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Sustainable Development in Hazard Mitigation Planning

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Introduction

Natural hazards affect every community and can cause severe damage and losses to those affected. A way to reduce the risks natural hazards possess is for communities to develop hazard mitigation plans at both the state and local levels. This past semester I had the opportunity to intern at the Waccamaw Regional Council of Governments where I was introduced firsthand to how local governments update expired county hazard mitigation plans. Some of my responsibilities included data collection and research while also helping to prepare for meetings to involve the local municipalities. This project will examine the impacts of hazard mitigation plans and related policies on the sustainability of communities, with an emphasis on the planning process. There will be a special focus on how hazard mitigation plans help to achieve the United Nations Sustainable Development Goals, more specifically Goal 11: Sustainable Cities and Communities, which focuses on making communities safe, resilient, and sustainable (United Nations, 2023).

Hazard mitigation refers to "any sustainable action that reduces or eliminates long-term risk to people and property from future disaster" (FEMA, 2023). Risk is defined as "the potential for damage or loss created by the interaction of natural hazards with assets, such as buildings, infrastructure, or natural and cultural resources" (FEMA, 2023, 21). The Federal Emergency Management Agency (FEMA) is the lead federal agency in the United States on disaster risk reduction as part of the Department of Homeland Security (DHS). According to the United Nations (UN), disaster risk refers to "the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity" (UNDRR, n.d.). The reduction aspect aims at preventing new and reducing existing disaster risk,

which help to strengthen resilience and achieve sustainable development, defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UNSDG, n.d.). Vulnerability refers to "the propensity or predisposition of assets to be adversely affected by threats. Vulnerability encompasses exposure, sensitivity, potential impacts and adaptive capacity" (NFWF, 2019, ii).

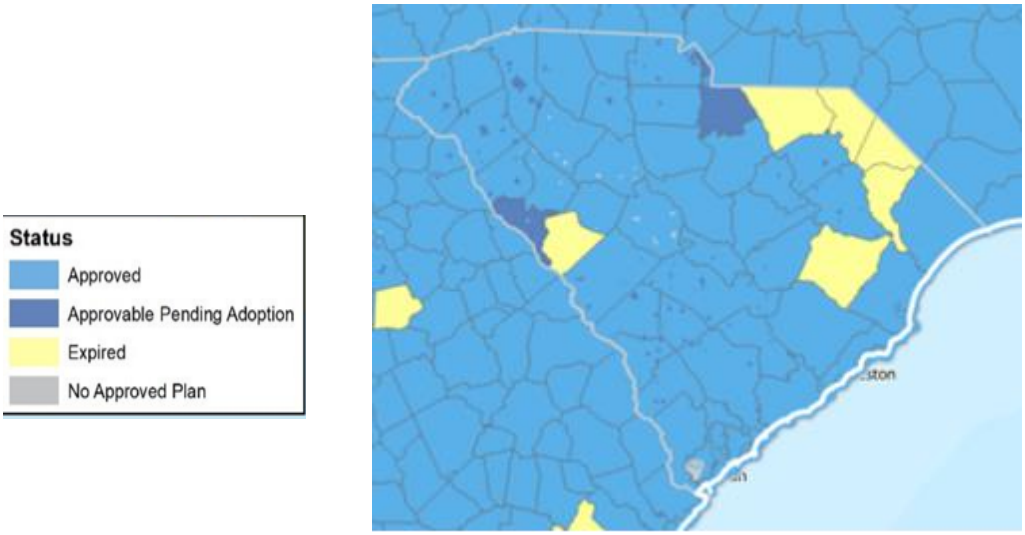
In 2020, South Carolina Governor Henry McMaster renamed the Disaster Recovery Office as part of South Carolina's Office of Resilience, which develops, implements, and updates the state resilience plan to coordinate disaster recovery and mitigation strategies statewide to less the impact of disasters in the future (SC.GOV, 2021). Resilience is a communities' ability "to resist, absorb, accommodate, adapt to, transform, and recover from the effects of a hazard in a timely and efficient manner" through mitigation efforts (UNDRR, n.d.). Mitigation activities increase resilience and lessen the impact of future disasters by reducing the long-term risks to communities (SCOR, n.d.). Hazard mitigation plans are the foundation of these activities for communities and provide them with a strategy to achieve resilience by establishing mitigation actions that are directed at reducing risks and losses and encouraging sustainable development.

Empirical Data

Hazard mitigation plans are an important first step for planning for future disasters. Figure 1 shows the status of South Carolina's County mitigation plans as tracked by the Federal Emergency Management Agency (FEMA) database for hazard mitigation plans (FEMA, 2023). There are 46 counties in South Carolina, six of which have expired plans, two have plans with approvable pending adoption status, and the other 38 counties have approved plans. I would like to note that one of the expired counties is Williamsburg County, which has been the focus of the work in my internship for the Waccamaw Regional Council of Governments and the inspiration

behind this report. Hazard Mitigation Plans are important not just for states, but counties too so that they can build resilient communities from a more localized level. Resilience and sustainability need to be built from the ground up, and that starts with local governments and counties because they know the region best. In my research for the Williamsburg County Hazard Mitigation Plan, I found some aspects of the plan that should be explored more. To demonstrate what I found, I am going to outline the steps I think should be taken to develop the best hazard mitigation plan for the Waccamaw Region, and even similar coastal communities.

Figure 1: South Carolina Hazard Mitigation Plan Status (FEMA 2023)



Before even looking at complete hazard mitigation plans, it is necessary to understand what is required by the federal government. As mentioned before, FEMA is the lead federal agency who provides planners with the *Local Mitigation Planning Policy Guide* that outlines the requirements to get federal approval for hazard mitigation plans (FEMA, 2022). These requirements are not specific and provide general requirements that must be included in the plans. Local planners are responsible for taking their planning documents to greater detail to

provide the community with the best mitigation plan. Consequently, when I first began my internship, I started by looking at other hazard mitigation plans of the local counties and even some not so local counties who had similar hazard risks, mostly coastal communities. Given that FEMA offers a vague set of requirements for hazard mitigation plans, by looking at similarly structured counties, I was able to compare the expired Williamsburg County plan to these other counties to see what the Williamsburg plan needed to provide the best assistance to local planners.

