NORTH CAROLINA

RESILIENT COMMUNITIES PLANNING GUIDE

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NCORR
NORTH CAROLINA OFFICE OF RECOVERY AND RESILIENCY

N★C DPS
DEPARTMENT OF PUBLIC SAFETY

EQUAL HOUSING OPPORTUNITY

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Executive Summary

North Carolina is blessed with abundant natural resources and scenic beauty; rich farmland; innovative and dynamic communities with world-renown centers of education; and—our greatest asset—smart, resilient, and friendly people. Businesses and people continue to flock to this state, and many communities have seen record population growth in the past ten years, especially along our coasts, our mountains, and our urban centers.

During this same period, many North Carolinians have suffered greatly, losing their homes and livelihoods to major hurricanes and devastating flash floods, and wrestling with the more frequent challenges of king tides, rising groundwater, periodic but intense drought, and higher temperatures. Population growth has meant that urban and suburban communities have sprawled into farmland and floodplains, challenging our stormwater and drainage systems and causing unintended harm to downstream communities.

These gifts and challenges raise important questions we must address if we are to continue to build a stronger, healthier, and more prosperous North Carolina for all. How do we support recovery from these major disasters, while also supporting growth and innovation? How do we make room for new people and new ideas, while not leaving folks behind or damaging what makes this state special and unique? How do we continue to build greater resilience to the challenges of natural disasters and climate change, while making room for uncertainty? How do we welcome new residents and foster economic growth without straining natural defenses and our existing infrastructure? Most importantly, how do we do this together?

The answers to these questions begin at the local level. Local community planning for land use, transportation, public health,

and public participation is the key to building greater community resilience because—although global warming and the increased threats of flooding, wind, wildfire, and high heat are widespread problems that affect our whole state—often the best solutions for adapting to and living with these changes are local. To do this, local communities must first understand where they are at risk—both already experiencing problems and where they might in the future—and then create a plan to address those risks and become more resilient.

The *North Carolina Resilient Communities Planning Guide* will help you and your community plan for natural hazards and climate resilience. It provides a step-by-step guide to walk you through the stages of resilience planning—from gathering the people and information you need to understand the challenges your community is facing, to assessing the problem through mapping and other tools, to creating a plan that prioritizes actions you can take to protect your community and build resilience, and, finally, to implementing your projects on the ground.

The *Guide* does this in two parts. First, the *Playbook* helps you create a high-quality community resilience action and implementation plan. You could also use the *Playbook* to develop a resilience component to add to a more general plan (such as a comprehensive plan or hazard mitigation plan). As a resource with statewide relevance, the *Playbook* provides a wide variety of information to address the resilience concerns of different communities. You can navigate to the desired content and level of detail by first reviewing the Table of Contents and identifying sections of interest. The *Playbook* provides a menu of options so that you can take what you need and leave what you don't. The second part of the *Guide*, the *Idea Book*, provides real-life examples of resilience strategies and projects, with practical tips and inspiration from across North Carolina.

The *Playbook* will guide you through a vulnerability and risk assessment process, with tools for engaging key interests and members of the public on your community's needs. It will walk you through the steps you need to take to assess your capacity, gather the right team, and document your community's resilience vision and goals. It will show you how to analyze your community's vulnerabilities to climate hazards using publicly available data, set goals, and draft a cohesive resilience strategy. This strategy will include proposed policies, programs, and projects prioritized by your community that help build resilience to climate hazards and other natural disasters. Finally, the *Playbook* will help you take the steps necessary to implement your strategy based on available resources and set a durable framework for learning from successes and adapting to changes. Along the way, the *Playbook* connects you to North Carolina-specific information and focuses on the issues most critical to the Tar Heel State.

Throughout this process, the *Playbook* will help you engage with key stakeholders and the public. By engaging with your community, you tap into the best sources of knowledge—both about the challenges of climate change and natural hazards as they exist on the ground, but also about what could be the best, most doable solutions. By prioritizing your proposed resilience actions, you can focus your time and resources on the most impactful ways to build your community's resilience. And by getting buy-in from your community throughout the process, approvals and funding will be easier to achieve.

Building community resilience to natural disasters and climate change is not a one-and-done strategy. Resilience requires ongoing commitment to monitor, evaluate, and strategize so we can adapt to changes in our environment, our population, and our capacity. We must remain flexible so that we can address new challenges and take advantage of new opportunities as they arise. This work is not easy, but it is important because it will protect us physically and economically the next time a storm, a wildfire, or a pandemic hits. The more resilient our community is to such shocks, the less harm we will experience in the first place—and we will be better able to bounce back faster when they do knock us down.

Climate change—and the increased risks of heavy rainfall and flooding, drought and wildfires, wind damage and heat waves—can seem like overwhelming problems that we can't possibly solve at the local level. Fortunately for us, this is not true. Local decisions, investments, and development patterns often determine how much harm disasters and climate impacts cause for residents, infrastructure, and businesses—for better or for worse. This means that we can play a big role in protecting ourselves and building more resilient communities by using information and a plan to guide local decisions. The *North Carolina Resilient Communities Planning Guide* will help you do just that.

Introduction

Welcome to the *North Carolina Resilient Communities Planning Guide*

Climate change and natural hazards affect every corner of North Carolina. From the mountains to the coastal plain, climate hazards are shaping North Carolina's diverse landscapes and communities. According to the North Carolina Climate Science Report (2020), North Carolina has warmed by about one degree Fahrenheit over the past century, causing the weather to become more warm, wet, and humid. Climatologists predict that in the coming decades the state will experience sea level rise, more hot days and nights, and more extreme rainfall. The state is likely to see more frequent and intense storms, such as Hurricanes Matthew (2016), Florence (2018), and Dorian (2019), and Tropical Storm Fred (2021). These storm events resulted in billions of dollars in damages to communities across the state, underscoring the economic and social costs associated with climate change and the importance of preparing for climate-related hazards.

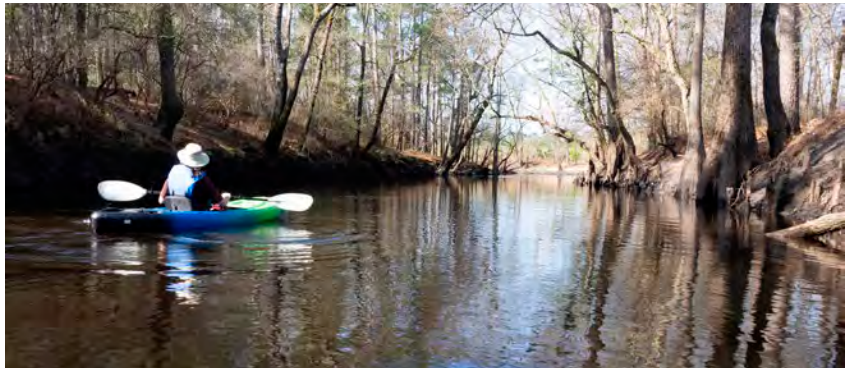
But the news is not all bad. There are many steps that communities can take to be prepared, to grow, and even to prosper as the climate changes. Many North Carolina communities are already taking action to build resilience, through investments like infrastructure upgrades, land conservation, and wise community development. The *North Carolina Resilient Communities Planning Guide* empowers communities to build resilience to climate change and natural hazards. The *Guide* fills the need for a streamlined, standard process for determining the right steps forward based on the best available science and stakeholder input. The *Guide* encourages each community to tailor strategies to match local values, culture, and assets.

In the *Guide*, we use the term "community" to refer to a place, county, or region that is the subject of the resilience plan.

Who Is the *Guide* For?

Our intention with the *Guide* is to enable local governments, a critical source of knowledge, authority, and funding, to take strategic action and build resilience. We also hope that other organizations outside local government will use the *Guide* to develop resilience strategies. For example, an organization representing multiple counties or defined by natural boundaries like a watershed could develop a regional plan based on the *Guide*. A nonprofit or other non-governmental group could examine resilience on behalf of their community using this *Guide*. These governments or organizations can use the *Guide* independently or can work with an outside entity, like a university group or consultant. Communities across North Carolina are already responding to climate challenges with innovative ideas, plans and projects, as highlighted in the *Idea Book*.

You do not need to create a standalone resilience plan to use the *Guide*. The *Guide* can help you identify and integrate resilience goals and strategies into planning documents like a hazard mitigation plan, land use plan, transportation plan, or stormwater or drainage plan. Resilience is also critical to economic development. To access federal Economic Development Administration funds, a local government must be part of a Comprehensive Economic Development Strategy (CEDS), which must include a section on resilience. Any North Carolina jurisdiction that wishes to



guide development through zoning ordinances must have a comprehensive plan. North Carolina General Statute Chapter 160D lists possible local comprehensive plan content, including "mitigation of natural hazards such as flooding, winds, wildfires, and unstable lands" (see resources page for source). These are just some examples of the ways that the *Guide* can help integrate resilience into other planning documents. Ideally, a community will use this *Guide* to look across multiple planning documents to ensure consistent commitment to resilience.

What Is Resilience?

Resilience is more than reducing the impact of hazards. The North Carolina Climate Risk Assessment and Resilience Plan (NC Resilience Plan, 2020) defines resilience as "the capacity of a community or business to prevent, withstand, respond to, and recover from a disruption." It encompasses the characteristics that enable a community to survive and thrive when bad things happen. Resilience helps us build the future that we want—it helps us bounce forward after a disaster, not just bounce back.

The NC Resilience Plan also tells us that "a resilient North Carolina is a state where our communities, economies, and ecosystems are better able to rebound, positively adapt to, and thrive amid changing conditions and challenges, including disasters and climate change; to maintain quality of life, healthy growth, and durable systems; and to conserve resources for present and future generations." Your community may wish to embrace its own definition of resilience, tailored to its unique location, values, and history.

We have a hazard mitigation plan. What is the difference between hazard mitigation and resilience?
Hazard mitigation planning is one part of resilience planning. Hazard mitigation focuses on reducing the direct impacts of natural hazards. Resilience includes reducing direct impacts but also considers the community's capacity to cope with and adapt to them. This capacity comes from many places, including the physical capacity of infrastructure along with the state of the economy, housing conditions, public health, and ecosystem health. Climate resilience also incorporates slow-onset hazards, like sea level rise, which will generate gradual but permanent flooding issues. Typically hazard mitigation has focused on rapid-onset hazards like hurricanes.

Why Should North Carolina Communities Plan for Resilience?

Plans are a fundamental element of building resilience to climate hazards and natural disasters. This is true whether plans focus exclusively on resilience or incorporate resilience into a different

focus area like transportation. A plan transforms separate ideas about problem areas and potential solutions into a comprehensive strategy for building resilience. A plan creates a clear path for achieving community goals. And a plan demonstrates your community's sustained commitment to enhancing resilience—a very important component when seeking resources like grant funding.

By planning for our changing climate today, we retain more options than if we wait to plan. Climate conditions are already changing, and so action is both time-sensitive and urgent. Rapid growth in some parts of the state and climate change are changing how hazards affect the everyday lives of North Carolinians. By acting now, communities will have the greatest number of options to adapt to changing conditions. For example, if we invest today in infrastructure that can protect us from storms we expect in fifty years, rather than just the storms we have today, we will avoid future damages and reduce the need to rebuild infrastructure too soon.

How Will the *Resilient Communities Planning Guide* Help My Community?

The *North Carolina Resilient Communities Planning Guide* has two primary components: Volume 1, a *Playbook*, and Volume 2, an *Idea Book*. The *Playbook* guides users through a process to develop a standalone resilience plan or content for inclusion in another kind of plan or official strategic document. The *Idea Book* has a Public Participation Supplement (Appendix B) that focuses on making the most of public engagement to enrich your resilience plan and engage the community in planning and next steps. The *Idea Book* reviews a variety of innovative strategies used to advance local resilience and provides inspiration from other communities in the form of real-life case studies.

My community is not able to undertake a big resilience planning effort right now.
Not a problem. The *Guide* offers many opportunities for taking what you want and leaving the rest. The information will be useful whether you are creating an entirely new plan, studying a problem, or just starting to explore ideas. Most steps in the *Guide* have options to scale up or scale down the step, based on available resources, capacity, and interest.

The *Guide* provides a standard process for resilience planning, whether you are creating a standalone plan or inserting elements of resilience into a different plan. The fundamental steps for creating a high-quality, equitable, and actionable resilience plan for your community include:

- Engaging key interests and members of the public on your community's needs
- Analyzing your community's vulnerabilities to climate hazards using publicly available data
- Setting goals and drafting a cohesive strategy, including policies, programs, and projects that help build community resilience to climate hazards
- Implementing the strategy based on available resources and setting a durable framework for learning from successes and adapting to changes along the way

Resilience planning is an ongoing practice, not a one-and-done strategy. Just like other planning processes, it is important to evaluate your resilience plan or strategy periodically to celebrate your progress and identify areas where values have shifted, the strategy needs to be amended, or increased capacity is needed to complete the project. Annual plan reviews are recommended, and complete updates or rewrites are suggested at a minimum every five years or as community needs require it. Planning, when done well, is an awareness-generating process and requires that plans be updated regularly because plans are developed in a constantly changing environment.

WHAT MAKES PLANNING FOR RESILIENCE DIFFERENT?

Building resilience to climate hazards is different from other types of planning in some ways. Special aspects of resilience planning include building relationships across jurisdictions and decision-makers, evolving needs, and uncertainty.[1]

Building relationships across jurisdictions and decision-makers: Proactive collaboration between various decision-makers and private parties is essential to building resilience. Climate hazards do not care about political or property boundaries. Furthermore, the authority and capacity of private landowners, local government, and state government are all different, and all are needed to build resilience. The **Collaboration** topic in the *Idea Book* provides additional ideas about building relationships across jurisdictions and decision-makers.

Evolving needs and uncertainty: We understand that the future will not look like the past. Because resilience needs will change over time, it is important to make sure that resilience plans are dynamic, too. This requires monitoring changing climate trends along with figuring out if local resilience strategies are generating desired outcomes. Phase 3 – Plan provides guidance on creating a flexible and responsive plan. Phase 4 – Implement provides guidance on measuring outcomes and adjusting course if needed.

[1] Sharifi, A. "A critical review of selected tools for assessing community resilience," *Ecological Indicators* 69 (2016) 629-647.

THE PLAYBOOK

NORTH CAROLINA
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Finding Your Way Around the Playbook

The *Playbook* is organized in four phases – Prepare, Assess, Plan, and Implement. You may complete all phases consecutively, or you may want to use certain sections and not others, depending on your community's needs and capacity.

- **Phase 1 – Prepare.** In Phase 1 you will create a customized scope of work, evaluate your community's capacity and level of preparedness, convene a steering committee, and create a community resilience vision statement and goals.
- **Phase 2 – Assess.** In Phase 2 you will develop your community's vulnerability assessment.
- **Phase 3 – Plan.** In Phase 3 you will develop and prioritize resilience strategies that, combined, form a plan. You will also identify and organize critical resources for success, adopt the plan if needed, and publish and communicate its strategies widely.
- **Phase 4 – Implement.** In Phase 4 you will implement the plan and assess and report progress.

The *Public Participation Supplement* covers best practices for community engagement across all four Phases.

As we've described, the work of building resilience is ongoing. As you implement strategies and learn from their successes, you should anticipate revisiting earlier phases with new information and perspectives. In fact, returning regularly to earlier phases will ensure that strategies are fresh and momentum continues.

The *Playbook* is just one component of the *North Carolina Resilient Communities Planning Guide*. The *Idea Book* provides a collection of resilience strategies and case studies to address a wide range of climate challenges, from coastal flooding to wildfire.

Figure 1. Resilience Planning and Action Process

The primary **elements of each phase** include:

- An introduction that summarizes the phase, its steps, and major outcomes.
- The "Why..." section explaining the importance of the phase for building community resilience and the motivation for the work.
- Two to four steps, with options for scaling the step up or down based on your community's needs, goals, and capacity. Many steps have optional associated exercises and templates. Exercises are included in the main text, while templates are in Appendix C.

GETTING READY

To lay the groundwork for your resilience planning effort, make sure that you have identified:

- ☐ The project's lead agency or organization
- ☐ A lead project manager
- ☐ Core project objectives
- ☐ A small group of two to five key staff who will form the core team for the project
- ☐ The departments, organizations, or staff that must endorse, support, or participate in your project; ensure that these organizations or individuals are on board

PHASE | 01
PREPARE

Exploring capacity, scoping the project, and setting goals are foundational to all resilience efforts. Phase 1 – Prepare details specific actions, information and resources to guide your community in the process of developing your resilience plan.

There are four steps in the Prepare phase:

Step 1.1 Assess capacity

Step 1.2 Create a scope of work and public participation framework

Step 1.3 Convene a steering committee

Step 1.4 Define your community's resilience vision and goals

STEP 1.1

Introduction: Why prepare?

We start with an assessment of your community's capacity in Step 1.1: Assess Capacity. This foundational step will help you right-size your project and find partners to add more staff and resources if desired. Developing a scope of work for your resilience plan, described in Step 1.2: Create a scope of work and work plan, establishes the boundaries for your resilience effort. It ensures that you are addressing issues, strategies, and challenges that are relevant to your community's needs and resources. This scope will guide you in determining appropriate levels of effort and resources related to public engagement, stakeholder collaboration, data collection, strategic planning, and plan implementation. In this step, you will also create a public participation framework to ensure that the plan is strengthened by community input and buy-in.

The most successful resilience planning efforts are championed by a broad range of community members and leaders. In addition to public participation, a steering committee will ensure that appropriate professional expertise is incorporated into your strategy. Steering committee engagement helps build collective commitment to successful plan implementation. Step 1.3: Convening a steering committee, covers development and agenda-building for your steering committee.

Finally, articulating resilience vision and goals, as captured in Step 1.4: Define your community's resilience vision and goals, will provide focus for your effort and reinforce the scope of the effort. Visions and goals can be helpful throughout a planning process. They can guide the use of limited resources. It can be helpful to refer to an agreed-upon vision and goals when disagreements come up or when a small detail or distraction takes center stage.

Step 1.1: Assess capacity

TASKS TO DO

☐	**1.1a: Assess capacity of the community or organization and identify gaps using the Assessing Capacity Exercise.**
☐	**1.1b: Locate needed resources (to address capacity using Appendix A. Potential Partners).**

1.1a: Assess capacity of the community or organization and identify gaps using the Assessing Capacity Exercise

Capacity can present a barrier to any kind of planning and implementation work, so it is important to assess your organization's capacity when you are in the Prepare phase of the planning process. With this knowledge, you will be able to scope a planning effort that fits your staff and resources or explore opportunities to partner with an external organization to help with the work you want to do. There are many resources and organizations available to assist local governments in all phases of building resilience. Also consider entities that will implement your plan, if not your department. Are they involved already? Do they have capacity to implement? It's a good idea to include potential implementers in the planning process from the beginning.

Use the questions in the Assessing Capacity Exercise to determine where additional assistance or experience may be needed. These questions will also help you understand what adopted plans, policies, and actions are already in place. This knowledge will help set the groundwork for your resilience planning effort and will also be valuable in Phase 2 – Assess, Phase 3 – Plan, and Phase 4 – Implement.

STEP 1.1

Assessing Capacity Exercise

WHO	PURPOSE
Project lead and/or core project team	Identify organizational capacity and gaps where assistance is needed. Use the following questions to identify gaps in capacity and where additional resources or technical expertise may be needed.

1. **Does the community have a building inspector, planner, certified floodplain manager (CFM), and/or emergency manager who could assist in understanding the community's vulnerability to hazards such as flooding, landslide, coastal hazards, etc.?**
2. **Does the community have relationships with larger organizations that might be helpful in planning or implementing resilience projects?** *See Appendix A. Potential Partners for ideas.* **What about local groups that could help connect with key stakeholder groups like faith or civic organizations or disaster relief networks?**
3. **Does your community have adopted plans that describe a community vision, values, or goals?** *The community vision, values, and goals may be helpful in developing a project scope that is consistent with existing community plans and desires.*
4. **Have you assessed your community's vulnerabilities in the past or do you know where to find this information? Does your community have adopted plans or documents, such as a hazard mitigation plan or wildfire management plan, that identify the community vulnerabilities to flooding, landslide, drought, wildfire, coastal hazards, or other vulnerabilities?** *Identifying plans that describe climate vulnerabilities may save time and money in your current planning process.*
5. **Do these or other adopted plans set policy, guide future investment for the community, or guide growth and development? Some examples include:**
   - Comprehensive, land use, small area, or corridor plan
   - Stormwater management plan
   - Transportation plan

- Hazard mitigation plan
- Emergency response plan
- Water, wastewater, or utilities plan
- Parks and recreation plan
- Housing plan
- Landslide plan
- Other special plans that examine special community issues or needs related to resilience

These documents will help ground your work in goals, strategies, and language that elected officials have already adopted.

6. **Do the adopted plans contain policies, actions, or projects that relate to resilience?** *Adopted policies, actions, or projects that relate to resilience demonstrate intentions that already have community buy-in. This analysis also helps you to understand what has been done and what has been identified as next steps in your resilience planning process. Use this information to frame how you move forward from this point.*

7. **Does your community participate in the FEMA National Flood Insurance Program (NFIP) or Community Rating System (CRS)?** *Communities that participate in the NFIP or CRS have adopted an ordinance regulating special flood hazards areas (SFHA). These communities may have additional policies, programs, or ordinances that will contribute to a resilience strategy.*

8. **Does the community have higher regulatory standards, like freeboard, or other policies that might help to guide development or infrastructure placement?** *Often, communities that participate in the NFIP or CRS have adopted standards above those that are minimally required by the state to regulate development in special flood hazard areas. Understanding these standards and policies will help inform your current efforts.*

9. **Does the community track repetitive loss properties within the NFIP?** *If your community does track repetitive loss, this will help you understand where there are "hot spots" for vulnerability to flooding or clusters of properties that have sustained repeated damage.*

10. **Does your community have a budget planning process that engages all departments?** *Understanding your community's budget process and how to get involved will ensure that projects identified through the planning process will be able to move forward into a recommended budget.*

11. **Does your community have a Capital Improvement Plan (CIP)?** *A CIP is the fiscal planning mechanism by which an elected body, such as a town council or board of commissioners, allocates its financial resources to implement long-term goals that are defined in adopted plans, studies, or other documents. The purpose of the CIP is to forecast and match projected revenues and major capital needs over a five-year period. Capital improvement planning is an important management tool that strengthens the linkage between*

STEP 1.1

community infrastructure needs and the financial capacity of the community. Understanding the CIP budget process and how to move projects into the process will ensure that actions in your adopted plan or strategy get implemented.

12. **Are projects identified in adopted plans incorporated in the budget and CIP? If not, why?** *Understanding if and why projects are being funded and implemented will help you learn how to move future projects forward. If projects are not being included and implemented, did they not make it into the budget planning process? Or did they go through the budget process but are not high enough priority to make it into the budget? Understanding these perspectives will help you better position projects identified through your current planning process for success.*

13. **Does your community have the capacity and time to write and manage grants or projects internally?** *If your community does not have the time and capacity to manage projects internally, how will your community retain the needed assistance? Will this require extra funding or time for the project? See Appendix A. Potential Partners for ideas on partners who may be able to assist your community.*

14. **Does your community have a standard process for seeking and retaining a consultant or firm for planning and infrastructure projects?** *Determine if your community has a process for hiring consultants. If not, see Appendix A. Potential Partners for ideas on partners who may be able to assist your community in developing the materials to hire a consultant.*

1.1b: Locate needed resources

After completing the Assessing Capacity Exercise, you should have a better understanding of where your community may need assistance in conducting the planning process and implementing its outcomes. In addition to Appendix A. Potential Partners, you may find additional ideas for partners in the *Idea Book* of the *North Carolina Resilient Communities Planning Guide*. The *Idea Book* calls out "Potential Project Leads, Experts, and Stakeholders" for each resilience topic, which may prompt additional ideas for external capacity.

STEP 1.2

Step 1.2: Create a scope of work and public participation framework

TASKS TO DO

☐	1.2a: Draft the scope of work, including Scoping Exercise. Use the Scope of Work Template in Appendix C, if desired.
☐	1.2b: Develop a public participation framework.

SCALE UP/DOWN

Ideas for Scaling Up Step 1.2:

- Conduct additional outreach and engagement.

Ideas for Scaling Down Step 1.2:

- Include a subset of your desired resilience planning tasks for this scope of work, or use a phased approach to make incremental progress on resilience planning.
- Integrate outreach & engagement with ongoing community activities or events.

1.2a: Draft the scope of work

A formal scope of work will guide you throughout your resiliency planning efforts. Creating your scope will allow you to define your project's boundaries and ensure all project needs are addressed. The scope of work serves the staff and volunteers who contribute to the plan; it can also help you build a scope of work for a consultant or partnering organization.

Your community's needs, budget, and schedule should drive the scope of work for your resilience planning efforts. The Scoping Exercise helps you think through what you hope to achieve through your resiliency planning efforts. The Scope of Work Template, found in Appendix C: Templates can be modified based on your needs, and it includes a step-by-step description of tasks, budget, and schedule for your community's resilience plan.

Your planning efforts do not have to lead to the creation of a standalone document, especially if you do not currently have the resources to create one. Particularly for smaller local governments, it may be more appropriate to include a resilience element for an existing plan or the creation of a document to provide supporting and enforceable language for a code update.

STEP 1.2

Scoping Exercise

WHO	PURPOSE
Project lead and/or core team	Identify key project elements that define the plan's scope of work. *Please answer the following questions. You will use your responses to create your scope of work, using the Scope of Work Template if desired. If none of the responses fit your needs, feel free to add your own response.*

1. **Is your resilience planning effort focused on one specific climate-related hazard or vulnerability or multiple hazards and vulnerabilities?**
   - ☐ One specific hazard or vulnerability (If yes, which one? _____)
   - ☐ Multiple hazards and vulnerabilities

2. **What is the geography or spatial extent of your resilience planning effort?**
   - ☐ Small area (e.g., neighborhood or specific location)
   - ☐ Community-wide (e.g., entire city, town, or county)
   - ☐ Regional (e.g., group of counties or watershed)

3. **What do you hope to achieve through your resilience planning effort? Select all that apply.**
   - ☐ **Share information and build awareness:** Gather and communicate information about community vulnerabilities and share solutions that are being or will be implemented to help build resilience.
   - ☐ **Develop a consensus-based community resilience vision and goals:** Facilitate opportunities to work collectively to define a shared resilience vision and goals.
   - ☐ **Assess hazards and vulnerabilities:** Analyze, map, and communicate the community's level of risk related to climate hazards.
   - ☐ **Select solutions to enhance resilience:** Learn about the range of strategies that help build resilience and choose the solutions that fit the community best.
   - ☐ **Implement strategies to build resilience:** Create a plan and identify the actions and resources needed to implement selected resilience strategies.
   - ☐ **Track and demonstrate progress on becoming more resilient.**
   - ☐ Other (describe): _____

4. **What type of resilience plan are you creating?**
   - ☐ A standalone comprehensive resilience plan
   - ☐ A resilience plan for a particular hazard

- ☐ A resilience element for an existing plan, like a land use plan or Comprehensive Economic Development Strategy
- ☐ Other (describe): _____

5. **Which of the following options best describes your resilience planning effort?**
   - ☐ **Limited:** Address a single resilience issue or implement a specific resilience project.
   - ☐ **Comprehensive:** Address multiple resilience-related challenges or a set of projects.
   - ☐ **Exploratory:** Investigate a range of potential solutions and/or develop flexible options that accommodate uncertainty.

