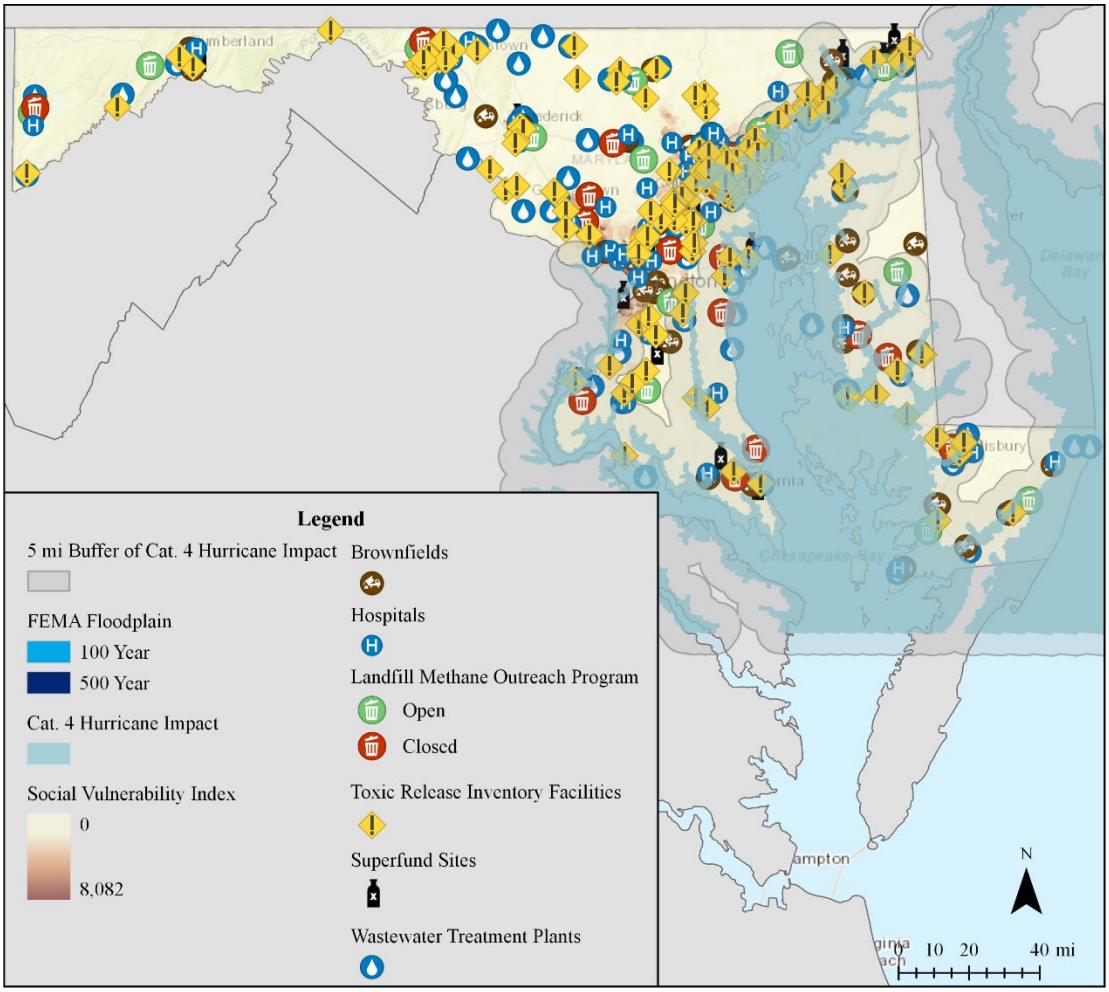

Figure 2: This map shows the entire state of Maryland with flood risk, social vulnerability, and toxic release sites displayed throughout.

Baltimore City map

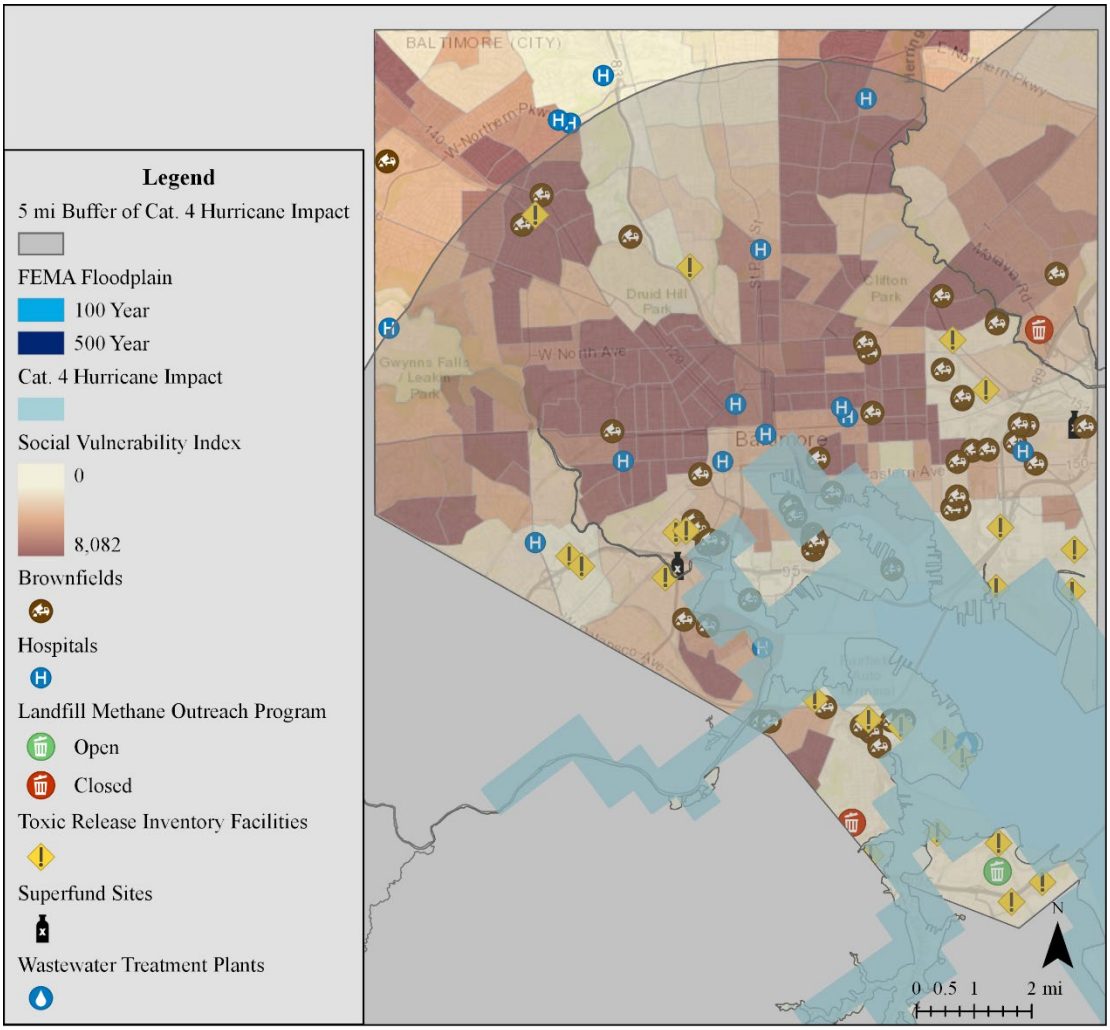

Figure 3: This map shows Baltimore City with flood risk, social vulnerability, and toxic release sites displayed throughout.

Anne Arundel County map

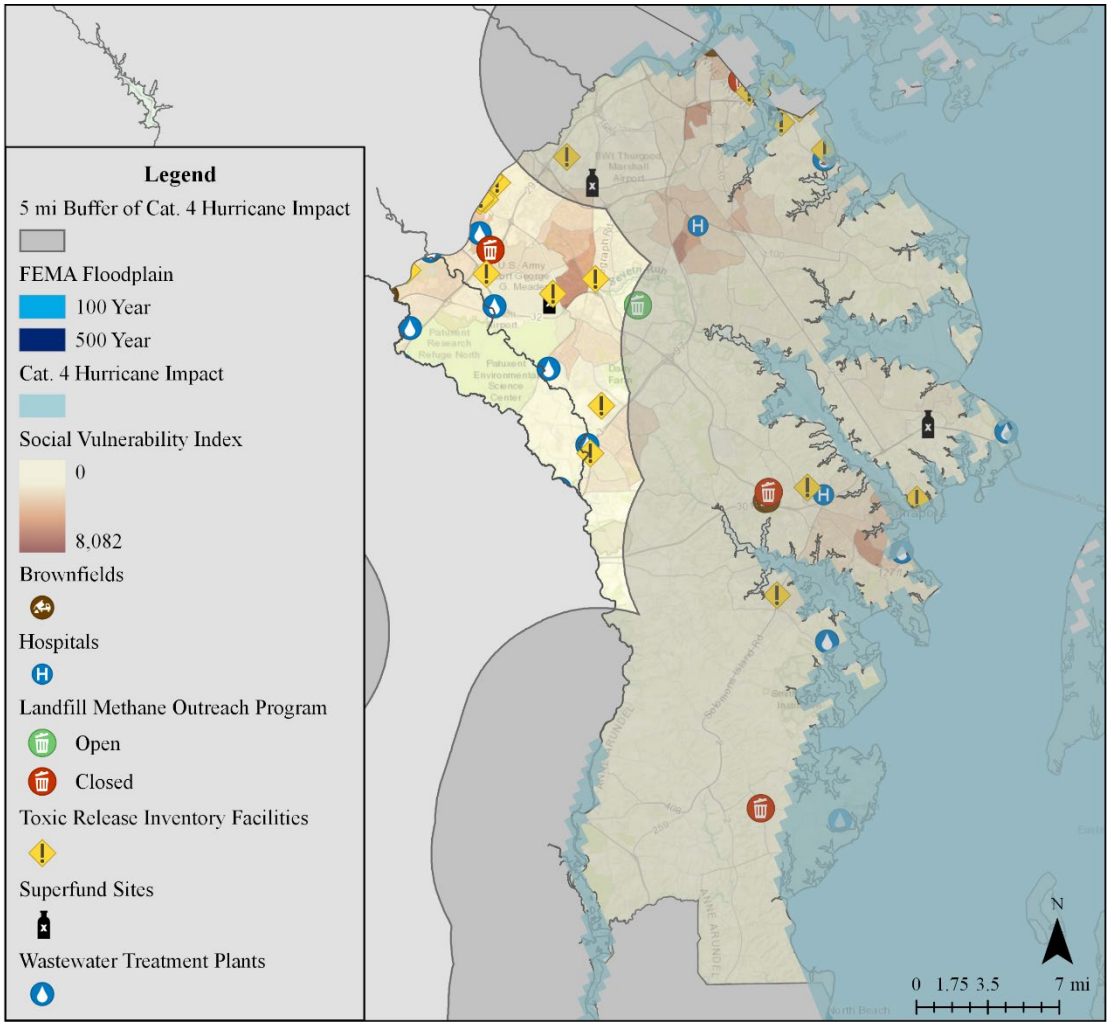

Figure 4: This map shows Anne Arundel County with flood risk, social vulnerability, and toxic release sites displayed throughout.