Based on my observations, the most important part of developing a plan of any kind is to have community involvement from not just the local officials and leaders but from members of the community too. No one will know the community better than those who live there, which is why FEMA requires community involvement in the planning process along with a detailed account of the process to be used as a model for the future (FEMA, 2022, p 19). The planning process should be open to everyone in the community because everyone will be affected by hazards and has the right to provide input on the necessary actions to reduce risk for the community. This begins by forming the planning committee and discovering what leaders in the county want to be a part of the process. It is then important to include everyday citizens from the community by creating a questionnaire asking about their experiences with different hazards to get a better understanding about what hazards have the most impact and where any vulnerabilities are in the plan. Community meetings are another way to get input and understand the risks of building a resilient community. This is significant because when you have counties like Williamsburg and Georgetown that have rural areas and encompass a lot of undeveloped land, there are parts of the county that may be affected by disasters or hazards more than emergency management and local planners are aware of. For example, community leaders may

not be aware of every place that floods in the county, but citizens who are impacted can help bring awareness to areas that are of most concern to them.

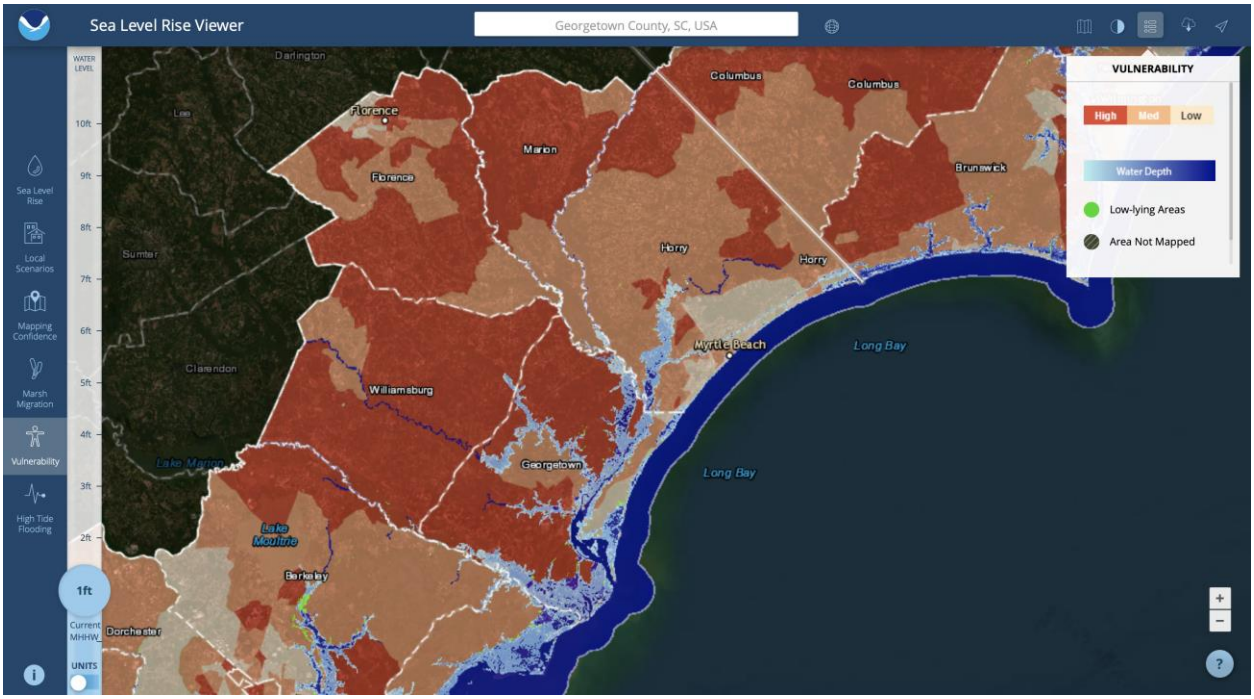
In my internship, this was described to me using road flooding as an example. One road may flood heavily, impacting those who need to drive on it to get to work, but emergency management may not know that it floods so badly because by the time they get to the road it has already drained. When citizens are given the opportunity to participate in the planning process and to attend community meetings, it reduces the risk by making community leaders aware of issues of which they were previously unaware. Community involvement promotes sustainable development by increasing awareness of potential risks so that they can be planned for accordingly. The key to a good hazard mitigation plan is having one whose main goal is to build resilience and ensure that community lifelines continue to support society (FEMA, 2023, 17).

The planning process determines overall goals and objectives for the plan. The best way to create a hazard mitigation plan is to set goals for what the document should achieve at the beginning, it is difficult to plan for something without knowing the objective of what you are planning for. Every community is different, so the goals for one plan are going to be different for another. Consequently, the goals for a plan should be reflective of what the community needs the most. For the Waccamaw Region, the largest need is flood prevention. One plan I read as an example listed the goals in order of importance. This allows for prioritization of goals based on community needs (Charleston County, 2021, 45). This can be more easily identified by listing the goals in the introduction in order of importance so that policy makers know what to prioritize for the development of the county. Mitigation plans are supposed to reduce the costs of disasters and to build a more resilient community that can withstand such disasters. This begins by identifying the hazard risks and deciding which ones have the greatest effect on the community.

Community meetings can allow for everyone to come together to establish which goals should be prioritized and what hazards put the community at the most risk so that they too can be prioritized in the action plan. Every plan should start by outlining its planning process, stating its goals, and outlining the hazards whose risk it wants to reduce the most to help build resilience.

The next section required by the policy guide produced by the Federal Emergency Management Agency (FEMA, 2023, 16) are hazard identification and risk assessment, and mitigation strategy. I found these two sections to be similar in the way that they feed into each other. When looking at examples, these were the sections that I found the most variation in how counties went about displaying the assessments because FEMA's only requirement is to have a full description of hazards, both potential and ones that have recently impacted the county, and of vulnerabilities, including structures that are a part of the National Flood Insurance Program (NFIP) (FEMA, 2022, 22-23). Every community in the Waccamaw Region is in the NFIP (FEMA, 2022). Hazards that affect the Waccamaw Region include hurricanes, flooding, tornadoes, severe thunderstorms, winter storms, storm surge, earthquake, wildfire, lightning, extreme heat, dam failure and drought (Williamsburg County HMP, 2016, Horry County HMP, 2020, Georgetown County HMP, 2019). Tsunamis, dam failure, sea level rise, and terrorism are hazards that are identified as hazards in some counties in the region but not all. Sea level rise should be identified as a hazard in each community's hazard mitigation plan considering the threat it possesses to the entire region. Figure 2 depicts a one-foot rise in sea level compared to vulnerability, which emphasizes how at risk the Waccamaw Region is to rising sea levels (NOAA, 2023).