6. **What is the time frame for actions that your resilience planning effort will include? Over what period of time do you want to investigate projected climate changes?** *There is a difference between these two questions. One is a time frame for implementing the actions in your plan and the other is a horizon for the climate impacts addressed. For example, a bridge might be rebuilt in the next five years but will be constructed to accommodate 100 years of projected sea level rise. A one- to two-year budget or a five-year capital improvement plan can be incorporated into any of the time frame options.*

7. **Which of the following elements do you intend to include in your final resilience plan?** *Some of these elements may be found in other plans or may already be completed; others will be developed as part of the steps described in this Guide. This can be noted in your scope of work.*
   - ☐ **Resilience vision, goals, and objectives:** Desired future state of resilience and how it will be accomplished
   - ☐ **Process and participation:** Description of the planning process and community outreach and engagement activities
   - ☐ **Community context:** Description of the area's planning and community history; description of related efforts that might inform your communitiy's resilience efforts; demographics and socioeconomic profile; important community assets, including natural, cultural, and historical landmarks; community infrastructure (including natural infrastructure such as trees, dunes, estuarine shorelines, wetlands, or floodplains that are important for their protective value)
   - ☐ **Hazard identification, vulnerability assessment, and risk analysis**
   - ☐ **Resilience strategy identification and prioritization**
   - ☐ **Implementation:** Details about how strategies will be actualized and how progress will be monitored

8. **Which internal or external partners will help you achieve these goals and the scope? How are you planning to work with them?** *See Appendix A. Potential Partners for ideas.*

Use these responses and any other relevant information to create your scope of work, using the Scope of Work Template (Appendix C) if desired.

STEP 1.2

1.2b: Develop a public participation framework

Establishing community support at the beginning of your project generates a high return on investment when it is time to adopt and implement your resilience plan. Benefits of investing in robust and meaningful public participation in the planning process include:

- **Setting project expectations** by describing what the plan can—and cannot—do.
- **Establishing your community's unique definition of resilience** and directly responding to the community's needs.
- **Understanding your community's readiness** for a range of resilience programs, policies, and projects.
- **Incorporating local knowledge** into the vulnerability assessment.
- **Fostering knowledge exchange and relationship building** to guide planning and implementation.
- **Including community-driven resilience ideas and strategies** in the planning effort.
- **Building consensus and momentum** needed for the planning project's success by finding common ground and transforming conflict into opportunities for mutual understanding.

While there are many benefits to public participation in the resiliency planning process, it takes time to engage your community, listen to feedback, and incorporate that into the planning process. Listening well and incorporating feedback where possible develops trust with your community and demonstrates that their input is valuable. Developing trust with the community is vital in developing your resilience plan and implementing projects long term. It is important to anticipate and allow time during your planning process for thoughtful engagement. Additionally, it is equally important to inform and educate your local government leadership about the value and time this type of engagement takes.

To support strong public participation, the *North Carolina Resilient Communities Planning Guide* provides a *Public Participation Supplement (Appendix B),* a companion document on effective public participation techniques. This supplement includes information to help you identify participants, best practices for equitable engagement, strategies for outreach and engagement, options to scale your approach, and ways to measure your success in engagement.

Before you select a community engagement technique like meetings or a survey, identify the intent of public participation for each phase. Each phase benefits from a different type of public feedback. For example, a particular time to emphasize local input is during the vulnerability assessment, in which local knowledge can ground truth findings that have been based on technical analysis and professional expertise, for example:

- Areas of frequent flooding after rainfall
- Other climate impacts outside of major disasters
- Places that flood outside the regulatory floodplain
- Non-climate stressors likely to intersect with climate stressors (e.g., population growth or decline)
- Community assets, both tangible and intangible, that may be vulnerable
- Historic or cultural connections to vulnerable landscapes
- Experiences with recent disaster and disaster recovery
- Communities' abilities to cope with identified impacts
- Other insights on the region's strengths and weaknesses

TIP

Reach out to planners or community organizers and ask what has been successful in the past in your community.

STEP 1.2

Public Participation Exercise

WHO	PURPOSE
Project lead, core team	Create a road map guiding your planning effort's outreach and engagement activities.

Part 1: Define overall public engagement approach.

Has your community or organization recently conducted any successful resident outreach and engagement efforts? What worked? What did not?

How will you share information about the project and event?

- ☐ Project-specific website
- ☐ Webpage on a preexisting website
- ☐ Direct mailings
- ☐ Email newsletter
- ☐ Social media
- ☐ Live stream/public access channel
- ☐ Resilience plan steering committee or other group of community stakeholders
- ☐ Trained community members (i.e., neighborhood ambassadors, block captains)
- ☐ Workshops or public meetings
- ☐ Other (describe) _____

How will you promote effective, accessible, and equitable outreach and engagement for this plan?

- ☐ Ensure multiple ways of participating at each project phase, such as in-person, virtual, verbal, written, etc.
- ☐ Provide online feedback avenues in the form of online surveys or virtual meetings
- ☐ Conduct targeted engagement for special groups like youth or seniors
- ☐ Conduct outreach at community events like an athletic tournament, festival, etc.
  List 2-3 specific events: _____
- ☐ Provide refreshments at events
- ☐ Host kid-friendly events
- ☐ Enhance accessibility of outreach and engagement approaches
- ☐ Incentivize participation through raffles, gift cards, or activities
- ☐ Compensate community members serving on the steering committee

- ☐ Translate written or audio-visual materials
  Languages: _____
- ☐ Provide interpretation services at engagement events
  Languages: _____
- ☐ Host events in locations accessible to public transportation if available

Are there times of the year, days of the week, and/or times of day that work well for resident engagement in your community?

Part 2: Develop a public engagement strategy for each of the four phases.

What is the purpose of engagement in this Phase?

- ☐ Inform/raise awareness (one-way flow of information)
- ☐ Consult the community (two-way flow of information)
- ☐ Collaborate with the community (two-way flow of information)

What kind of information will strengthen the content in this phase?

How will you use the feedback you gather?

- ☐ We are collecting feedback for informational purposes only
- ☐ We will consider feedback and make revisions as feasible
- ☐ We will only move forward with strategies if we have community consensus

Who needs to be engaged in this phase?
Select all that apply.

- ☐ General public
- ☐ Select community members
- ☐ Key stakeholders or interest groups: _____
  Elected officials
- ☐ Funders or implementers
- ☐ Other: _____

How will you engage them? What techniques will you use?

STEP 1.2

How will you advertise engagement opportunities?

- ☐ Project-specific website
- ☐ Webpage on a preexisting website
- ☐ Direct mailings
- ☐ Email newsletter
- ☐ Social media
- ☐ Posted flyers
- ☐ Information kiosks in public locations
- ☐ Direct invitations
- ☐ Live stream or public access channel
- ☐ Resilience plan steering committee or other group of community stakeholders
- ☐ Trained community members like neighborhood ambassadors, block captains
- ☐ Workshops or public meetings
- ☐ Other (describe) _____

Use the answers from this Exercise and Appendix B. Public Participation Supplement to draft a description and schedule of outreach and engagement. The descriptions should be integrated into your scope of work, and the schedule of outreach and engagement should be integrated into your overall planning project schedule (see Scope of Work Template in Appendix C). This schedule is also available as a template.

Schedule of Outreach and Engagement Activities							
	[MONTH]	[MONTH]	[MONTH]	[MONTH]	[MONTH]	[MONTH]	[MONTH]
Phase 1 – Prepare							
[STRATEGIES]							
Phase 2 – Assess							
[STRATEGIES]							
Phase 3 – Plan							
[STRATEGIES]							
Phase 4 – Implement							
[STRATEGIES]							

Collect and maintain contact information for anyone who participates in any phase of the process. Send these contacts updates about any future engagement opportunities open to the public, and be sure to share the final version of the plan or plan content with them.

The Schedule of Outreach and Engagement Activities table is also available in Appendix C as a fillable template.

STEP 1.3

Step 1.3: Convene a steering committee

TASKS TO DO

❑	1.3a: Propose steering committee membership (see Steering Committee Exercise).
❑	1.3b: Invite steering committee members (see Steering Committee Invitation Template in Appendix C).
❑	1.3c: Draft steering committee schedule and agenda (see Steering Committee Schedule and Agenda(s) Template).

SCALE UP/DOWN

Ideas for Scaling Up Step 1.3:

- Expand steering committee membership or establish sub-committees to focus on specific plan tasks.
- Formalize steering committee organization and responsibilities by establishing an official task force or commission.

If thoughtfully organized and sustained, a steering committee composed of experts from a variety of relevant sectors and backgrounds helps guide, develop, implement, and advocate for your community's resilience plan.

1.3a: Propose steering committee membership

The steering committee is a group of people who actively support and participate in the planning process, bringing their expertise to help guide the effort and provide input. Specifically, they:

- Participate in regular meetings over the life of the planning effort (and often beyond).
- Provide feedback informing the plan's administration and policy direction.
- Participate in small group discussions about key planning topics.
- Provide local knowledge and expertise.
- Help plan and promote engagement opportunities, including supporting outreach efforts.
- Act as a liaison between community members and the core team, including sharing accurate information about the planning effort with the community.
- Attend and help facilitate planning events and workshops.
- Champion the plan's implementation and help identify implementation resources.
- Help monitor plan progress and success over time.

TIP
Communities and organizations have different rules and structures for forming oversight groups and naming/appointing members. Work with your municipal manager, mayor, council, or executive director to identify the appropriate framework and protocols.

STEP 1.3

Effective steering committee members are sources of community information and specialized knowledge in a sector relating to climate hazard resilience. They are respected members of the community, who are ready and willing to step into leadership roles. They are also committed to taking on the challenge of supporting implementation of the resilience plan. It is extremely important to include members who bring diverse expertise and perspectives to appropriately plan for climate hazard resilience. While many members have paid employment that covers time and travel related to involvement in a steering committee, some may not. Consider compensation for those members who need to be involved but are not being paid. This may especially hold true for representatives of historically underserved communities. Consider members representing the following groups while brainstorming ideas for a steering committee:

Typical membership

- Planning department
- Local appointed or elected officials
- Emergency management
- Natural resources or parks and recreation
- Transportation
- Public works
- Building or zoning code compliance
- Stormwater or other engineering

Additional beneficial members to include

- Representation from different geographic parts of your community
- Local business leader or chamber of commerce
- Council on aging or senior affairs
- Faith-based entities
- Nonprofits
- Youth or youth organizations
- Neighborhood organizations
- Agriculture
- Economic development
- Soil and water conservation
- Public health
- Utilities
- Public information
- Public safety
- Cooperative extension

Steering Committee Exercise

WHO	PURPOSE
Project lead, core team	Convene a steering committee that has people with a diversity of skillsets and expertise necessary for successful resiliency planning.

Brainstorm

- ☐ **Identify your target number:** The number of steering committee members is dependent on your needs, community size, capacity to manage the group, and other variables. Committees average between 5 and 30 members, with larger groups often breaking into subcommittees to focus on specific tasks. What is your target number (or range) of committee members?
- ☐ **Crowdsource ideas:** Solicit help from others who are familiar with your community and ask for recommendations. You can also convene in person to discuss ideas.

Create Short List

- ☐ **Narrow down your options:** Once you have generated your list of potential members, work as a group to narrow the list down to a size that makes sense based on your ideal committee size. We recommend identifying at least 10-20% more invitees than you would like on the committee, accounting for individuals unable or unwilling to participate.
- ☐ **Check composition:** Looking at your list of potential members, ensure that there is good representation of different areas of expertise. Checking for race, age, and gender diversity is also beneficial at this point.
- ☐ **Identify inviters:** Determine who will invite each potential steering committee member. Personal invitations like a phone call are great, but sending an email is also an option. If members of the core team have personal relationships with invitees, leverage those relationships when sending invitations.

STEP 1.3

1.3b: Invite steering committee members

Send or extend invitations on the same day if possible and establish a simple method for tracking invitees who have accepted or declined the invitation. Provide a firm date and clear instructions for responding in the invitation. Send a reminder email or reach out to invitees who have not responded two days before and the day of your response deadline. The Steering Committee Invitation Template (in Appendix C) provides example language. The best invitations come in the voice of the person sending them, so take the time to tailor it.

Once you have a full committee, send a group email confirming membership and thanking all who agreed to participate. If possible, provide the following information in this initial correspondence:

- A list of steering committee members' names, email addresses, and affiliations.
- The date, time, and location of the first steering committee meeting, including options for remote participation, if applicable.
- A draft or final agenda for the first meeting.
- An attachment describing the steering committee's role and responsibilities, information on standing meetings, the overall project timeline, and participation expectations.
- A request to come prepared to nominate or self-nominate a chair or co-chairs at the kickoff meeting, if desired; if you have a large steering committee, you may choose to also establish subcommittees.
- Contact information for the staff liaison for the steering committee.

1.3c: Draft steering committee schedule and agenda

Finally, set up a tentative schedule for how and when the steering committee will meet. Consult the Steering Committee Schedule and Agenda Template (in Appendix C) to help plan out the meetings.


Seuppernong Water Management Study
This Study Will:

STEP 1.4

Step 1.4: Define your community's resilience vision and goals

TASKS TO DO

☐	1.4a: Define a vision for your community resilience effort.
☐	1.4b: Draft community resilience goals.

SCALE UP/DOWN

Ideas for Scaling Up Step 1.4:

- Expand outreach and engagement efforts for community visioning and goal setting tasks or use innovative or interactive methods of soliciting community feedback and vetting goals.

Ideas for Scaling Down Step 1.4:

- Use existing plans or previous community feedback to develop your vision and goals.
- Identify a smaller, well-defined set of goals or prioritize your goals and work on them in phases.

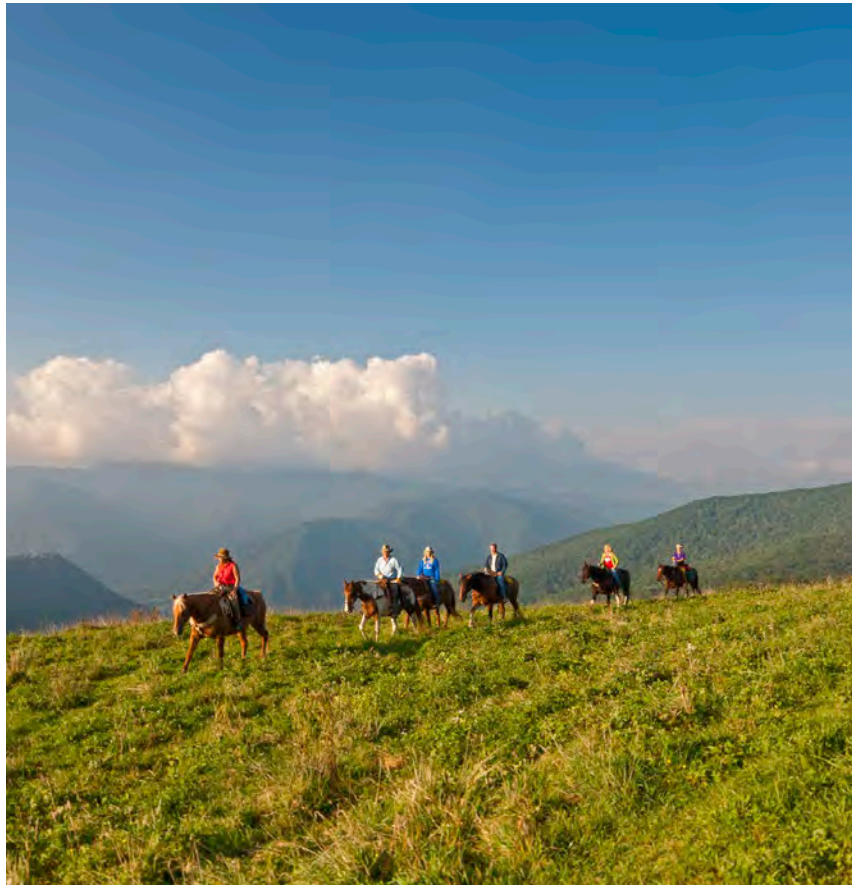
This step provides you with the actions, information, and resources needed to facilitate the process for defining your resilience vision and goals. Your vision statement will describe the resilient future your community hopes to achieve; your goals, which will eventually be supplemented by more specific actions, will help move your community closer to your vision.

This forward-looking perspective is very important to resilience planning. Defining a clear vision and goals for resilience to climate hazards establishes a shared definition of resilience; clarifies intended project outcomes; and helps build the consensus, momentum, and inspiration needed for your resilience plan to succeed. Establishing clear goals will help you prioritize limited resources in terms of funding, staff time, physical assets, and community efforts.

You can also choose to build on the vision in your comprehensive plan (or other document), which is a great way to integrate resilience into stated community values and existing plans. You will likely refine your goals over the course of the planning effort, but this initial draft will provide the foundation needed to begin identifying your community's resilience strategies.

Incorporating public engagement efforts to develop your vision and goals and to receive feedback is very valuable. This helps ensure that your vision and goals accurately capture the community's needs, challenges, opportunities, and desired outcomes. The combination of local knowledge and community-based ideas with scientific expertise can help determine where programs and interventions will be most effective in combating the adverse impacts of climate hazards.

The exercises in this step will guide you to complete visioning and goal setting, through engaging the public, your steering committee, or other project support staff. You may find that you also need to revise your scope of work and work plan based on your vision and goals or vice versa.



STEP 1.4

Visioning and Goal Setting Exercise

WHO	PURPOSE
Project lead, core team (optional: steering committee, public and key stakeholders)	Conduct engagement to gather community feedback and use this feedback to create or refine your community's resilience vision statement and draft goals.

Follow the steps and answer the questions below to gather feedback or information needed to identify a resilience vision and goals.

1.4a: Define a vision for your community resilience effort

A resilience vision describes or illustrates the community's desired future condition in how it is impacted by or responds to climate hazards or natural disasters. A vision statement can be short—one or two sentences—or it can be more extensive. It usually is written, and it can include images or graphics. The vision statement provides the basis for generating the community's resilience goals and objectives. There is no right or wrong way to write a vision statement, but strong visions share several characteristics. They are:

- Inspirational
- Forward-looking
- Descriptive and easy to visualize
- Conceptual, not overly specific
- Values-driven
- Unique to your community

What is the status of your visioning and/or goal setting?

- ☐ We do not have a vision statement or goals.
- ☐ We have a vision statement and/or goals but not specific to resilience.
- ☐ We have a resilience vision statement but not goals. *(if yes, skip to Section 2: Draft community resilience goals)*
- ☐ We have an existing resilience vision statement and goals. *(if yes, skip Step 1.4: Define your community's resilience vision and goals)*

What is your primary method for gathering the information or feedback needed to create a community resilience vision?

☐ Conduct public outreach and engagement.
☐ Ask steering committee.
☐ Refine an existing community vision.
(if yes, skip to Section 2: Draft community resilience goals)

If you are gathering feedback from the public or a group of people like the steering committee, below are suggested steps to stimulate ideas and prompt discussion. The Public Participation Supplement (Appendix B) also offers a variety of strategies for gathering public feedback. Skip to "Review your statement against the following characteristics of a strong vision…" on the next page if you are not conducting interactive exercises to create a vision.

Generate ideas:

1. **Find a facilitator:** Provide an experienced facilitator to guide discussions, establish ground rules for discussion, and clearly describe goals of the exercise and how feedback will be used.

2. **Encourage participation:** Challenge participants to think big, and ask participants to be descriptive and use their own words. If you have a large group, you may want to break out into smaller groups. If your community has a sizeable population that primarily speaks a language other than English, hire a translator to allow participants to contribute in their own language. The following questions can be used for in-person activities or for digital or paper surveys to stimulate ideas and discussion:

   - What does a resilient [COMMUNITY NAME] look like in [5, 10, 20] years?
   - What hazards need to be addressed?
   - What does it look like to live with these hazards into the future?

3. **Document discussion:** Ensure you have enough staff to take notes or ask participants to volunteer as scribes to help record key discussion points.

Draft the community resilience vision:

Review and aggregate the feedback you have gathered. List the top five ideas, themes, messages, and/or topics. If there are many emerging themes, it may be helpful to focus on those most related to climate hazard resilience. If you are generating your vision using existing information or an established community vision, use this step to translate the broader community vision into a more specific vision focused on resilience.

1.

2.

3.

4.

5.

STEP 1.4

Translate each theme or idea into a clear statement. You may want to try sentences that start with the following:

"[COMMUNITY] is..."

"Our community will be..."

"Our community will maintain..."

1.

2.

3.

4.

5.

Refine and aggregate these individual statements into a unified vision. There are lots of examples of vision statements online in comprehensive plans from across North Carolina and the United States.

Review your statement against the following characteristics of strong vision statements and refine if necessary. Your draft vision statement will be further refined after vetting and review by the community.

- Inspirational
- Forward-looking
- Descriptive and easy to visualize
- Conceptual, not overly specific
- Values-driven
- Unique to your community

1.4b: Draft community resilience goals

Your community resilience goals, if achieved, will help your community realize its resilience vision. The goals also help you identify, organize, and prioritize more specific resilience strategies as you continue developing your resilience plan. Like vision statements, effective goals usually share several characteristics. These goals:

- Are qualitative or descriptive, rather than measurable
- Are more specific than the vision
- Describe how to achieve the vision
- Set direction and inspire the community to take action

Use your community resilience vision and your responses to the questions below to create your draft community resilience goals.

What is your draft community resilience vision?

What needs to change or be accomplished in the community to achieve your vision?

Using active, present-tense language, translate the needs identified above into 3-5 resilience goals. Make sure each goal is qualitative and broad, and moves your community towards a more resilient future.

Tip: Use action words like “provide,” “enhance,” “improve,” “ensure,” “establish,” “maintain,” and “protect.”

1.

2.

3.

4.

5.

At the end of Phase 1 – Prepare you will have developed a scope of work, public participation plan, and steering committee, and will have formalized vision and goal statements. Now you are ready to begin Phase 2 – Assess.

PHASE | 02
ASSESS

Why assess?

Good resilience plans are based on a thorough analysis of a community's climate vulnerabilities and strengths. Phase 2–Assess includes identifying hazards of greatest concern and mapping them if possible, mapping and identifying built assets and socially vulnerable communities, and understanding the effect of the identified hazards on your community's assets and populations. At the conclusion of this phase, you will examine the overall findings and pull out those that are most critical to communicate and address. These findings will be written up to support the rest of the planning process and for general communications. Completing Step 2.1: Identify and map hazards of concern, and Step 2.2: Assess vulnerability, will assist you in developing the information necessary to complete Step 2.3: Synthesize vulnerability assessment findings.

Step 2.1 Identify and map hazards of concern

Step 2.2 Assess vulnerability

Step 2.3 Synthesize vulnerability assessment findings

STEP 2.1

Introduction: Options for the vulnerability assessment

This phase's guidance provides a flexible methodology that can be adapted to different levels of detail, technical expertise and resources. For example, some communities may have access to Geographic Information System (GIS) staff, some may have the resources to hire a consultant, and some may have neither of these. Each step in Phase 2: Assess builds upon previous steps to collect and summarize the information necessary to complete a vulnerability assessment.

To accommodate both low-tech and high-tech approaches, guidance is offered in two ways. The first is a **qualitative baseline approach**, which requires less time and expertise. Generally, the qualitative approach is the foundation for all vulnerability assessments, whether or not you will add more detail. The second option is to continue on from the qualitative approach and add **quantitative and mapping analysis**. Typically, this level of analysis requires more in-depth GIS analysis.

DEEP DIVE: THE CONCEPT OF VULNERABILITY

Assessing your community's vulnerabilities is an important step in creating an effective resilience plan, but what exactly is vulnerability? The U.S. Climate Resilience Toolkit defines vulnerability as the probability that a given community or asset will be adversely affected by hazards. Vulnerability is determined through consideration of three main criteria: exposure, sensitivity and adaptive capacity.

Vulnerability = Exposure + Sensitivity – Adaptive Capacity

The first step in determining the vulnerability of a community or asset is to understand the level of exposure present. Exposure refers to the probability that an asset or community may come into physical contact with hazards such as sea level rise, precipitation, temperature, heat waves and wildfires.

Once you have determined the level of exposure, you can determine the sensitivity of an asset or community to a hazard by identifying how much it will be impacted. This might involve identifying the structures (e.g., essential facilities, residential communities, schools), functions (e.g., energy delivery, emergency services), and populations (e.g., seniors, children, low-income communities) that could be impacted by a given hazard.

Lastly, adaptive capacity describes the ability of a community or asset to adjust to a hazard through changes in characteristics or behavior. A high adaptive capacity indicates that measures already exist to address projected impacts, thus reducing the overall vulnerability of a community or asset. By conducting a vulnerability assessment, you can better identify and incorporate adaptive measures that will help make your community more resilient overall.

Generally, in the qualitative approach you would describe vulnerabilities in terms like "low," "medium," or "high," whereas a quantitative approach will provide more specific numbers and maps to describe the vulnerabilities. Of course, you may choose to use quantitative analysis for some parts of your vulnerability assessment and not others.

Whatever the level of detail in your vulnerability assessment, the first step in your assessment work is to collect information and analysis that others have already done on your community's vulnerability. For example, check any relevant existing plans, such as:

- ☐ Local hazard mitigation plan, disaster recovery plan, or previous resilience plan (for example, Hurricane Matthew Resilient Redevelopment Plans)
- ☐ Local Threat and Hazard Identification and Risk Assessment (THIRA)
- ☐ Regional plans like a multijurisdictional hazard mitigation plan
- ☐ RISE Resilience Portfolio and Vulnerability Assessment (available for the eastern half of North Carolina)
- ☐ Local comprehensive land use plan
- ☐ Coastal Area Management Act (CAMA) plan
- ☐ Stormwater management plan
- ☐ Local or county economic development plan or Comprehensive Economy Development Strategy (CEDS) (which is required to address economic resilience)

These documents are great sources of information to start with. However, we do not recommend a wholesale replacement of this phase with your community's THIRA or local or regional hazard mitigation plan risk assessment. These analyses have information to get you started, but usually are very specific to FEMA requirements. They may not include all the components of your community's risk or resilience, especially considering population-based vulnerabilities specific to your community. They also may not have actionable conclusions, which is a goal of the vulnerability assessment outlined here.

TIP

What if my community does not have data or information about climate hazards and vulnerabilities?

North Carolina has fantastic data resources that are available for free. There are two lists of these resources in this chapter, one focused on hazards alone and one focused on mapping assets that might be affected by hazards. You can also consult the NC Resilience Exchange online.

STEP 2.1

Step 2.1: Identify and map hazards of concern

TASKS TO DO

☐	2.1a: Identify hazards and key characteristics.
☐	2.1b: Describe past occurrences and future projections.
☐	2.1c: Describe hazard effects and spatial considerations.
☐	2.1d: Prioritize and summarize the hazard for your community.

SCALE UP/DOWN

Consult the *Idea Book* to learn more about how other communities have identified and mapped hazards in their communities.

Ideas for Scaling Up Step 2.1:

- Identify and map hazards that are a risk but less common to your community.
- Share the GIS layers of hazards of concern on a local GIS dashboard.
- Conduct a community engagement meeting or workshop to engage the community in identifying areas of known risk. Consult Appendix B. Public Participation Supplement to guide you.

Ideas for Scaling Down Step 2.1:

- Identify and map a small number of hazard risks.
- Build from hazards identified as part of another planning process or in adopted plans such as a hazard mitigation plan.

In this step, you will review the climate hazards affecting North Carolina using several resources described below and determine which are the highest concern for your community based on their potential impact. Climate hazards include weather or climate change related hazards. While this *Guide* is focused on building resilience to climate hazards, much of this information is relevant to other kinds of hazards like earthquakes, hazardous materials events, and infectious diseases.

Information about hazards will be summarized in a Hazards of Concern Table (see below for an example). For the **quantitative and mapping analysis**, the Hazards of Concern Table becomes a summary, with detailed documentation in writing and maps. Based on hazards or areas of concern, this approach would use GIS data to map the extent of certain hazard risks across the landscape, like flood risk or landslide risk, and describe the certainty of future projections.

Information Sources

Sources of information for identifying and mapping hazards of concern:

- Knowledge held by core team, steering committee, or community members. It can be incredibly valuable to capture information that people know but has not been documented.
- Other plans and vulnerability assessments, as described in the Introduction to this phase.
- Online resources listed in Resources for Identifying and Mapping Hazards on page V1-42.