Prince George's County map

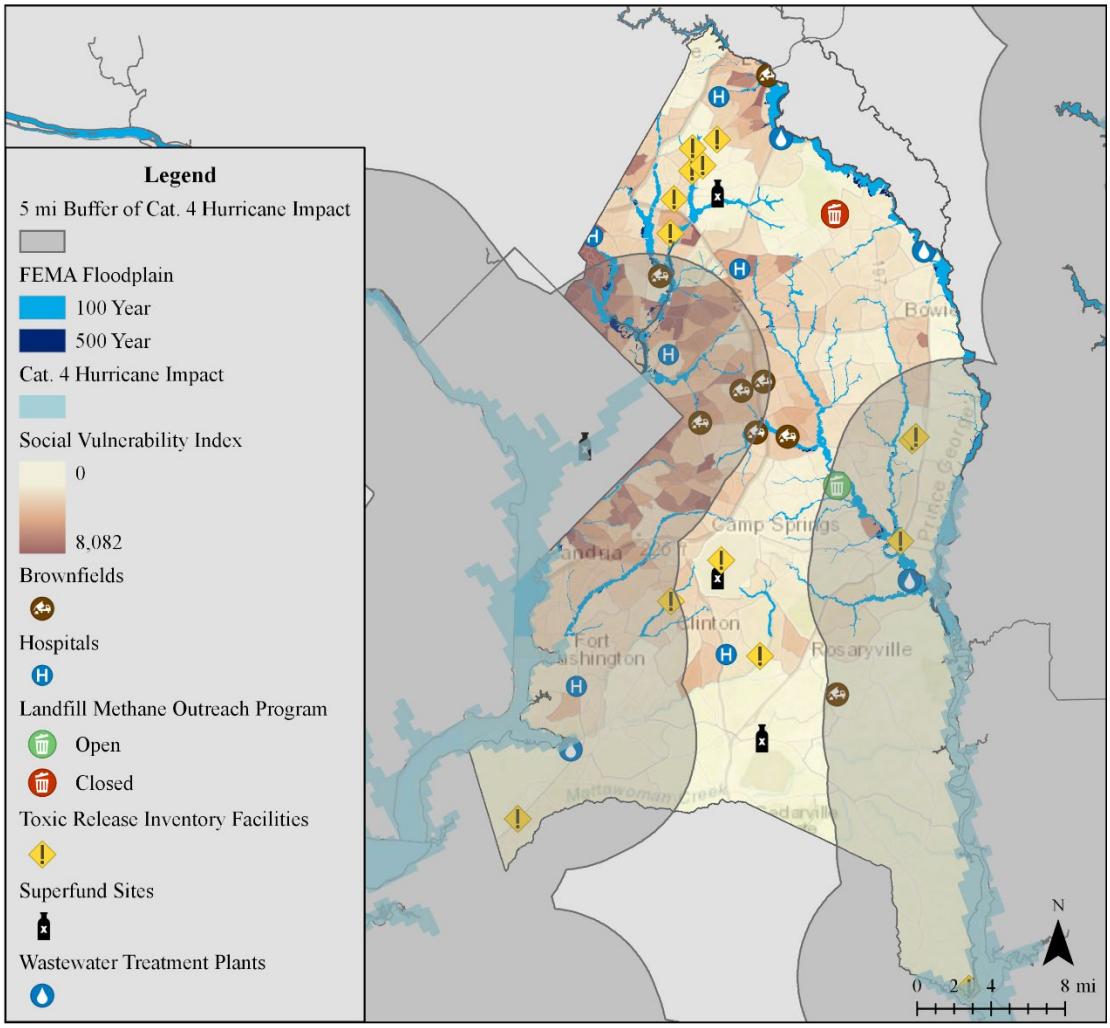

Figure 5: This map shows Prince George's County with flood risk, social vulnerability, and toxic release sites displayed throughout.

Dorchester County map

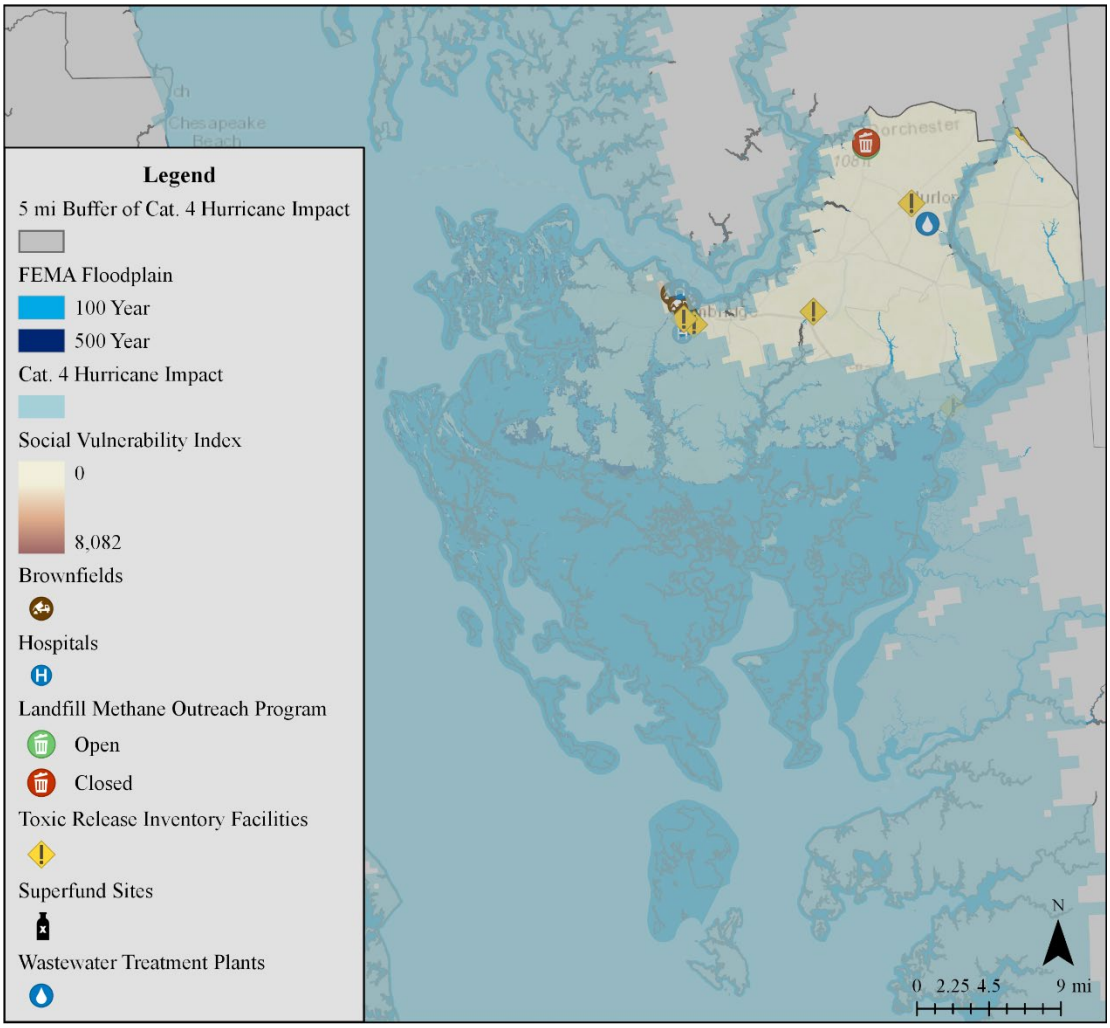

Figure 6: This map shows Dorchester County with flood risk, social vulnerability, and toxic release sites displayed throughout.

Mapping Risks

After mapping polluting sites, social vulnerability, and flooding risk, we ranked all of the counties in the state of Maryland for each factor, with 1 being the most at-risk and 24 being the least-at-risk. The overall rank for each factor, as well as the average of the ranks for each factor per county, can be found in the tables below.

Polluting sites.

For polluting facilities, the rank was based on the number of polluting facilities in each county. The ranking for each county from highest amount to least amount of polluting sites can be found below.

Table 2: Polluting Facilities Rank

County	Number of Methane Sites	Number of TRI Sites	Number of Hospitals	Number of Brownfields	Number of Superfund Sites	Number of Wastewater Treatment Plants	Number of Facilities	Rank
Baltimore City	3	21	15	54	2	1	96	1
Prince George's	5	14	6	8	3	4	40	2
Anne Arundel	4	14	2	2	4	10	36	3
Baltimore	2	23	6	1	2	1	35	4
Washington	2	13	3	3	1	7	29	5
Frederick	2	6	1	8	1	7	25	6
Harford	1	10	2	4	2	5	24	7
Montgomery	4	7	8	1	0	3	23	8
Cecil	1	4	1	7	5	3	21	9
Carroll	2	5	2	3	0	4	16	10
Allegany	1	3	2	5	1	3	15	11
Dorchester	2	5	3	3	0	2	15	12
Charles	2	5	1	0	1	4	13	13
Wicomico	1	4	3	2	0	3	13	14
Worcester	1	1	1	4	0	4	11	15
Howard	1	7	1	0	0	1	10	16
Saint Mary's	1	2	1	2	2	2	10	17
Somerset	1	1	1	5	0	2	10	18
Caroline	1	2	0	3	0	2	8	19
Kent	1	2	1	3	0	1	8	20
Talbot	1	1	1	3	0	2	8	21
Garrett	1	2	1	0	0	2	6	22
Queen Anne's	0	1	0	2	0	2	5	23
Calvert	1	1	1	0	0	1	4	24

Social vulnerability.