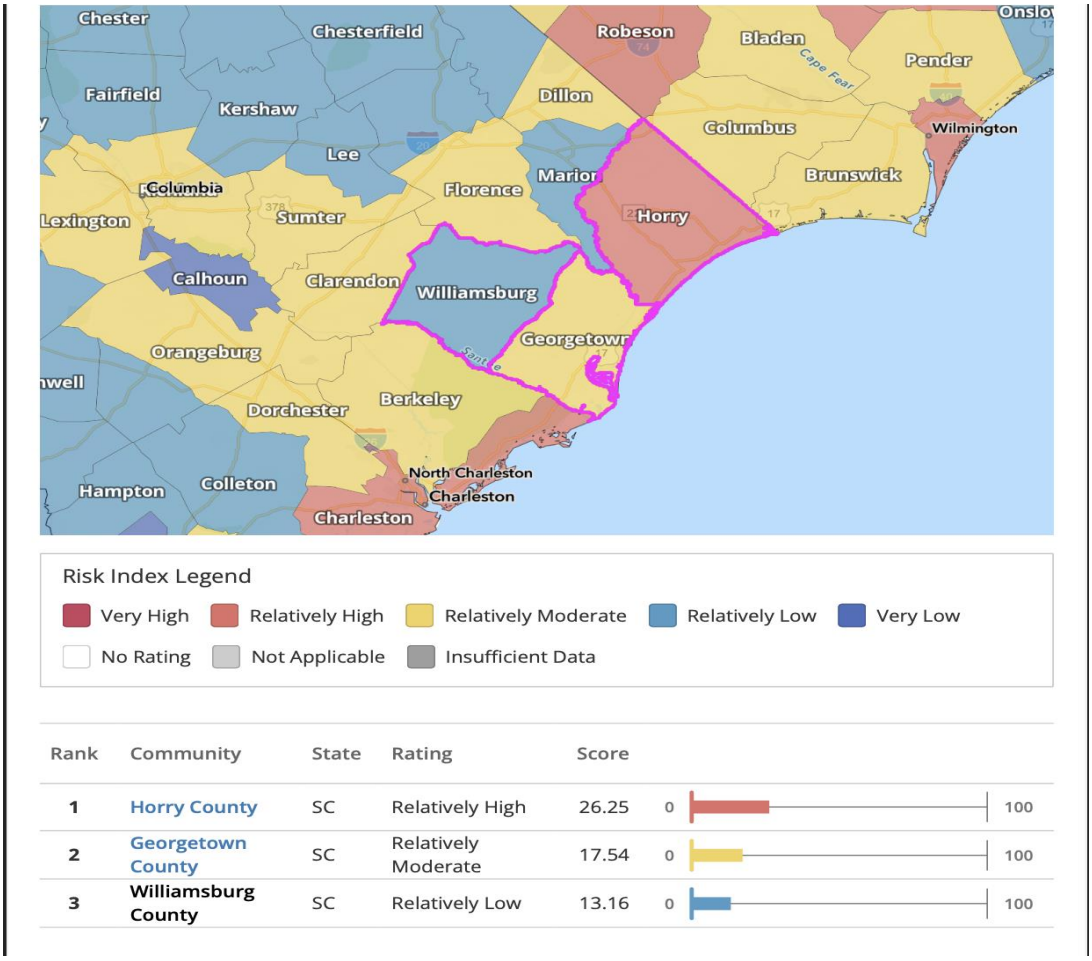
Figure 2: Sea Level Rise for the Waccamaw Region (NOAA 2023)



The federal government provides planners, stakeholders, and the public with many resources that range from different Geographic Information Systems (GIS) software and data to planning guides. These various databases can provide insightful information on how hazards affect the community which can be further used to develop sustainable plans. A key tool is FEMA's HAZUS software that is an open source and allows for planners to add their own data to estimate more accurately risk from hazards at various levels of analysis (FEMA, 2022). FEMA has created an interactive map known as the National Risk Index. This map provides the user with the option to view the nation as a whole or specific counties, which even allows for county comparisons. The risk index is calculated using expected annual loss, community resilience, and social vulnerability. It can show the overall risk index of the desired location, or it can focus on one of the variables. In addition, users are able to look at specific hazards for the

overall risk and expected annual loss (FEMA, 2023). Below in Figure 3 is a county comparison of the Waccamaw Region's overall risk index.

Figure 3: National Risk Index Comparison Waccamaw Region (FEMA 2023)