Hazards of Concern Table (also available in Appendix C. Vulnerability Assessment Table Templates)

Hazards and Key Characteristics	Past Occurrences and Future Projections	Effects and Spatial Considerations	Priority
Example: Hurricane Key Characteristics: High winds, storm surge, shoreline erosion, heavy precipitation	In the past, three hurricanes/tropical storms since 2010 In the future, hurricanes are expected to increase in severity and have higher amounts of rainfall	Flood damage, road washouts, loss of power, crop loss Community-wide flood damage, road washouts, loss of power; White Birch subdivision access cut off during hurricanes and large storms; Jones Beach especially subject to erosion	High
[Insert hazards and key characteristics here]	[Insert past occurrences and future projections]	[Insert effects and spatial considerations]	[Insert priority]

STEP 2.1

Developing a hazards of concern summary

2.1a: Identify hazards and key characteristics

Select hazards to include in your Hazards of Concern Table based on local context, adopted plans or studies, and statewide documents, including the North Carolina Climate Science Report (Report Findings and Executive Summary, Plain Language Summary, 2020) and the State of North Carolina's Hazard Mitigation Plan (2018). Call out the key characteristics of each hazard as it affects your community.

Select among the following climate-related hazards most likely to impact North Carolina communities. Some of these hazards overlap with one another, like riverine flooding and hurricanes. You may wish to group these hazards or treat them separately, noting their similarities.

If capacity allows, this could be a good time in the planning process to engage your community as you identify and map these hazards. Your community can help you identify hazards of concern, as well as review your summary. Consult Appendix B. Public Participation Supplement to help you identify the outcomes you hope to achieve, determine your audience, and guide you through the best strategies to get there.

Flooding	Other
• Riverine flooding • Flash flooding • Stormwater flooding, not connected to a natural body of water • Tidal flooding, including sunny day flooding or king tides • Storm surge • Sea level rise • Dam failure	• Excessive heat and urban heat island effect • Hurricanes • Landslide • Saltwater intrusion • Rising groundwater tables • Land subsidence • Drought • Wildfire • Severe winter weather • Strong wind • Tornado

2.1b: Describe past occurrences and future projections

Looking back over the last 50 to 100 years, record any specific instances of each hazard or the general frequency in which the community has experienced the hazard. Use the North Carolina Climate Science Report (2020) to capture how scientists expect changes to occur with this hazard in the future.

For **quantitative and mapping analysis**, the table and accompanying documentation should capture data such as:

Mapping

- Special flood hazard areas (SFHAs), including but not limited to the 10-, 25-, 50-, 100- and 500-year floodplains
- Water surface elevations
- Estimated current flood risk, taking into account flooding sources not currently included in FEMA maps, such as NCEM's advisory map of current flood risk outside of the 100-year floodplain, if available in your area, or Flood Factor
- Future flood risk, such as Flood Factor
- Storm surge risk (NOAA's National Hurricane Center–Sea, Lake, and Overland Surges from Hurricanes [SLOSH] model, reflects estimated storm surge)
- Erosion rates (NC DCM)
- Historic flood extents and high water marks
- Areas with high groundwater occurrence
- Extent of impervious surfaces, which can be a good stand-in for stormwater flooding risk as well as urban heat island effect risk
- Wind risk zone
- Wildland-urban interface (WUI) or other measure of wildfire risk
- Areas susceptible to landslide (NC DEQ Landslide Hazard Data Viewer)
- Previous landslide occurrence locations and deposits
- Steep slopes
- Other hazard related data appropriate for your community

Data, including current trends and future projections

- Average daytime and nighttime temperatures and heat indexes
- Frequency of very hot days and very warm nights
- Annual hottest temperatures
- Cooling degree days
- Annual precipitation totals
- Local precipitation records

More advanced modeling might consider the extent of compound flooding during hurricanes or other coastal storms.[1] Compound flooding refers to flooding from multiple sources such as rainfall, riverine, or coastal flooding simultaneously or within a short period of time. For example, 2018's Hurricane Florence caused compound flooding in places like New Bern, Jacksonville, and Bogue Sound.

[1] https://collaboratory.unc.edu/wp-content/uploads/sites/476/2021/05/compound-flooding.pdf

STEP 2.1

2.1c: Describe hazard effects and spatial considerations

For each identified hazard, record the actual and potential impacts based on the hazard's key characteristics, past occurrences, and future projections. Focus on a high-level description of major effects. Using available tools, maps, and local knowledge, identify any specific places or locations in the community that are more or less likely to experience the impacts of each hazard.

2.1d: Prioritize and summarize the hazard for your community

For each hazard, conduct a simple prioritization exercise based on the likelihood of the hazard and its impact, using the matrix below. This prioritization will be used for the full vulnerability assessment and to develop resilience strategies and projects. Deciding how to categorize an impact and its likelihood is subjective and discussing these decisions with core team members and steering committee members or engaging the community will help build confidence in the prioritization of each hazard.

If a Hazard is...	Less Likely	More Likely
Low Impact	Low Priority	Medium Priority
High Impact	Medium Priority	High Priority

Use the prioritization in the Hazards of Concern Table to select the hazards that you will focus on for the resilience planning effort. You may choose to continue with all climate hazards or just the highest priority hazards for the remainder of the planning process.

Resources for Identifying and Mapping Hazards

Check NCORR's North Carolina Climate Resilience Data webpage and the NC Resilience Exchange for guidance on many of these datasets and others.

High-level screening of climate hazards common in your community.

Maps of physical risks to the U.S. landscape, including Mapping Climate Risks by County and Community (American Communities Project) Maps of physical risks to the U.S. landscape, including sea level rise; hurricanes; extreme rainfall; water stress; and heat stress, characterized by higher temperatures.

Climate Hazards Overlays Maps showing potential climate hazards. Users can perform a high-level screen to check if assets in their community are exposed to various threats.

Disaster & Risk Mapping (NOAA) Provides information on historic and future risks down to the census tract level of geography.

National Risk Index (FEMA) The National Risk Index is a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards.

Hazard-specific resources providing greater detail on the characteristics of hazards in your community, including, for example, historic occurrences, severity of events, and more detailed geographic information.

North Carolina Flood Risk Information System The Flood Risk Information System (FRIS) contains digitally accessible flood hazard data, models, maps, risk assessments and data-based reports. It also provides geospatial base map data and imagery for download and use.

Advisory Flood Maps NC Emergency Management is developing maps of current flood risk outside of the 100-year floodplain, moving across the state over the course of multiple years to complete these time-intensive effort. They are called "advisory" maps to distinguish them from regulatory flood maps.

Flood Maps (FEMA) The FEMA Flood Map Service Center is the official online location to find all flood hazard mapping products created under the National Flood Insurance Program (NFIP). You can search for addresses or places across the entire U.S.

Coastal Risk Screening Tool (Climate Central) A set of interactive maps showing areas threatened by sea level rise and coastal flooding. As these maps incorporate big datasets, which always include some error, they should be regarded as screening tools to identify places that may require deeper investigation of risk.

Sea Level Rise Viewer (NOAA) Interactive map viewer and data available for download of sea level rise.

National Integrated Drought Information System Usable, reliable, and timely drought forecasts and assessments of associated risks to facilitate proactive decision-making. At Drought.gov, you will find information about current drought conditions, historical drought, drought impacts, outlooks, forecasts, reports, research, events, and news at the local to international levels.

Historic Probability of Large Wildfire (NOAA) Static maps and snapshots of historic probability of large wildfire across the country. Underling datasets also available for download upon request.

Landslide Maps of Western North Carolina Interactive maps of Western North Carolina showing landslide hazard areas. Some data available for download hosted on different websites.

National Inventory of Dams (FEMA) Interactive map of all known dams in the U.S., providing information about emergency response preparedness and date of latest inspection. This includes links to other general resources on preparedness for dam-related emergencies.

HAZUS Downloadable free software from FEMA that provides standardized tools and data for estimating risk from earthquakes, floods, tsunamis, and hurricanes. Hazus models combine expertise from many disciplines to create actionable risk information to increase community resilience.

STEP 2.2

Step 2.2: Assess vulnerability

A vulnerability assessment communicates the likelihood and extent of climate hazard impacts. To arrive at these findings, planners and analysts methodically explore the interaction between hazards on the one hand, and people, places, and infrastructure that matter to the community on the other hand. This analysis usually considers both the location and condition of people, places, and infrastructure. These factors make a big difference in how well a community can withstand any given hazard.

This assessment considers two types of vulnerability: physical and social. Physical vulnerability concerns structures, infrastructure and natural environmental features (all referred to as assets). Social vulnerability concerns people. The concept of social vulnerability helps us account for the divergent experiences of different people in the same hurricane, for example. While not a perfect proxy, we often look at issues like income, age, gender, disability, race and ethnicity, or language and national origin to help us understand why some populations suffer more during a disaster.

SCALE UP/DOWN

Consult the *Idea Book* to learn more about how other communities have assessed vulnerability.

Ideas for Scaling Up Step 2.2:

- Conduct an in-depth quantitative analysis with custom outputs.
- Consider multiple scenarios of flooding, for example the 10-year, 100-year, and 500-year storms.
- Identify and analyze impacts to all critical facilities affected.
- Engage the community at a workshop to identify and map assets vulnerable to hazard, socially vulnerable populations, and hot spots. Consult Appendix B. Public Participation Supplement to guide you.

Ideas for Scaling Down Step 2.2:

- Focus on one climate hazard for the vulnerability assessment and your resilience planning effort.
- Select only a few assets to analyze.
- Utilize the steering committee or other existing community groups, such as your planning board, to assist in identifying and mapping assets vulnerable to hazards, socially vulnerable populations and hot spots. Consult Appendix B. Public Participation Supplement to guide you.

TASKS TO DO

☐	2.2a: Identify and map critical assets from the built and natural environments.
☐	2.2b: Assess physical vulnerability.
☐	2.2c: Assess social vulnerability.
☐	2.2d: Identify any hot spots of overlapping physical and social vulnerability.

STEP 2.2

2.2a: Identify and map critical assets from the built and natural environments

Use the knowledge of the core team, steering committee, stakeholders, and community, along with online resources, to select assets to include in the vulnerability assessment. For this guidance, physical assets have been broken into four categories, Buildings and Critical Facilities, Infrastructure, Natural and Land Resources, and Community Assets. You can also use another categorization, such as FEMA Lifelines, if it works better for your community's planning context. Depending on resources or the focus of the plan, you may want to focus on just some categories or just some asset types.

Assets To Consider for Inclusion in Physical Vulnerability Assessment

	Buildings and Critical Facilities	Infrastructure	Natural and Land Resources	Community Assets
Asset Type	• Housing • Businesses (grocery store or pharmacy) • Healthcare facilities • Schools • Government buildings (especially those defined as critical) • Emergency services (police, fire, EMT, shelters)	• Roads, rail and bridges • Dams and levees • Energy production and distribution (electricity, natural gas, gasoline) • Water and wastewater (including septic systems, water towers, or pump/lift stations)	• Wetlands • Special flood hazard areas (SFHAs) • Sources of freshwater • Conservation areas • Dunes/beaches • Farmland • Parks, including state or federal parks • Forests • Natural areas • CAMA-designated Unique Coastal Geologic Formations • Wellhead protection areas	• Historically designated buildings, districts or locations • Culturally significant buildings, locations, artifacts or natural/land resources • Viewshed protection areas • Areas designated as National Historic Landmarks • Areas designated as Natural Heritage areas, NC Natural and Scenic Rivers, federal Wild and Scenic Rivers • Tree protection areas

Some questions to consider when identifying assets:[2]

1. Which assets are critical to maintaining safety, health and productivity in the community?
2. Which assets would have significant consequences to the community if they failed?
3. Are there unique or critical assets that the community relies upon?
4. What are the places or aspects that the community loves?
5. How do your goals relate to specific assets?

For the **baseline assessment**, list these assets in a consistent manner, including simple notes on location, condition and ownership. If not using GIS, consider mapping these assets on Google Maps or paper maps so that multiple assets can be viewed on one map.

For **quantitative and mapping analysis**, use GIS to map all assets and capture notes on location, condition and ownership. Review Resources for Identifying and Mapping Hazards to explore potential data sources on assets.

This step also provides an opportunity to engage your community if capacity allows. Examples of public engagement during this task include a simple electronic survey to ask the community for help in identifying buildings and critical facilities, infrastructure, natural resources and lands, and community assets vulnerable to hazards. You could ask participants to respond electronically with a list of assets, or paper copies of a survey could be made available at key community locations and returned in person or by mail or email. If more capacity allows, public engagement could include a public workshop with paper maps to identify assets or having a staff member attend at an existing community event with maps to engage attendees in identifying assets.

Consult Appendix B. Public Participation Supplement to help you determine your public participation objectives for this this activity, who from the public could best help you identify and map critical assets, and what type of engagement strategies you have the capacity to conduct.

[2] Adapted from RCCP Handbook, EPA/FEMA Regional Resilience Toolkit

STEP 2.2

Resources for Identifying and Mapping Assets

Check NCORR's North Carolina Climate Resilience Data webpage and the NC Resilience Exchange for guidance on many of these datasets and others.

Many local governments have identified structures and critical facilities at risk in their hazard mitigation plans. Consider checking there first. If your jurisdiction does not have a hazard mitigation plan, these resources may be helpful:

Structures and Critical Facilities

NC OneMap statewide parcel data Statewide parcel data available through an interactive map and by download.

North Carolina State Historic Preservation Office mapping tool Historic resources, sites and districts available through an interactive map and by download.

NC OneMap Data on the location of the following:

- Law Enforcement Locations
- Nursing Homes
- Medical Facilities

Infrastructure

CISA Gateway Map View National dataset that displays real-time information on critical infrastructure to increase situational awareness and provide a common operating picture of the nation's critical infrastructure.

Bureau of Transportation Statistics National transportation maps and their associated geospatial data for five modes of transportation including aviation, marine, rail, roads and transit.

NC Department of Transportation's data portal Includes NC DOT–maintained roads, bridges, and structures.

NC OneMap Data on the location of the following: Public Municipal Stormwater Systems.

Natural Resources

Land Cover (Esri) Collection of national land cover datasets available for viewing and mapping.

Shoreline Data Explorer (NOAA) Interactive map viewer and data available for download of shorelines.

North Carolina Natural Heritage Data Explorer North Carolina specific interactive map and data available for download showing Natural Heritage resources and other conservation values.

2.2b: Assess physical vulnerability

The final step in assessing physical vulnerability is to overlay hazard information with assets at risk and estimate the consequences to the community. To accomplish this, work through hazards of concern one at a time. Combine the information in your Hazards of Concern Summary with a list or map of assets selected for analysis. Where are assets exposed to this hazard? For a **baseline analysis** only, you may want to consider assets in groups by location, like "downtown area," or "Southwest neighborhood," or asset types, like "housing," "businesses," and "roads."

Then, using the judgment of the core team and other local experts, like the steering committee or other stakeholders, estimate the consequence of this exposure on the community. For example, a town hall with deferred maintenance may be more likely to experience hurricane damage than the library next door, which has a new roof and a higher first floor elevation. Flooding a substation will affect more households than flooding an individual home. Flooding a substation near a senior care facility may have particularly serious consequences for residents if the facility does not have adequate backup power.

To add **quantitative and mapping analysis**, run the overlay of hazard information and assets at risk as a GIS analysis. This is known as an exposure analysis. Export a list of assets and the hazards to which they are exposed. Note that some hazards, like extreme heat and wildfire risk, impact a wide area, so all assets in your community may be exposed.

With the **quantitative and mapping analysis**, look for additional data points to help understand the consequences of a hazard on an asset or an asset type. For example, North Carolina Emergency Management tracks the first-floor elevations for all buildings in the state, so with information about expected inundation levels, you may be able to see whether flooding will cause structural damage.

Whether you use quantitative and mapping analysis or stick with the qualitative baseline approach alone, list the highest vulnerability assets in the Physical Vulnerability Table, along with the address or location and ownership. You will likely want to break the table into multiple tables by type of asset or use spreadsheet software like Excel to manage the information. Using narrative text, describe likely impacts of hazards and their consequences to the community.

STEP 2.2

Physical Vulnerability Table, Baseline Analysis (Also available in Appendix C. Vulnerability Assessment Table Templates)

Hazard: *Example: Hurricane and riverine flooding for a community in the coastal plain*		
Asset at Risk	**Address/Location/Ownership, if applicable**	**Impacts and consequence to community**
Structures and Critical Facilities		
Housing on the south side of town	Between Main St. and the river/private ownership	Potential to displace over 200 households through flooding
Elementary school #2	64 Smith Street/local public ownership	Potential to flood in 100-year floodplain. Impact would disrupt education and cause community to revert to online learning; cost to repair or rebuild likely over $1 million
Fire station	Corner of Main St. & 1st St.	Potential to impact ability to provide fire service and respond if impacted by flooding
Electrical substation	Hwy 90	Potential to lose electrical service for half of the city if flooded
Infrastructure		
Hwy 275	Mile Marker 10-22	Potential to cut off Roseville from communities to the north. This route is main supply route for trucks and connects Roseville to the nearest hospital
Bridge – Greene St. Bridge	Greene St. Bridge (St. George County)	Potential of flooding to overtop bridge will cut off access between Roseville (St. George County) and Smith Town
Natural Resources		
Marsh	Marshes along the sound side of St. George County	Potential to worsen storm surge events if marsh lost. Marsh breaks up the wave energy and protects roads, bridges, and other key infrastructure

If capacity allows, this could be an opportunity in the planning process to engage your community. Examples of public engagement in assessing physical vulnerabilities include having your steering committee or other stakeholders (e.g., planning board, city council, or other stakeholder groups) review and provide feedback on a draft physical vulnerability analysis. This process might be as simple as presenting the analysis and discussing feedback or concerns that you can incorporate into your analysis.

Consult the Appendix B. Public Participation Supplement to assist you in determining your public participation objectives for this activity, who you might want to engage with to assess physical vulnerability, and what type of engagement strategies you have the capacity to conduct.

2.2c: Assess social vulnerability

Social vulnerability is a term describing how resilient a community is when confronted by external stressors to its people, such as a natural disaster. Climate change does not affect all people equally as socially vulnerable populations have less capacity to prepare, respond to, and recover from climate-related hazards. Socially vulnerable populations are especially at risk due to age, ethnicity, economic status, language ability, access to transportation or health care, housing type, and/or existing medial conditions such as physical disability, poor mental health, or chronic diseases such as kidney disease, diabetes, asthma, or heart disease that can be worsened by climate-related hazards. Climate-related hazards can have immediate impacts, like housing loss due to a hurricane, and may also have long-term impacts that negatively impact both physical and mental health, such as when routine health screenings are postponed. To learn more about how to integrate and plan for social vulnerability, explore Topic 7: Equity and Justice in the *Idea Book*. The *Idea Book* highlights potential partners and stakeholders who are important to include when assessing social vulnerability and includes several resources for doing this kind of assessment.

For the **baseline analysis**, develop a list of populations in your community that may be more vulnerable to a given climate hazard because of their demographics such as age, race, ethnicity, gender, income, language barriers, limited access to transportation, housing type, or physical disability. Next, consider the potential consequences of climate hazards to that community. This is referred to as “sensitivities to climate hazards” in the Social Vulnerability Table below. Some populations may have hazard-specific sensitivities, like seniors, children, and outdoor workers who are all more vulnerable to health effects from high heat. Other populations may have multi-hazard sensitivities, such as populations that do not speak English fluently, who may not receive critical and timely information about a hazard. Using the tools provided below or other resources, identify locations in your community where there are higher concentrations of socially vulnerable residents.

STEP 2.2

Social Vulnerability Table, Baseline Analysis (also available in Appendix C. Vulnerability Assessment Table Templates)

Population	Locations with Higher Concentrations of Population	Sensitivities to Climate Hazards
Examples below		
Nursing home residents	Nursing homes in special flood hazard areas (SFHAs) along the Green River	Unable to evacuate on their own during flooding event
Mobile home and RV park residents	Mobile home and RV parks along the Green River	Need advance warning to evacuate and move RVs ahead of flood event due to proximity of inhabitants to the river
Special needs or physically disabled populations	Adult care homes near the hospital along the Green River	Need advance warning time to evacuate ahead of event

For the quantitative and mapping assessment, add geographic data on vulnerable populations to your map of hazards and assets. Maps can help illustrate where socially vulnerable populations may have elevated exposure to climate impacts. Good sources of this data include the following resources. You may wish to download and use census data for specific socially vulnerable populations as well.

- CDC Environmental Justice Index Tool
- Justice40 Initiative's Climate and Economic Justice Screening Tool (CEJST)
- Environmental Justice Screening and Mapping Tool (US EPA) (census tract)
- EPA Supplemental Demographic Index (SDI) layer (socioeconomic indicators) in EPA's Environmental Justice Screening and Mapping Tool (EJScreen)
  NC DEQ Community Mapping Tool (Select Potentially Underserved Block Groups 2019)
- Neighborhoods at Risk (census tract, town, or county level; easier of the two tools to use) or Populations at Risk (census tract, town, or county level; more detailed data points)
- National Risk Index (FEMA) (census tract or county level)
- Social Vulnerability Index (SVI) Map (CDC) (census tract, town, or county level)

In addition to these mapping resources, use the knowledge of the core team, steering committee, and stakeholders to further define socially vulnerable populations in your community.

Make several maps of your community with social vulnerability data overlaid with hazards and assets. These maps can explore different kinds of social vulnerabilities and their proximity to hazards. For example, one map may focus specifically on the overlap between the floodplain and socially vulnerable populations. A different map might focus on a widespread hazard like high heat, identifying where populations at greatest risk for heat illness live and work. Add descriptive details based on the mapping to the Socially Vulnerable Populations Table and provide a narrative that explains the findings.

2.2d: Identify any hot spots of overlapping physical and social vulnerability

Using core team and steering committee knowledge, along with GIS data if available, identify hot spot areas in your community with a strong overlap of social and physical vulnerabilities. Make a list of these hot spots.

If capacity allows, ask for your community's help in identifying socially vulnerable communities (Step 2.2c) and hot spot areas (Step 2.2b) through public engagement. An example of public engagement during this task includes having the steering committee and other stakeholders (your local planning board, town council, or a specific stakeholder group) review and provide feedback on a list of socially vulnerable populations in the community and any identified hot spots. Feedback from this discussion should be incorporated into the analysis. This activity could be coupled with community engagement or be a standalone activity.

Consult Appendix B. Public Participation Supplement to assist you in determining your public participation objectives for this activity, who you might want to engage with to assess social vulnerability, and what type of engagement strategies you have the capacity to conduct.

STEP 2.3

Step 2.3: Synthesize vulnerability assessment findings

TASKS TO DO

☐	**2.3a: Complete Climate Vulnerabilities Synthesis Exercise.**
☐	**2.3b: Draft the vulnerability assessment.**

In this step, you will figure out the most important takeaways from all the information you collected during the physical and social vulnerability assessments. These takeaways will play a central role in writing up the vulnerability assessment, along with a review of findings by theme or sector.

SCALE UP/DOWN

Consult the *Idea Book* to learn more about how other communities have assessed vulnerability.

Ideas for Scaling Up Step 2.3:

- Include more detail and more maps in your vulnerability assessment.
- Determine other uses for your vulnerability assessment, such as incorporation into your hazard mitigation plan.

Ideas for Scaling Down Step 2.3:

- Focus on a small number of key takeaways that are actionable by your community.

2.3a: Complete Climate Vulnerabilities Synthesis Exercise

WHO	PURPOSE
Project lead, core team	Document and share information about your community's climate related hazards and vulnerabilities.

Using the hazard and vulnerability assessment you created or information you identified in an existing plan, synthesize the findings of the vulnerability assessment, using the following questions as a guide:

1. What were the highest priority hazards included in the vulnerability assessment? Do any medium or high priority hazards need more awareness and attention in your community?

2. In the physical vulnerability assessment, which assets have a significant risk of impact from hazards and significant consequences to the community of that impact?

3. In the social vulnerability assessment, which populations or locations raised the greatest concerns about climate hazard vulnerabilities?

4. If not already captured, across both the physical and social vulnerability assessments, which findings stand out to you as most significant?

5. Which findings stand out as most actionable?

6. Which findings stand out as most urgent?

STEP 2.3

2.3b: Draft the vulnerability assessment

Use the findings from the Climate Vulnerabilities Synthesis Exercise to write up the most important conclusions of the vulnerability assessment. Be sure to support each of the key findings with some examples from your qualitative, quantitative, and mapping assessment data, including the source of the data. Vulnerability assessments generate a lot of information, so it is critical to pull out highlights and examine how the findings relate to one another. Otherwise, important findings can get lost in lists of detail. Be sure to give this step attention; it cannot be glossed over or completed quickly.

Compile these findings with the detailed results of the vulnerability assessment. We recommend organizing the findings by sector or theme, such as in the example outline on the following page. These sectors help us understand where the same asset or population is vulnerable to multiple hazards. Those assets or populations are places where multi-hazard resilience strategies will be most useful.

Example Vulnerability Assessment Outline

I. Executive Summary
   a. A clear set of summary findings tailored to the region
   b. Brief section on methodology, including stakeholder engagement

II. Community's strengths related to resilience

III. Hazards by type. Within each section, discuss risk today and in the future.

IV. Impacts by sector. Within each section, discuss vulnerability today and in the future. Note any work underway/committed to address vulnerabilities that are named.
   a. Housing
   b. Businesses or other economic development assets
   c. Critical facilities
   d. Critical infrastructure
   e. Land and environmental resources
   f. Social vulnerability and public health

V. Hot spots. Discussion of key issues in the area, including issues of social vulnerability

VI. Appendices

VII. Bibliography

VIII. List of data sources

Consider sharing the results of the draft vulnerability assessment to involve and engage stakeholders. At a minimum, consider sharing the draft vulnerability assessment with the core team, steering committee, and appointed or elected boards involved in your community's decision-making and ask for feedback. If capacity allows, you could consider hosting a community meeting in person or online to share the results of the vulnerability assessment. Sharing with stakeholders at this point in the planning process heads off major issues that could stall adoption of the plan. Explore Appendix B. Public Participation Supplement to assist you in scaling this activity up or down.

At the end of Phase 2 - Assess, you will have developed a data-backed vulnerability assessment and drawn out the most important conclusions from that study. Now you are ready to begin Phase 3 - Plan.

PHASE | 03
PLAN

Now that you have a stronger understanding of the greatest vulnerabilities in your community, Phase 3 – Plan helps you plan a set of actionable strategies. These strategies can take the form of proposed policies, projects, programs, or other initiatives. This phase will guide you through identifying and refining resilience strategies to address the goals and priorities you have already defined.

Step 3.1
Develop a long list of potential strategies to build resilience

Step 3.2
Prioritize strategies for a right-sized set of actions

Step 3.3
Develop implementation pathway and performance tracking

Step 3.4
Write and adopt your resilience plan or plan content

STEP 3.1

Introduction: Why plan?

The process of planning allows communities to propose multiple strategies that build resilience. This approach yields greater results than one-off projects, initiatives or policies. Other good reasons to plan include:

- Integration of resilience strategies into other documents that set forth spending priorities, such as capital improvement plans.
- Documentation of the need for a project, which supports funding requests, or the need for a policy, which can help build support over time.
- A resilience plan established before a disaster can help a community build toward a more resilient future after disaster. When state or federal assistance becomes available, communities that know what they want to use those resources for will have a much easier time navigating the funding streams.
- Preestablished strategies can also help a community rebuild stronger and faster, rather than simply building back to pre-event conditions that may leave a community just as vulnerable as it was before.

SCALE UP/DOWN

Ideas for Scaling Up Step 3.1:

- Engage subject matter experts in strategy creation and development. Explore Appendix A. Potential Partners, to identify partners with subject matter expertise.
- Use public participation techniques to brainstorm strategies. Explore Appendix B. Public Participation Supplement, for strategies appropriate for your community.

Ideas for Scaling Down Step 3.1:

- Focus on a limited type of action such as, for example, only capital projects.
- Limit strategy brainstorming to a small group such as the steering committee.