For social vulnerability, the rank was based on the minority population concentration from the census data, in number of people, divided by the census tract area, in square miles. The ranking for each county from highest minority population concentration to lowest minority population concentration can be found below. Counties with the same ranking had similar values.

Table 3: Social Vulnerability Rank

County	Rank
Baltimore City	1
Prince George's	2
Montgomery	3
Baltimore	4
Anne Arundel	5
Howard	6
Frederick	7
Charles	8
Wicomico	9
Harford	10
Washington	11
Dorchester	12
Saint Mary's	13
Somerset	14
Talbot	15
Carroll	16
Allegany	17
Worcester	18
Cecil	19
Calvert	20
Caroline	20
Garrett	20
Kent	20
Queen Anne's	20

Flood risk.

Flood risk rankings were based on visual observations from our maps as to how much land was modeled to be covered by water in the case of a category 4 hurricane with a 5-mile radius of buffered impact, from most to least impact. Counties with the same ranking had similar values.

Table 4: Flood Risk Rank

County	Rank
Dorchester	1
Somerset	2
Wicomico	3
Worcester	4
Talbot	5
Queen Anne's	6
Baltimore City	7
Anne Arundel	8
Harford	9
Saint Mary's	10
Calvert	11
Charles	12
Baltimore	13
Kent	14
Cecil	15
Carroll	16
Prince George's	17
Montgomery	18
Howard	19
Allegany	20
Caroline	20
Frederick	20
Garrett	20
Washington	20

Overall risk.

The overall rank was determined by averaging the rank of the three factors investigated. The county with the highest average rank was given the overall rank of 1, for the highest risk, and the county with the lowest average rank was given the overall rank of 24, for the least risk.

Table 5: Overall Rank

County	Facilities	Social Vulnerability	Flood Risk	Average Risk	Overall Risk
Baltimore City	1	1	7	3.0	1
Anne Arundel	3	5	8	5.3	2
Baltimore	4	4	13	7.0	3
Prince George's	2	2	17	7.0	4
Dorchester	12	12	1	8.3	5
Harford	7	10	9	8.7	6
Wicomico	14	9	3	8.7	7
Montgomery	8	3	18	9.7	8
Charles	13	8	12	11.0	9
Frederick	6	7	20	11.0	10
Somerset	18	14	2	11.3	11
Washington	5	11	20	12.0	12
Worcester	15	18	4	12.3	13
Saint Mary's	17	13	10	13.3	14
Howard	16	6	19	13.7	15
Talbot	21	15	5	13.7	16
Carroll	10	16	16	14.0	17
Cecil	9	19	15	14.3	18
Allegany	11	17	20	16.0	19
Queen Anne's	23	20	6	16.3	20
Kent	20	20	14	18.0	21
Calvert	24	20	11	18.3	22
Caroline	19	20	20	19.7	23
Garrett	22	20	20	20.7	24

As indicated above, the five counties deemed to be the most at-risk due to their flooding risk, social vulnerability, and polluting facilities were: Baltimore City, Baltimore County, Anne Arundel County, Prince George's County, and Dorchester

County, in descending order from highest to lowest risk. Baltimore City had the highest risk ranking, with an average ranking of 3, and facilities, social vulnerability, and flooding rankings of 1, 1, and 7, respectively. Anne Arundel County followed Baltimore City in highest overall risk, with an average ranking of 5.3. Baltimore County and Prince George's County both had average ranks of 7, and Dorchester County had an average rank of 8.3. Though Dorchester County had relatively low social vulnerability and facilities risks compared to the other highly-ranked counties, their flood risk ranking was 1, the highest of all counties in Maryland.

To provide a point of contrast, we selected four additional counties that had relatively high or mid-range rankings for one of the three aforementioned factors. These counties were: Montgomery County, Wicomico County, Howard County, and Carroll County.

Montgomery County had a low flood risk ranking (18), but was deemed at-risk based on their social vulnerability (3) and polluting facility (8) rankings. In contrast, Wicomico County had mid-range rankings for polluting facilities (14) and minority populations (9), but had a high flood-risk ranking (3). Howard County had a low risk for flooding (19) and polluting facilities (16), but had a high social vulnerability risk (6). Lastly, we picked Carroll County because it was relatively mid-range across all rankings, ranking 10 for polluting facilities, 16 for minority population, and 16 for flooding.

Policy Results

The second phase of our research involved analyzing the emergency management plans for hazard mitigation policies of the counties we selected.

For the counties with the highest risk and the counties we selected as points of contrast, we searched local government websites or emailed the emergency management offices to request access to EPCRA Emergency Response Plans for LEPCs, EOPs, and HMPs. Table 6 below shows which plans were analyzed for each jurisdiction's scorecard. Most counties had an EOP that was also considered as an EPCRA Emergency Response Plan. Baltimore City was the only jurisdiction that had a separate EPCRA Emergency Response Plan that was evaluated. Baltimore City did not publish its EPCRA Emergency Response Plan on its website and required members of our team to read the plan in person at the emergency management office. Every county had a HMP, and it was the only plan available for Dorchester County and Wicomico County. In particular, Dorchester County did not have its EPCRA Emergency Response Plan available for review because it was being updated (Dorchester County Emergency Management Personnel, personal communication, December 14, 2018).

Table 6: Plans for Policy Analysis

County	EPCRA Emergency Response Plan	EPCRA Plan Integrated into EOP	Hazard Mitigation Plan
Anne Arundel		X	X
Baltimore		X	X
Baltimore City	X		X
Carroll		X	X
Dorchester			X
Howard		X	X
Montgomery		X	X
Prince George's		X	X
Wicomico			X

This table shows which plans were used for each county's policy analysis.

We evaluated each county based on a total possible score of 33 points, using the scorecard explained in our methodology. Points were awarded based on the presence of specific content, meaning that a plan with a high score of 33 would be robust and contain all of the criteria in our framework. The framework used had five categories: the Policy, Leadership, and Collaboration score, which was out of five points; the Risk Assessment and Emergency Management score, which was out of eight points; the Flooding Risk and Appropriate Planning score, which was out of seven points; the Community Engagement, Health, and Well-Being score, which was out of four points; and the Environmental Justice score, which was out of nine points. The median score for the nine counties was 25, so a score greater than 25 was considered a high score. The categorical and total scores can be found in Table 7.

Montgomery County received the highest overall score of 30, as well as the highest scores in each category. Baltimore City scored 19 points and Anne Arundel scored 21 points, the lowest overall scores. Both counties received particularly low scores for Flooding Risk and Appropriate Planning and Environmental Justice. The

counties with high scores include Wicomico County (28), Baltimore County (27), Howard County (27), and Montgomery County (30). Counties with a score less than or equal to the median were Carroll County (23), Dorchester County (25), Prince George's County (24), Anne Arundel County (21) and Baltimore City (19).

The categories with the least variability were Policy, Leadership, and Collaboration; Community Engagement, Health, and Well-Being; and Environmental Justice. There was considerable variation among the remaining categories. A breakdown of each category's score designations for each county is detailed below. If a county did not include a specific criteria, it received a "No" score, which is highlighted in gray.

Table 7: Scorecards

County	Policy, Leadership, and Collaboration (5 total)	Risk Assessment and Emergency Management (8 total)	Flooding Risk and Appropriate Planning (7 total)	Community Engagement, Health, and Well-Being (4 total)	Environmental Justice (9 total)	Total Score
Baltimore City	5	7	2	3	2	19
Anne Arundel	5	6	3	4	3	21
Carroll	5	6	4	3	5	23
Prince George's	5	4	6	3	6	24
Dorchester	4	6	5	3	7	25
Baltimore	5	7	6	3	6	27
Howard	5	6	6	3	7	27
Wicomico	5	7	6	3	7	28
Montgomery	5	8	6	4	7	30

This table is the overall scorecard for each jurisdiction that was evaluated, with a breakdown of each category.

For the Policy, Leadership, and Collaboration section of our policy analysis, we scored each county using five questions, which allowed for up to 5 points. All counties scored a 5, except for Dorchester County, which failed to note methods and schedules for exercising their emergency plan.

Table 8: Policy, Leadership, and Collaboration

Policy, Leadership, and Collaboration	Anne Arundel	Baltimore City	Baltimore	Carroll	Dorchester	Howard	Montgomery	Prince Georges	Wicomico
Specific Policy									
Does the plan identify facilities subject to policy requirements?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Does the plan identify the departments and agencies designated to perform response and recovery activities and specify tasks they must accomplish?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Leadership									
Are the roles and responsibilities of all these parties and partners clearly defined, up-to-date, and documented?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Are leadership training and educational resources readily available to leaders?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Does the plan have methods and schedules for exercising the emergency plan (such as doing drills)?	Y	Y	Y	Y	N	Y	Y	Y	Y
Section Score (/5)	**5**	**5**	**5**	**5**	**4**	**5**	**5**	**5**	**5**

This table shows the scores for the Policy, Leadership, and Collaboration section of our policy analysis.

For the Risk Assessment and Emergency Management section of our policy analysis, we scored each county using eight questions, which allowed for up to 8 points. Montgomery County received the highest score (8) for including all measures in our scorecard. Anne Arundel County received a score of 6, as it met all requirements with the exception of identifying facilities subjected to additional risks

and identifying routes to transport hazardous substances. Baltimore City received a score of 7, for it met all requirements except for identifying facilities subjected to additional risks. Baltimore County also received a score of 7, for it did not identify routes to transport hazardous substances. Both Carroll County and Howard County received a 6, because both counties did not include routes to transport hazardous substances or evacuation plans. Dorchester County also received a 6 for not identifying facilities contributing to additional risk or providing evacuation plans. Wicomico County received a 7 for not outlining methods and procedures to be followed by facility owners in response to any releases of toxic substances. Prince George's County received the lowest score (4) for not including facilities contributing to or subjected to additional risk, routes for transporting hazardous substances, or the methods and procedures to be followed by facility owners after a toxic release.