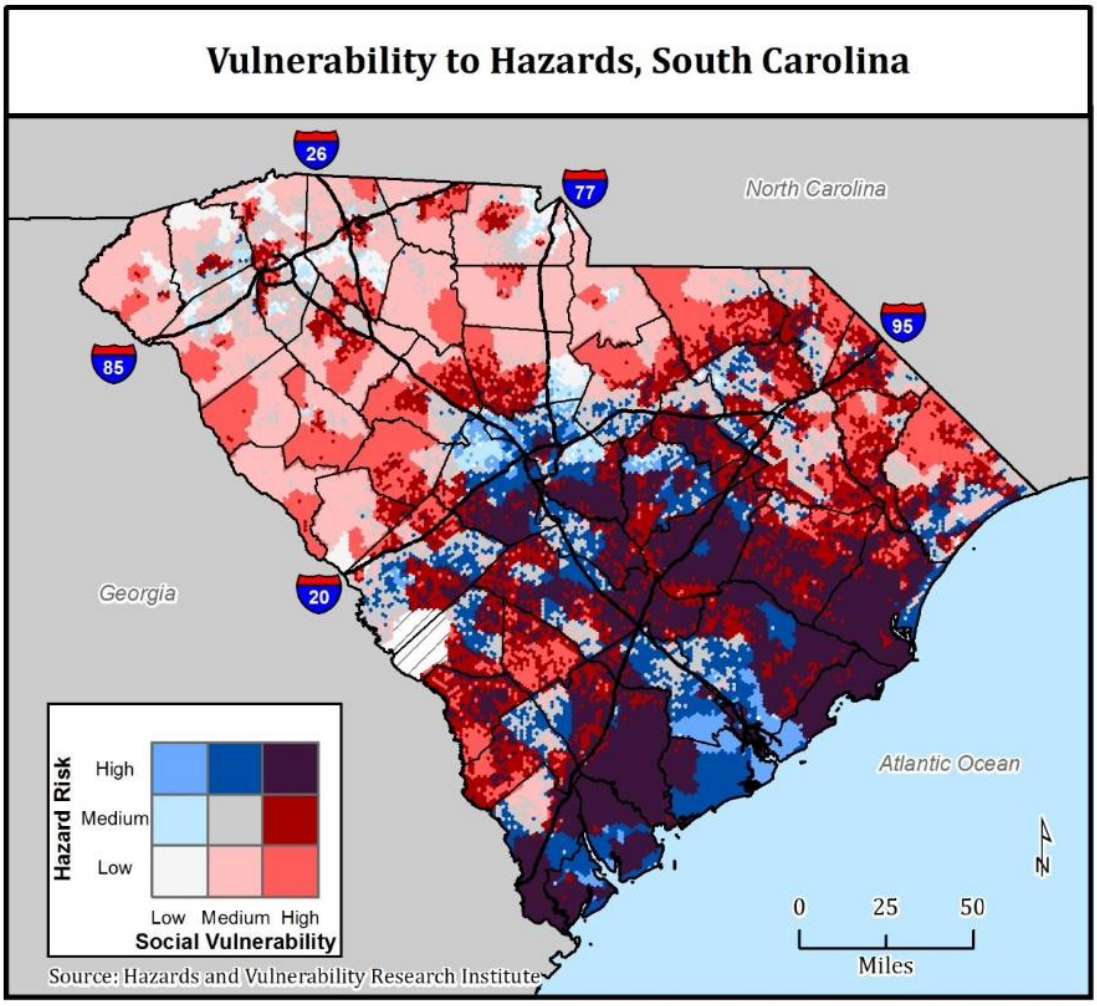


Rank	Community	State	Rating	Score		
1	Horry County	SC	Relatively High	26.25	0	100
2	Georgetown County	SC	Relatively Moderate	17.54	0	100
3	Williamsburg County	SC	Relatively Low	13.16	0	100

Horry County has a relatively high-risk index and Williamsburg County has a relatively low risk index meaning that "low risk is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience" (FEMA, 2023). The report goes into further detail of how each county compares to one another on expected annual loss, with hazard specific data, social vulnerability, and community resilience. This is a useful resource that can show planners what hazards should get more focus and which aspects of the community are increasing the potential risk factor from disasters. However, I it is important to note that FEMA's model is

not conclusive as they underrepresent the risk to the region. In South Carolina's state hazard plan, they provide a different model that places this region at more risk than FEMA's analysis. Figure 4 shows the vulnerability to hazards for the state of South Carolina which places Georgetown and Williamsburg at higher risk than FEMA's National Risk Index (SCHMP, 2018, 202). The National Fish and Wildlife Foundation's Coastal Resilience Assessment (2018, 41) and its CREST Tool place the South Atlantic Region at a greater risk to flooding through its Community Exposure Index, with higher threats being along the coast and in large urban areas. These assessments emphasize why planners need to use multiple data sources other than those provided by FEMA because FEMA will not give the most accurate risk assessment as they do not always have the most localized data.

Figure 4: Vulnerability to Hazards (SCHMP 2018)



The National Oceanic and Atmospheric Administration (NOAA) has a wide range of tools that can provide coastal planners with developing mitigation plans that are sustainable for the community. Digital Coast is a platform created to provide those in coastal management with tools and data to help solve coastal issues. The National Weather Service, under the NOAA, has developed several mapping programs, such as the Advanced Hydrologic Prediction Service and the Climate Prediction Center, which provide different tools that can be used to predict various climate-related activities (NOAA, 2023). These resources are especially useful for communities like Georgetown and the Waccamaw Region that are frequently affected by flooding and other

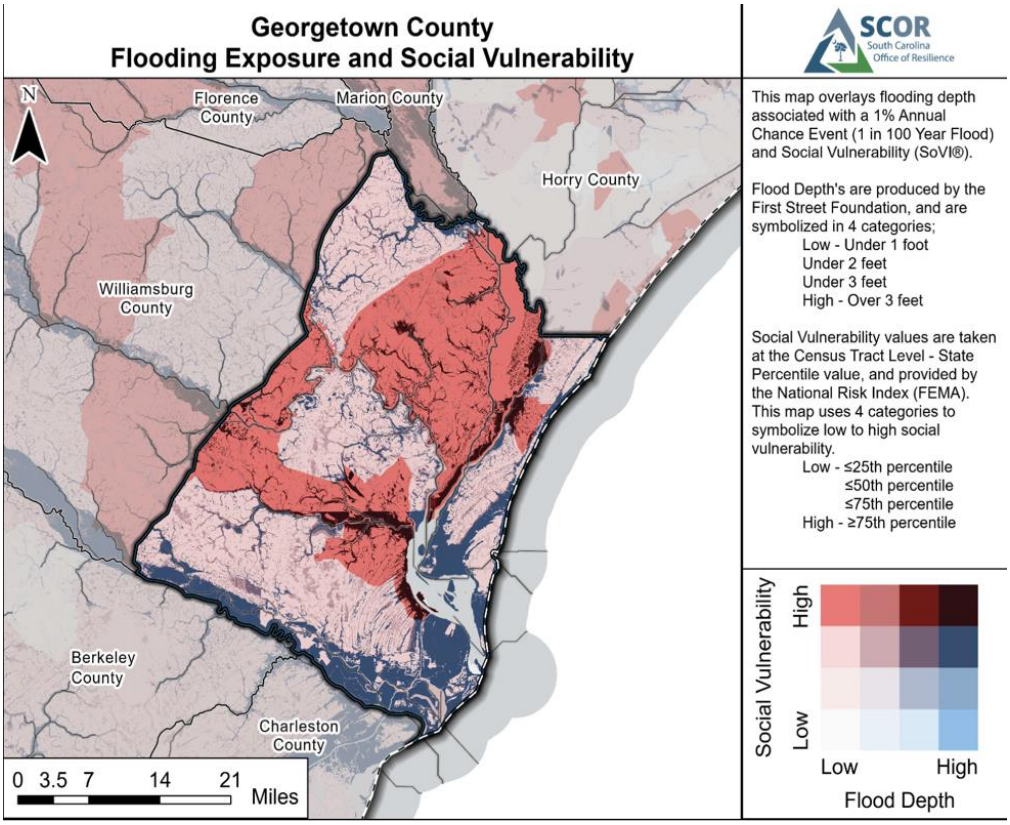
coastal hazards. The benefits of hazard mapping and data are best described when stating that "advance actions to lessen property damage and human injury are much more cost-effective than after-the-fact reconstruction" (Godshalk, 1999, 17). NOAA has calculated that "For every dollar invested in mitigation strategies, the nation saves about eleven dollars in future costs" and "collectively, mitigation programs, such as those encouraging more stringent building codes, save the American public about $3.4 billion every year" (Hazard Mitigation Value, 2023). NOAA presents many other statistics in addition to these that emphasize the value of hazard mitigation for communities. FEMA (2023) conducts Loss Avoidance Studies that measure how effective a plan has been at reducing losses. It is not just beneficial to have a hazard mitigation plan but necessary for the development of communities as plans help to reduce the risks from disasters.