Characteristics of strong resilience strategies

As you brainstorm potential strategies to build resilience in your community, consider the following:

- **Multiple strategies to address a single vulnerability.** Think about multiple lines of defense. For example, a heat emergency might call for communication strategies, cooling centers, and a pre-disaster identification of high-risk households. Mitigating heat emergencies might also require weatherizing homes, a policy prohibiting electricity shutoffs during emergencies, and helping low-income households purchase air conditioners.
- **Strategies that have multiple benefits** within or outside resilience. For example, planting trees mitigates urban heat island effect. It also reduces energy costs and stormwater runoff, as well as beautifies a place. These additional benefits are called co-benefits.
- **Nature-based strategies.** Historically, we have underestimated the power of nature to reduce climate hazard vulnerabilities and overestimated the ability of infrastructure—and our ability to maintain infrastructure—to prevent damages. Check out the following pages for DEEP DIVE: Nature-Based Solutions.
- **Strategies that reflect local strengths**, such as significant natural resources, economic drivers, community structure, or buildings with historic importance.
- **Strategies that build on the vulnerability assessment.** Use best available science and stakeholder input. Explore Appendix B. Public Participation Supplement to identify ways to involve and engage stakeholders in developing these strategies.
- **Strategies that do not make a problem worse elsewhere.** Solving one community's flooding problem, for example, should not increase flooding for the next community downstream.

STEP 3.1

DEEP DIVE: NATURE-BASED SOLUTIONS

In FEMA's guide for local communities, Building Community Resilience with Nature-Based Solutions, FEMA defines nature-based solutions (NBS) as "sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience. Such solutions enlist natural features and processes in efforts to combat climate change, reduce flood risks, improve water quality, protect coastal property, restore and protect wetlands, stabilize shorelines, reduce urban heat, add recreational space, and more."

Strategies for NBS are diverse and one size does not fit all. Examples of nature-based infrastructure designed to reduce flooding and other water-related impacts to and from construction include, but are not limited to: land conservation; preservation of trees and other natural landscape features outside of the required footprint for construction; wetland restoration and protection; floodplain restoration; greenways; stormwater parks; living shorelines, including oyster reefs and dunes; green roofs; rainwater harvesting with cisterns; suspended and other permeable pavement for plazas, parking areas, and sidewalks; disconnecting impervious surfaces where such surfaces are used; rain gardens; bioretention areas; tree canopies and trenches; and vegetated swales.

While NBS vary, in many instances, they have several advantages over other kinds of solutions. They are often cheaper to install and maintain than grey infrastructure. They have added benefits of beautifying a site or landscape. NBS can often accommodate additional amenities, like educational signage, recreational opportunities, or elements specific to local culture.

While NBS are not a cure-all, North Carolina has only begun to tap their significant potential for communities. Many funding programs are starting to prioritize NBS, such as FEMA's Building Resilient Infrastructure and Communities (BRIC) and NC DEQ's Natural Infrastructure Flood Mitigation Program.

North Carolina also has tremendous land-based assets that support climate change mitigation and adaptation. These resources are natural and working lands. Natural and working lands in North Carolina include wetlands, forests, and farms that provide a variety of important economic, social, and environmental services. For more information, check out North Carolina's Natural and Working Lands Action Plan.

For more in-depth information, consider exploring the *Idea Book*, Topic 12: Planning and Decision-Making Frameworks, to learn more about different strategies and resources that may be helpful in your community's planning process.

Step 3.1: Develop a long list of potential strategies to build resilience

TASKS TO DO

☐	**3.1a: Decide on foundational characteristics of your plan or plan content.**
☐	**3.1b: Develop a long list of potential strategies.**

In this step, you will figure out what your final plan, or plan content, will look like. For example, you will determine if your plan will be long or short or whether it will include aspirational goals or focus on actions that are easier to take. Your resilience strategies should work to accomplish your resilience vision and goals as well as reflect your local strengths including natural resources, economic context, community structure, elements of historical importance, and more. To do this, refer to the results of your Assessing Capacity Exercise in Step 1.1: Assess capacity and your community's project scope, developed through the Scoping Exercise in Step 1.2: Create a scope of work for your community's resilience planning effort. Also consult your community's resilience vision and scopes, developed in the Visioning and Goal Setting Exercise in Step 1.4: Document your community's resilience vision and goals. In this step, you will also brainstorm a long list of potential strategies to consider including in your final resilience plan.

STEP 3.1

3.1a: Decide on foundational characteristics of your plan or plan content

Before digging into individual projects, plans, or policies, take some time to determine what you want from the plan content. The Strategy Development Groundwork Exercise asks questions to guide these decisions. We recommend summarizing the answers, and any other relevant priorities for your plan, in a paragraph. This is a good time to check in with the core team and steering committee to ensure a shared understanding. This exercise will also help anyone involved in developing the strategies for the plan.

Strategy Development Groundwork Exercise

WHO	PURPOSE
Project lead, core team	Determine the overall plan content and topical areas that the plan should address.

1. **Thinking about where your community is now and where you want your resilience to be, what is the gap between existing and ideal conditions?**
   - ☐ Large (we have a long way to go)
   - ☐ Moderate (we have a few major policies or projects to complete, but we're moving in the right direction)
   - ☐ Small (we're close, we just need to tie up some loose ends)

2. **What types of changes do you believe your community would make, to achieve greater resilience to climate hazards?**
   - ☐ Cautious: small tweaks to existing policies and projects that are the low-hanging fruit
   - ☐ Moderate: willing to try some new ideas but nothing that is too far outside the box
   - ☐ Aggressive: wholesale changes, innovative strategies, big results

3. **Based on the vulnerability assessment (developed in Step 2.3: Synthesize vulnerability assessment findings), what is the gap between existing and ideal conditions for each of the categories of vulnerabilities in your community? Rank each as large, moderate, or small.**

   ☐ Buildings and critical facilities
   ☐ Infrastructure
   ☐ Natural resources
   ☐ Human and social vulnerability

4. **Using your vulnerability assessment, identify your community's highest priority vulnerabilities to address. If these vulnerabilities are numerous, group them together in similar categories to facilitate strategy development.**

5. **Which of the topics in the *Idea Book* are the strongest match for your community, its vulnerabilities, and its resilience goals? Use these topical areas as a guide to group your strategy types.**

   __ Business and Economy
   __ Coastal Management
   __ Collaboration
   __ Communication and Education
   __ Ecosystem Protection, Restoration, and Enhancement
   __ Energy and Utilities (electric, gas, broadband, water (potable), wastewater, etc.)
   __ Equity and Justice
   __ Funding and Technical Assistance Mechanisms
   __ Housing
   __ Infrastructure and Capital Investment
   __ Land Use and Development
   __ Planning and Decision-Making Frameworks
   __ Public Health
   __ Stormwater Management and Flooding

6. **Refer to Step 1.1's Assessing Capacity Exercise. How might other plans your community already has feed into the new strategies you are developing in this plan? How can you strengthen or refine the strategies to help your community be more resilient? Are there gaps in existing strategies and new strategies are needed to address the vulnerabilities identified in the Vulnerability Assessment Outline in Step. 2.3: Synthesize vulnerability assessment findings?**

7. **Reference your resilience vision and goals from Step 1.4: Document your community's resilience vision and goals. Do the strategies you are developing work to implement or put into action the resilience vision and goals? Are the strategies consistent with and support the vision?**

STEP 3.1

8. **Do you have any goals for the overall composition of strategies in the plan? For example, is geographic balance a consideration? Is a diversity of kinds of approaches important? Are certain types of strategies important to include or exclude, like capital projects, nature-based solutions, or changes to policy and regulations? Refer to your responses to the Scoping Exercise in Step 1.2: Create a scope of work for your community's resilience planning effort.**

9. **Are there specific strategies that need to be included to address concerns identified through community engagement efforts or steering committee meetings in Phase 1—Prepare or Phase 2—Assess?**

3.1b: Develop a long list of potential strategies

Now that the stage has been set for the plan, work with the core team, steering committee, and the community, as capacity allows, to develop a long list of potential strategies that you will refine and narrow later. Selecting the final projects for inclusion from a longer set helps you make sure that the strategies are the best match for the aims of the plan and the needs of the community. Another advantage of a long list is that it allows for innovative ideas to take shape.

Potential strategies, including projects, policies, or other initiatives, may come from many locations:

- The companion to this *Playbook*, the *Idea Book*
- Previous discussions of the core team, steering committee, or stakeholder outreach
- Gaps identified during the Assessing Capacity Exercise in Step 1.1: Assess capacity
- Existing plans (see more detailed list of plans in the Assessing Capacity Exercise in Step 1.1: Assess capacity)
  - Regional/local hazard mitigation plans
  - Comprehensive plans
  - Comprehensive economic development strategies
  - Recovery or resilience plans, such as Hurricane Matthew Resilient Redevelopment Plans
  - Transportation plans
- Community input from meetings, workshops, and other public outreach
- Subject matter experts (See Appendix A. Potential Partners)

Here are some questions to prompt the development of the list:

- Has each of the highest priority vulnerabilities been considered?
- Are there overall sources of resilience, such as communication networks or housing quality, that should be addressed?
- Have we considered strategies from across the spectrum of capital projects, nature-based solutions, communications and outreach, studies or assessments, policy, regulation, or protocol changes?
- Are there strategies that we cannot do alone but would be feasible if we partnered with another jurisdiction, a nonprofit, or a business?
- Do we have a range of easier projects that are within reach and more transformational projects that might take time?
- Are there ongoing efforts in the community that could be enhanced to include resilience components?

After you create a long list of strategies, consider sharing a draft and meeting with the core team and steering committee. This will give you an opportunity to gain buy-in, refine the list, and determine if there are gaps or redundancies. If capacity and time allow, you could share the draft list with the community and ask for feedback. Utilize Appendix B. Public Participation Supplement to guide which engagement strategy might be most appropriate to gain the desired feedback. With limited staff and time, you could make the draft list of strategies available on the community's website and through existing communication channels, such as email lists or social media, to notify the community that their input is desired.

STEP 3.2

Step 3.2: Prioritize strategies for a right-sized set of actions

TASKS TO DO

☐	3.2a: Refine the long list of strategies.
☐	3.2b: Prioritize strategies.
☐	3.2c: Check for consistency.
☐	3.2d: Organize details for each proposed strategy.

There are endless strategies to strengthen climate resilience in your community, but resources like staff time, funding and leadership are more limited. This step will help you refine your strategies and select the most promising ones for inclusion in the final plan content. It will also ensure consistency within the strategies and with other plans, policies, or programs.

SCALE UP/DOWN

Ideas for Scaling Up Step 3.2:

- Conduct community engagement to help define prioritization criteria and to vet potential strategies. Refer to Appendix B. the Public Participation Supplement to guide your community engagement efforts.
- Expand prioritization criteria to include more resilience strategies.

Ideas for Scaling Down Step 3.2:

- Use standard prioritization criteria.
- Use a phased approach and focus on just one resilience goal at a time.
- Prioritize strategies that are most tangible and easy to implement.

3.2a: Refine the long list of strategies

Brainstorming may lead to great ideas that are too broad or vague to be considered a strategy. If an idea is too broad, take the time to identify more achievable and actionable strategies moving the community towards its resilience goals or consider breaking the project down into several smaller projects that work to achieve the broad outcome over a longer period. Additionally, examine your project scope and goals from Step 1.2: Create a scope of work for your community's resilience planning effort, and examine your community resilience vision from Step 1.4: Define your community's resilience vision and goals. Ensure that your strategies are consistent with the community resilience vision and work to accomplish the scope and goals of your effort. You can further refine your strategies by asking:

- How do we accomplish this strategy? What steps are needed to accomplish the task?
- Is additional research or another planning step needed to complete the strategy?
- Are there regulatory changes needed to accomplish this strategy?
- Is there education needed to accomplish this strategy?
- Is there a physical project needed to complete the strategy?

Active and specific language helps turn ideas into strategies. Active and specific language also helps when communicating about potential strategies to the core team, steering committee, and stakeholders.

Example

Original Idea	Refined Strategy
Increase capacity of stormwater management system *(action-oriented, but too broad)*	Assess performance and capacity of current stormwater system.
	Conduct a performance and feasibility assessment for stormwater upgrades.
Conservation subdivision regulations *(specific, but not action-oriented)*	Propose conservation subdivision regulations for adoption.

In practice, refining strategies and prioritizing strategies are likely to overlap. This overlap will strengthen the strategies, and refining the strategies can continue through the drafting process and even into implementation.

STEP 3.2

3.2b: Prioritize strategies

The next step is to winnow down the long list of strategies. In this section, we provide recommendations about a scoring technique to prioritize. The decision about whether to include strategies does not need to hinge on a structured prioritization process alone and should be developed in consultation with your core team, steering committee, and even the community. This prioritization highlights the strongest strategies and helps conversation with the core team, steering committee, and stakeholders.

To conduct prioritization, you can either use a standard prioritization method or select your own criteria.

Recommended prioritization criteria

- Magnitude of reduction in physical vulnerability
- Serves socially vulnerable populations
- Cost
- Social and political acceptability
- Provides cobenefits and does not risk harm somewhere else
- Ease of implementation
- Consistent with the vision and goals of the resilience plan and overall community vision, if one has been articulated in a comprehensive plan or other document

Additional criteria you may wish to consider

- Strategy addresses priority vulnerabilities.
- Strategy addresses priority locations.
- Strategy can be implemented by local government.
- We can acquire the resources to implement this strategy.
- We already have the resources to implement this strategy.
- This a low or no resource strategy.
- It will be more difficult or impossible to implement this strategy if we wait. / A problem will get worse if we do not implement this strategy soon.
- The benefits of this strategy will be equitably distributed.
- This strategy reduces social vulnerability.
- There are multiple benefits to this strategy.
- The strategy already has political or community support.
- This strategy is supported by another plan or policy.
- This strategy can be implemented quickly.
- The strategy is innovative or can be replicated in other places in the community.
- There are interim steps we can take now to help implement this strategy later.

Strategy Prioritization Exercise

WHO	PURPOSE
Project lead, core team, steering committee	Developing a refined list of strategies to move into implementation planning.

Follow the instructions below to identify a set of prioritization criteria and assess your preliminary resilience strategies.

Check each preliminary strategy against the prioritization criteria you have selected and defined. Evaluations can be simple. For example, each project can be awarded 0-5 points, or more, depending on the value of each you place on that criterion.

Building on the example strategy used above, "Assess performance and capacity of current stormwater system," a weighted scoring criteria might look like:

- Does the strategy address a high priority hazard?
  - If flood was a high priority hazard for your community, identified in Step 2.1 Identify and map hazards of concern, you would assign 30 points.
- Is the strategy consistent with your land use/comprehensive plan or adopted zoning?
  - If yes, assign 20 points.
- Does the strategy or project serve a socially vulnerable population?
  - If yes, assign 15 points.
- Does the project incorporate nature-based infrastructure?
  - If yes, assign 10 points.
- Does the strategy or project provide other co-benefits like public open space or recreational opportunities?
  - If yes, assign 5 points.
- Is this strategy a priority for the community?
  - If yes, assign 10 points.

You may wish to assign partial points if a strategy meets the criterion in part. For each strategy identified in the plan, you would tally the criterion.

The prioritization could be a sum of the total points or you could leave the scores separated by category, depending how detailed your prioritization process was. You may also weight the criteria based on your community needs and priorities, assigning more points to different categories.

Use this prioritization in conversation with the core team, steering committee, and stakeholders to determine the right set of strategies to meet the community's needs and vision for the plan content.

Engaging the community could be done as a part of or after the Strategy Prioritization Exercise. Review Appendix B. Public Participation Supplement to determine your objectives for the engagement effort, identify the audience that you would like to reach, and determine the best types of engagement strategies for your time and staffing levels. For example, host an open house meeting where the community could view the proposed strategies on large format boards. Give each attendee five colored dots to vote for their top five priorities. After the meeting, tally and rank the strategies based on the community's desires. This can supplement the Strategy Prioritization Exercise.

STEP 3.2

3.2c: Check for consistency

One way to ensure that your plan has a good shot at implementation is to examine its consistency with other plans, policies, and documents that guide community functioning and development. The Consistency Checklist Exercise will help you methodically identify synergies and conflicts with your draft strategies and preexisting plans and documents. A more thorough resource for ensuring consistency is provided afterwards.

Consistency Checklist Exercise

WHO	PURPOSE
Project lead, core team	Ensure that resilience strategies are consistent within the plan and with other community plans and policies.

Follow the instructions below to review your plan for internal and external alignment. If strategies fail to meet the tests of internal or external consistency, consider ways to reframe them or address challenges in a different way.

Internal Plan Consistency

Test each of your plan's preliminary strategies against the following statements:

- ☐ Does the strategy directly address your plan's resilience vision and goals? (See Step 1.4: Define your community's resilience vision and goals)
- ☐ Does the strategy contradict or conflict with another strategy?
- ☐ Could the strategy generate downstream impacts, worsening other hazards or making the hazard worse in another community or neighborhood?
- ☐ Does the strategy place an undue burden on a historically marginalized population?

External Consistency and Synergies

Review the visions, goals, and objectives in other adopted plans and policies to ensure your strategies are aligned with other community initiatives and identify opportunities for partnerships, collaboration, and resource pooling. Use a table like the one below to track information like relevant goals, complementary strategies, or contradictory strategies. Good plans to compare your strategies with include a comprehensive plan, hazard mitigation plan, and the regional Comprehensive Economic Development Strategy (CEDS), which is required to include an economic resilience component.

	Notes on relevant goals, complementary strategies, contradictory strategies		
Resilience Strategy	**Hazard mitigation plan**	**Comprehensive or master plan**	**CEDS**

Hold onto this information for creating a draft plan. A strategy that is supported in multiple plans signals commitment to local decision-makers and external funders.

A great resource to ensure consistency across your plans to build resilience is the Plan Integration for Resilience Scorecard.

STEP 3.2

3.2d: Organize details for each proposed strategy

As you get more specific about strategies, start adding details or notes where possible. Organize information for each project or action selected for inclusion with a template like the following:

	Strategy Description
Action name	Brief title for project, initiative, program, etc.
Description	Summarize the main components.
Vulnerability/vulnerabilities addressed by action	List vulnerabilities, noting those that were highest priority in the vulnerability assessment. Document importance, urgency and need; identify shared challenges; and establish common ground.
Type of solution	Infrastructure, nature-based solutions, outreach/education, policy or protocol, assessment, other.

STEP 3.3

Step 3.3: Develop implementation pathway and performance tracking

TASKS TO DO

❑	3.3a: Develop implementation pathways for each strategy in the plan.
❑	3.3b: Develop performance metrics and communications opportunities.

In this step, you will identify the resources needed for implementation and develop a path forward for obtaining those resources. Often, we think of resources as funding, but resilience strategies require other kinds of resources, too, like staff time, expertise, and community and political support. It is helpful to name these resources and consider where they come from, even if you are not planning to share all this material in the published plan. Use Appendix A. Potential Partners to brainstorm resources.

The second part of this step is devoted to measuring success for your plan. Selecting metrics ahead of time to track progress ensures that measuring success is not an afterthought. Measuring success is not just about reporting or accountability, although those are important reasons to track performance. Tracking success also creates a narrative about resilience work in your community, which builds momentum and justifies past, present, and future investments.

SCALE UP/DOWN

Ideas for Scaling Up Step 3.3:

- Engage partners and facilitate a roundtable to identify implementation resources.
- Consider a broad range of performance metrics that include indicators of resilience expected to move slowly over the long term.
- Create a data dashboard or StoryMap to track and share progress.

Ideas for Scaling Down Step 3.3:

- Focus on only implementing highest need and priority strategies.
- Focus on implementation resources that already exist in the community or are relatively easy to get.
- Integrate progress reporting with existing reporting or communications protocols.
- Select fewer metrics to report on, based on how easy it is to get the data.

3.3a: Develop implementation pathways for each strategy in the plan

In the past, we have seen resilience plans that look great on paper but fall short when it comes to implementation. One reason is because the plan is not tied to the realities on the ground. These include limitations of capacity in local government and funding challenges. This section provides detailed guidance to help overcome these limitations by directly discussing them. Frank conversations are helpful here; the information that you publish for public consumption may be just a small selection of more detailed notes that you and your core team hold onto to help with implementation.

What if you have strategies that you like, but they do not have obvious pathways to implementation? Go back to earlier discussions about the overall characteristics of the plan in Step 3.1: Develop a long list of potential strategies to build resilience. Aspirational and ambitious plans do not always have a complete guide to implementation, which is okay. On the other hand, if you are looking for concrete and tangible progress in the near future, you may want to consider focusing your plan on those strategies where implementation is within reach. Do not lose track of bigger ideas, but they might live in a different section of your plan.

To consider the implementation pathway for each of the plan's strategies, you will need to discuss them one by one. This discussion benefits from the input of many partners who might not be on your core team but would be needed for implementation. The Implementation Workshop Exercise that follows offers a process for a larger group meeting on this topic.

Make sure to identify possible obstacles to implementation of each strategy and discuss ways to overcome those barriers. Key details to determine for each action include those in the table on the next page, also included as an Implemtation Template (also available in Appendix C).

STEP 3.3

Strategy Implementation Template	
Strategy: [Fill in]	
What organization or department will serve as the implementation lead for this strategy?	Identify the organization or department that is or may be responsible for leading implementation of the strategy. In internal notes, include specific names of people who will have a role, because it's important to engage them now, rather than after the plan is published. Do they have the capacity to take on this action or project? For any publicly published documents, do not include specific individual's names, but rather the organization or department. Does it have the capacity to take on this action or project?
Who will provide implementation support for this strategy?	Document the organizations, departments, agencies, and staff who are needed to implement the strategy. This may include existing staff, a hired consultant, and partners listed in Appendix A. Potential Partners, among others.
What is the implementation time frame for this strategy?	Break down each strategy or project into achievable tasks and phases in distinct time periods. Include gathering needed resources in your timeline (e.g., going through the budgeting process or applying for grants or finding an external partner to support your effort). Immediate Next Steps (0-6 months) Short Term (6 months–2 years) Longer Term (2+ years) Consider which projects would have an immediate start and which you will wait on.
What is the estimated cost to complete this strategy?	Estimate financial and human resources needed to implement each strategy. If you do not know what resources are needed, make this research an immediate next step. Look for projects like yours in the *Idea Book's* case studies. They might help identify potential project costs.
What other implementation resources might be needed to implement this strategy?	Consider personnel, leadership, community/political support, technical expertise, data/modeling, additional research or planning, or further conversation with key stakeholders.
What funding sources could be accessed to implement this strategy?	Identify possible funding sources, including local budget, grant funding, integrated with existing budget items like capital improvement, user fees, or public-private partnerships. Document specific details for the funding strategy, such as the names of grants and the calendar for budget planning in your community.
What would moving in the right direction look like for this strategy?	Briefly describe what moving in the right direction looks like for this strategy. Think broadly. You will explore measures of success in more detail in the next step.

Because this step requires a lot of information and conversation, you may wish to gather a group of potential implementers and big-picture thinkers for a focused session on implementation. The following exercise provides a suggested format.

Implementation Workshop Exercise

WHO	PURPOSE
Steering committee, core team, key stakeholders, potential funders, implementation champions	Identify the resources, information, and people needed to implement your priority resilience strategies through conversation with multiple partners.

Materials/Preparation

Select the list of strategies that you want the group to work on. This list might include all or just some of your projects. Consider your format; small group breakouts could discuss different projects from one another, or they could all discuss the same set of projects to ensure that everyone's expertise is included for each.

- Provide copies of priority resilience strategies (p. V1-78). Send in advance of the meeting and bring printouts for each participant.
- Printed implementation matrix posters. See the following example posters. Print these at 30" x 40" and put them on tables or on walls.
- Sticky notes
- Markers or pens
- Location large enough to accommodate invited guests
- Tables and chairs set up to face one another, either as one group or in smaller groups
- See Appendix B. Public Participation Supplement for equitable participation tips

Working together or in small groups, you will discuss and document needs and resources for each of your resilience strategies on a poster-sized Implementation Exercise. Ensure that there is a facilitator for each small group if you are using breakouts. Start by introducing the project or action and asking for clarifying questions before moving on to a discussion on implementation.

Invite participants to write ideas on sticky notes and add them to the large poster while conversation goes on. This helps get more people to contribute simultaneously while only one person is talking. The facilitator can act as scribe, writing down ideas while a person discusses them, if needed.

STEP 3.3

Example Poster for Implementation Workshop Template (also available in Appendix C)

Strategy or Project	Implementation Lead and Support	Implementation Timeline	Estimated Cost and Other Resources Needed	Possible Resources	Direction Check
Include resilience as part of capital improvement scoring process	Budget & Management (Andre Williams, Director)	Research models and provide report to council and mayor Pilot prioritization process Assess progress and success	Support from Council Staff time to research and write scoring language Training or guidance needed for staff? Staff time to capture progress and outcomes	Planning staff, summer intern	More funded projects consider hazard mitigation or resilience

3.3b: Develop performance metrics and communication opportunities

To develop performance metrics for your plan, first consider the reasons for reporting success that are most compelling for your community. These might include:

- Demonstrating accountability to community members
- Assessing progress for the purpose of revisiting and revising strategies later. This topic will be revisited in Step 4.2: Revisit and revise your plan regularly
- Building the will and momentum to continue to support resilience projects and resilience planning, including demonstrating the need for additional capacity and staff
- Educating people about the value of resilience work in your community. Audiences could include elected officials, community members, other departments, or potential future funders

These are all good reasons to track the success of your efforts, but the measures that you select might be different, depending on your goals. You may even want separate or overlapping sets of metrics for different purposes.

Use the table below to track the metrics as you develop them. Note that quantitative metrics are great, but some good success metrics are qualitative, especially when capturing interim progress on an effort. The US Climate Resilience Toolkit highlights a tool, Resilience Metrics, that may be helpful to further guide your community through developing and identifying metrics appropriate for your community.

Example Metrics Tracking Table for Community Strategies (also available in Appendix C)

Strategy	Direction Check	Metrics	Tracking and Report Lead
Describe the proposed strategy	*From implementation strategy*	*Identify one or more metrics for each strategy that you know can be feasibly assessed and reported. Also identify the data or resources needed to track and report each metric and how often each will be measured and shared.*	*Identify who specifically will track and report each metric; consider partners or organizations that might help track or report metrics.*
Elevate, enhance, and/or relocate roads most susceptible to flooding or wash out.	Roads/bridges that are passable more days of the year	Number of road or bridge closures per year	Engineer
Address repeated flood risk properties through property buy-outs	Fewer properties at risk for flooding	Number of flood risk properties purchased	Planning Director
Improve business preparedness	Businesses experience less loss and can open more quickly following an event	• Percentage of businesses with disaster preparedness, recovery, or business continuity plans • Percentage of equipment elevated above base flood elevation (BFE) • Time for businesses to reopen after event	Planning Director

STEP 3.3

As you develop your metrics, determine the process for reporting out, including the format and audience. The exercise below will help you explore who is responsible for putting together the report.

Communicating Progress Exercise

WHO	PURPOSE
Project lead, core team, and/or steering committee	Identify a process for sharing measurable successes.

Answer the following questions to set up a method for measuring and communicating progress on the plan.

How often will you create and distribute progress reports?

- Quarterly
- Biannually
- Annually
- Other: _____

How will you provide progress reports? (Select all that apply)

- Electronically (email, social media)
- Web (static)
- Web (digital dashboard or other dynamic reporting tool)
- Public presentation, e.g., at a council meeting

What information will you include in your progress reports? (Select all that apply)

- Metrics for each strategy (current and trends over time)
- Narrative summary/update
- Highlights/accomplishments
- Calls to action
- Events/opportunities to participate
- Resources needed
- Resources or programs available to the community
- Key staff or personnel changes
- Other: _____

Who is primarily responsible for aggregating the reporting metrics and creating the report?

_____

_____

Who will support them?

_____

_____

As you move toward writing and adopting your plan in Step 3.4: Write and adopt plan content, consider what information about performance metrics you would like to share for public consumption. Greater public exposure to performance metrics builds accountability on one hand; however, you may want flexibility in the details that you plan to report. At a minimum, you should include the basics of when you will report out and the topics and format. You may wish to keep more of the details in an internal-facing document.