Table 9: Risk Assessment and Emergency Management

Risk Assessment and Emergency Management	Anne Arundel	Baltimore City	Baltimore	Carroll	Dorchester	Howard	Montgomery	Prince Georges	Wicomico
Does the plan outline methods for determining the occurrence of a toxic release?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Does the plan list the area or population likely to be affected by such release?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Does the plan identify facilities contributing to additional risk based on their use or location (such as waste management sites)?	Y	Y	Y	Y	N	Y	Y	N	Y
Does the plan identify facilities subjected to additional risk (such as hospitals)?	N	N	Y	Y	Y	Y	Y	N	Y
Does the plan outline methods and procedures to be followed by facility owners and operators to respond to any releases of toxic substances?	Y	Y	Y	Y	Y	Y	Y	N	N
Does the plan outline methods and procedures to be followed by local emergency and medical personnel to respond to such release?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Does the plan identify routes to transport hazardous substances?	N	Y	N	N	Y	N	Y	N	Y
Does the plan have evacuation plans, including provisions for a precautionary evacuation and alternative traffic routes?	Y	Y	Y	N	N	N	Y	Y	Y
Section Score (/8)	**6**	**7**	**7**	**6**	**6**	**6**	**8**	**4**	**7**

This table shows the scores for the Risk Assessment and Emergency Management section of our policy analysis.

For the Flooding Risk and Appropriate Planning section of our policy analysis, we scored counties using seven questions, allowing for a total section score of 7 points, four of which related to populations and areas vulnerable to flooding. Baltimore City received the lowest score of 2, for not having separate sections for

hazard elements and flood planning, addressing toxic hazards that can be exacerbated by flooding, identifying developed areas that have been or are likely to be flooded, requiring additional flood storage capacity to buildings in flood-prone areas, and discussing strategies to determine whether to relocate structures that have been repeatedly flooded. Anne Arundel County received a score of 3 for not updating flood exposure and vulnerability assessments, addressing toxic hazards that can be exacerbated by flooding, or identifying areas and potential vulnerabilities that are likely to be flooded. Except for Anne Arundel County, all of the counties identified additional potential vulnerabilities.

Furthermore, Carroll County and Montgomery County both did not discuss strategies to determine whether to relocate structures that have been repeatedly flooded. However, Carroll County did not conduct flood exposure and vulnerability assessments or address toxic hazards that can be exacerbated by flooding, so it received a score of 4 while Montgomery County received a 6. Dorchester County, Prince George's County, and Wicomico County did not address toxic hazards that could be exacerbated by flooding. Also, Dorchester County did not require additional flood storage capacity to buildings in flood-prone areas while Prince George's County did, so it received a score of 5 while the latter received a 6. Howard County, Wicomico County, and Baltimore County also all received scores of 6. Baltimore County did not require additional flood storage capacity to buildings in flood-prone areas, Howard County did not have a hazard element and flood planning section, and Wicomico County did address toxic hazards that could be exacerbated by flooding.

Table 10: Flooding Risk and Appropriate Planning

Flooding Risk and Appropriate Planning	Anne Arundel	Baltimore City	Baltimore	Carroll	Dorchester	Howard	Montgomery	Prince Georges	Wicomico
Does the community's comprehensive plan have a hazard element AND flood planning section?	Y	N	Y	Y	Y	N	Y	Y	Y
Are flood exposure and vulnerability assessments conducted and updated every 5 years or less?	N	Y	Y	N	Y	Y	Y	Y	Y
Does the plan address that toxic hazards that can be exacerbated by flooding?	N	N	Y	N	N	Y	Y	N	N
Vulnerable Populations									
Do the local comprehensive plan and the HMP identify developed areas that have been or are likely to be flooded?	N	N	Y	Y	Y	Y	Y	Y	Y
Does the community require developers who are rebuilding in flood-prone locations to add additional flood storage capacity?	Y	N	N	Y	N	Y	Y	Y	Y
Are additional potential vulnerabilities related to health, economy, cultural and historic resources, environment, property, physical damages, population, land, critical infrastructure, and ecosystems identified?	N	Y	Y	Y	Y	Y	Y	Y	Y
Does the comprehensive plan or HMP discuss strategies to determine whether to relocate structures that have been repeatedly flooded, including identifying an equitable approach for community involvement in relocation decisions and potential funding sources (e.g., funds from FEMA, stormwater utility, or a special assessment district)?	Y	N	Y	N	Y	Y	N	Y	Y
Section Score (/7)	**3**	**2**	**6**	**4**	**5**	**6**	**6**	**6**	**6**

This table shows the scores for the Flooding Risk and Appropriate Planning section of our policy analysis.

For the Community Engagement, Health, and Well-being section of our policy analysis we scored counties using four questions, allowing for a total section score of 4 points. Anne Arundel County and Montgomery County both received 4 points for meeting all of our criteria. Baltimore County, Carroll County, Dorchester County, Howard County, Prince George's County, and Wicomico County each received a score of 3 because they did not designate a community emergency coordinator or a facility emergency coordinator. Baltimore City received a score of 3 for not having the community engagement information accessible outside of their plan.

Table 11: Community Engagement, Health, and Well-Being

Community Engagement, Health, and Well-Being	**Anne Arundel**	**Baltimore City**	**Baltimore**	**Carroll**	**Dorchester**	**Howard**	**Montgomery**	**Prince Georges**	**Wicomico**
Does the plan designate a community emergency coordinator and facility emergency coordinators?	Y	Y	N	N	N	N	Y	N	N
Does the plan outline a clear procedure for reliable, effective, and timely notification by emergency coordinators?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Are any non-government organizations involved with community outreach related to emergency preparedness?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Is this information accessible outside of plans?	Y	N	Y	Y	Y	Y	Y	Y	Y
Section Score (/4)	**4**	**3**	**3**	**3**	**3**	**3**	**4**	**3**	**3**

This table shows the scores for the Community Engagement, Health, and Well-being section of our policy analysis.

A central part of the policy analysis included the consideration of environmental justice for vulnerable populations in emergency management planning for these counties. There were nine questions in the criteria checklist that corresponded to the Environmental Justice category, with 9 total points possible. None of the counties scored the maximum number of points for the Environmental Justice section. Four counties had the highest score of 7; these were Dorchester County, Howard County, Montgomery County, and Wicomico County. None mentioned environmental justice explicitly and did not address vulnerability in connection to flooding and toxic release together. Both Baltimore County and Prince George's County received a score of 6. Baltimore County did not explicitly mention environmental justice nor public involvement and did not address vulnerability in connection to both flooding and toxic release simultaneously. Prince George's County did not address vulnerability in connection to flooding and toxic release either separately or together. They were followed by Carroll County with a score of 5, as it did not contain data on vulnerable populations, address vulnerability in connection to toxic release, or address vulnerability in connection to both flooding and toxic release. Anne Arundel County received a score of 3, as its plans did not address vulnerability in connection to both flooding and toxic release together, even though they communicated with residents regarding flooding and environmental risks. Baltimore City received a score of 2, the lowest for the Environmental Justice section. Its plans only mentioned public involvement and addressed vulnerability in connection to toxic release only and not with respect to flooding.

Table 12: Environmental Justice

Environmental Justice	Anne Arundel	Baltimore City	Baltimore	Carroll	Dorchester	Howard	Montgomery	Prince Georges	Wicomico
Do plans explicitly mention "environmental justice"?	N	N	N	N	N	N	N	Y	N
Do plans explicitly mention meaningful involvement of the public?	N	Y	N	Y	Y	Y	Y	Y	Y
Does the locality's HMP address needs of socially vulnerable communities, include input and review by organizations that can represent vulnerable communities and/or members of these communities?	N	N	Y	Y	Y	Y	Y	Y	Y
Does the locality's HMP contain data on vulnerable populations gathered through direct observations and/or measurement?	N	N	Y	N	Y	Y	Y	Y	Y
Does the plan address vulnerability in connection with flooding?	Y	N	Y	Y	Y	Y	Y	Y	Y
Does the plan address vulnerability in connection to toxic release?	Y	Y	Y	N	Y	Y	Y	N	Y
Does the plan address vulnerability in connection to both flooding and toxic release?	N	N	N	N	N	N	N	N	N
Is there a method to address community members' concerns?	N	N	Y	Y	Y	Y	Y	N	Y
Do you communicate with residents regarding flooding and environmental risks?	Y	N	Y	Y	Y	Y	Y	Y	Y
Section Score (/9)	**3**	**2**	**6**	**5**	**7**	**7**	**7**	**6**	**7**

This table shows the scores for the Environmental Justice section of our policy analysis.

Interview Results

To analyze the results of our interviews, we organized portions of the interview responses into several categories and used that division to identify trends of similarities and/or differences between the county emergency plans. It is important to emphasize that the responses from the interviews were based solely on the knowledge of the personnel that contributed to the creation of the emergency management plans. This portion of the research shows any disparities between personnel understanding of the plans and the language of the plans. Our interview data is limited, as many counties did not respond to our request for interviews. Officials from Dorchester County declined to be interviewed, while representatives from Montgomery County, Baltimore County, and Wicomico County were receptive to the idea of an interview, but after numerous attempts to schedule an interview, no time was chosen.

Summary of Interviews

According to all of the interviews, each county primarily used an EOP under MEMA, which was developed in collaboration with federal and state agencies. All counties reported holding LEPC meetings on a quarterly basis as required by EPCRA. Each county noted that LEPCs acted as more of an advisory board than as a forum to help write and update the plans. All counties mentioned using an emergency notification system and social media to update residents on flooding events. Each county reported working with several community organizations in their LEPCs and using social media to recruit meeting attendees. All counties, apart from Baltimore City, mentioned using after-action reports following flooding events. Only Prince George's County explicitly mentioned environmental justice in its plan, but the

interviewee from that county was not aware of what document spoke of environmental justice. Interviewees from other counties were unaware of the term's definition. Using the results of our coding and categorizing process, a consolidated summary of each county's interview is found below.

Anne Arundel County.