When talking about risk reduction and hazard mitigation planning, it is important to realize that these plans are not just necessary for reducing the risk at a community level but at an individual level too. At the state-local level, the University of South Carolina has completed two studies that evaluate vulnerability in communities. The Social Vulnerability Index uses 29 socioeconomic variables to analyze a community's ability to prepare for and recover from disaster (USC, 2014). Another study completed by the Hazards and Vulnerability Research Institute Baseline Resilience Indicators for Communities (BRIC) study. BRIC focuses on six categories of community disaster resilience to be compared at the county level. It allows counties to see specific drivers behind resilience and to measure progress made towards resiliency (USC, 2015). The data produced by these studies are important for knowing more specifically who is more vulnerable and what specific hazards create more risk. As previously stated, FEMA has created the National Risk Index that further develops the study of social vulnerability to include

expected annual loss and community resilience to evaluate a county's overall risk (FEMA, 2023).

The South Carolina Office of Resilience (SCOR), which is tasked with developing and implementing a statewide resilience plan, also provides local planning officials with several resources to aid the process of development. This includes a Draft Flood Vulnerability Assessment and a County Flooding Exposure and Social Vulnerability study which expands on the research previous done at the University of South Carolina (SCOR, 2023, 23), Georgetown County's map is pictured below in Figure 3. Not only does the SCOR provide studies like these, but their website provides local planners with access to resources like FEMA's National Risk Index and links to other state-led efforts related to hazard mitigation and resilience. These are only just some of the resources that are available to planners. Efforts are being made at all levels of government, from global to local, to enhance the methods used in disaster risk reduction to help build more resilience in communities. In developing a hazard mitigation plan, planners should try to use all available resources to gain the most knowledge about what actions need to be prioritized to make the community more resilient.

Figure 5: Georgetown Flood Exposure and Social Vulnerability Assessment (SCOR 2023)



The following required elements after the risk assessment are mitigation strategy, plan maintenance, plan update and adoption (FEMA, 2023, 16). These elements build on the risk assessment to establish projects and a strategy for the county to continue the mitigation process. An effective mitigation plan does not stop at the adoption of the plan. Communities should be implementing actions to reduce risk, recommended actions such as nature-based solutions will be discussed further in the following sections. The goal of the plan is to reduce risk and vulnerabilities over time. The goals established for the plan should be implemented into these sections by developing strategies and actions to take to reduce risk.

Analysis

Sustainable Development Goal 11 is to "make cities and human settlements inclusive, safe, resilient, and sustainable" (United Nations, 2023). Hazard mitigation plans help to achieve this goal by setting a framework for preparation and recovery for communities to use when affected by disasters. Goal 11 is not the only goal that disaster risk reduction is incorporated into, disaster risk touches Goal 1: End Poverty, Goal 2: Zero Hunger, Goal 3: Health and Well-being, Goal 4: Education for All, Goal 6: Clean Water, Goal 9: Infrastructure, Industrialization, and Innovation, Goal 13: Climate Change, Goal 14: Life Below Water, and Goal 15: Life on Land; however, Goal 11 provides specific targets and indicators to measure risk reduction (UNISDR 2014, 1). Target 11.5 states "By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations" (United Nations, 2023). This target can be measured by the number of those affected by disaster and by the economic losses. It is reported that in 2022, 387 natural disasters were recorded, 30, 704 lives were lost, affected roughly 185 million individuals, and totaled around $223.8 billion in economic losses (CRED, 2022). The number of disasters and economic losses suffered increased from the previous year. The United States suffered from $155.8 billion in economic losses from 26 disasters, with flooding contributing most to these two numbers.

An additional target that helps to measure disaster risk is target 11.b whose goal is to increase "the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement…holistic disaster risk management at all levels" (United Nations, 2023). The best way to measure this target is by how many countries

have risk reduction strategies and the proportion of communities that develop their own strategies in line with the national plan.

On a global scale, the United Nations Office of Disaster Risk Reduction (UNDRR) has developed a framework for nations to follow to reduce the effects of disasters. The Sendai Framework sets the standards for nations to follow for disaster risk reduction to maximize the world's efforts to prepare for and mitigate disasters. It was adopted in 2015 at the United Nations World Conference on Disaster Risk Reduction to build on previous work from the 2005 risk reduction conference. The conference established a framework of priorities for countries to follow that include understanding disaster risk, strengthening disaster risk governance to manage risk reduction, investing in disaster risk reduction for resilience, and enhancing disaster preparedness for an effective response (United Nations, 2015, 7). The framework is meant to help integrate disaster risk reduction at all levels, local, national, regional, and global, to minimize economic and human loss surrounding disasters. Each priority outlines activities that states can use when relevant to prepare for and mitigate disasters. This helps measure target 11.b by documenting communities' efforts to implement risk reduction strategies. The Global Facility for Disaster Reduction and Recovery (GFDRR) has taken gone even further to establish a work plan called "Managing Disaster Risk for a Resilient Future" that identifies five pillars of action – risk identification, risk reduction, preparedness, financial protection, and resilient recovery – that can be used to further implement the Sendai Framework priorities and targets (GFDRR, 2015, 3-7). Nations can use these priorities and pillars to ensure they are developing mitigation plans that focus on sustainable development and building resilience in communities.