STEP 3.4

Step 3.4: Write and adopt your resilience plan or plan content

Now that you have moved through Phase 1—Prepare, Phase 2—Assess, and most of Phase 3—Plan, you are ready to draft your resilience plan or integrate your resilience strategies into an existing document. Drafting and adopting a plan is a way for your community to share your resilience story and build a foundation for implementation. Further, formally adopting a resilience vision and goals demonstrates your community's level of commitment and how you will go about addressing the problems and needs identified through the planning process. This is important because it allows potential partners, funders, and even business investors to better understand community values, desires, and needs around resilience. Through greater understanding, they can determine if they are well suited to assist you or if your community is a place where they want to invest.

Your resilience plan responds to the questions you have already answered in Phases 1 to 3:

- How does your community define resilience?
- What are the vulnerabilities of your community?
- How do you achieve a more resilient future considering your vulnerabilities?
- Who will be responsible to carry out the actions that make your community more resilient?
- How much will it cost?

Whether you are writing a standalone plan or integrating resilience into an existing document, summarizing the content and key findings from the steps above will create the content needed to generate a draft plan.

Suggested Outline for a Standalone Resilience Plan

A. Cover page. *Create an engaging cover page including images of the community, the plan's title, your community or organization's name, and the date of the draft or adoption.*

B. Table of contents and acknowledgments. *Describe the plan's contents and thank plan participants and supporters, particularly the steering committee.*

C. Executive summary

D. Introduction

E. Resilience vision and goals from Step 1.4

F. Process and participation. *Describe the planning process and community outreach and engagement activities from Steps 1.1 and 1.2. Include photos of engagement events if available.*

G. Vulnerability assessment synthesis from Step 2.3. *Include full vulnerability assessment as an Appendix.*

H. Resilience strategies. *Introduce your resilience strategies, starting with the Strategy Description details from Steps 3.1 and 3.2.*

I. Implementation. *You may wish to include implementation plans with the individual strategies or in a separate section. Use the Strategy Implementation details from Step 3.3.*

J. Appendix: Vulnerability Assessment from Steps 2.1, 2.2, and 2.3.

Note that sections A through F should be relatively short in your plan, compared with sections G, H, and I, which cover the vulnerability assessment, resilience strategies, and implementation details.

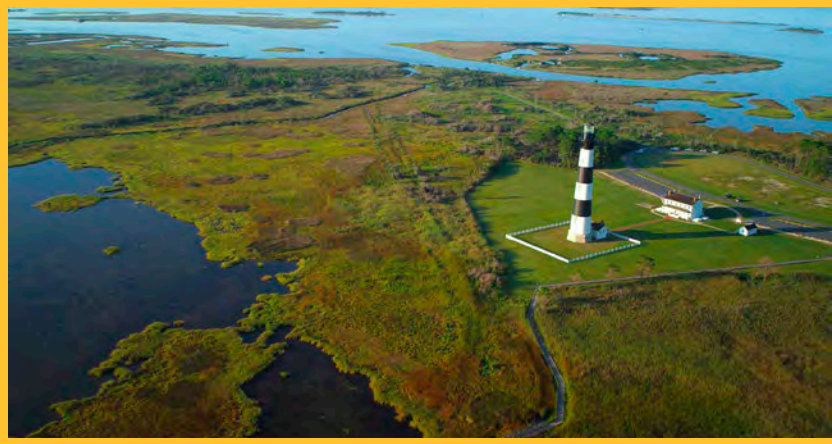
Once you have a draft plan, make sure to hold a final meeting with your core team and steering committee. Have the core team and steering committee review the draft plan and provide any final feedback. The more often and earlier you engage the core team, steering committee, and even the public in sharing feedback, the more likely there will not be major changes to content and you will have a successful plan adoption. This is also a good opportunity to share the draft plan with the community ahead of the adoption process. Consult Appendix B. Public Participation Supplement to determine what strategies will work best given your staffing levels and time.

Outreach for the final draft plan document might involve a community open house meeting. Sharing the draft plan on your community's website two weeks ahead of time would give stakeholders the opportunity to review the document. At an open house, participants could explore stations that highlight the different parts of the plan: resilience vision and goals; vulnerability assessment; and resilience strategies. At each station, a summarized copy of the relevant materials would be available. Staff might be positioned at each station to answer questions or provide clarifications. You could also give attendees the opportunity to provide written feedback at each station. This could be as simple as providing paper and pens as well as a collection basket for comments at each station. If you have specific concerns and want to ask for additional feedback, consider listing out several questions that you want to know more about from the community at each station.

Just like other planning processes, the adoption or integration of resilience strategies should follow the typical plan adoption processes for your community. This may involve presenting the draft document to appointed decision-making bodies, such as a planning board or the elected officials of your community. In addition, a public hearing may be required before adoption of your proposed plan. Whatever the final steps may be, make sure to consider them in your timeline toward adoption.

Now you are ready to begin Phase 4—Implement.

PHASE | 04
IMPLEMENT



Implementation is where the action happens. While this *Guide* covers planning, not how to do the projects in your plan, this phase of the process connects good planning to positive changes on the ground. It is included in the *Playbook* to lower the risk of writing a good plan that is never used. These strategies help keep your plan alive and motivate others to care about resilience outcomes as well. This phase includes ongoing steps that should occur more than once.

The *Idea Book* features 14 resilience topics that each contain strategies and a case study demonstrating real world examples of Phase 4—Implement. Each case study includes a section titled Making It Happen that breaks down key steps for successful implementation.

Step 4.1

Build local interest and desire for continued implementation

Step 4.2

Revisit and revise your plan regularly

STEP 4.1

Step 4.1: Build local interest and desire for continued implementation

TASKS TO DO

☐	4.1a: Share and promote the plan.
☐	4.1b: Convene local government staff leadership to discuss the plan.
☐	4.1c: Use your performance metrics strategy to communicate progress.

4.1a: Share and promote the plan

Once the plan is adopted, make sure to share the adopted plan with the core team, steering committee members, appointed and elected boards, and other interested stakeholders. Consider placing the adopted document on your community's website, sharing a press release about its adoption, and sharing on your community's social media platforms or other public-facing spaces.

Additional ideas to promote the plan

- **Create an executive summary or brochure:** Create a short summary of the plan including the resilience vision, goals, strategies, and implementation plan. Share via social media, email, personal correspondence and other means.
- **Distribute a press release.**
- **Announce the plan's completion:** Celebrate adoption/completion online and on social media, and email a link of the plan to all participants. Encourage the community to share the plan with their personal and professional networks.
- **Host a launch party:** Hosting an in-person or virtual launch event is a great way to retain interest in the plan, convene potential funders and implementers, celebrate the community's effort, and share the final product. This strategy can also be used to kickstart specific initiatives, provide annual plan updates, and celebrate progress.
- **Roadshow:** Identify meetings or other events for community groups and organizations and ask to give a plan update and make a call to action.

Additional ideas to sustain community engagement

- **Communicate:** Identify diverse communication channels to share progress and gather additional community input. Provide user-friendly ways for community members to offer suggestions, resources, and feedback.
- **Make engagement engaging:** Identify opportunities for events like resilient neighborhood walks, project showcases, business tours, networking, skill sharing, or socializing with a mission.
- **Celebrate success:** Small steps lead to big changes. And big changes take time. If you forget to highlight your small wins, it might feel like you're not making progress. Keep eyes on the long game by celebrating every step towards change, no matter how big or small.
- **Pay it forward:** Share your experiences and lessons learned with peers and help build a statewide practitioner's network for building community resilience.

STEP 4.1

4.1b: Convene local government staff leadership to discuss the plan

Sometimes, good plans sit on shelves because the value of the plan is not understood. Take time to sit down with your local government staff and walk them through the value of the plan and their role in implementation. In this step, plan meetings with several people who will be key to forward momentum on the plan. If these individuals have not been on the core team, you should plan a substantive meeting with them:

- Planning director, who may be focused on day-to-day permitting and need some time to digest how a long-range plan can be implemented and integrated into the department's workplan and budget process
- City or town manager
- Budget or finance director
- Staff identified in Step 3.3: Develop Implementation Strategy and Performance Tracking, as the implementation lead for the strategy
- Other individuals who are often involved in moving initiatives forward

Focus on helping these staff members see the big picture of your plan, including addressing vulnerabilities and investing in the future of your community, the intent and a few strategies from the plan, the process that you went through to develop it, and if there are shared goals or actions with other adopted plans. For staff identified as lead for strategies, consider hosting a group meeting or periodic, individual meetings throughout the year to learn which specific strategies they have been assigned and connect on the status of strategies being led by their departments. Discuss how your departments can work together to accomplish the strategies; identify priority strategies that should be moved forward in the next budget cycle, how the strategies can be worked in your department's yearly budget or Capital Improvement Plan (CIP), and if additional grant funding is needed to implement; and identify any barriers that may prevent strategies from being implemented. Further, examine the strategies where additional information might be needed for inclusion in your community's budget or to seek grant funding. This early and frequent discussion of your priority strategies will ensure you are prepared to move the strategies into the next budget cycle or apply for grant funding.

When setting up these meetings, consider timing of the budget cycle in your community. Some of your initiatives may require funding, and you will want them to get programmed into the local budget. If your community's budget process begins in February with a required adoption by July 1, start early to vet any additional information or partnerships that may be needed to implement the project. You will want to make sure these key individuals are informed of the value of the plan and its strategies before budget planning begins.

4.1c: Use your performance metrics strategy to communicate progress

Communicating progress is essential to demonstrating the need for the plan and obtaining the staff and financial resources needed to implement it. Put the schedule you developed for reporting on performance metrics in Step 3.3: Develop implementation strategy and performance tracking, into the calendar of the people responsible for aggregating data, writing the report, and disseminating it. Make sure that you share your progress with external audiences, like community members. At a minimum, place an update of the strategies on your community's website or consider presenting strategy updates to the community's planning board, elected body, or other related committees. Elected and appointed officials need to understand the impact of ongoing work and may not have a background in planning or resilience. These presentations are often higher impact than written updates.

Coordinate with your community's public information officer or staff person who is responsible for sharing news from your community to identify opportunities to provide updates to the public. If your community produces an annual report, consider including an update. Another way to share updates and performance metrics is to work with partners. Identify partners who were part of the initial planning process or who have shared interests, and have those partners share performance updates through their communication networks.

STEP 4.2

Step 4.2: Revisit and revise your plan regularly

TASKS TO DO

☐	4.2a: Reconvene the steering committee and core team to revisit the plan at least annually.
☐	4.2b: Update your plan.

4.2a: Reconvene the steering committee to revisit the plan at least annually

One of the hallmarks of resilience planning is flexibility. The future is full of unknowns, including climate change, development patterns, economic growth and challenges, internal capacity, and leadership changes. Reconvening the steering committee helps your resilience plan stay alive and relevant.

One of the key purposes of reconvening the steering committee is to look with fresh eyes at the plan and its performance so far. Identify areas where values may have shifted or the strategy to implement a project needs to be amended. Examine internal and external capacity to implement projects. Are additional resources, including staffing or budget, necessary to complete a project? Discussion may also include interim metrics that are not issued publicly. These metrics sometimes hold disappointing news, like a project that is not producing its intended benefits, or an unforeseen obstacle in implementation. The steering committee is the right forum to discuss these setbacks and make key decisions about whether to stay the course or make changes in approach. While some people see setbacks as failure, the field of resilience planning embraces the idea that failure is part of the process, as long as we learn from it. In fact, in the natural resources field, a practice called adaptive management builds regular progress check-ins and opportunities to change course into the process. Some resilience programs have borrowed this approach, ensuring honest performance assessment and the ability to change course.

The other key purpose of reconvening the steering committee is to look forward. Collectively, discuss the next steps for implementation. Are there new

opportunities coming online? Which pieces of the plan are more or less relevant now? This conversation is especially important in tandem with the budget planning cycle to determine what to ask for in the local budget. For this reason, as with meetings with local government leadership, ensure that you consider the budget cycle timing in planning the steering committee reconvening.

4.2b: Update your plan

Effective plans are updated on a regular cycle, typically every five years. Hazard mitigation plans must be updated every five years. Comprehensive Economic Development Strategies get updated every five years. Many transportation plans must be updated on a four-year cycle. Updating your plan helps it stay relevant to community needs and continue to be taken seriously.

However, not every plan may need a wholesale rewrite. You may want to take the opportunity to dig deeper into a particular topic or type of project. Your vulnerability assessment may need small tweaks but it is possible that nothing major has changed. Use the performance data on your plan, along with local priorities and opportunities, to revisit and revise your plan.

You are now building a more resilient community. For inspiration and practical tips on how others in North Carolina have done the same, please view the Idea Book.

RESOURCES

RESOURCES

Stat. §§ 160D-501. (2020). https://www.ncleg.gov/EnactedLegislation/Statutes/PDF/BySection/Chapter_160D/GS_160D-501.pdf

Final Report to the North Carolina Policy Collaboratory. NC Flood Resilience Study. UNC-Chapel Hill. May 2021. https://collaboratory.unc.edu/wp-content/uploads/sites/476/2021/05/compound-flooding.pdf

RCCP Handbook, EPA/FEMA Regional Resilience Toolkit https://www.deq.nc.gov/coastal-management/resilience/rccp-planning-handbook-1-1-2024/download?attachment

Building Community Resilience with Nature-Based Solutions. A Guide for Local Communities. FEMA. June 2021. https://www.fema.gov/sites/default/files/documents/fema_riskmap-nature-based-solutions-guide_2021.pdf

International Association for Public Participation (IAP2) Spectrum of Public Participation (2018) https://www.iap2.org/page/pillars

North Carolina Local Government Contracting: Quick Reference and Related Statues https://www.sog.unc.edu/publications/books/north-carolina-local-government-contracting-quick-reference-and-related-statutes

APPENDICES

NORTH CAROLINA
RESILIENT COMMUNITIES PLANNING GUIDE

DECEMBER 2024

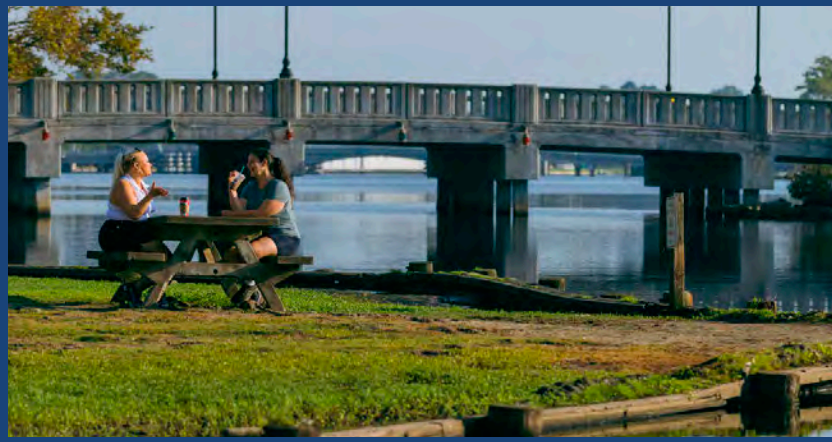
NCORR
NORTH CAROLINA OFFICE OF RECOVERY AND RESILIENCY

N★C DPS
DEPARTMENT OF PUBLIC SAFETY

EQUAL HOUSING OPPORTUNITY

APPENDIX | A

POTENTIAL PARTNERS



APPENDIX A

This list of potential partners is a summary of partners that can assist in various aspects of your resilience planning. For a more in-depth list of partners, subject matter experts, and other resources, check out the NC Resilience Exchange.

- **State Climatologist and State Climate Office**
- **Other State Agencies:**
  - NC Department of Environmental Quality, Division of Coastal Management
  - NC Department of Health and Human Services, Climate and Health Program
  - NC Department of Public Safety, Office of Recovery and Resiliency
  - NC Department of Public Safety, Division of Emergency Management (in particular, the floodplain mapping program)
  - NC Department of Transportation, Resilience Program
  - NC Natural Heritage Program, NC Department of Natural and Cultural Resources
  - NC Wildlife Resources Commission
- **UNC School of Government ListServs:** connect to various peer-to-peer networks such as
  - Planners and Planning Departments (ncplan)
  - Floodplain (ncfloodplain)
  - Emergency Management (ncem)
- **University Programs**
  - Eastern Carolina University, Community and Regional Planning Program and Coastal Studies Institute (CSI)
  - North Carolina Sea Grant and NC State University Extension
  - NC State University, Department of Landscape Architecture and Environmental Design, especially the Coastal Dynamics Design Lab
  - North Carolina Clean Energy Technology Center at NC State University
  - University of North Carolina at Chapel Hill, Department of City and Regional Planning
  - Collaboratory for Coastal Adaptation over Space and Time (C-CoAST)
  - UNC Asheville National Environmental Modeling & Analysis Center
  - Appalachian State University
- **Professional Associations**
  - American Planning Association – NC Chapter
    - APA Community Planning Assistance Teams
  - North Carolina Association of State Floodplain Managers
  - Storm Water Association of NC
  - NC American Institute of Architects
  - NC Association of Zoning Officials

- **Nonprofits**
  - The Conservation Fund, especially Resourceful Communities
  - Conservation Trust for North Carolina
  - Environmental Defense Fund
  - The Nature Conservancy
  - NC Inclusive Disaster Recovery Network at MDC, Inc.
  - Coastal Federation
- **Nonprofits with Environmental Justice or Disaster Recovery Expertise**
  - AMEXCAN
  - NC Black Alliance
  - NCVOAD
  - NC Environmental Justice Network
- **Regional Organizations**
  - Regional Council of Governments (COG)
  - Resource Conservation and Development Councils
  - Health Department
- **County Agencies and Committees**
  - Cooperative Extension Office
  - Soil and Water Conservation Office
  - County Engineer
  - Planning Department
  - Planning Board
  - Local Floodplain Administrator
  - Emergency Management
  - Drainage District Boards
- **Other**
  - AmeriCorps/VISTA
  - Conservation Corps North Carolina

APPENDIX | B

PUBLIC PARTICIPATION SUPPLEMENT

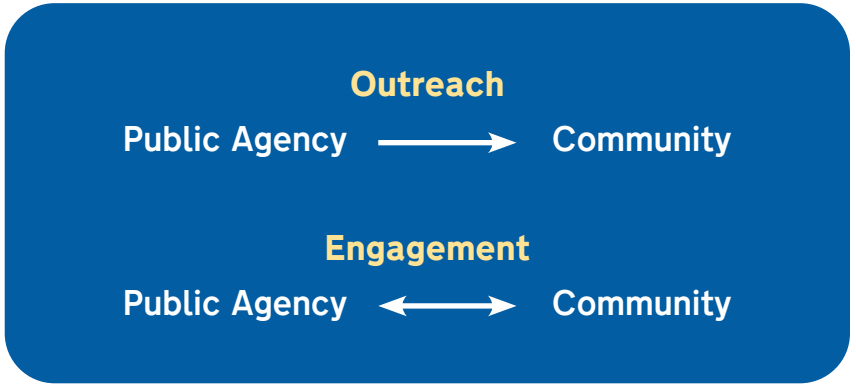
APPENDIX B

Contents

Introduction

Outreach and engagement are essential to the success of your resilience initiatives. The Public Participation Supplement to the *North Carolina Resilient Communities Planning Guide* provides information, tips and best practices to help you plan, prepare for, and facilitate effective communication and opportunities for engagement over the course of your project. It is a companion document to the *North Carolina Resilient Communities Planning Guide Playbook*. The *Playbook* walks you through the process of developing a resilience plan. Strong community engagement will improve the process and the end results. The *Playbook's* Step 1.2: Create a scope of work and public participation framework, refers you to this Public Participation Supplement to develop a plan for public engagement and feedback throughout the planning process. You may wish to consult this supplement at multiple points in your planning process.

Outreach and engagement are separate, but related, actions requiring different approaches and strategies. **Outreach is a one-way flow** of information while engagement is building relationships with the community, listening to community needs, collaborating and providing people with the tools and information they need to participate in a public process. Outreach makes important information easy to understand and then shares it with those who need it in the community. This includes things like emergency alerts, understanding your flood risk and sharing resources. **Engagement is a meaningful, sustained, and intentional two-way exchange** of knowledge, information and ideas built on a foundation of trust, accountability and responsibility to the community.



Each community will have a different capacity and level of resources available to dedicate to public participation outreach and engagement. The information in this supplement is flexible and should be tailored to your unique context. The most common challenges in public participation include competing priorities, lived experience or barriers that lead to community disinterest in participation. Suggestions for overcoming these challenges are included throughout this supplement.

Identify Public Participation Objectives

Effective outreach and engagement are important to every planning effort and project, but the reasons to connect with the public and other stakeholders vary. Different project phases have different goals or objectives. The most common reasons for outreach and engagement include:[1]

- **Raising awareness:** Introducing the effort to the public and stakeholders, providing information about how to learn more and how to stay involved and setting expectations for the project's process and outcomes.
- **Setting context and framing key issues:** Providing the public, stakeholders and elected officials with balanced and objective information to assist them in understanding alternatives, opportunities and solutions.
- **Consulting the community:** Gathering feedback on alternatives, analysis and decisions.
- **Involving the community:** Ensuring that the community's concerns and aspirations are understood, considered and reflected in the plan.
- **Collaborating with the community:** Partnering with the public and key stakeholders at every project phase to identify and select alternatives, strategies and other preferred solutions.

[1] Adapted from International Association for Public Participation (IAP2) Spectrum of Public Participation (2018)

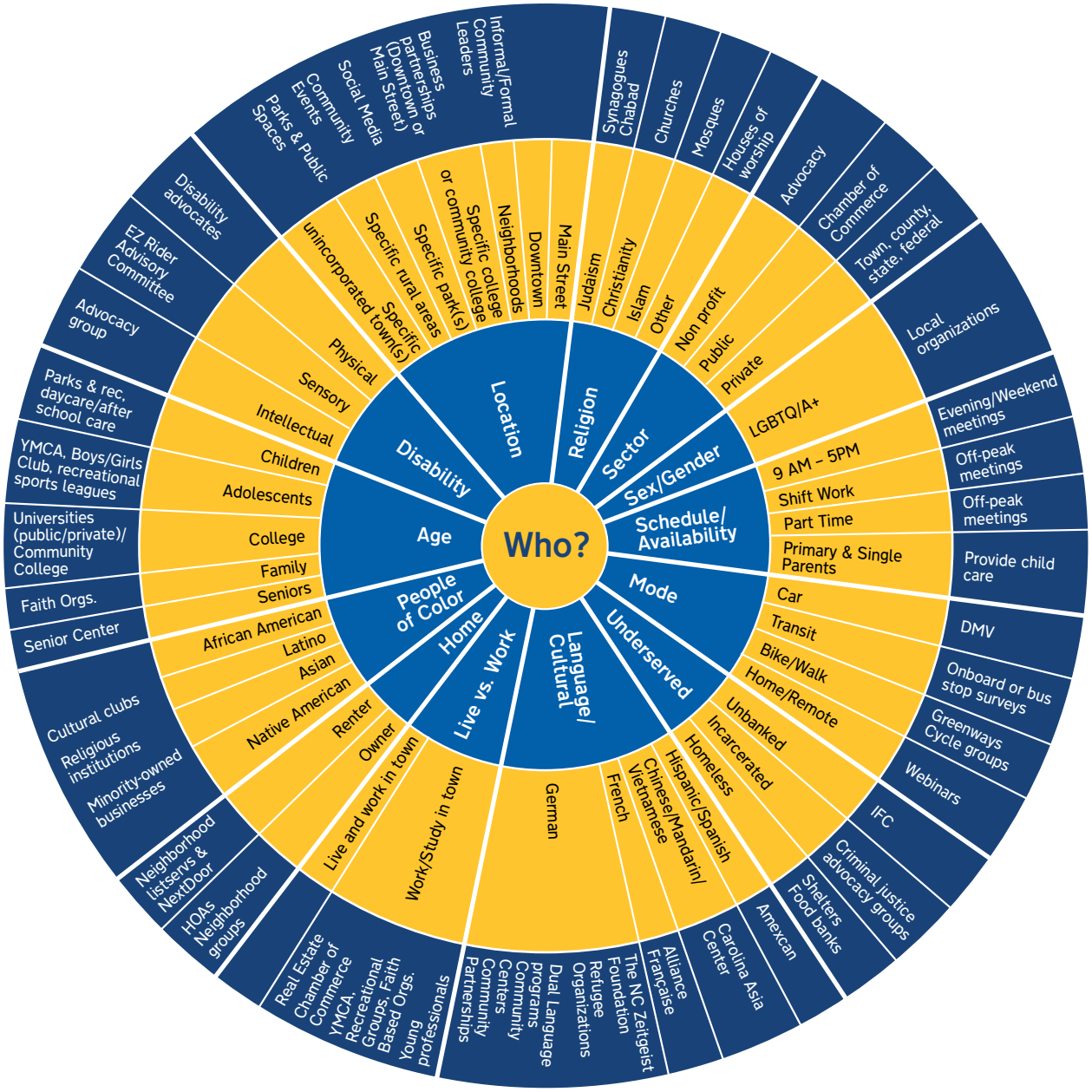
Objective	Example Activity
Raise awareness Build brand/project awareness, provide information, offer accountability for process and outcomes.	Let community members know the planning process is beginning and that their feedback impacts outcomes. Provide a way for the public to sign up and receive project update emails.
Set context and frame issues Provide the tools and information people need to make informed decisions.	Illustrate tradeoffs through a hands-on activity by asking participants to learn about project options and then "spend money" on their highest priority projects.
Consult Request and gather feedback on alternatives, analysis, and/or decisions.	Administer a public survey asking the community to weigh in on a preferred option or project.
Involve Work directly with the public, stakeholders and elected officials to hear, understand and consider their concerns and aspirations.	Conduct a workshop where participants can share their ideas, discuss concerns, and explore possible resilience strategies.
Collaborate Community-generated vision, goals and strategies.	Conduct a workshop or a more extended multiday charrette with staff, community members and elected officials to envision and plan a more resilient community through facilitated discussions and activities. Participants might have the opportunity to provide specific feedback on their vision or prioritize goals and strategies.

Identify Participants

Your outreach and engagement objectives also guide who needs to participate and the audience for outreach. Knowing your audience helps you identify strategies with a higher likelihood of success. It also ensures that public participation is representative of your community. It is important to make room for a broad range of perspectives and opinions.

Typical Groups for Engagement	Who is included?
General population	Anyone and everyone who lives, works, owns a business or spends time in the community.
Select community members	People or groups impacted by, or with a specific interest, in project outcomes; may be geographic-based or project-based.
Key stakeholders	Agencies, organizations, interest groups, etc. impacted by, or representing people impacted by, project outcomes.
Elected or appointed officials	Leaders representing the community at large or specific places or interests in the community. This might be a council, commission or planning board member.
Funders, implementors and champions	People who can help build support for the plan or who have access to resources needed for implementation.

To brainstorm more diverse engagement beyond your typical participants, use the engagement wheel on the next page. The wheel identifies different characteristics and interests of community members and helps draw out considerations for their engagement in a planning process. For example, if age diversity is an important component, you can start with the broad category of age, then subdivide into more specific groups like teens or seniors. The outermost ring provides guidance on how and where to engage each subgroup.