Anne Arundel County's interview was conducted with a representative of the Office of Environmental Management. According to the interview, Anne Arundel County mitigated flooding primarily with an EOP that was developed in collaboration with federal agencies. Along with an EOP, the county had several supporting plans developed through an Emergency Support Function office including a sheltering plan, mass casualty plan, and long-term recovery plan. The county was working on improving their response to environmental contamination from flooding, having recently hired a new employee responsible for improving the plans from an environmental perspective. A new nuisance flooding plan was being developed at the time of the interview, and the office was working on improving their consistency between plans. When flooding events occurred, after-action reports and updated flood maps were developed. Their EPCRA Emergency Response Plan for LEPCs was included in their EOP, and LEPC meetings were held quarterly. The LEPC meetings served as more of an advisory board than a contributor to writing the plans. The county had unique outreach techniques, noticeably focusing on youth awareness programs such as children's books and lessons in Scouts programs. Overall, the interviewee was very aware of operations in the office and indicated that the county was interested in improving its plan.

Baltimore City.

Baltimore City was the only jurisdiction with two interviewees. The interviews were conducted with representatives of the Department of Planning and the Mayor's Office of Emergency Management. Baltimore City primarily used an EOP, which was developed in conjunction with MEMA and FEMA. The offices responsible for emergency plans deferred to other departments, such as Fire and Police, for supporting plans for issues such as sheltering and relocation. According to the interview, the EOP identified critical facilities vulnerable to flooding and outlined a step-by-step safety guide to emergency preparedness, which were both accessible to the public. Businesses and residents were notified about flooding emergencies through an emergency notification system. The city was also working on new stormwater management infrastructure to monitor and predict floods as well as protect the community. When flooding events occurred, the city updated their plans but did not develop after-action reports. At the time of the interview, the city was working on improving emergency response with "resiliency hubs," made up of several community organizations working on post-disaster work. The EPCRA Emergency Response Plan for LEPCs was separate from the EOP, and the interviewee indicated that the city needed to improve their LEPC. That plan had not been updated in 6 years, and the LEPC Section Chief position was vacant at the time. There were some education programs regarding preparedness in the community and new plans were expected to have a larger focus on the needs of disabled, homeless, and/or non-English speaking community members. Overall, there seemed to be a

disconnect between departments responsible for emergency planning in the city. Individuals in both the Planning Department and the Office of Emergency Management (OEM) were interviewed, and each referred questions to the other because they were unsure of specific answers. Both interviewees mentioned that the city was working on improving its plans.

Carroll County.

Carroll County's interview was conducted with a representative of the Emergency Management Office in the Department of Public Safety. Carroll County used an EOP to mitigate flooding. According to the interview, flooding happened less often and with less intensity in Carroll County than in other areas of Maryland, so flooding was of lower concern than in some of the other counties we researched. The county focused on stormwater infrastructure as a mitigation strategy and worked in conjunction with a hazardous materials team to respond to environmental contamination. The LEPC operated under the name "Disaster Preparedness Group" and met quarterly. According to the interviewee, the county strived to represent different communities in meetings. The community was notified about flooding through National Weather Service notifications. The county used seasonal flooding awareness campaigns such as "Turn Around, Don't Drown" to educate the community. The interviewee did not have much to say about supporting minority populations in county plans and programs. Overall, the interviewee seemed to be very aware of the functions of the office.

Howard County.

Howard County's interview was conducted with a representative of the Office of Environmental Management. Howard County used a Comprehensive Emergency Response and Recovery Plan, a guidance plan more specific to the county, in place of an EOP. This unique plan included lessons learned from the Ellicott City floods in 2016 and 2018 and replaced the county's EOP in 2015 (OEM, 2019). According to the interview, the OEM worked with the Department of Public Works for stormwater management and kept track of at-risk areas with GIS floodplains. After-action reports were developed in response to flooding events and focused on compounding risks, including environmental concerns. The community was notified of flooding events through an Integrated Public Alert and Warning System under FEMA. LEPC plans were separate from the EOP, but the committees contributed to the plans by gathering information from community members. The county had a Community Emergency Resiliency Network, which had its own strategic plan for engaging the community. The Network emphasized communication feedback loops with community organizations. Overall, the interviewee seemed very aware of operations in the office and in LEPCs.

Prince George's County.

Prince George's County's interview was conducted with a representative of the Office of Emergency Management. Prince George's County used an EOP and worked closely with the Department of Planning to mitigate floods using stormwater management funded through federal grants. The EOP acted as more of a guidebook to multiple supporting plans that are specific to different emergencies. Other partner response agencies were involved to aid with evacuation. After-action reports were

prepared and discussed after each flooding event. The community was notified of emergencies through a reverse-911 program. The EPCRA Emergency Response Plan for LEPCs was a part of the EOP, but the LEPC did not aid in writing the plan. The interviewee reported that the LEPC was diverse and representative of the community. Attendees of LEPC meetings were given educational literature at each meeting and were encouraged to use the literature to educate others in the community. The literature focused on marginalized communities, such as disabled and non-English speaking communities. Overall, the interviewee seemed very aware of the functions of their office.

Non-participating counties.

We were unable to interview officials from several counties. Officials from Dorchester County declined to be interviewed, stating that they were currently updating the plan so their responses would no longer be relevant by the time our project was completed. Representatives from Montgomery County, Baltimore County, and Wicomico County were receptive to the idea of an interview, but after numerous attempts to schedule an interview we were unable to do so. Communications regarding interview requests began in March of 2019 and finished in late October 2019, and dozens of emails were exchanged with representatives from the counties we researched.

Summary of Trends

After reviewing the interview data, we observed key similarities and differences among the counties in regards to the awareness and execution of the plans.

LEPCs.

The use and treatment of LEPCs differed greatly between counties. EPCRA Emergency Response Plans for LEPCs were part of the EOPs in Anne Arundel County, Prince George's County, and Howard County but were separated from EOPs in Baltimore City and Carroll County. Baltimore City stood out as having the least involved LEPC in comparison to other counties. Their LEPC plan had not been updated in six years and the LEPC Section Chief position, the position responsible for updating the plan, was vacant at the time of the interview. The committee also had no say in the development of plans.

Collaboration between agencies.

Each county reported working with other government agencies in emergency response, but the agencies they partnered with varied greatly. Baltimore City mentioned deferring responsibilities such as sheltering and evacuation. We interviewed two representatives from the city, one from the OEM and the other from the Department of Planning. There seemed to be a disconnect between the two, as both interviewees continuously referred certain questions to the other because they were unsure of the answers. Prince George's County worked with the Department of Planning, but referred to it as a partner agency that helped them handle certain responsibilities. Howard County mentioned working with the Department of Public

Works on stormwater management and flood predictions. Anne Arundel stood out with a separate Emergency Support Function office responsible for supporting plans including a sheltering plan, mass casualty plan, and long-term recovery plan.

Flooding mitigation and response.

Some counties had notable differences in mitigation and response to floods. Anne Arundel County and Howard County both used GIS maps to predict flooding events. Howard County made their maps interactive and available on their county website, updating them after each event. Baltimore City and Anne Arundel County were both working on Nuisance Flood Plans. Each county mentioned stormwater infrastructure, but Anne Arundel County and Carrol County were the only counties who addressed protecting residents from environmental contamination resulting from flooding in their EOP. Baltimore City identified critical facilities which may release toxic substances in their EOP, and Howard County included environmental concerns as a compounding risk factor in their after-action reports. Otherwise, none of the interviewees were aware whether their EOPs addressed environmental contamination that results from flooding.

Community involvement.

Each county had unique approaches to community outreach. Each county mentioned some educational programs for the community to learn about what to do in an emergency. Anne Arundel County focused heavily on youth programs, creating children's books and Scouts programs on the issue. Carroll County mentioned a "Turn Around, Don't Drown" campaign specific to the county. Howard County and

Baltimore City both expressed that they were working to improve the inclusion of the community in emergency response. Howard County had its own plan to engage the community called the Community Emergency Response Network, using communication feedback loops to improve their response. Baltimore City reported working on a similar program using "resiliency hubs," but it had not been developed by the time of the interview.

Environmental justice.

The subject of environmental justice was not specifically mentioned in any of the EOPs except for Prince George's County, but other counties addressed social justice in some form. Baltimore City mentioned updating its plan to include more of an equity lens, and Howard County gave out literature at LEPC meetings that specifically focused on the issues that marginalized communities face. Interviewees from the other counties assumed that marginalized communities were represented in their plans but could not provide any specific examples.

Intersection of Phases: Results

Overall, those jurisdictions determined to be low risk by the GIS analysis had a higher policy score. Conversely, those determined to be high risk had lower policy scores. This section will focus on the intersection of the GIS data, policy data, and interview analysis.

High Risk, Low Policy Score

The jurisdictions determined to have high risk based on the GIS analysis and who also had low policy scores were Anne Arundel County, Baltimore City, and

Prince George's County. We were able to interview personnel from all of these counties. The interviewee's answers did not always reflect the policy analysis framework score given to them.

Anne Arundel County scored 21 points on the policy scorecard, with their EOP scoring the second lowest in the category for Flooding Risk and Appropriate Planning. However, the interview revealed that Anne Arundel County is developing a Nuisance Flood Plan that is expected to be implemented by the end of the year 2020. This standalone plan would identify areas at risk for recurrent flooding and work in parallel with the EOP and HMP (Maryland Department of Natural Resources, 2019). This would mitigate the inconvenience caused by repetitive flooding but is not required to address catastrophic events that result in damage.

Baltimore City had the lowest policy score with 19 points and also ranked the overall highest of all counties for risk factors in the GIS analysis. Baltimore City had the lowest score in the Environmental Justice category out of all of the plans analyzed, despite having the highest number of polluting facilities and the highest score on the Social Vulnerability Index. Both interviewees acknowledged the EOP's deficiencies and cited the lack of resources as the reason. Additionally, both expressed the desire to improve the plans.

Prince George's County scored 24 on the policy scorecard, close to the median threshold of 25 points, and ranked fourth for overall risk factors in the GIS portion of our research. Prince George's County's EOP was the only plan to explicitly mention environmental justice. When asked about environmental justice in the interview, the interviewee answered that it was mentioned in some documents,

however, they did not explicitly specify where. Although they were not clear about how they approached the subject, this response stood out because the interviewee made it clear that it was an issue they were aware of and working to improve upon. Interviewees from the other counties did not know if the term was mentioned anywhere, and some counties needed us to define or further explain the term.