Steps taken by the UNDRR to further implement the Sendai Framework include creating a database for voluntary commitments. There are about 112 commitments that allow

organizations and relevant stakeholders to document their efforts to implement the Sendai Framework. It informs the public on who is doing what and where to reduce disaster risk while allowing stakeholders to report on their progress (UNDRR, 2023). The platform gives information on the Sendai priorities the company is focused on, selected indicators that they are measuring, the sustainable development goals they are hitting, as well as a full description of the commitment that includes the budget, scope, and progress reports. Outside of these commitments, the United Nations reports that as of 2022, the "number of countries with local disaster risk reduction strategies nearly doubled between 205 and 2021 (51 to 98 countries)" (SDG Report, 2022, 18). In addition to the commitments, UNDRR has another resource called Prevention Web, which is another platform dedicated to information sharing about disaster risk reduction and resilience (Prevention Web, 2023). Platforms like this one allow for risk reduction practices to be shared globally, and the UNDRR provides several similar resources that allow countries to share information on disaster risk (UNDRR n.d.). This is important because disasters affect everyone, and some communities may develop strong strategies that could help similar communities in different parts of the world. Local planners should utilize these resources to find policies that may be beneficial to their community in building resiliency.

By committing to the Sendai Framework, nations agree to not only a global effort at disaster risk reduction but one that must also be done internally at the local level. Part of target 11.b is to measure not only national strategies, but local ones too. FEMA helps to measure the United States progress in achieving this goal by not only having a National Mitigation Investment Strategy but by also tracking which states have developed their own state hazard mitigation plans (DHS, 2019). It is reported that "all 50 states, the District of Columbia, and five territories… have approved mitigation plans. A total of over 24,700 local governments and 240

tribal governments have approved or approvable-pending-adoption mitigation plans" (FEMA, 2023). The National Mitigation Investment Strategy goals are to show how mitigation investments reduce risk, coordinate mitigation investments to reduce risk and to make mitigation investment standard practice (DHS, 2019, ii). The strategy emphasizes the importance of integrating mitigation activities throughout states and in coordination with private shareholders. Hazard Mitigation is most effective in reducing risk and loss when the whole community is involved.

In relation to this, FEMA has the Hazard Mitigation Grant Program which provides funds to states and local communities to aid mitigation efforts (FEMA, 2023). The federal government provides states and local communities with a monetary incentive, which is done through grants, to encourage state leaders and planners to develop and implement these plans. The States that develop enhanced hazard mitigation plans can "receive 20% of estimated eligible Stafford Act assistance instead of 15%" and as of 2022 there are only 15 states that have these plans, South Carolina is not included (FEMA, 2022). This extra funding can be beneficial for the community, especially coastal communities that are affected the most by storms and flooding. Ken Worman, the chief of the Hazard Mitigation Planning Division and state hazard mitigation officer for the California Emergency Management Agency, describes in an article he writes that state hazard mitigation plans are beneficial for a sustainable and resilient community. Plans are useful for all communities because they "reduce or eliminate the long-term risk to human life and property from natural, human-caused and technological hazards and their effects" (Worman, 2011). This is not just applicable to California and coastal states, but to the globe in preparation for a resilient future. To achieve this elevated status, states must go beyond the minimum requirements set by FEMA.

There are no set guidelines for states to follow to achieve this, but if planners utilize all resources possible to gain the most awareness of disaster risk and develop plans that implement sustainable actions, states can have enhanced hazard mitigation plans. In the previous section of this report, I outlined what I thought were necessary steps planners should take and included many resources that can be used to achieve this elevated status. The purpose of this enhanced plan is to show that emergency management is committed to continuing the mitigation process past the development of the plan. This means plan integration, something that I will further elaborate on in the next section, to make sure all departments are trying to reduce risk, using all resources possible, and are "able to support risk reduction through disasters, staff turnover, or new funding" (FEMA, 2022). It is hard to say which specific aspects of a state hazard mitigation plan can give it this enhanced status, but I have learned that timing and funding affect the planning process and can impede a state's ability to create and continue developing an enhanced hazard mitigation plan. Figure 6 shows the economic losses to South Carolina from hazard events. The Waccamaw region, and most of the coast, is represented by the darkest green, which means they suffer the most in annualized hazard loss from anywhere between $3.9 billion and $5.6 billion (FEMA, 2018, 197). These numbers not only emphasize how important hazard mitigation plans and risk reduction strategies are for the region to help limit the economic losses, but also how important federal funding is to this region considering having an updated plan is a requirement to get funding (FEMA, 2023). The region has only suffered from one declared disaster in the last year, Hurricane Ian, but that does not mean other hazardous events have not occurred to negatively affect the region (FEMA, n.d.).

Figure 6: Economic Losses from Hazards (SCHMP 2018)