Who?
Location
Religion
Sector
Sex/Gender
Schedule/ Availability
Mode
Underserved
Language/ Cultural
Live vs. Work
Home
People of Color
Age
Disability
Main Street
Downtown
Neighborhoods
Specific college or community college
Specific park(s)
Specific rural areas
Specific unincorporated town(s)
Judaism
Christianity
Islam
Other
Non profit
Public
Private
LGBTQ/A+
9 AM - 5PM
Shift Work
Part Time
Primary & Single Parents
Car
Transit
Bike/Walk
Home/Remote
Unbanked
Incarcerated
Homeless
Hispanic/Spanish
Chinese/Mandarin/ Vietnamese
French
German
Work/Study in town
Live and work in town
Owner
Renter
Native American
Asian
Latino
African American
Seniors
Family
College
Adolescents
Children
Intellectual
Sensory
Physical
Informal/Formal Community Leaders
Business partnerships (Downtown or Main Street)
Social Media
Community Events
Parks & Public Spaces
Synagogues Chabad
Churches
Mosques
Houses of worship
Advocacy
Chamber of Commerce
Town, county, state, federal
Local organizations
Evening/Weekend meetings
Off-peak meetings
Off-peak meetings
Provide child care
DMV
Onboard or bus stop surveys
Greenways Cycle groups
Webinars
IFC
Criminal justice advocacy groups
Shelters Food banks
Amexcan
Carolina Asia Center
Alliance Française
The NC Zeitgeist Foundation
Refugee Organizations
Dual Language programs
Community Centers
Community Partnerships
Real Estate Chamber of Commerce YMCA, Recreational Groups, Faith Based Orgs.
Young professionals
HOAs Neighborhood groups
Neighborhood listservs & NextDoor
Cultural clubs
Religious institutions
Minority-owned businesses
Senior Center
Faith Orgs.
Universities (public/private)/ Community College
YMCA, Boys/Girls Club, recreational sports leagues
Parks & rec, daycare/after school care
Advocacy group
EZ Rider Advisory Committee
Disability advocates

Potential Participants and Community Stakeholders

Use the list of key participants in the table to identify organizations and departments to involve in your resilience planning effort. This list is intentionally broad to help spark ideas. Everyone does not need to be engaged at every phase of planning. The example participants may be relevant at different points in your resiliency planning effort for different reasons. The table indicates the types of participants and examples of each. For instance, if you want to understand the cultural resources that may be at risk in your community, you can refer to the examples under the cultural resources type of participant. Or, if you need subject matter expertise regarding stormwater services, you can refer to public works stakeholders.

Depending on the size of your community and local government, some of these potential participants and community stakeholders may not exist, and your ability to reach a broad audience will be more limited. In these cases, consulting with representatives from a larger regional or state organization may be helpful.

Type of participant	Examples
Advisory boards and commissions	• Planning commission or board • Soil and water conservation district • Stormwater • Transportation • Zoning board of appeals • Environment, natural resources, cultural resources • Historic preservation • Recreation
Businesses and business advocacy organizations	• Chamber of commerce • Economic and workforce development • Downtown or business improvement district • Small businesses • Startups and business incubators • Restaurants and food service • Retail establishments • Personal service establishments • Design professions – engineers, architects and landscape architects • Insurance providers • Home builders

Type of participant	Examples
Clubs, non-profit organizations and interest organizations	• Community-based organizations (CBO) • Main Street organizations • Environmental advocacy organizations • Land trusts • Rotary Club • Kiwanis Club • Faith-based organizations and groups • Homeowners' associations (HOA) • Cultural- or language-based interest groups • Age-based (seniors, youth) organizations • Recreation groups
Cultural resources	• Historic preservation organization • Arts council • Museums • Libraries • Tourism or visitor's bureau • State or federal parks and lands
Education	• Childcare providers • Pre-kindergarten • K-12 • Higher education
Elected officials	• Senator or congressional representative (or staff) • State senator or assembly person • County commissioners • Mayor • Town, city or county commissioners or council members • Soil and water conservation district representative

Type of participant	Examples
Emergency management and services	• Emergency management • Hazard mitigation • Police • Fire • Emergency medical services (EMS)
Environment and natural resources	• Environmental planner • Coastal zone planner • Natural resources • Soil and water conservation district representatives • State or federal parks, lands or other assets
Federal agencies and departments	• Federal Emergency Management Agency (FEMA) • Environmental Protection Agency (EPA) • Department of Transportation (DOT) • Department of the Interior (DOI) • Department of Health and Human Services (DHHS)
Financial institutions and funders	• Community Development Finance Institution (CDFI) • Foundations • Philanthropic organizations
Health and social services	• Healthcare providers • Public health department or clinic • Public housing • Retirement living facilities • Senior center • Community center • Hospital

Type of participant	Examples
Media	• Local or regional television stations • Radio stations (especially Spanish or other non-English stations) • Newspaper and other news media • Local social media personalities • Local bloggers or social media groups/sites
Municipal administration	• Finance or budget officer • Municipal attorney • Manager or assistant manager (county, city or town)
Planning, development and land use	• Planning director • Sustainability planner • Chief resilience officer • Land use or long-range planner • Development review or short-range planner • Certified floodplain manager • Code enforcement • Parks and recreation • Zoning administrator • Councils of government or regional commissions • Developers and real estate professionals

Type of participant	Examples
Public services and public works	• Public service or public works director • Facilities maintenance director • Sanitation manager • Water operations • Stormwater manager or utility representative • Transportation • Transit providers • Utility providers • Metropolitan Planning Organization (MPO) • Rural Planning Organization (RPO) • Engineer
State agencies and departments	• Agriculture and Consumer Services • Environmental Quality, including its divisions of Coastal Management and Water Resources • Commerce, including its Small Business Advisors team and Rural Economic Development Division • Emergency Management, including its National Flood Insurance Program (Floodplain Management) team • Health and Human Services • Transportation • Insurance

Best Practices for Equitable Engagement

Successful outreach and engagement requires thoughtful strategies to ensure accessibility so participants have opportunities to receive information and participate. Accessibility includes physically accessible events, which are easy to attend and are held on days and times that take into consideration various schedules. Accessibility also refers to being psychologically accessible, or making the meeting space safe and comfortable for participants to share information. Additionally, culturally-linguistically accessible means people can participate in their preferred language or mode of communication and are not required to participate in unfamiliar or uncomfortable ways. Overall, equitable engagement represents your community's geography, race and ethnicity, age, gender and other demographic characteristics. Equitable engagement also emphasizes and centers historically marginalized community members.

People give many reasons for not participating in planning engagement and outreach efforts, but common reasons include:

- Lack of knowledge of the political system or the opportunity
- Previous negative community engagement experience
- Economic barriers; needing to focus on basic needs of self and family
- Not seeing one's own culture or identity reflected in meeting format or content
- Fear of being judged, and feeling emotionally unsafe or unwelcome
- Transportation barriers
- Childcare needs
- Spiritual beliefs and practices
- Immigration status
- Meeting time or date does not consider work schedules, religious holidays, mealtimes or other family needs
- Historical patterns of municipal decisions do not reflect community input; broken promises made by politicians or government staff, resulting in reinforced distrust of government and institutions[2]

These challenges may result in engagement efforts that always attract the same group of people, are unfruitful, or do not produce representative community input because community members are uncomfortable or uninterested in public meetings or workshops altogether. To address these challenges, you may want to consider establishing a resident "ambassador" or "champion" program to work with and through established community leaders (compensating them for their time if possible), or providing childcare at outreach and engagement events. Additionally, you may consider conducting outreach and engagement at well-attended community events that are already occurring, like farmers markets, cultural or holiday celebrations, block parties, festivals and school or sporting events. Meeting community members where they already gather helps you reach a wider range of people than may normally be comfortable coming to a government building and reduces the resources you need to support such an event.

The following table provides recommendations for ways to enhance your outreach and engagement efforts specific to some of the common challenges you may face in community engagement.

[2] Adapted from *Equitable Community Engagement Blueprint,* City of Durham, and Groundwork USA and "Establishing Norms", Advancing Racial Equity in Schools

Challenges in community engagement	Outreach strategies to address challenge
You anticipate challenges based on a historical lack of trust.	Building trust and sustaining engagement by establishing relationships with community leaders and residents through dedicated efforts like small group listening sessions. Holding pop-up events in locations or at events where the community already gathers. Considering the needs already voiced, and ensuring your messaging and outreach acknowledges those needs.
Participants do not reflect the community's demographic profile.	Providing childcare, food, compensation or transportation service to increase participants' ability to attend events. Finding organizations or individuals who can speak on behalf of a particular community or providing two-way information exchange.
Your target participants work in service industries or have school-aged children.	Varying the days and times of your engagement events and conducting events at non-traditional times in non-traditional locations (e.g., transit stop surveys, school or sports events).
You have significant shares of older or younger people in the planning area.	Conducting targeted outreach and engagement using methods and focusing on issues important to youth or seniors.
You have non-English-speaking residents in the planning area.	Translating outreach materials and provide interpretation services at events; make sure residents know there will be interpretation.
You have residents who are hearing- or vision-impaired.	Providing enhanced accessibility services (e.g., sign language interpretation) at events. Consider a hybrid meeting option or recording the meeting to make it safe and easy for those with physical disabilities to attend.

Name and Reinforce Ground Rules or Group Norms

To ensure participants in your community engagement efforts feel welcome, you should establish and reinforce agreements of mutual respect and confidentiality including:

- **Stay engaged.** Limit distractions, mute your microphone when not actively speaking, listen to speakers even if you don't understand their perspective.
- **Speak your truth and acknowledge it is only part of the truth.** Your experience is not universal.
- **Accept and explore your discomfort.** Engaging in difficult conversations in a meaningful way often means stepping outside of your personal comfort zone. This is normal and necessary.
- **Be okay with a lack of closure.** Difficult situations require long-term commitment to change. Commit for the long-haul and identify the steps needed to get started.
- **Step up and step back.** If you talk a lot, try listening more, even when you have something to say; this helps create space for others to speak. If you are someone who tends to hold back in these types of forums, take a chance to step up and share your thoughts.
- **Disagree with an idea, not a person.** Be intentional about language, tone and intent.
- **Be respectful.** Assume best intentions but make no other assumptions. Stay curious and ask questions to better understand.[3]

[3] Adapted from "Establishing Norms", Advancing Racial Equity in Schools

Identify Strategies for Outreach and Engagement

After identifying who you need to engage, and any specific challenges or other considerations, next think about how you will do it. Outreach and engagement strategy selection depends on your plan goals, phasing, timeline, target participants and available resources. The table below introduces outreach and engagement approaches and, using icons, identifies how the strategy is executed, the relative level of effort (i.e., required time and resources), and the outreach or engagement goals that each strategy helps achieve. As you read through the ideas, identify the options you believe would work best in your community, and consider them for inclusion in your scope of work (*Playbook*, Step 1.2) and public participation framework.

Technique	Description	How	Level of Effort	Best for...
Workshop	Interactive events where people exchange information and collectively identify/prioritize goals, issues, challenges, and brainstorm solutions.	In person Virtual	Medium	Gathering, sharing background and contextual information Getting feedback/considering alternatives
Design Charrette	Appropriate for placemaking and physical design topics. During a charette, facilitators prepare on-the-spot plans, sketches, and illustrations or present ones that have been prepared for the event beforehand. Participants are asked to provide instant analysis and feedback on the designs.	In person Virtual	High	Raising awareness/project recognition Getting feedback/considering alternatives
Open House	Drop-in education or informative events to keep the community informed and engaged. Feedback and input on information can also be collected during this type of event.	In person	Medium	Raising awareness/project recognition Getting feedback/considering alternatives
Focus Group	Brings together a small group of like-minded stakeholders (e.g., bicycle enthusiasts or members of a church congregation) to discuss issues of particular concern to them.	In person Virtual	Low	Gathering, sharing background and contextual information
Community Conversation	Facilitators go where community members are (e.g., senior centers, schools, low-income housing developments, community centers, barber shops/beauty salons, sporting events) to talk with them about their vision and goals for their community.	In person	Medium	Gathering, sharing background and contextual information Getting feedback/considering alternatives Storytelling/documentation

Technique	Description	How	Level of Effort	Best for...
Interviews	One-on-one conversations with community members to dive deeper into their concerns and vision for their community. Can be organized or conducted on the fly on street corners.	In person Virtual	Low	Gathering, sharing background and contextual information Storytelling/documentation
Walking Tour	Led by community members, facilitators are shown around streets and neighborhoods and shown issues and opportunities from the perspective of the people who live, work and play there.	In person	Medium	Raising awareness/project recognition Gathering, sharing background and contextual information Storytelling/documentation
Educational Forums	Usually involve presentations by thought leaders and facilitated discussions. Important when there is a need for knowledge exchange within the community about emerging issues, best practices, etc.	In person Virtual	Medium	Raising awareness/project recognition Gathering, sharing background and contextual information
Roadshow	A set of prepared materials and posters that can be distributed at various existing community events. Facilitators set up a table at the event, and passersby can ask questions about the project and provide feedback.	In person	Medium	Raising awareness/project recognition Getting feedback/considering alternatives
Pop-Up	Facilitators can share materials at various public spaces (e.g., street corners, bus stations, grocery stores, parks, coffee shops) ask community members questions, hand out information and collect feedback.	In person	Medium	Raising awareness/project recognition Getting feedback/considering alternatives
Storytelling	On-the-spot solicitation of local stories from community members. Can be part of workshops, standalone pop-up events or leveraged with other similar arts, cultural or educational events. Stories can be gathered in written, visual, oral or video formats.	In person Virtual	Medium	Gathering, sharing background and contextual information Storytelling/documentation
Survey	Using online or printed copy tools to gather information from the public and stakeholders. Surveys can be paper or online and utilize questions, words or pictures.	In person Virtual	Medium	Gathering, sharing background and contextual information Getting feedback/considering alternatives
Demonstration Projects	Short-term, low-cost installations in public spaces to attract passersby, engage them in conversations about the municipality, and provide examples of the types of solutions, projects or spaces that could exist.	In person	Medium	Raising awareness/project recognition

Technique	Description	How	Level of Effort	Best for...
Webinar/ Livestream	For those who cannot make it to in-person events, webinars and live broadcast events allow people to participate in the process, receive project information, ask critical questions and provide feedback remotely.	Virtual	Low	Raising awareness/project recognition Gathering, sharing background and contextual information
Vision Book	Displayed in public locations, like a library; allows for in-person, anytime engagement by writing feedback in a "vision book." Participants may be asked to describe their vision for the municipality, for resilience or their values.	In person	Low	Gathering, sharing background and contextual information Getting feedback/considering alternatives
Public Installation	Posters and flyers with project information and FAQs displayed prominently in public spaces. There may be opportunities for engagement, such as a chalk board mural with the statement "The Future of [COMMUNITY] is..." allowing community members to complete the sentence. No facilitation necessary.	In person	Medium	Raising awareness/project recognition Getting feedback/considering alternatives Storytelling/documentation
Website	A way to provide and collect information. Resource for educational materials, process and timeline information, upcoming meetings/events and postings for feedback and surveys.	Virtual	Medium	Raising awareness/project recognition Getting feedback/considering alternatives
Social Media	Platforms like Facebook, X (formerly Twitter), and Instagram can be used to advertise planning efforts, promote community engagement, and host surveys. These sites often attract participants who are new to the public process or who may be fearful of participating in person.	Virtual	Low	Raising awareness/project recognition Getting feedback/considering alternatives
Photography Initiative	Community members receive disposable cameras or create an online version of the initiative through Instagram to capture both positive and challenging daily experiences in the municipality. The photographs are printed and displayed in a public space and/or online.	In person Virtual	Medium	Gathering, sharing background and contextual information Storytelling/documentation

Technique	Description	How	Level of Effort	Best for...
Explainer Video	High production value videos (animated or live action) can be one of the most effective ways to communicate complex planning concepts and policies. Videos can include interviews, moving infographics and many other exciting communication techniques. Videos are shown at meetings and are accessed online for free.	Virtual	Medium	Raising awareness/project recognition Storytelling/documentation
Video Tour	To set community context and provide background information, a video tour can be produced for a project. The tour introduces the project extent, key contextual information, and helps tell the community's story.	In person Virtual	Medium	Storytelling/documentation
Video Documentation	Videos can capture and share engagement efforts, helping to tell the story of a project. These can be short videos to share on social media or longer videos to memorialize a project's public involvement efforts and outcomes.	In person Virtual	Medium	Storytelling/documentation
ESRI Story Map	The online Story Map platform is an engaging way to use maps, spatial information, photos and videos to share the story of a place or product online.	Virtual	Low	Storytelling/documentation Gathering, sharing background and contextual information
Newsletter	Produced and distributed when key milestones are met to keep the public up to date with progress. May be online, email or in print.	Virtual	Low	Raising awareness/project recognition
"Table Talk" Dinner Party Kit or "Out of the Box" Campaign	Small groups such as families and roommates receive a box with educational materials, worksheets, prompting questions and self-facilitated exercises. They sit down together to complete the exercises and return their materials—with their feedback—to the project team for analysis.	In person	Medium	Gathering, sharing background and contextual information Getting feedback/considering alternatives
Podcast	Work with community members to capture their experiences and their vision via audio diaries or a podcast.	In person Virtual	Medium	Gathering, sharing background and contextual information Storytelling/documentation
Video Diaries	Work with community members to capture their experiences of city life and their vision for the municipality in video or audio diaries or a short docuseries.	In person Virtual	Medium	Gathering, sharing background and contextual information Storytelling/documentation

Spreading the Word

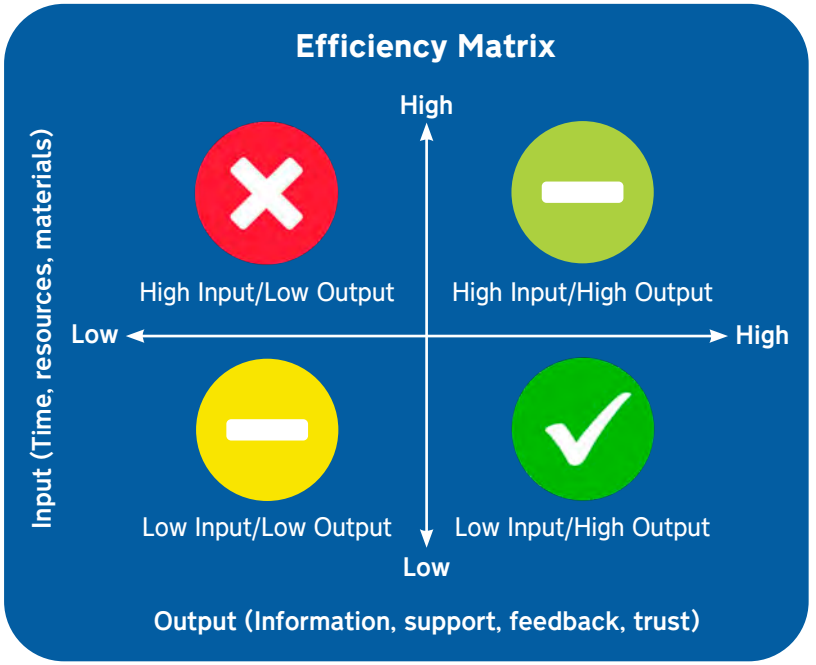
Use the following strategies to share information about opportunities to participate:

- **Tell People:** A personal invitation is an effective way to generate interest. Set goals for your project team and steering committee members challenging them to connect with people via email, call, text or a visit.
- **Enlist Trusted Organizations:** Ask long-standing and trusted community partners to help spread the word.
- **Promote through Mailings:** Include project information in municipal mailings like utility or tax bills.
- **Leverage Digital Neighborhoods:** Ask steering committee members to share information via neighborhood email listservs, homeowners' associations, NextDoor online platform, and virtual neighborhood bulletin boards.
- **Connect with Local Media:** Reach out to community-based media like a local newspaper and/or community bloggers and share information.
- **Use Social Media:** Create and share information via Facebook, X (formerly Twitter), Instagram, TikTok, etc.; ask community organizations to share with their networks as well.
- **Speak with Community Groups:** Ask to attend meetings of neighborhood associations, Main Street groups, city or town committees and other groups to provide updates.
- **Translate Materials:** If your community has populations that speak languages other than English, translate flyers and invitations into languages commonly spoken in your community.

Scaling Your Approach

Available resources are typically the limiting factor when considering which strategies to apply for a project's outreach and engagement efforts. This is true for both small and large municipalities and counties but may feel especially challenging for those with limited staff. Aligning strategies with your target participants and project goals ensures the most efficient use of limited resources. When identifying strategies for your resilience plan, increase efficiency by:

- Choosing "low input, high output" strategies, meaning strategies requiring few resources but generating good results. These strategies will vary based on your needs and target audience (see Efficiency Matrix below).



- Scaling strategies to make them more feasible. For example, by using Zoom or PowerPoint to record a 30-second audio/video update to share on social media versus a video produced by a professional videographer.
- Working with a public information officer from your municipality, county, or a local tourism/visitor's bureau to develop and share information about your effort. You may be able to identify a partner outside your organization who has resources to assist you in developing your outreach and engagement strategy or in disseminating information.
- Utilizing existing community groups or attending community events hosted by others to evaluate strategies and information. Examples of this include using the community's planning board or council/board meeting to share or receive information from the community or attending an Earth Day event hosted by a local nonprofit at a community park to seek public input.

Measuring Success

Successful, meaningful, and equitable outreach and engagement is achieved when participants reflect the overall community. By regularly assessing if we are meeting this goal, we can hold ourselves accountable and recalibrate the approach if needed. The table below identifies various measures of success and example metrics you can use to assess your outreach and engagement efforts. If you find that you are not meeting the performance metrics you've established, revisit the Best Practices for Equitable Engagement section of this document and recalibrate your approach. Consider which measures of success might be useful for your planning effort as you review the following table.

Measure of Success	Example Metrics
Characteristics of Participants (should reflect the planning area)	• Demographic characteristics (age, race, language) of participants, survey respondents, etc. • Geographic distribution of participants, survey respondents, etc. • Overall stakeholder characteristic types or subtypes engaged (e.g., resident, visitor, part-time resident, business)
Accessibility	• Number of participants attending events with interpretation services • Number of participants traveling to events via transit • Number of events held concurrently with scheduled neighborhood events • Effectiveness of outreach to Limited English Proficiency (LEP) participants
Equity	• Number of events with childcare • Days, times and locations of engagement events are varied
Reach and Effectiveness	• Number of attendees at events (in person and/or virtual) • Number/frequency of engagement opportunities • Number of comments received (if applicable) • Number of survey responses (if applicable)
Integration and Communication of Feedback	• Comments/feedback tracked, documented, and responses provided • Project/plan clearly describes how community feedback informed outcome(s) • Accessible summaries of feedback and input are available

Conclusion

Strong community engagement and outreach will improve your resilience plan by putting the knowledge and creativity of your community to work. But community engagement and outreach are also key to eventual implementation of your plan's strategies. Community buy-in, support, and excitement about the actual work outlined in your plan is essential to obtaining the political will of decision-makers and in supporting requests for funding, both from your municipality or county and from grant makers. With the information, tips, and best practices outlined in this Public Participation Supplement to the *North Carolina Resilient Communities Planning Guide*, you now have the tools you need to create an effective, equitable, and accessible public participation framework to support your plan.

APPENDIX | C
TEMPLATES

APPENDIX C

Contents

All Appendix C documents are also downloadable as editable Word and Excel files on the *North Carolina Resilient Communities Planning Guide* webpage at www.resilientplanning.nc.gov.

Scope of Work Template

Supports Step 1.2: Create a scope of work and public participation framework. This can be integrated into a request for proposals (RFP) or request for qualifications (RFQ) or used as an internal scope of work. Feel free to customize the template or use only some parts to fit your needs. ***You will need to refer to your answers from the Scoping Exercise in Step 1.2 of the Playbook.*** *Also consider reviewing the guide North Carolina Local Government Contracting: Quick Reference and Related Statues by Norma Houston for additional guidance on contracting requirements.*

Introduction

This is a scope of work for [NAME OF COMMUNITY, GROUP, OR ORGANIZATION]'s resilience plan. This document describes the elements of the plan and informs the work plan guiding this project. The goal of this project and the plan is to address [INSERT RESPONSE(S) TO QUESTION 1 FROM SCOPING EXERCISE: Is your resilience planning effort focused on one specific climate related hazards or vulnerability or multiple hazards and vulnerabilities?].

Here's an example of what this might look like when you are finished:

This is a scope of work for the Town of Smithville Resilience Action and Implementation Plan. This document describes the elements of the plan and informs the work plan guiding this project. The goal of this project and the plan is to address our community's vulnerability to climate-related hazards.

Plan Focus

[INSERT NAME OF COMMUNITY, GROUP, OR ORGANIZATION]'s resilience plan will focus on building resilience over a [INSERT RESPONSE TO QUESTION 6 FROM THE SCOPING EXERCISE: What is the time frame for actions that your resilience planning effort will include? Over what period of time do you want to investigate projected climate changes?] time frame for [INSERT RESPONSE TO QUESTION 2: What is the geography or spatial extent of your resilience planning effort? AND A BRIEF DESCRIPTION OF THE WHOLE PLANNING AREA].

The following climate hazards and vulnerabilities will be considered and addressed in this plan:

[INSERT A BRIEF DESCRIPTION OF THE SPECIFIC HAZARDS AND VULNERABILITIES TO BE ADDRESSED. IF YOU INTEND TO ADDRESS MULITIPLE HAZARDS AND VULNERABILITIES BUT ARE NOT SURE WHICH YOUR COMMUNITY MIGHT BE MOST IMPACTED BY OR YOU ARE SCOPING A BROAD-BASED RESILIENCE PLAN, INCLUDE A LONGER LIST OF CLIMATE-RELATED HAZARDS MOST LIKELY TO IMPACT NORTH CAROLINA COMMUNITIES.]

This planning effort focuses on building resilience by creating a [INSERT ANSWER TO QUESTION 5] plan focusing on [INSERT ANSWER TO QUESTION 6]. Specifically, [INSERT A BRIEF DESCRIPTION OF YOUR ANSWER TO QUESTION 3: What do you hope to achieve through your resilience planning effort?].

Here's an example of what this might look like when you are finished:

The Town of Smithville's Resilience Action and Implementation Plan will focus on building resilience over a ten-year period and will investigate projected climate changes in the coming thirty years for the Town of Smithville. The town is a small, rural community with a population of 2,500.

The following climate hazards and vulnerabilities will be considered and addressed in this plan: increased intensity of precipitation and the town's vulnerabilities to flooding and erosion; high heat and public health vulnerabilities; and drought and vulnerability to wildfires.

This planning effort focuses on building resilience by creating an exploratory plan focusing on actions the town can take within the next five years to address climate change impacts projected to occur over the next 25 years. Specifically, by developing a consensus-based community resilience vision and goals and assessing the hazards and vulnerabilities most likely to impact our town, we will be able to select solutions to enhance our resilience.

Tasks

The following tasks will be completed to create [INSERT NAME OF COMMUNITY, GROUP, OR ORGANIZATION]'s resilience plans.

Unless otherwise described, the tasks and subtasks below are more fully described in the North Carolina Resilient Communities Planning Guide Playbook. If other local plans, policies, or documents are important for context or for completing the work, include them here and provide a link. Delete project tasks, subtasks or deliverables that are not relevant to your project.

For each task, identify the following elements as relevant to your needs. Don't forget to estimate resources needed for outreach and engagement activities.

***Subtasks:** Each task's individual elements or specific deliverables. Use the steps in the Playbook as a starting point.*

***Lead:** The individual responsible for managing and executing the successful completion of the task.*

***Support:** The staff or people needed to complete each task.*

***Level of Effort:** The estimated number of hours required for successful completion of the task.*

***Budget:** The estimated resources needed to complete the task, based on hours and personnel.*

Task A: Process and participation

Subtask A1: Develop public participation framework (*Playbook* Step 1.2).

Subtask A2: During Phase 1, lead the following engagement activities: [LIST ENGAGEMENT ACTIVITIES]

Subtask A3: During Phase 2, lead the following engagement activities: [LIST ENGAGEMENT ACTIVITIES]

Deliverable(s): [DESCRIBE DELIVERABLES] *Facilitate outreach and engagement as described in your scope of work and public participation framework. Provide a brief narrative, supporting graphics, and images describing the planning process and outcomes of community outreach and engagement activities.*

Lead: [INSERT LEAD]

Support: [INSERT PEOPLE OR STAFF NEEDED TO COMPLETE TASK]

Number of community engagement meetings, type (steering committee or general community and in-person or hybrid), **and timing:** [INSERT NUMBER OF MEETINGS AND TYPE]

Level of Effort: [INSERT NUMBER OF HOURS TO COMPLETE TASK] hours

Task Budget: $[INSERT ESTIMATED BUDGET]

Task B: Define your community's resilience vision and goals. (*Playbook* Step 1.4)

Subtask B1: Develop a vision for your community resilience effort, using the Visioning and Goal Setting Exercise.