Low Risk, High Policy Score

The jurisdictions determined to have low risk based on the GIS analysis and high policy scores were Howard County, Montgomery County, and Wicomico County. We were only able to interview Howard County personnel.

Howard County received a policy score of 27, which was the third highest score out of the nine counties analyzed. It was ranked at number 15 out of 24 counties in the risk factors in the GIS analysis, which was the lowest risk out of the nine counties which were assessed in the policy section. Their positive policy scores in Flooding Risk and Appropriate Planning, Community Engagement, and Environmental Justice were supported by the results of the interview, which revealed they have an EOP specifically tailored to the county rather than one that only fulfills basic requirements. The interviewee mentioned updating the plan with lessons learned from the Ellicott City floods in 2016 and 2018, using GIS floodplains to predict disasters, and using a Community Emergency Resiliency Network.

High Risk, High Policy Score

Baltimore County was the only region that fell into the category of having high risk based on GIS analysis and a high policy score. However, we were unable to

interview personnel from Baltimore County, therefore we are unsure of how well their EOP is implemented and enforced.

Chapter 5: Discussion

Introduction

Our research aimed to identify counties in the state of Maryland with high socio-economic vulnerability, flood risk, and environmental risk and to assess whether emergency preparedness policies in these areas are effective in ensuring environmental justice, particularly with regards to the meaningful involvement of vulnerable populations. A cross-analysis of GIS data, qualitative policy analysis, and supplemental interview responses revealed that counties with high social vulnerability, flood risk, and sites with hazardous waste had poor preventative planning and enforcement policies. Though there were some exceptions to this finding, overall, our research exposed trends and themes that separate successful emergency preparedness policies from unsuccessful ones.

Our GIS maps indicated that there are five counties in Maryland that have the highest risk based on the factors we studied: Anne Arundel County, Baltimore County, Baltimore City, Dorchester County, and Prince George's County.

Fragmentation Among Plans and Personnel

Our policy analysis and interviewee answers revealed fragmentation among emergency preparedness plans. According to the U.S. Government Accountability Office (GAO), "fragmentation occurs in circumstances in which more [...] than one organization is involved in the same area of need and there are opportunities to improve service delivery" (Calderon, 2019). In the context of our research, fragmentation is a lack of agency coordination and efficacy regarding emergency

preparedness plans. For example, counties are burdened with multiple requirements for emergency management despite a statewide shift toward an "All-Hazards Approach." This approach focuses on developing plans for a full spectrum of emergencies and/or disasters in a more 'catch-all' manner. However, there are still active plans in counties in Maryland that address only a single part of an emergency response, such as Nuisance Flooding Plans. This fragmentation can lead to ineffective implementation of plans and redundant efforts by multiple entities during emergencies. For example, Baltimore City's Planning Department oversees the HMP, while the City's Office of Emergency Preparedness oversees the EPCRA Emergency Response Plan, LEPCs, and EOP, and the City's Health Department manages its own Emergency Preparedness Group. When asked about EPCRA and community involvement, the interviewee said it was not the responsibility of the Baltimore City's Department of Planning, but rather the Office of Emergency Management and Health Department. This is an example of fragmentation because plans that should be managed in tandem are overseen by separate offices, and the office responsible for writing the HMP should be actively involving the community in the development of their plan. Furthermore, when a jurisdiction has to handle multiple plans at the same time, like the EPCRA Emergency Response Plan, EOP, and HMP, they fail to prioritize document maintenance and risk mismanaging them all, as it is a time-consuming effort.

Given that most counties use a combination of EOPs and EPCRA Emergency Response Plans, many have omitted some important features that can reduce fragmentation. For example, the results from the Community Engagement, Health,

and Well-being section of our policy analysis revealed that the only jurisdictions that designated positions for both a community emergency coordinator and a facility emergency coordinator were Anne Arundel County, Montgomery County, and Baltimore City. While other counties engaged in other forms of community notification, we believe that not having a designated person makes communication among departments cumbersome and inefficient. We experienced this difficulty firsthand when contacting signatories and contributors of local emergency plans to interview, as we were repeatedly redirected to several different department and office heads. This redirection can be another barrier for community members trying to learn about or get involved with their emergency preparedness options. There was further miscommunication through rejection at various levels that included confirming an interview through email and then never setting a date, rescheduling phone calls the day of, among other actions. Examples of such miscommunications include our encounters with government officials in Dorchester County and Baltimore City. Officials in Dorchester County originally chose not to participate in our study because their plans were currently under review, so there was not a plan available that they could discuss. Afterwards, the director of Dorchester's' Emergency Management Office offered to do an interview, but after replying to them, we didn't hear back from them until after we had concluded the interview portion of our research. In regard to our experience with officials in Baltimore City, we had difficulty setting up a meeting time to read over their plans housed in their office because our original contact no longer worked with the office anymore. We also had to carry out interviews with two different departments within Baltimore City. This was done to get a complete

understanding of all of the Emergency Management Offices' plans but in the end made it unclear which department handled which plans.

Inconsistencies within Policy Requirements

We also found that there were inconsistencies with federal and state requirements and local emergency preparedness plans. The majority of the criteria we used for our scorecard were required by EPCRA as information necessary for an emergency response, so we anticipated that most counties would receive high scores in our policy analysis. However, some criteria required by EPCRA were not found in any of the plans we analyzed, specifically the requirements in the Risk Assessment and Emergency Management section. There were only three criteria that were included in the plans of every county we interviewed: outlining methods for determining the occurrence of a toxic release, listing the area or population likely to be affected by such release, and outlining methods and procedures to be followed by local emergency and medical personnel to respond to toxic releases. Since these were required by EPCRA, it was expected that they would be included in every plan. The criteria that was excluded the most from plans was identifying routes to transport hazardous substances. Even though this is required by EPCRA, it was only included in the plans from Montgomery County, Dorchester County, Wicomico County and Baltimore City. Three counties, Dorchester County, Carroll County, and Howard County did not include evacuation plans for toxic releases, with Carroll County and Howard County excluding both evacuation plans and transport routes.

Role of Local Emergency Planning Committees

According to EPCRA, LEPCs are responsible for developing an emergency response plan, reviewing that plan at least annually, and providing information about hazardous materials to the community. This is where we expected to see an interaction between the community and policy, as it was the only mandate that we found that explicitly concerned the meaningful involvement of community members in emergency preparedness. However, interviews revealed that LEPCs do not have an integral role in emergency planning. All jurisdictions that were interviewed stated that LEPCs do not directly develop the plan, but rather act as an advisory board in reviewing the plans. LEPCs are used mostly as a forum for stakeholders including, but not limited to, different agencies involved in emergency planning, non-government organizations, and community members. Both interviewees from Baltimore City acknowledged their LEPC is in need of improvement: their Section Chief of LEPC position has been vacant for the past six years. The interviewee from Prince George's County believes that the role of LEPCs has drastically changed over the past 20 years and recognizes that their LEPC has not been contributing meaningfully to the department, providing only advice, and very limited at that. Carroll County's LEPC operates under the name of "Disaster Preparedness Group", and further exemplifies the movement away from criteria required for LEPCs that were explicitly required under EPCRA associated with toxic release information.

Lack of Intersectionality

Intersectionality is a theoretical framework used by most political scientists to characterize the emphasis of the interaction of differences in political phenomena

(Crenshaw, 1990). Intersectionality in the context of our research characterizes the interconnected nature of environmental concerns, social vulnerability, and flood risk. It is important that counties address intersectionality between departments and among their plans to encourage environmental justice. This lack of intersectionality in emergency preparedness plans is reflected in criteria from our policy checklist that are missing in the planning documents.

One criterion that some plans missed was outlining methods and procedures to be followed by facility owners and operators in response to the release of toxic substances. It is important to acknowledge that Prince George's County and Wicomico County did not include this criterion, as its exclusion reflects a lack of attention to the management of toxic releases. However, we believe that its absence has a different significance for Prince George's County than for Wicomico County. Wicomico County had an otherwise high score suggesting that there are other planning measures in place for hazard mitigation, and it is not as significant that there are no methods specifically outlined for facility owners. In contrast, Prince George's County received the lowest score of all counties, reflecting an overarching lack of planning and precaution. Because of Prince George's County's low score, the exclusion of this criterion has more of an impact because there is less planning for other facets of county and facility leadership.

Another lack of intersectionality we found between plans was with regards to the potential impact of flooding on vulnerable populations. In the Flood Risk and Appropriate Planning section, three of the four criteria pertain to addressing the needs of vulnerable populations, and we found that many plans failed to meet these criteria.

Anne Arundel County and Baltimore City were deemed most at risk for flooding and social vulnerability. This was significant because both of these areas received low scores in the other parts of the Flood Risk and Appropriate Planning section and in their overall policy score, which means that they are likely ill-prepared to address the needs of vulnerable populations when there are floods. In contrast, while Montgomery County, Baltimore County, and Dorchester County each excluded one criterion with regards to vulnerable populations, all of these counties had otherwise strong policies regarding flood risk. This suggests that they are able to assist vulnerable populations and mitigate flooding in other ways. Baltimore County, Montgomery County, and Howard County are the only jurisdictions that included both toxic hazards that can be exacerbated by flooding and a vulnerability assessment that is updated every five years in their plans, separately.

In the Environmental Justice criterion of our policy analysis, we found that no county had a plan that addressed vulnerability in connection to both flooding and toxic release. This lack of explicit intersection among the three factors we focused on is highly concerning, as the problem is not being holistically addressed. We believe that addressing the connection is a crucial step towards keeping vulnerable communities safe in the face of toxic releases during flooding events.

Environmental Justice

We found that out of the nine counties studied, only Prince George's County used the term "environmental justice" explicitly in their plans. For interviews, the question of whether environmental justice is a factor mentioned explicitly in any emergency planning documents elicited varying responses. Interviewees from

Howard County and Anne Arundel County were not familiar with the term, and required a definition from the interviewer. Carroll County was not familiar with the term as defined by the U.S. EPA, but believed their non-discriminatory mission and plans aligned with the idea behind the concept. Baltimore City said the term is not mentioned in the plan, but they work from an "equity point of view," specifically mentioning West Baltimore as an area of flood risk with a predominantly African American population. Prince George's County said the term is mentioned in some documents, but could not specify which documents.