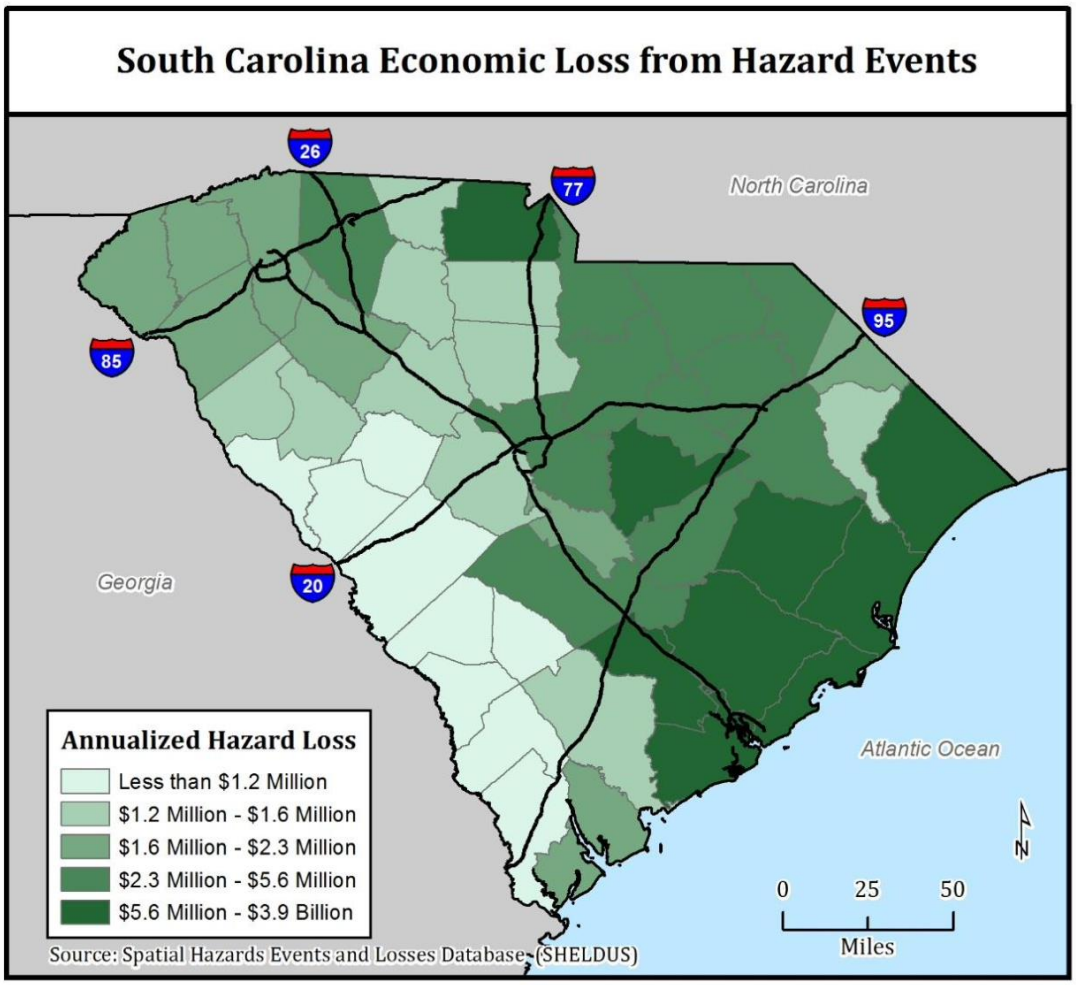


Figure 99: Economic Loss from Hazard Events

Simply by developing plans, counties are implementing the Sustainable Development Goals. By continuing this, and by ensuring that plans are continuously updated, the Waccamaw Region and its counties are hitting these targets under Goal 11. Target 11.5 is all about reducing the risk to those who are affected and decreasing the economic losses caused by disasters. Hazard mitigation plans help to do this but by emphasizing which hazards are more costly and to whom this target can be reached. As for target 11.b, "Implement policies for inclusion, resource efficiency and disaster risk reduction," the development of these plans is not enough. Planners

need to have integrated and localized disaster risk management that encourages sustainable development, which in turn will increase resilience and reduce risks (Ritchie & Mispy, 2018).

Recommendations

Several recommendations for the development of local hazard mitigation plans are to emphasize plan integration, incorporate green infrastructure or nature-based solutions, and utilize all available funding options that aid in creating the most effective plan. Incorporating these recommendations into the planning process will only benefit the community by allowing for more sustainable development and build resiliency to combat whatever risks the future holds.

Plan integration is "the process of harmonizing a network of plans to support a community priority, such as climate resilience" (Berke et. al., 2021). This can be done by aligning the goals of the Comprehensive Plan, Zoning Ordinances, and other similar community plans with the hazard mitigation plan to create a more cohesive plan that encourages sustainable development (Schwab, 2010, v-vi). The National Mitigation Investment Strategy "encourage[s] plan integration" (DHS, 2019, 15) as one of its recommendations to "coordinate mitigation investments to reduce risk" (DHS, 2019, 10). This means there should be consistency between and among all plans, which includes long term plans, local land use regulations and code enforcement. Planners should be able to identify similarities in plan goals so that they can limit conflicts and encourage coherence among all plans. One way to do this is by creating a community plan list that tracks what plans have been adopted, when they were adopted, and how often they need to be updated (NJOCM, 2010, 4).

Coherence will allow the community to thrive by using plans to their greatest potential, "by better understanding the spatial impacts of plans, goals, and policies, communities can make

better use of limited resources, funding, and capacity" (Berke et. al., 2021). Planners can take steps during the planning process to achieve this by taking advantage of plan or code updates to advocate for plan integration and climate resilience. These actions promote sustainably development by "ensuring that plans result in complementary policies that build resilience in at-risk geographies is crucial to long-term community health and safety" (Berke et. al., 2021). Plan integration is beneficial for communities because it helps to reduce the risks and costs associated with hazards, something that will only help in the future development of the community. This can be done in Georgetown, and more so at the Waccamaw Region Council of Governments because they are the center of the region, by having the local planners keep a running list of all community plans and goals to be able to get a broader view as to how these plans are interconnected.

Nature-based solutions, which are defined as "sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to build more resilient communities," (FEMA, 2021, 4) are identified as cost-effective ways to help invest in mitigation efforts by the National Mitigation Investment Strategy (DHS, 2019, 4). FEMA identifies three categories of nature-based solutions. First, the watershed or landscape scale that uses interconnected systems of natural areas and open space, such as land conservation or greenways. Next, the neighborhood or site scale includes projects like rain gardens, green streets, and rainwater harvesting. Lastly, there are coastal areas solutions that are specifically designed to support coastal resilience. These include projects such as coastal wetlands, oyster reefs, dunes and living shorelines (2021, 5-9). Implementing these solutions can help to reduce the effects of hazards. Solutions that could be used in the Waccamaw Region are land conservation to keep development away from hazards and living shorelines or dunes that

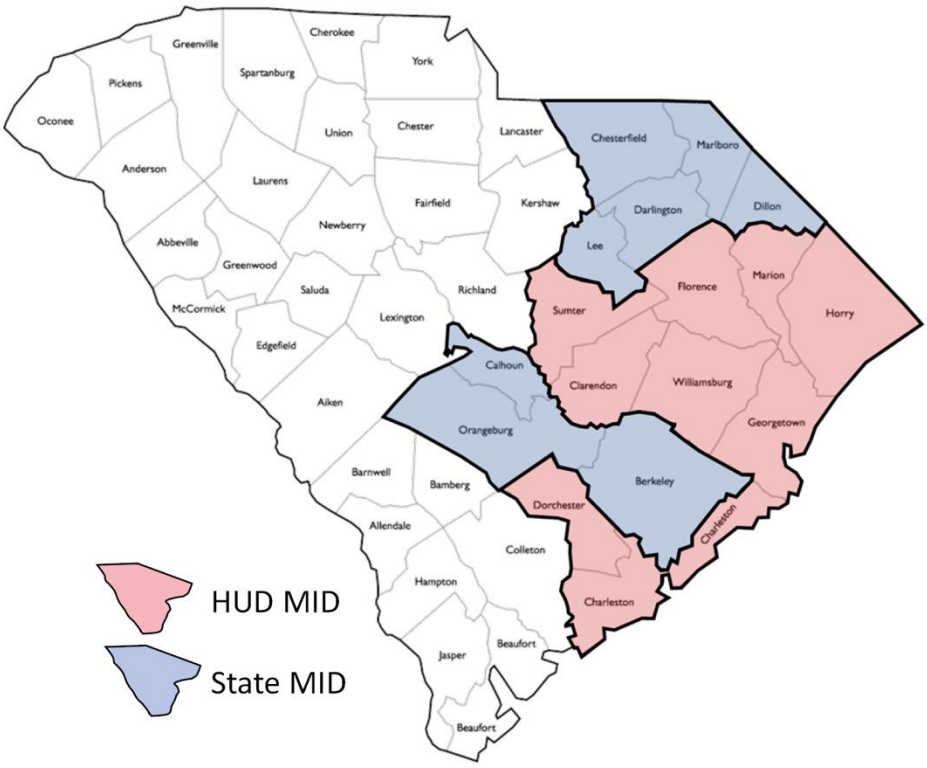
can mitigate the effects waves have on the environment. Nature-based solutions not only help mitigate hazard effects but also provide “environmental, economic, and social advantages that improve a community’s quality of life and make it more attractive to new residents and businesses” (FEMA, 2021, 11).