Subtask B2: Develop goals to support your vision, using the Visioning and Goal Setting Exercise.

Subtask B3: Conduct community engagement and steering committee meetings as outlined in the public participation framework (Task A and Step 1.2).

Subtask B4: [INSERT ANY OTHER SUBTASKS NEEDED]

Deliverable: [DESCRIBE THE DELIVERABLES] A narrative, supported by graphics and/or data, of the resilience vision and goals, including a description of the desired future state of resilience and how it will be accomplished.

Lead: [INSERT LEAD]

Support: [INSERT PEOPLE OR STAFF NEEDED TO COMPLETE TASK]

Number of community engagement meeting, type (steering committee or general community and in-person or hybrid), **and timing:** [INSERT NUMBER OF MEETINGS AND TYPE]

Level of Effort: [INSERT NUMBER OF HOURS TO COMPLETE TASK] hours

Task Budget: $[INSERT ESTIMATED BUDGET]

Task C: Vulnerability assessment (*Playbook* Steps 2.1 – 2.3)

Subtask C1: Identify and map hazards of concern, including the following: Identify hazards and their key characteristics; Describe previous occurrences in the community, along with historic and potential future impacts; Determine the level of concern (high, medium, low) for the hazard for your community; Summarize this information in a Hazards of Concern Table (*Playbook* Step 2.1).

Subtask C2: Assess vulnerability, including the following: [INSERT ANY SPECIFICATIONS ABOUT DATA SOURCES AND QUANTITATIVE OR MAPPING ANALYSIS DESIRED] (*Playbook* Step 2.2).

Subtask C3: Conduct community engagement and steering committee meetings as outlined in the public participation framework (Task A and *Playbook* Step 1.2)

Subtask C4: [INSERT ANY OTHER SUBTASKS NEEDED]

Deliverable: [DESCRIBE THE DELIVERABLES] A narrative and tables, maps and other graphics, providing a comprehensive understanding of vulnerability in the planning area.

Lead: [INSERT LEAD]

Support: [INSERT PEOPLE OR STAFF NEEDED TO COMPLETE THE TASK]

Number of community engagement meeting, type (steering committee or general community and in-person or hybrid), **and timing:** [INSERT NUMBER OF MEETINGS AND TYPE]

Level of Effort: [INSERT NUMBER OF HOURS TO COMPLETE TASK] hours

Task Budget: $[INSERT ESTIMATED BUDGET]

Task D: Resilience Plan

Subtask D1: Develop a list of strategies that have been prioritized by the steering committee and through community engagement (*Playbook* Steps 3.1 and 3.2).

Subtask D2: Develop implementation pathways and metrics for each strategy. This information should include: the organization or department that will serve as the implementation lead for this strategy; who will provide implementation support; the implementation time frame; estimated cost; other implementation resources; funding sources; and what success would look like for this strategy. In addition to being listed in written format, provide an implementation matrix that summaries each strategy and its implementation pathway (*Playbook* Step 3.3).

Subtask D3: Conduct community engagement and steering committee meetings as outlined in the public participation framework (Task A and *Playbook* Steps 1.2 and 1.3).

Subtask D4: Assist staff in the adoption of the plan by attending city/town/county meetings necessary for adoption including planning board and town/city council or board of commissioners meetings.

Deliverable: Create a resilience plan that brings together and describes Task A: Process and participation; Task B: Identify and describe resilience vision and goals (*Playbook* Step 1.4); Task C: Vulnerability Assessment (*Playbook* Steps 2.1 – 2.3); and the subtasks of Task D: Resilience Plan. The outline for the plan should include the following components:

A. Cover page
B. Table of contents and acknowledgments
C. Executive summary
D. Introduction
E. Resilience vision and goals (*Playbook* Step 1.4)
F. Process and participation. *Describe the planning process and community outreach and engagement activities (Playbook Steps 1.1 and 1.2). Include photos of engagement events.*
G. Vulnerability assessment synthesis (*Playbook* Step 2.3). *Include full vulnerability assessment as an appendix.*
H. Resilience strategies (*Playbook* Steps 3.1 and 3.2)
I. Implementation

Lead: [INSERT LEAD]

Support: [INSERT PEOPLE OR STAFF NEEDED TO COMPLETE THE TASK]

Number of community engagement meeting, type (steering committee or general community and in-person or hybrid), **and timing:** [INSERT THE NUMBER OF MEETINGS AND TYPE]

Level of Effort: [INSERT NUMBER OF HOURS TO COMPLETE TASK] hours

Task Budget: $[INSERT ESTIMATED BUDGET]

Task E: Framework for Implementation

Subtask E1: Develop framework and task list necessary for plan promotion that outlines the community approach to sharing the plan internally with staff and externally with the public.

Subtask E2: Sort and provide list of strategies by responsible person/agency that can be shared at a larger staff meeting to review each department's responsibilities for plan implementation. Include the Strategy Implementation (*Playbook* Step 3.3 Develop Implementation Pathway and Performance Tracking) Matrix for each strategy.

Deliverable: Materials described in Subtask E1 and E2 above that are necessary to implement the plan.

Lead: [INSERT LEAD]

Support: [INSERT PEOPLE OR STAFF NEEDED TO COMPLETE THE TASK]

Number of community engagement meeting, type (steering committee or general community and in-person or hybrid), **and timing:** [INSERT THE NUMBER OF MEETINGS AND TYPE]

Level of Effort: [INSERT NUMBER OF HOURS TO COMPLETE TASK] hours

Task Budget: $[INSERT ESTIMATED BUDGET]

Create a schedule based on the tasks above and the primary plan milestones to accompany your scope and help you stay on track. Modify the example below as needed to fit your specific plan.

This schedule begins at planning kick off as outlined in the scope of work. However, make sure you allow enough time in the planning process for advertising for, interviewing, and selecting a consultant (consistent with the practices typically for retention of a consultant in your community) to assist your community in the plan development process. Retaining a consultant may take eight to twelve weeks depending on the requirements of your community and who has to approve the contract. Also consider reviewing the guide ***North Carolina Local Government Contracting: Quick Reference and Related Statues*** *by Norma Houston for additional guidance on contracting requirements.*

The time to complete each task will vary for each project and community. Factor in staffing levels, availability of your consultant and turn-around time for producing materials and getting feedback from your steering committee and community at large. Relevant Playbook Steps and Exercises are noted in this table for ease of use. Remove them from your final version.

	[Year] Aug.	Sept.	Oct.	Nov.	Dec.	[Year] Jan.	Feb.	March	April	May	June	July	Aug.
Task A: Process and participation													
Task B: Identify and describe resilience vision and goals (*Playbook* Step 1.4)													
Task C: Vulnerability Assessment (*Playbook* Steps 2.1 – 2.3)													
Task D: Resilience Plan													
Task E: Framework for Implementation													
[List other Tasks]													

Schedule of Outreach and Engagement Activities

Supports Playbook Step 1.2: Create a scope of work for your community's resilience planning effort.

Use your answers from the Playbook's Public Participation Exercise and Public Participation Supplement to draft a schedule of outreach and engagement activities. After completing this schedule, make sure to integrate it into the overall project schedule and make revisions based on that, if needed. The timing of outreach and engagement activities will vary with each project and community. Factor in staffing levels, availability of your consultant, and turn-around time for producing materials and getting feedback from your steering committee and community at large.

	[Year] Aug.	Sept.	Oct.	Nov.	Dec.	[Year] Jan.	Feb.	March	April	May	June	July	[Year] Aug. & beyond
Phase 1: Prepare [Describe outreach activities for this phase.]													
Appoint Steering Committee													
Conduct Kick Off Steering Committee Meeting – Orientation to Planning Process													
Conduct Steering Committee Meeting #2 – Community Engagement Approach													
Conduct Steering Committee Meeting #3 – Resilience Vision & Goals													
Conduct community meeting 1 – Resilience Vision & Goals													
Phase 2: Assess													
Conduct Steering Committee Meeting #4 – Identify & Map Hazards of Concerns													

	[Year] Aug.	Sept.	Oct.	Nov.	Dec.	[Year] Jan.	Feb.	March	April	May	June	July	[Year] Aug. & beyond
Conduct Steering Committee Meeting #5 – Identify Critical Assets & Assess Vulnerability													
Conduct Steering Committee Meeting #6 – Review Vulnerability Assessment													
Conduct community meeting 2 – Vulnerablity Assessment													
Phase 3: Plan [Describe outreach activities for this phase.]													
Conduct Steering Committee Meeting #7 – Develop list of potential strategies & prioritization exercise													
Conduct Steering Committee Meeting #8 – Review final prioritized strategy list													
Conduct Steering Committee Meeting #9 – Develop implementation pathways													
Conduct community meeting 3 – Provide feedback on draft strategies, conduct prioritization exercise, and review implementation pathways													
Conduct community meeting 4 – Provide feedback on draft plan													

	[Year] Aug.	Sept.	Oct.	Nov.	Dec.	[Year] Jan.	Feb.	March	April	May	June	July	[Year] Aug. & beyond
Planning Board Meeting													
Town/City Council or Board of Commissioner Presentation													
Town/City Council or Board of Commissioner Adoption													
Phase 4: Implement [Describe outreach activities for this phase.]													
Distribute press release for adopted plan													
Conduct Steering Committee Meeting #10 – Develop and discuss outreach strategies													
Conduct Department Head Meeting with those identified as project lead to communicate their departments responsiblity for implementation. Include manager and finance director as well as others identified													
Conduct pre-budget meeting with project leads													
Conduct quality meetings on project status													

Steering Committee Invitation Template

Supports Step 1.3: Convene a Steering Committee

Use the template and follow the instructions below to create an invitation for your potential Steering Committee members. The template is designed to assist the project lead and core project team in drafting an invitation to potential steering committee members that will help them make an informed decision about their ability and desire to participate. The template includes several best practices for more equitable participation including offering flexible meeting formats and meeting times, providing childcare and refreshments, and sharing detailed information about the time commitment. Delete those that you do not plan to use. The Public Participation Supplement provides additional information and ideas for promoting equitable and accessible participation opportunities.

Dear [NAME],

On behalf of [COMMUNITY, ORGANIZATION, DEPARTMENT], I'm pleased to invite you to serve on the [PLAN, PROJECT NAME] Steering Committee. The addition of your expertise, leadership and strong community connections would greatly enhance our ability to create and implement a responsive, equitable and actionable resilience plan for [COMMUNITY, NEIGHBORHOOD, ETC.].

The [PLAN, PROJECT NAME] Steering Committee will play a critical role in the planning effort. As a member, you can expect to:

- Attend and participate in regular meetings
- Guide plan development
- Share expertise and local knowledge related to key resilience topics
- Get the word out about the plan and opportunities to participate
- Plan, promote, and attend engagement events
- Champion the plan's implementation, help identify resources, monitor plan progress and success over time, and regularly revisit the plan's actions

Steering Committee members can anticipate dedicating approximately [XX] hours per month to resilience planning efforts, including a standing [MONTHLY, BIWEEKLY, WEEKLY] meeting. The [MONTHLY, BIWEEKLY, WEEKLY] standing meeting will alternate between meeting on [DAY/TIME 1] and [DAY/TIME 2] to better accommodate the various schedules of committee members. We also have a remote meeting option through [PLATFORM], if necessary.

To accept this invitation to serve, or if you have any questions or concerns, please reply to [CONTACT] at [CONTACT INFORMATION] by [RESPONSE DEADLINE]. If you want to participate but have challenges preventing you from serving in the role as described, please let us know. We will work with you to find a solution! We also understand if you're not interested or able to participate at this time.

We look forward to your response and we thank you for your continued support and leadership in our community.

[INSERT CLOSING SALUTATION AND SIGNATURE]

Steering Committee Schedule and Agenda Template

Supports Step 1.3: Convene a steering committee. This template will assist the project lead, core project team, and (optionally) the steering committee chair or cochairs in identifying milestone steering committee meetings and creating meeting agenda outlines.

Complete the table below to map out a schedule for your steering committee meetings during the planning process. Align meetings with the process steps described in the scope of work. After completing the schedule, integrate it into the overall project schedule, adjusting as needed. Please note that the timing of steering committee meetings will vary for each project and community. Factor in staffing levels, availability of your consultant, availability of your steering committee to meet, and turn-around time between meetings for summary and production of materials. Relevant Playbook Steps and Exercises are noted in this table for ease of use. Remove them from your final version.

	Milestone	Steering Committee Meeting Topic	Tentative Date (align with scope of work and project schedule)	*Playbook* Step	Associated *Playbook* Exercise
PHASE 1: PREPARE	Conduct steering committee kick off	Kick-Off Steering Committee Meeting – Orientation to Planning Process and review of project scope (*Playbook* Step 1.2).	October {insert date/year}	Step 1.3 Convene a steering committee	
	Develop a public participation framework	Steering Committee Meeting #2 – Community Engagement Approach. Review and receive feedback on the public participation framework (*Playbook* Step 1.2 and Public Participation Exercise).	November	Step 1.2 Create a scope of work for your community's resilience planning effort	Public Participation Exercise
	Identify vision and set goals	Steering Committee Meeting #3 – Resilience Vision and Goals. Review and provide feedback on the draft resilience vision and goals developed by staff.	December (avoid the later two weeks due to the holidays)	Step 1.4 Document your community's resilience vision and goals	Vision and Goal Setting Exercise

	Milestone	Steering Committee Meeting Topic	Tentative Date (align with scope of work and project schedule)	*Playbook* Step	Associated *Playbook* Exercise
PHASE 2: ASSESS	Identify and map hazards	Steering Committee Meeting #4 – Identify and Map Hazards of Concerns. Have committee identify hazards/characteristics, describe occurrences in community (historic and future impacts), determine level of concern.	January	Step 2.1 Identify and map hazards of concern	
	Assess physical and social vulnerability	Steering Committee Meeting #5 – Identify Critical Assets and Assess Vulnerability. Have committee identify critical assets from the built and natural environments through mapping exercise. Have committee assess physical and social vulnerability using the vulnerability table (poster size) exercise.	January	Step 2.2 Assess vulnerability	
	Create a vulnerability assessment	Steering Committee Meeting #6 – Review Vulnerability Assessment. Have committee review the Climate Vulnerabilities Synthesis Exercise and Findings (*Playbook* Step 2.3) as well as the mapped hot spots (*Playbook* Step 2.2).	February	Step 2.3 Synthesize vulnerability assessment findings	Climate Vulnerabilities Synthesis Exercise

	Milestone	Steering Committee Meeting Topic	Tentative Date (align with scope of work and project schedule)	*Playbook* Step	Associated *Playbook* Exercise
PHASE 3: PLAN	Create draft list of prioritized strategies	Steering Committee Meeting #7 – Develop List of Potential Strategies and Prioritize. Have committee develop a long list of potential strategies, based on the foundational characteristics of your plan identified through the Strategy Development Groundwork Exercise. Have committee prioritize strategies using dot voting on sticky notes.	March	Step 3.1 Develop a long list of potential strategies to build resilience Step 3.2 Prioritize strategies for a right sized set of actions	Strategy Development Groundwork Exercise
	Develop final list of prioritized strategies	Steering Committee Meeting #8 – Review Final Prioritized Strategy List. Have the committee review, discuss, and provide feedback on the final strategy list prepared by staff (*Playbook* Steps 3.1 and 3.2).	March	Step 3.1 Develop a long list of potential strategies to build resilience Step 3.2 Prioritize strategies for a right sized set of actions	
	Develop strategy implementation tables	Steering Committee Meeting #9 – Develop Implementation Pathways. Have the committee participate in the Implementation Workshop Exercise to develop implementation pathways for each strategy. Have the committee review and provide feedback on the performance metrics developed for each strategy.	April	Step 3.3 Develop implementation pathway and performance tracking	Implementation Workshop Exercise Communicating Progress Exercise
PHASE 4: IMPLEMENT	Develop and discuss outreach strategy	Steering Committee Meeting #10 – Develop and Discuss Outreach Strategy. Have the committee participate in a brainstorming activity to identify ways to share and promote the plan in the community.	July	Step 4. 1 Build local interest and desire for implementation	

Vulnerability Assessment Table Templates

Supports Playbook Step 2.1: Identify and map hazards of concern. Fill out the template below with your community's information and delete the examples provided.

Hazards of Concern Table

Hazards and Key Characteristics	Past Occurrences and Future Projections	Effects and Spatial Considerations	Priority
Hurricane *Key Characteristics: High winds, storm surge, shoreline erosion, heavy precipitation*	*PAST- Three hurricanes/tropical storms since 2010; more frequent, high intensity rainfall events* *FUTURE- Hurricanes are expected to be more intense and frequent. (Utilize the North Carolina Climate Science Report or RISE Regional Vulnerability Assessments for each region to address future impacts)*	*Flood damage, road washouts, loss of power, crop loss* *Community-wide flood damage, road washouts, loss of power; White Birch subdivision access cut off during hurricanes and large storms; Jones Beach especially subject to erosion*	*High*
[INSERT HAZARDS AND KEY CHARACTERISTICS]	[INSERT PAST OCCURANCES AND FUTURE PROJECTIONS FOR EACH HAZARD]	[INSERT EFFECTS AND GEOGRAPHIC SCOPE FOR EACH HAZARD]	[INSERT PRIORITY (HIGH, MEDIUM, LOW) FOR EACH HAZARD]

Supports Playbook Step 2.2: Assess vulnerability. Fill out the templates below with your community's information and delete the examples provided.

Physical Vulnerability Table (Baseline Analysis)

Example Hazard: Hurricane and riverine flood for a community in the coastal plain		
Asset at Risk	**Address/Location/Ownership if applicable**	**Impacts and consequence to community**
Structures and Critical Facilities		
Housing on the south side of town	*Between Main Street and the river/Private ownership*	*Potential to displace over 200 households through flooding*
Critical Facilities and Infrastructure		
Elementary School #2	*64 Smith Street/local public ownership*	*Potential to flood in 100-year flood. Impact would disrupt education and cause community to revert to online learning; cost to repair or rebuild likely over $1m.*
Natural Resources		
Marsh along River Road	*Between Green Street and Church Street*	*Potential to lose the protective value of the marsh to River Road and the homes on the west side of River Road.*

Social Vulnerability Table (Baseline Analysis)

Population	Locations with Higher Concentrations of Population	Sensitivities to Climate Hazards
Nursing Home	*Sunshine Meadows Nursing Home- off of River Road*	*Nursing home is at risk of being cut off from road access to the hospital during a flood event.*

Strategy Implementation Template

Supports Playbook Step 3.3: Develop implementation pathway and performance tracking. Use the template and delete content that you do not plan to use.

Strategy Implementation Table

Strategy: [Fill in the strategy]	
What organization or department will serve as the implementation lead for this strategy?	*Identify the organization or department that is or may be responsible for leading implementation of the strategy. In internal notes, include specific names of people who will have a role, because it's important to engage them now, rather than after the plan is published. Do they have the capacity to take on this action or project? For any publicly published documents, do not include specific individual's names, but rather the organization or department. Does it have the capacity to take on this action or project?*
Who will provide implementation support for this strategy?	*Document the organizations, departments, agencies, and staff who are needed to implement the strategy. This may include existing staff, a hired consultant, and partners listed in Appendix A, among others.*
What is the implementation time frame for this strategy?	*Break down each strategy or project into achievable tasks and phases in distinct time periods. Include gathering needed resources in your timeline (e.g. going through the budgeting process or applying for grants or finding an external partner to support your effort).* *Immediate Next Steps (0-6 months)* *Short Term (6 months-2 years)* *Longer Term (2+ years)* *Consider which projects would have an immediate start and which you will wait on.*

Strategy: [Fill in the strategy]	
What is the estimated cost to complete this strategy?	*Estimate financial and human resources needed to implement each strategy. If you do not know what resources are needed, make this research an immediate next step. Look for projects like yours in the Idea Book's case studies. They might help identify potential project costs.*
What other implementation resources might be needed to implement this strategy?	*Consider personnel, leadership, community/political support, technical expertise, data/modeling, additional research or planning, or further conversation with key stakeholders.*
What funding sources could be accessed to implement this strategy?	*Identify possible funding sources, including local budget, grant funding, integrated with existing budget items like capital improvement, user fees, or public-private partnerships. Document specific details for the funding strategy, such as the names of grants and the calendar for budget planning in your community.*
What would moving in the right direction look like for this strategy?	*Briefly describe what moving in the right direction looks like for this strategy. Think broadly. You will explore measures of success in more detail in the next step.*

Example Poster for Implementation Workshop

Supports Step 3.3: Develop implementation pathways for each strategy in the plan. Use the template and delete content that you do not plan to use.

Example Poster for Implementation Table

Strategy or Project	Implementation Lead and Support	Implementation Timeline	Estimated Cost and Other Resources Needed	Possible Resources	Direction Check
Include resilience as part of capital improvement scoring process	*Budget & Management (Andre Williams, Director)*	*Research models and provide report to council and mayor* *Pilot prioritization process* *Assess progress and success*	*Support from Council* *Staff time to research and write language* *Training or guidance needed for staff?* *Staff time to capture progress and outcomes*	*Planning staff, summer intern*	*More funded projects consider hazard mitigation or resilience*
Conduct an assessment and map drainage ditches and other stormwater conveyance systems.	*Public Works (Susan Harrell, Director)*	*Draft scope of work* *Retain consultant* *Engage the community* *Complete assessment and mapping*	*Council approval* *Staff time to retain consultant, prepare scope, orient the consultant to the project/community* *Cost of assessment and mapping- Approximately $150,000*	*DEQ grant* *Non-profit partner will assist with community engagement*	*Completed assessment and mapping*

Example Metrics Tracking Table for Community Strategies

Supports Step 3.3: Develop performance metrics and communication opportunities. Use the template and delete content that you do not plan to use.

Strategy	Direction Check	Metrics	Tracking and Report Lead
Describe the proposed strategy	*From implementation strategy*	*Identify one or more metrics for each strategy that you know can be feasibly assessed and reported. Also identify the data or resources needed to track and report each metric and how often each will be measured and shared.*	*Identify who specifically will track and report each metric; consider partners or organizations that might help track or report metrics.*
Elevate, enhance, and/or relocate roads most susceptible to flooding or wash out.	Roads/bridges that are passable more days of the year	Number of road or bridge closures per year	Engineer
Address repeated flood risk properties through property buy-outs	Fewer properties at risk for flooding	Number of flood risk properties purchased	Planning Director
Improve business preparedness	Businesses experience less loss and can open more quickly following an event	• Percentage of businesses with disaster preparedness, recovery, or business continuity plans • Percentage of equipment elevated above base flood elevation (BFE) • Time for businesses to reopen after event	Planning Director

THE IDEA BOOK

NORTH CAROLINA
RESILIENT COMMUNITIES PLANNING GUIDE

VOLUME 2 • DECEMBER 2024

NCORR
NORTH CAROLINA OFFICE OF RECOVERY AND RESILIENCY

N★C DPS
DEPARTMENT OF PUBLIC SAFETY

EQUAL HOUSING OPPORTUNITY

Table of Contents

Finding Your Way Around the *Idea Book*

The *Idea Book* is Volume 2 of the *North Carolina Resilient Communities Planning Guide* and is organized into **14 resilience topics** listed alphabetically. Each topic contains an overview, a description of the topic's importance to resilience, key players, informational resources, featured strategies and a real-world case study. Depending on your community and the climate and natural hazard challenges you face, some of these topics may be more relevant than others. Likewise, your unique community may be faced with a climate or natural hazard challenge not addressed here. Either way, this document can serve as a resource guide and inspiration for understanding how to address climate change and natural hazard threats, whatever they may be.

The Resilience Topics include:

- Business and Local Economy
- Coastal Management
- Collaboration
- Communication and Education
- Ecosystem Protection, Restoration and Enhancement
- Energy and Utilities (electric, gas, broadband, potable water, wastewater, etc.)
- Equity and Justice
- Funding and Technical Assistance Mechanisms
- Housing
- Infrastructure and Capital Investments
- Land Use and Development
- Planning and Decision-Making Frameworks
- Public Health
- Stormwater Management and Flooding

Organization – Each resilience topic has three main sections: overview, strategies and a case study.

Overview – The overview provides a short explanation of the resilience topic and explains its role in resilience. This section also lists potential project leads, stakeholders and experts.

Strategies Chart – Each of the resilience topics contains strategies for all stages in the planning process, including the initial assessment, plan creation and implementation. The strategies chart contains a brief description of each strategy, how it supports resilience and a more tailored set of resources for further learning and inspiration. These resources are organized by information, examples and case studies.

Case Study – Each resilience topic contains a case study to illustrate a real-world solution. Each case study includes the project basics (cost, funding mechanisms and key players), information on making it happen, and how the project addressed, or could have addressed, equity and outcomes. Each case study also provides the name and contact information of a person who can tell you more about the project in case you want to replicate it in your hometown.

TOPIC | 01

BUSINESS AND LOCAL ECONOMY

Overview

Natural hazards can be detrimental to businesses and the local economy. Floods and heavy winds can destroy a business's facilities, financial records, and products, especially if that business is in a vulnerable area. Loss of utilities and displaced employees can also impact a business's operations and bottom line. Even when a hurricane hits another part of the state or country, a business may experience supply chain and transportation disruptions (FEMA, 2020).

Local businesses, chambers of commerce and other economic development stakeholders can build resilience by preparing for disruptions. Communities with businesses that are adequately prepared will bounce back more quickly from hazards. These communities can also rely on their businesses to provide sustainable income for their residents and tax revenue to support local needs.

Role in Resilience

Because businesses, organizations and other economic stakeholders contribute to a community's wellbeing, it is important for local leaders to engage them throughout the cycle of climate resilience planning. Locally produced goods and services fulfill day-to-day needs, provide employment opportunities for residents, and generate tax revenue supporting a range of public investments. Local businesses also attract people from other communities, provide recreation and entertainment, and help keep money in the community. Local North Carolina economies may be highly reliant on one industry sector or employer, like seasonal tourist communities and college towns, or they may be highly diversified, with a wide range of businesses representing many different economic sectors. Regardless of a town's economic structure, local leaders can work with businesses and economic development organizations to mobilize actions and networks that support climate resilience.

Communities can reduce or help protect themselves against short-term and long-term economic stressors from hurricanes, heat waves, droughts, wildfires and other extreme weather and natural disasters. Local businesses can reduce the costs of recovery by incorporating climate resilience into existing planning efforts and budgets, and the local economy can begin to pursue new opportunities that might arise as the climate changes. This section lists several strategies communities can use to support local businesses' climate change preparedness efforts.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on economic development, sustainability, floodplain management, and emergency management
- Chambers of commerce

- North Carolina's councils of governments (COGs) and regional economic development partnerships
- Workforce development organizations, such as the North Carolina Business Committee for Education
- Local businesses
- Higher education institutions, especially community college small business centers
- State government agencies, such as NC Department of Commerce
- Federal government agencies, such as US Economic Development Administration
- Nonprofits and academic entities focused on climate and economy, such as the NC State University Tourism Extension
- Consultants
- Seasonal and year-round employees
- Residents

FOR MORE INFORMATION

**To note: some resources below and within the strategy chart are related to business resilience in the wake of the COVID-19 pandemic. While this was not a climate-related event, there are lessons learned applicable to climate change resilience.*

The Disaster Resilience Toolkit Supporting America's Southern Rural Communities **provides an introduction to workforce disaster resilience and outlines ways local economies can prepare for, stabilize during, and recover from natural disasters. The resource, which was created by Bloomberg Philanthropies and Jobs for the Future, includes a checklist for local leaders who want to build a disaster-resilient workforce.**

Leadership in Times of Crisis: A Toolkit for Economic Recovery and Resiliency **is designed for a wide range of public and private sector officials working with businesses and industries in the economic recovery process, including but not limited to climate hazards. This resource was created by the International Economic Development Council.**

Triangle Farms for Food: Strategy + Action Plan **presents methods for protecting agricultural land to "keep farmland in farming, support current and beginning farmers, advance agricultural awareness and build a strong local food economy."**

BUSINESS AND LOCAL ECONOMY | 01

STRATEGIES

Actively engage businesses in resilience planning and implementation

This strategy supports participation by local businesses and other key economic players during community resilience planning processes, such as a resilience section in a comprehensive plan. Local businesses can often provide people power, support relationship building, and contribute resources supporting resilience building initiatives. Working directly with businesses and economic development organizations also provides greater insights into their resilience-related challenges and needs and ensures the community's resilience efforts include programs and projects directly supporting the local economy.