While many counties had a method in place to address community members' concerns, such as email listservs or community meetings, Anne Arundel County, Baltimore City, and Prince George's County, which are all high-risk areas, did not. This raises an environmental justice issue because, as previously stated in the U.S. EPA's definition of the term, community members should have "meaningful involvement" in the decision-making process. For example, in order to review the emergency preparedness plans from Baltimore City, we had to travel to their department and read the plans in person. The City's lack of community involvement exemplifies this aspect of environmental injustice by creating a large accessibility barrier for community members who do not have access to transportation, have inflexible work hours, disabilities, or other extenuating circumstances. Baltimore City also had the lowest score for Environmental Justice, which is especially notable because our GIS results found that this geographic area has the most environmental risk, flood risk, and social vulnerability.

We found that engaging these agencies was more difficult than expected. We initially aimed to have at least 30 interviews, but we were only able to conduct six. There was an initial lack of response from some counties until a formal email was made that stated our research would indicate their lack of response in our data. Those jurisdictions that were contacted but were not interviewed, including Montgomery County, Baltimore County, and Wicomico County, were receptive to the initial request, but no interview was scheduled after multiple attempts through email correspondence. Dorchester County was the only jurisdiction that denied the request. At the time, their plans were under review per federal regulation, so their answers would have been outdated immediately after they finished the reviews. Afterward, the head of the Emergency Management Office offered to participate in an interview, but we were not able to schedule a time before we concluded the interview portion of our project. These examples of lack of communication and cooperation from agency personnel are indicative of community members' barriers to meaningful involvement in environmental decision-making.

Exceptions to Research Expectations

There were a few instances where our county level research did not support our hypothesis. Carroll County had the lowest overall risk, but it also had the third lowest score in policy. Carroll County is the only county in our study that had a significantly low risk along with significantly low policy scores. Specifically, they had a particularly low rank in social vulnerability risk and received a low score in the environmental justice section. Furthermore, the interviewee was unsure whether minority populations were represented in the plans and did not go into detail about

measures they are taking concerning environmental justice. The interviewee also mentioned that flooding is not as much of a priority in their all-hazards approach because flooding is less common in that area, which was supported by the relatively low score the county received in the Flooding Risk and Appropriate Planning section. These lapses in policy may point to an instance where a county is not rigorous with certain aspects of plans because they have determined that these aspects are not necessary given the risks and demographics of the county.

On the other hand, Baltimore County and Prince George's County had high risk but had slightly better policy scores than expected. In particular, Prince George's County was the only county to explicitly mention environmental justice in their plan, and received a relatively high score in the Environmental Justice section. The interviewee from that county also mentioned that at the LEPC meetings, there is an effort to provide literature and educate the public on issues facing marginalized communities. However, Prince George's County received just below the median score overall, and was ranked just after Baltimore City as having the highest risk in social vulnerability. The explicit mention of the term environmental justice is a step in the right direction towards some of the measures necessary to address the needs and concerns of vulnerable populations, but further work to follow the implicit principles of the term by improving relevant policies is crucial.

Recommendations

The most concerning oversight in examining these counties and their emergency preparedness procedures is the absence of explicit or implicit principles of environmental justice. To address this deficiency, counties should not only explicitly

mention environmental justice but also actively address the fair treatment and meaningful involvement of all people by including facilities, areas, and populations subject to additional risk in emergency planning documents. Such language should be included specifically in EPCRA Emergency Response Plans, HMPs, and EOPs. In order to have more meaningful involvement from the community, LEPCs and community members should also have more opportunities to have input in the development of plans. Furthermore, each county should intentionally intersect flooding and hazard emergency preparedness protocols for communities that are vulnerable to toxic releases from flooding events, as floods are expected to become more frequent due to climate change.

Relevant departments should also consider putting maps similar to ours on county websites so community members can look in their residential area to see where hazards may come from and feel more involved in their safety. LEPCs should also be more intentional about representing the most environmentally-vulnerable communities within their meetings and intersect racial and socioeconomic justice concerns with emergency preparedness planning. However, before major improvements or restructuring can be made to legislation relating to emergency preparedness, guidance for the relationship between LEPCs and emergency management offices should be updated to determine the effectiveness of the current level of involvement from LEPCs.

There are structures in place to implement required emergency preparedness procedures in existing plans because most counties scored high in the Policy, Leadership, and Collaboration section. However, due to intense fragmentation, it is

difficult to maintain a smooth working relationship between agencies and departments. To mitigate this, counties should work together to develop similar frameworks for the content of each plan so differences between county protocols are easier to find. A collaborative group of county representatives can be established to support this work. The group could have calls periodically to discuss improvements that can facilitate more effective communication between departments and counties so all relevant parties are aware of concerns within their jurisdiction. Further, counties should also make use of existing frameworks, such as the Governor's Emergency Management Advisory Council. Activating the mandated community emergency coordinator and facility emergency coordinator positions from EPCRA could also mitigate fragmentation by having a point of contact for all departments to coordinate the drafting of plans. A common trend we found among interviewed counties is that many departments are understaffed and, because of this, do not have the capacity to address pressing concerns. Therein, we also recommend filling all required positions mandated by EPCRA and increasing the funding given to emergency preparedness departments.

The varying degree of understanding and implementation of the term environmental justice demonstrates the need for clarification of the term to all government agencies engaged in the protection of the environment and community safety. In 2019, EPA launched the Environmental Justice Learning Center, a collection of online training resources on environmental justice. We recommend county agencies to review the provided materials on how to better identify and serve the needs of vulnerable communities. It is imperative that all agencies are actively

considering and involving vulnerable communities in an understanding of environmental laws, regulations, and policies that aim to protect them. This is important because it can ensure that the policy is effective, addresses their needs, and maintains fair treatment and meaningful involvement of communities most at risk.

Future Research

There are a number of further research opportunities that can follow from our research. Community engagement is a key aspect of environmental justice, but various limitations of this project prevented our ability to cultivate relationships with the communities at study. Future studies can prioritize this community-based research. There is also little evidence of community members having the ability to provide input to government offices related to their experiences with flooding. This could be expanded upon through interviews with residents to gather information about their experiences with flooding events in the state of Maryland, how they viewed the government's response, and how prepared they feel to protect themselves and their families from future disasters based on resources provided by the government. With regards to interviews, there is still information that can be garnered from the government offices that did not participate in our initial interview. Further, a more comprehensive GIS map could be developed with additional industrial sites for statistical analysis on the compound impact of the materials present in the environment. More detailed research within certain counties could also reveal that there are regional flooding issues that may occur in certain areas or regional issues related to vulnerability. Lastly, investigating the relationship between flood insurance and its impact on vulnerable populations could yield an interesting

relationship with the financial implications of living in a flood prone area. There are a variety of other research pathways that can be pursued, but equity and justice must be prioritized in the face of climate change.

Appendices

Appendix A: List of Data Points in GIS Maps

Dataset	Source	Description
Maryland Floodplain - Effective FEMA Floodplain	Maryland GIS data catalog: https://geodata.md.gov/imap/rest/services/Hydrology/MD_Floodplain/FeatureServer/1	The Effective Floodplain layer represents the official regulatory floodplain as adopted by FEMA and a given local community for the National Flood Insurance Program. Effective data should be used wherever it is available, but it is not available statewide.
Maryland Coastal Resiliency Assessment: Community Flood Risk Areas	Maryland GIS data catalog: http://data.imap.maryland.gov/datasets/a3f31811f225482da591e8931c9c6c70_4/geoservice	The Community Flood Risk Areas represent residential areas at risk of coastal flooding where populations may be less equipped to prepare for, respond to, or recover from a coastal hazard event.
Maryland 2016 Social Vulnerability Index	CDC: https://svi.cdc.gov/SVIDataToolsDownload.html	CDC's SVI uses U.S. Census data to determine the social vulnerability of every census tract.
5-Mile Buffer of Category 4 Hurricane Impact	Produced by us: https://services1.arcgis.com/qTQ6qYkHpxlu0G82/arcgis/rest/services/Buffer_of_Category_4_Hurricane_Impact/FeatureServer	Created to show the impact that a Category 5 Hurricane might have on Maryland.
Category 4 Impact	NOAA's SLOSH. Data retrieved from program: https://www.nhc.noaa.gov/surge/slosh.php	Estimates storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data.
Maryland Counties	Maryland GIS data catalog and National Hydrology Data (NHD):	Map of all counties in Maryland.

	https://geodata.md.gov/imap/rest/services/Boundaries/MD_PhysicalBoundaries/FeatureServer/0	
Toxic Release Inventory Facilities	EPA: https://iaspub.epa.gov/triexplorer/tri_factsheet.factsheet_forstate?&pstate=MD&pyear=2016&pParent=TRI&pDataSet=TRIQ1	Gives locations of all TRI Facilities in the state of Maryland.
Hospitals	Maryland GIS data catalog: http://data.imap.maryland.gov/datasets/maryland-hospitals-hospitals	Gives locations of all Hospitals in the state of Maryland.
Landfill Methane Outreach Program	EPA: https://www.epa.gov/lmop/landfill-technical-data	Gives locations of all Landfills in the state of Maryland.
Brownfields	Maryland GIS data catalog: http://data.imap.maryland.gov/datasets/maryland::maryland-land-restoration-program-sites	Gives locations of all Brownfields in the state of Maryland.
Wastewater Treatment Plants	Maryland GIS data catalog: http://data.imap.maryland.gov/datasets/c37ed894979e4ab895fc8175958dea6c_0/geoservice	Gives locations of all Wastewater Treatment Plants in the state of Maryland
Superfund Sites	EPA: http://www.epa.gov/md/list-superfund-sites-maryland	Gives locations of all Superfund Sites in the state of Maryland.