Technology has made it much easier for information to be shared. There are a wide range of resources available to planners and emergency management that can aid in the understanding of risks when creating a hazard mitigation plan that best fits the community’s needs. These resources, which include those previous mentioned, range from data sets, risk information, different mapping software that can predict and analysis different hazards effects, and other sources that provide information on successful mitigation practices. The National Mitigation Investment Strategy places an emphasis on the need for mitigation investments, and within that recommends that such information be shared to provide the biggest picture of the risks that hazards possess (DHS, 2019). In addition to hazard research, funding is another important resource for planners to have when creating hazard mitigation plans.

FEMA provides communities with several funding options to make such investments that provide communities with “a critical funding opportunity to reduce risk to individuals and property from natural hazards” (Thomas, 2014, 4). Most grants require that applicants have a hazard mitigation plan (FEMA, 2023). These programs include the Hazard Mitigation Grant Program (HMGP) and the Flood Mitigation Assistance (FMA) program. It should be noted that that both these grants have other requirements as well, including parameters such as who can apply and for what kind of projects; however, I do not find it necessary to focus on these as they can be met easily if the applicant has an approved mitigation plan (44 CFR 206.434). As mentioned before, states are also eligible for an increase in funding if the state hazard mitigation

plan receives the elevated status of being an enhanced hazard mitigation plan (FEMA, 2022). The Building Resilient Infrastructure and Communities program is one example of the various funding opportunities provided by FEMA that assists in hazard mitigation projects for communities who have had a major disaster declaration (FEMA, 2023). Another source of federal funding is offered by the Department of Housing and Urban Development (HUD) through their Community Development Block Grant Disaster Recovery Funds (HUD, 2023). These funds help communities who are recovering from Presidentially declared disasters that may not have the resources to recover on their own. In 2020, South Carolina received a Community Development Block Grant Mitigation (CDBG-MIT) funds that would increase the total grant amount that the state receives to $162,188,000 (SCOR 2023). The Office of Resilience has identified the most impacted and distressed (MID) counties in South Carolina that all mitigation work would focus on, these areas are identified in Figure 7.

Figure 7: Most Impacted and Distressed (MID) Counties in South Carolina (SCOR 2023)



It should be noted that the Waccamaw Region is identified by HUD and the state of South Carolina as being most impacted and distressed. In addition, NOAA provides funding through the Community-Based Restoration Program and the National Coastal Resilience Fund (FEMA, 2021, 25). Under the Clean Water Act, the Environmental Protection Agency (EPA) created the Section 319 Nonpoint Source Management Program that can be used for projects directed at water quality (FEMA, 2021, 27). In 2013, the Forestland Stewards Initiative was established by the National Fish and Wildlife Foundation and International Paper to provide grants to help conserve and restore the southern forests. So far, the Initiative has cultivated $192 million in total conservation impact, which includes project funding and leveraged funds (NFWF, 2022).

Federal sources are not the only place where funding is available, and it does not need to only be funding direct at hazard mitigation. State governments can offer their own funding

opportunities for local communities (Thomas, 2014, 5). Often times funding is a problem that arises at the local level, so planners should try to find different funding sources in other community aspects that can help to build community resilience. This can allow for communities to implement development projects while also implementing hazard mitigation practices, for example, by applying for water quality grants (FEMA, 2021). The use of various funding options builds on the importance of plan integration for the sustainable development of the community because it shows how effective understanding where the goals of the county overlap can be for the growth of the county. Implementing resilience practices into communities can help to improve the capabilities they have to recover quickly and with less costs so that hopefully the need for federal funds because less of a necessity. Federal funding is one of the only ways communities are receiving funds for mitigation projects, but it does not have to be this way. If communities can find a way to partner with different industries, there could be a more holistic approach to sustainable development.

Conclusion

Hazard Mitigation Plans are essential for protecting the health and safety of the community (APA, 2020, 8). The planning process is important in creating a plan that best supports the community's goals. The Waccamaw Region has a diverse geography and population that needs the best possible plans to achieve resilience. Important aspects of the planning process that need to be emphasized are community involvement and understanding the complex risks hazards pose to the community. This can be achieved by building resilience through sustainable development, which is always easier said than done. Efforts can be made by utilizing the planning process to put an emphasis on resiliency and sustainable development.

The planning process is the first step towards improving the effectiveness of hazard mitigation plans. During this step, planners can integrate other community plans so that there is a cohesive policy throughout the county that allows for sustainable development. This step is also where planners can emphasize the need for green infrastructure and other nature-based solutions because they allow us to use our environment to develop the community in a more sustainable way. Finally, the planning process is when all the data and information is collected. As much as data can be boring to the average person, the stories it can tell can be very revealing into the risks that the community faces in future disasters. Disasters are going to continue to affect the region, it is very hopeful to think we can stop them, but we cannot, the only thing we can do is comeback stronger afterwards. The most important thing community planners, emergency management, and others interested in combating the risks of disaster is to understand the importance of creating hazard mitigation plans that emphasize building resilience. The United Nations Sustainable Development Goal 11 is to "make cities and human settlements inclusive, safe, resilient, and sustainable" (UNSGD 11). The Waccamaw Region can achieve this goal by continuously updating each counties' hazard mitigation plans with sustainable goals and actions that help to protect the community from future risks.

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