Appendix B: Table 1: Flood and Toxic Release Policy Evaluation Checklist

Criteria Checklist	Source of Criteria
Policy, Leadership, and Collaboration	
Specific Policy Requirements	
Does the plan identify facilities subject to policy requirements?	EPCRA Statute's Criteria for Emergency Response Plans
Does the plan identify the departments and agencies designated to perform response and recovery activities and specifies tasks they must accomplish?	EOP Criteria from MEMA/FEMA
Leadership	
Are the roles and responsibilities of all these parties and partners clearly defined, up-to-date, and documented?	Virginia RAFT
Are leadership training and educational resources readily available to leaders?	Virginia RAFT
Does the plan have methods and schedules for exercising the emergency plan (such as doing drills)?	EPCRA Statute's Criteria for Emergency Response Plans
Risk Assessment and Emergency Management	
Hazardous Material Response	
Does the plan outline methods for determining the occurrence of a toxic release?	Additional question (Team E-JUSTICE)
Does the plan list the area or population likely to be affected by such release?	Additional question (Team E-JUSTICE)
Does the plan identify facilities contributing to additional risk based on their use or location (such as waste management sites)?	EPCRA Statute's Criteria for Emergency Response Plans
Does the plan identify facilities subjected to additional risk (such as hospitals)?	EPCRA Statute's Criteria for Emergency Response Plans
Does the plan outline methods and procedures to be followed by facility owners and operators to respond to any releases of toxic substances?	EPCRA Statute's Criteria for Emergency Response Plans
Does the plan outline methods and procedures to be followed by local emergency and medical personnel to respond to such release?	EPCRA Statute's Criteria for Emergency Response Plans
Does the plan identify routes to transport hazardous substances?	EPCRA Statute's Criteria for Emergency Response Plans
Does the plan have evacuation plans, including provisions for a precautionary evacuation and alternative traffic routes?	EPCRA Statute's Criteria for Emergency Response Plans
Flooding Risk and Appropriate Planning	

Are there flood exposure and vulnerability assessments conducted? (and are they updated every 5 years or less)?	Virginia RAFT
Are additional potential vulnerabilities related to health, economy, cultural and historic resources, environment, property, physical damages, population, land, critical infrastructure, and ecosystems identified?	Virginia RAFT
Does the plan address that toxic hazards that can be exacerbated by flooding?	Additional question (Team E-JUSTICE)
Does the community's comprehensive plan have a hazard element AND flood planning section?	EPA Flood Resilience Checklist
Vulnerable Populations	
Do the local comprehensive plan and the Hazard Mitigation Plan identify developed areas that have been or are likely to be flooded?	EPA Flood Resilience Checklist
Does the community require developers who are rebuilding in flood-prone locations to add additional flood storage capacity?	EPA Flood Resilience Checklist
Does the comprehensive plan or Hazard Mitigation Plan discuss strategies to determine whether to relocate structures that have been repeatedly flooded, including identifying an equitable approach for community involvement in relocation decisions and potential funding sources (e.g., funds from FEMA, stormwater utility, or a special assessment district)?	EPA Flood Resilience Checklist
Community Engagement, Health, and Well-Being	
Community Notification	
Does the plan designate a community emergency coordinator and facility emergency coordinators?	EPCRA Statute's Criteria for Emergency Response Plans
Does the plan outline a clear procedure for reliable, effective, and timely notification by emergency coordinators?	IRB-approved interview question (Team E-JUSTICE)
Are any non-government organizations involved with community outreach related to emergency preparedness?	IRB-approved interview question (Team E-JUSTICE)
Is this information accessible outside of plans?	Additional question (Team E-JUSTICE)
Environmental Justice	
Do plans explicitly mention "environmental justice"?	IRB-approved interview question (Team E-JUSTICE)
Do plans explicitly mention meaningful involvement of the public?	IRB-approved interview question (Team E-JUSTICE)
Does the locality's Hazard Mitigation Plan address the needs of socially vulnerable communities, include input	Virginia RAFT

and review by organizations that can represent vulnerable communities and/or members of these communities?	
Does the locality's Hazard Mitigation Plan contain data on vulnerable populations gathered through direct observations and/or measurement?	Virginia RAFT
Does the plan address vulnerability in connection with flooding?	Additional question (Team E-JUSTICE)
Does the plan address vulnerability in connection to toxic release?	Additional question (Team E-JUSTICE)
Does the plan address vulnerability in connection to both flooding and toxic release?	Additional question (Team E-JUSTICE)
Is there a method to address community members' concerns?	IRB-approved interview question (Team E-JUSTICE)
Do you communicate with residents regarding flooding and environmental risks?	IRB-approved interview question (Team E-JUSTICE)

Appendix C: Consent to Participate Form

Project Title	*Flood Risk and Environmental Injustice in Maryland*
Purpose of the Study	*This research is being conducted by a team of students with the Gemstone Honors Program at the University of Maryland, College Park under the supervision of Professor Joanna Goger. We are inviting you to participate in this research project because you were involved with an Emergency Preparedness Plan in your county. The purpose of this part of the research project is to clarify questions about the contents of the plans and learn more about implementation of these plans in order to determine if they are effective in ensuring the fair treatment and meaningful involvement of vulnerable populations.*
Procedures	*The procedures involves a sit down 30-45-minute interview in whatever capacity is most comfortable for you.* - *phone interview* - *skype/ video call* - *in-person* *Example questions include:* - *What is your role in crafting Emergency Plans and LEPC plans?* - *When is the last time that this county's LEPC plan has been updated?* - *How often are these plans reviewed? Who reviews them?*
Potential Risks and Discomforts	*There may be some risks from participating in this research study. Because this research will ask you to answer questions about your county's emergency preparedness and planning, you may experience discomfort or question your potential satisfaction with the county's planning efforts. Additionally, there is the potential risk of a loss or breach of confidentiality. To protect against these risks, data will be stored in a secure, password-protected computer only accessible by the team of researchers.*
Potential Benefits	*There are no direct benefits to participation. However, interviewees will be contributing to a greater understanding of emergency policy and implementation which could benefit the interviewee's organization as well as other similar organizations.*
Confidentiality	*Any potential loss of confidentiality will be minimized by* ***storing data in a secure password protected computer drive*** *only accessible by the team of researchers. We may ask for permission to use names of persons or counties in the final report but that we would obtain written permission if we are to do so.* ***If the interviewee so chooses,*** *the publication of research will omit the names of said interviewees.*

<table>
<tr><td>Right to Withdraw and Questions</td><td colspan="2">Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.
If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:
Joanna Goger
0218 Symons Hall,
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(301) 405-4104
jgoger@umd.edu
OR
Maud Acheampong
(443) 943-6782
teamejustice@gmail.com</td></tr>
<tr><td>Participant Rights</td><td colspan="2">If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:

University of Maryland College Park
Institutional Review Board Office
1204 Marie Mount Hall
College Park, Maryland, 20742
E-mail: irb@umd.edu
Telephone: 301-405-0678

For more information regarding participant rights, please visit:
https://research.umd.edu/irb-research-participants

This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</td></tr>
<tr><td>Statement of Consent</td><td colspan="2">Your signature indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You will receive a copy of this signed consent form.
If you agree to participate, please sign your name below.</td></tr>
<tr><td rowspan="3">Signature and Date</td><td>NAME OF PARTICIPANT [Please Print]</td><td></td></tr>
<tr><td>SIGNATURE OF PARTICIPANT</td><td></td></tr>
<tr><td>DATE</td><td></td></tr>
</table>

Appendix D: Interview Questions

Description

This research is being conducted by a team of students with the Gemstone Program at the University of Maryland, College Park under the supervision of Professor Joanna Goger. We are inviting you to participate in this research project because you were involved with an Emergency Preparedness Plan in your county. The purpose of this research project is to clarify questions about the contents of the plans and learn more about implementation of these plans in order to determine if they are effective in ensuring the fair treatment and meaningful involvement of vulnerable populations.

Questions

Team E-JUSTICE is investigating the effectiveness and accessibility of policies in place regarding toxic release regulation, emergency planning, and hazard mitigation of flooding in Maryland.

1. What is your role in crafting Emergency Plans and LEPC plans?
2. When is the last time that this county's LEPC plan has been updated?
3. How often are these plans reviewed? Who reviews them?
4. When will this LEPC plan (or another emergency plan) be updated next?
5. How does the county respond to floods? To environmental hazards that occur during flood events?

6. What types of preventative actions are taken to address the risks that could be posed by flooding combined with environmental hazards as outlined in planning documents?
7. Can you explain the various emergency planning documents that have been written by your jurisdiction? Do you have a separate emergency plan under EPCRA or is it found within another document? (be sure to ask them to identify all documents that could be relevant)
8. What type of documents does your county provide that would apply to environmental contamination as a result of flooding?
9. Does your LEPC plan address environmental hazards that may be caused or become more likely due to flooding?
10. Was your county's LEPC plan or other emergency preparedness plan designed to address county needs or state needs?
11. What improvements would you like to see in future revisions of this county's LEPC plan?
12. Are your county's LEPC plans separate or are they both in the Emergency Operations Plan?
13. How important are LEPCs in the formation of Emergency Preparedness plans in the county?
14. What are other effective ways to enforce Emergency Planning and Community Right-to-Know Act without the incorporations of LEPCs?
15. Who are the members of your LEPC?
16. Are minority groups represented on your LEPC?

17. Are any non-government organizations involved with community outreach related to emergency preparedness?
18. What are the pressing concerns affecting the community that are addressed in this county's LEPC plan or Emergency Operations Plan?
19. How is the community notified about upcoming LEPC meetings?
20. If community members express concerns at meetings, how are they addressed?
21. If community members express concerns in other ways, how are they addressed?
22. How often does the LEPC meet?
23. Are toxic release reports available to the public?
24. What do you, as a county, do to ensure the community is up to date on the hazards and risks they are facing?
25. How do you communicate with residents regarding flooding and environmental risks?
26. Is Environmental Justice a factor mentioned explicitly in any emergency planning documents, including LEPC plans? If so, how is it incorporated?
    a. If not mentioned explicitly, is it something that is considered by the county when revising LEPC plans or when planning for an emergency?
27. What actions are taken if LEPC plans are not carried out properly?

Snowball method question: Are there any other people that you think we should talk to, and are there people you would be willing to connect us with?

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