FOR MORE INFORMATION

Building Resilient Futures **(Enterprise Community Partners) This site provides guidance on how to help affordable housing owners write business continuity plans and more. Refer to the Business Continuity Toolkit.**

Planning Framework for a Climate-Resilient Economy (US Environmental Protection Agency) **This document outlines a framework to help "the business community prepare for and adapt to projected changes and think creatively about ways to prosper in a changing climate."**

EXAMPLE

Roadmap to Recovery and Resilience (Downtown Austin Alliance, TX)

Provide local business with support services for building resilience

This strategy helps businesses determine whether they are in locations vulnerable to hazards and implement hazard migration strategies. It also promotes preparedness measures like business continuity planning, which includes backing up important business and financial records, protecting inventory, and establishing redundant supply chains for goods and materials. Trainings could include asking businesses to consider how to utilize their skills, resources and networks during storm events to develop alternative revenue streams or branding opportunities.

Providing support services like risk and vulnerability assessments, guidebooks, technical assistance and one-stop-shops for resources and information builds resilience by ensuring businesses know what to do before, during and following climate and other disasters.

FOR MORE INFORMATION

Establishing A Business Recovery Center (Restore Your Economy) **This resource outlines the steps to developing a business recovery center: a "one-stop-shop set up to provide local, state and federal resources and services for businesses after a catastrophic event."**

EXAMPLES

Community Economic Recovery and Resiliency Initiative (NC Department of Commerce)

Disaster Planning/Business Interruption Consulting Services (Pennsylvania Small Business Development Center)

Homegrown Leaders training (North Carolina Rural Center)

Providence Resilience Partnership

Resiliency Innovations for a Stronger Economy (New York City Economic Development Corporation)

CASE STUDY

Polk County, FL, facilitates business recovery after disasters

Promote and support diversification of the local economy

This strategy supports resilience by supporting the economy's ability to react to and recover from climate hazards.

Supporting economic development strategies such as attracting business incubators and new or small businesses provides a diverse economy that spreads the impact of climate-related hazards.

FOR MORE INFORMATION

EXAMPLES

Accelerate Rural NC (Eastern Carolina University)

Bethesda Green Innovation Lab Incubator (Bethesda, MD)

Rhode Island Infrastructure Bank

CASE STUDY

*See the **Business and Economy** case study on the following pages.

Protect and enhance redundancy of supply chains and critical resource availability

Building flexibility and redundancy into sourcing, distribution and transport systems builds resilience by accommodating and adapting to uncertainty rather than relying on single-source production pathways. This ensures that businesses, manufacturers and consumers experience the least amount of disruption possible and helps the overall economy quickly bounce back following an event.

FOR MORE INFORMATION

Achieving Supply Chain Resilience in a Volatile World (BCG) **This set of slides provides an overview of supply chain challenges to expect and how to withstand them.**

Supply Chain Resilience Guide (FEMA) **This guide is designed to help emergency managers think through the challenges and opportunities presented by supply chain resilience.**

EXAMPLE

Supply Chain Resilience Initiative (Los Angeles, CA)

CASE STUDY

Puget Sound, WA, responds to pandemic with private-public collaborations to facilitate supply chain resilience

BUSINESS AND LOCAL ECONOMY | 01

CASE STUDY

CASE STUDY Oyster Trail protects oyster habitat and grows economy

Project Purpose

Oyster harvest levels are decreasing. This decrease is the result of poor water quality, disease and predation, habitat loss, increased harvest pressures and natural disasters (North Carolina Division of Marine Fisheries, 2017). Severe storms can cause water quality impairments that force oyster harvesting to stop until the NC Department of Environmental Quality confirms that shellfish are safe to eat (North Carolina Coastal Federation, 2023). The North Carolina Coastal Federation, North Carolina Sea Grant and North Carolina Shellfish Growers Association launched the NC Oyster Trail in 2020 to diversify and expand the local oyster economy through tourism experiences.

What is an oyster trail?

The North Carolina Oyster Trail is a collection of oyster-related tourism experiences. The trail features shellfish farm tours, tasting events and educational opportunities. These events aim to help oyster farmers, harvesters and restaurants diversify their revenue streams. Diversified revenue streams help the industry withstand climate and non-climate stressors.

Key Players: North Carolina Coastal Federation; North Carolina Sea Grant; North Carolina Shellfish Growers Association; and oyster farmers, sellers, and educators

Quick Facts

1. As of 2022, oyster harvest levels have decreased an estimated 80-85% from historic harvest levels.
2. Hurricane Florence caused an estimated $10 million in damages to North Carolina's shellfish aquaculture industry in 2018 (North Carolina Coastal Federation, 2021)
3. In 2020, the North Carolina Coastal Federation, North Carolina Sea Grant and North Carolina Shellfish Growers Association launched the NC Oyster Trail.
4. In 2021, the statewide Oyster Steering Committee released the 2021-2025 Oyster Restoration and Protection Plan for North Carolina: A Blueprint for Action. This Oyster Blueprint names the trail as an opportunity to improve the marketing, promotion and distribution of shellfish products.
5. The **NC Oyster Trail** and other Oyster Blueprint initiatives increased the amount of attention and funding for North Carolina oysters. This funding helped restore 450 acres of oyster habitat (North Carolina Coastal Federation, 2021).

Making It Happen

- In 2014, community members started discussing the idea of a North Carolina oyster trail after Virginia launched its trail.
- Trail partners worked with graduate students and professors at the UNC Kenan-Flagler Business School. The academic partners recommended a structure and estimated the economic impact of the trail. (See the report.) In 2018, trail partners presented this information to the North Carolina General Assembly. The state Senate included funding for the Oyster Trail in its 2017-2018 appropriations bill (General Assembly of North Carolina, 2017, p. 249). However, that funding was not included in the final state budget.
- The North Carolina Sea Grant funded a survey of tourists to understand their preferences for oyster tourism (Kozak, 2020).
- In 2019, the North Carolina Coastal Federation, North Carolina Sea Grant and North Carolina Shellfish Growers Association hosted stakeholder focus groups. They conducted these focus groups over a year-long planning period. They used stakeholder input to structure the NC Oyster Trail to meet the needs of potential members.
- Trail partners hired a private firm to design the trail's webpage.
- They recruited an initial 10 NC Oyster Trail members from focus groups and by contacting oyster-related businesses and organizations. To become a member, trail participants must offer a "memorable, participatory element that engages tourists with NC oysters." Members must pay a $50 registration fee and an annual $100 membership fee (North Carolina Coastal Federation and North Carolina Sea Grant, 2023).
- The North Carolina Sea Grant promotes Oyster Trail members. The organization uses an interactive online map, social media, brochures, news releases, local visitor bureaus and the annual NC Oyster Week.
- In 2020, the North Carolina Coastal Federation, North Carolina Sea Grant and North Carolina Shellfish Growers Association launched the NC Oyster Trail.

Spotlight on Equity

One core goal of the NC Oyster Trail is to seek economic development opportunities for less-economically-developed coastal communities (UNC Kenan-Flagler Business School and NC Policy Collaboratory, 2018). In addition, trail administrators ensure a diverse group of stakeholders work together to build and support the trail. To increase the trail's commitment to equity, trail administrators can ensure restaurants and farms owned by people of color are included in the trail's tourism experiences, and that trail events are planned in partnership with diverse community representatives.

Advice from the project manager

Trail members are the backbone of the NC Oyster Trail. Communities seeking to replicate this project should devote significant time and resources toward building and sustaining stakeholder relationships during the planning and implementation phases.

Forming a focus group composed of diverse stakeholders and at least one member from each type of trail organization or business is a great starting point. The focus group can ensure that the project meets their needs.

Outcomes

- The NC Oyster Trail helps sustain and grow the local oyster industry by connecting seafood producers, sellers and consumers through shellfish farm tours; seafood restaurants, raw bars and markets; and educational opportunities with ecotourism, aquariums, coastal museums and special events.
- The trail helps build a state-specific brand that leads consumers to choose and pay more for North Carolina oysters, adding value to the shellfish product.
- The trail supports the coastal ecosystem with volunteer opportunities to protect and restore oyster habitats.
- The trail advances the business success of wild harvesters and oyster farmers.
- Increased attention on oyster programs builds the case for increased funding for oyster-related programs, including from the NC Division of Marine Fisheries Oyster Sanctuary Program.
- Overwhelming interest from stakeholders along the coast and inland grew the number of Oyster Trail members to over 75 participants as of December 2022.
- Increased attention on North Carolina oyster populations, along with the support of other Oyster Blueprint initiatives, has increased funding for oyster-related programs by a factor of 10, and led to the restoration of 450 acres of oyster habitat, supporting half a billion oysters.

Project Contact

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Additional Resources

Coastal Review News Article on the Environmental and Economic Benefits of Shellfish

Island Free Press News Article on the N.C. Shellfish Industry and a New State Bill That Would Support the Industry

N.C. Policy Collaboratory's 2030 Strategic Plan for Shellfish Mariculture Report to the General Assembly

Virginia Oyster Trail website

Related Case Studies

- See **Energy and Utilities**: Electric Cooperatives install microgrid on Ocracoke Island.
- See **Infrastructure and Capital Investments:** Raleigh includes nature-based stormwater solutions in its roadway widening project.

Costs and Funding

- The NOAA National Sea Grant provided the trail's first major grant ($119,784) to fund the survey of tourists.
- Trail partners obtained additional grant funding to hire a private firm to design the trail's webpage.
- State and regional tourism departments dedicate staff time and volunteer hours to support trail operations.
- Annual trail membership fees contribute to trail operations.
- The North Carolina Sea Grant and the North Carolina Coastal Federation continue to support the trail financially.

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TOPIC | 02
COASTAL MANAGEMENT

Overview

Sea level rise and extreme weather are increasing risk in vulnerable coastal areas in North Carolina. The effects of these hazards on natural and human-made environments include acute loss of life and property as well as longer-term impacts like erosion; heavier and more frequent flooding, including greater king tides and sunny-day flooding; and the accumulation of marine debris (Kunkel, et al., 2020). Local governments and organizations can build resilience for estuarine and oceanfront shorelines with plans, policies and infrastructure. Such efforts can help people, property and habitats by protecting the natural environment against the long-term impacts of climate change and uncoordinated development.

Role in Resilience

Policy- and program-based coastal management strategies build resilience by limiting or prohibiting development in hazardous and sensitive coastal zones and by protecting or restoring vulnerable coastal areas in North Carolina. Examples include regulations requiring nature-based solutions like living shorelines or wetlands restoration to absorb or slow water; prohibiting new residential development in flood-prone coastal areas; building ordinances requiring elevation of homes to mitigate the impacts of storm surge and flooding; and, in extreme cases, programs to purchase privately owned properties in hazardous locations to avoid damages and convert the land to a more appropriate use.

Coastal management strategies can also focus on providing information and tools to educate the public about the importance of protecting our coastal environments and about risk exposure along the oceanfront and across the coast's broad network of brackish waterways.

Infrastructure is another strategy used to protect oceanfront shorelines and estuaries from climate hazards. Gray and green infrastructure build resilience by forming physical barriers between the sea and land.

Gray, or hard, infrastructure along the coast includes human-built physical barriers like sea walls, jetties or groins, and flood and tidal gates that mitigate the impacts of sea level rise, storm surge, king tides and the accumulation of marine debris. Constructing these structures is also called "shoreline armoring" or "coastal hardening." Such strategies have benefits but they also tend to be expensive, permanent and sometimes generate negative impacts in adjacent or downstream areas. Armoring the shoreline can also alter erosion and accretion (the graduation accumulation of sand and sediment) patterns: groins and seawalls tend to exacerbate erosion on one side of the wall.

Green infrastructure, also called soft infrastructure or nature-based solutions, mimics natural coastal features by using materials like sand,

rocks, vegetation, or living organisms such as oyster reefs to buffer the transition between land and water. Examples of green infrastructure strategies include building artificial reefs to buffer tidal energy, replanting dune grasses to prevent erosion and stabilizing shorelines with constructed oyster beds. Green infrastructure is less disruptive to ecosystems and sensitive habitats. In some cases, it can even strengthen these systems and the services they provide to communities in North Carolina. These natural strategies often cost less than hard infrastructure, as well (EPA, 2023). This section lists several strategies local governments and partners can use to embrace climate-resilient coastal management.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on public infrastructure, planning, sustainability, water and wastewater
- Nonprofits and academic entities focused on coastal issues, such as the North Carolina Coastal Federation, North Carolina Sea Grant, The Nature Conservancy and the NCSU Coastal Dynamics Design Lab
- Design and construction professionals (e.g., landscape architects, water resource professionals, and civil engineers) in the private, nonprofit, government and academic sectors
- State government agencies focused on coastal issues, such as NC DEQ Albemarle-Pamlico National Estuary Partnership, Division of Coastal Management and Division of Marine Fisheries; NC DNCR; and Wildlife Resources Commission
- Federal government agencies, such as NOAA and US EPA
- Consultants
- Residents

FOR MORE INFORMATION

Digital Coast aggregates resources for coastal managers. The site, hosted by NOAA, provides coastal data and the tools, training and information needed to make the data useful. Datasets range from economic data to satellite imagery. The site contains visualization tools, predictive tools, and tools that make data easier to find and use. Training courses are available online or can be brought to the user's location. Information is also organized by focus area and topic.

The National Coastal Zone Management Program is a voluntary partnership between the federal government and coastal states. Authorized by the Coastal Zone Management Act of 1972, this NOAA program provides the basis for protecting, restoring, and responsibly developing diverse coastal communities and resources. The page provides links to supporting legislation, data, tools, performance metrics and training resources for coastal managers.

Sea Level Rise Viewer (NOAA) Decision-makers can "use this web mapping tool to visualize community-level impacts from coastal flooding or sea level rise (up to 10 feet above average high tides)." The resource includes photo simulations and "data related to water depth, connectivity, flood frequency, socio-economic vulnerability, wetland loss and migration and mapping confidence." This tool does not include dates by which sea levels will reach specific levels.

COASTAL MANAGEMENT | 02 STRATEGIES

Monitor emerging conditions

Rapidly changing coastal conditions mean past trends are not enough to predict future changes. More frequently assessing vulnerabilities and monitoring conditions, such as sea level rise and changing coastlines, helps communities understand environmental changes and plan appropriately for expected changes.

Monitoring emerging conditions can be used to improve land management. For example, non-dynamic zoning systems may become outdated as climate change continues. Static approaches are less flexible and can slow municipal responses to emerging needs. Instituting review cycles for zoning updates may better suit emerging needs.

FOR MORE INFORMATION

Interactive Maps and Data (NC DEQ Division of Coastal Management) **This site hosts GIS data on coastal erosion rates and coastal wetlands, interactive maps on waterfront access and field representatives, and more.**

EXAMPLE

Flood Vulnerability Assessment (Beaufort, SC)

Monitoring and Adaptive Management Plan (Swan Island, MD)

Risk and Vulnerability Assessment (Sunset Beach, NC)

Risk and Vulnerability Assessment (Town of Leland, NC)

CASE STUDY

Southwest Florida Assesses Salt Marsh Vulnerability to Sea Level Rise

Develop plans for coastal zones

Plans might focus on protecting, managing and restoring coastal areas to support a natural ecosystem's ability to manage rising sea levels and storm surge.

FOR MORE INFORMATION

CAMA Land-Use Planning Guide (NC DEQ) **This manual is designed to help local governments prepare Coastal Area Management Act (CAMA) land use plans.**

EXAMPLES

Comprehensive and Land Use Plan and Infrastructure Vulnerability Assessment (Duck, NC)

Lower Cape Fear River Blueprint (NC Coastal Federation)

North Carolina Oyster Blueprint (NC Coastal Federation)

Planning for Sea Level Rise (Nags Head, NC)

Adopt land use and development policies and ordinances that manage coastal hazards

Zoning and development management regulations help coastal communities regulate and direct growth. An ordinance is an adopted law. These types of policies and ordinances contribute to resilience by directing development to safer locations, regulating characteristics of development and structures to reduce vulnerabilities, and prohibiting certain activities in hazardous locations.

FOR MORE INFORMATION

Uniform Floodplain Management Policy for State Property (North Carolina) The state has recently updated its requirements for construction on state lands that are at risk for flooding. The updated Uniform Floodplain Management Policy (January 2024) includes requirements for locating state construction outside the floodplain, elevating structures that must be constructed in areas at risk for flooding, and incorporating nature-based solutions to reduce flooding.

Managed Retreat Toolkit (Georgetown Climate Center) This online resource "combines legal and policy tools, best and emerging practices and case studies to support peer learning and decision-making around managed retreat and climate adaptation," specifically in vulnerable coastal areas.

(See **Land Use and Development** for additional resources)

Mitigate coastal hazards using green infrastructure or nature-based solutions

Green infrastructure and nature-based solutions build resilience by slowing and absorbing water, wind and wave action in the same way as natural features like wetlands and reefs. They can be alternatives to hard or grey infrastructure and are designed to mimic natural systems. Sometimes these systems are entirely introduced into the landscape. Other times, they are restorations or enhancements to existing natural features. Either way, the benefits of green infrastructure are wide-ranging, including stormwater management, air-cooling benefits from plants, the promotion of community identity and more.

*Note: North Carolina's Coastal Area Management Act (CAMA) does not permit the construction of hardened erosion control structures along ocean shorelines, with the exception of terminal groins in specific locations.

FOR MORE INFORMATION

Living Shoreline Resources (US EPA) **This page describes how to build and maintain living shorelines.**

Restoration and Management of Coastal Dune Vegetation (NCSU Extension) **This page describes the importance of coastal dunes as well as strategies for their protection and management.**

North Carolina Coastal Resilience (The Nature Conservancy) **This page describes nature-based solutions that protect coastal communities from the impacts of severe storms, flooding and rapid shoreline change.**

EXAMPLES

Dune planting and stabilization (Carteret County, NC)

Green and gray stormwater infrastructure (Smithsonian Magazine)

Moor Shore Road living shoreline (North Carolina Coastal Federation)

North River wetlands restoration (North Carolina Coastal Federation)

CASE STUDY

*See the following **Coastal Management** case study.

COASTAL MANAGEMENT | 02

CASE STUDY

CASE STUDY Sunset Beach installs a living shoreline

Project Purpose

The North Carolina town of Sunset Beach experiences repetitive flooding, sound side erosion, wind damage from hurricanes and rising sea levels, including more recently from Hurricanes Florence and Dorian. To manage these impacts, town officials and residents decided to install a living shoreline.

What are living shorelines?

Living shorelines are designed to protect and stabilize coastal edges. They are made of natural materials such as plants, sand and rock. Unlike a concrete seawall or other hard structures, which impede the growth of plants and animals, living shorelines grow over time. They assist in erosion control, restore coastal habitat, mitigate coastal flooding, improve water quality and serve as an education tool (National Oceanic and Atmospheric Administration, 2022). Living shorelines also experience less damage during storms than hardened shorelines because they reduce the intensity of waves (National Oceanic and Atmospheric Administration, 2016).

Key Players: Town of Sunset Beach, North Carolina Coastal Federation, East Coast Engineering and Surveying, Inc. (permit consultant), volunteers

Quick Facts

1. Sunset Beach, a small coastal town with a population of 4,000 residents, is split by an intercoastal waterway and the Atlantic Ocean—a location that exposes the town to flooding and severe storms.
2. The town partnered with the North Carolina Coastal Federation and volunteers to construct a 200-foot **living shoreline** in its Town Park, which borders the Atlantic Intercoastal Waterway.
3. The living shoreline is made of oyster domes and a marsh sill with native marsh grasses planted directly behind it. The structure helps manage nearby flooding and protect the town's coast from erosion.
4. The site's informational kiosk describes the benefits of nature-based adaptation strategies.

Making It Happen

- Staff attended a North Carolina Coastal Federation workshop at an existing living shoreline at Veterans Park on Oak Island. Workshop attendees learned how the living shoreline was constructed.
- In 2017, the town government secured funding from multiple sources and established a partnership with the North Carolina Coastal Federation to build the living shoreline. These partnerships helped them plan and construct the living shoreline within its Town Park.
- The scoping and design process took place in the latter half of 2017. In 2018, Sunset Beach hired a local consulting firm to finalize the plans and apply for permits. At the time, North Carolina project owners were required to apply to the North Carolina Department of Environmental Quality Division of Coastal Management (DCM) and the Army Corps of Engineers (USACE) for a permit. In 2019, DCM and USACE released a more streamlined regulatory process. Through the new process, living shoreline projects under 500 linear feet only need to obtain a permit from DCM. Projects over 500 linear feet still require a permit from USACE. As of June 2023, the new permit approval process only takes a few weeks and costs $200.
- During the permitting process, project managers moved the project forward in other ways. They obtained construction material and used an outreach campaign to promote the project and recruit volunteers.
- During the first two volunteer events, an estimated 150 individuals filled 3,000 bags with recycled oyster shells and gravel granite for the oyster reef sill (North Carolina Coastal Federation, 2019). During the third event, approximately 150 volunteers used the oyster and gravel bags to construct the 60-by-6-foot oyster reef-marsh sill structure. The town then constructed two 50-by-8-foot oyster reef-marsh sill structures using the oyster domes with guidance from the Coastal Federation. During the final event, 30 volunteers planted native ***Spartina alterniflora*** and ***Spartina patens*** marsh grasses and other vegetation. The town government completed the living shoreline in summer 2019.
- As the recipient of the project permit, the town is responsible for monitoring the impacts of the living shoreline and making living shoreline repairs, as needed. However, the NC Coastal Federation assists with shoreline monitoring and repairs. Volunteers run transects through the marsh to measure density and diversity of the marsh plant species. They also test different aspects of water quality, measure new oyster growth and examine the different species inhabiting the reef.

The town complemented the living shoreline project with stormwater run-off reduction measures nearby. The Town Park captures stormwater runoff and enables it to soak into the ground instead of contaminating the adjacent living shoreline.

Spotlight on Equity

Toward More Equitable Nature-based Coastal Adaptation in California *features recommendations on how to incorporate equity and justice into a living shoreline project. This report suggests defining equity goals with local partners. Another recommendation is to incorporate education and workforce development into projects.*

Advice from the project manager

Seek input from as many community members as possible. Because of community outreach, project managers in Sunset Beach learned of another project underway. The newly discovered project sought to install rip rap along the shoreline of the park and dredge an adjacent creek. Seeking input from community members also enabled a project design that fits within residents' vision for the property.

Current and future land uses are important factors to consider when implementing a living shoreline. The surrounding built environment can have a significant impact on the performance and durability of restored coastal area.

Outcomes

- The 200 feet of living shoreline restored coastline along the Atlantic Intercoastal Waterway (North Carolina Coastal Federation, 2020).
- The living shoreline's components—oyster domes, a marsh sill and native marsh grasses—control erosion by buffering waves and wakes. The oyster domes are made of nearly 3,000 bags of recycled oyster shells.
- The shoreline enables salt marsh and oyster reefs to thrive while providing aquatic plants and animals with an enhanced habitat.
- Restoring oyster and saltwater marsh habitat improves local water quality. An adult oyster can filter up to 50 gallons of water per day.
- The artificial reef and saltwater marsh provide the town with flood management benefits. The natural structure slows and disperses coastal floodwaters across the shoreline.
- An informational kiosk describes the benefits of nature-based adaptation strategies.
- In 2022, the town installed an additional 60-foot-long oyster dome and shell bag oyster reef-marsh sill, bringing the total project length to 260 feet.
- With promotion and volunteer events, the project increased community awareness of nature-based adaptation and resilience tools.

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Additional Resources

NC Division of Coastal Management description of a living shoreline permitting process

Sunset Beach Living Shoreline YouTube Video

Living Shoreline Academy: A resource for living shoreline construction

Related Case Studies

- **See Ecosystem Protection, Restoration and Enhancement**: New Bern project grows natural stormwater resilience while improving native ecosystems

Costs and Funding

- The Town of Sunset Beach received a $35,000 grant from Duke Energy's Water Resource Fund for staff time and construction material. Sunset Beach supported the project with additional funds from its annual operating budget.
- The NC Coastal Federation used funding from a National Coastal Resilience grant. The National Oceanic and Atmospheric Administration awarded this grant so the NC Coastal Federation could support several living shorelines in North Carolina.
- Sunset Vision, a local community group, provided funding for an informational kiosk (Sunset Vision, 2020).

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North Carolina Coastal Federation. (2020, September 02). Sunset Beach Living Shoreline. Retrieved from https://www.nccoast.org/project/sunset-beach-living-shoreline/

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TOPIC | 03
COLLABORATION

Overview

Building resilience in North Carolina's communities requires a systems-level approach to planning and problem-solving, and collaboration is a critical ingredient. Collaboration brings people out of their siloes to diversify perspectives and improve problem-solving. It also helps organizations to share knowledge and avoid duplication of efforts.

Role in Resilience

Much like a forest of trees connected by a network of roots that strengthens the entire ecosystem, a community that fosters collaboration is more likely to be resilient to the effects of hazards. For local governments, collaboration may mean looking internally to work across departments, or it may mean collaboration with the community, academia, or the private sector. For example, nonprofit organizations are often good partners for identifying systemic failures or emerging problems. Successful collaborations in resilience work can take many forms, including working with key stakeholders or subject matter experts through partnerships, joining or establishing pathways to provide and receive mutual aid or support, creating formal or informal opportunities for peer learning, and supporting cooperation across and within departments or offices at the leadership level. This section lists several strategies for harnessing a variety of perspectives, disciplines, and resources to address complex hazards like sea level rise, hurricanes, and other climate impacts.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on the issues to be addressed
- Nonprofits and other community organizations (e.g., neighborhood associations, advocacy groups, community foundations, tribal governments and faith communities), especially those that can help convene individuals from often overlooked communities (e.g., Association of Mexicans in North Carolina (AMEXCAN), Hispanic Federation, NC Black Alliance, NC Environmental Justice Network and NC Commission on Indian Affairs)

More North Carolina community-based organizations:

- NC Conservation Network Affiliates
- NC Environmental Justice Network member organizations
- NC Justice Center
- NC NAACP
- NC Rural Center
- NC Tribal Communities

- State government agencies focused on the issues to be addressed
- Regional organizations, such as North Carolina's councils of governments (COGs) and area agencies on aging
- Local businesses
- Higher education institutions
- Residents

FOR MORE INFORMATION

View a recording of Unlocking Resources for Climate Resilience Through Private Sector Partnerships, an event hosted by Devex and RTI International that reviewed "how partnerships with actors from both local and global private sectors can unlock urgently needed funds and resources for climate resilience and how the various parties can best work together to build a sustainable and resilient future."

COLLABORATION | 03

STRATEGIES

Establish partnerships

Partnerships, or collaborations among two or more people, organizations, agencies or departments, support resilience by connecting people and organizations with common goals to assess, plan and implement resilience-building strategies. Partnerships between universities, local businesses, and nonprofits, and between government departments and agencies can reduce duplication of effort and identify opportunities for knowledge sharing. Civil society groups are also highly effective at identifying emerging problems. They often help local communities monitor conditions.

Local governments can help collaborators identify statewide or federal sources of funding to support community-based resilience efforts or offer in-kind resources such as public meeting spaces, use of equipment, or access to public databases that can store or map information.

FOR MORE INFORMATION

Building Resilience Together: Military and Local Government Collaboration for Climate Adaptation (RAND Corporation) **This report reviews strategies for collaboration "between military services and local government to improve collective capacity to address climate change."**

North Carolina Inclusive Disaster Recovery Network **This "collaborative of public, private, nonprofit, and faith organizations" facilitates cross-sector support for disaster recovery. Its website hosts resources for marginalized communities, among others.**

Resilience Hubs (USDN) **This page provides guidance on the development of resilience hubs, which are partnership-based, community-serving facilities that aid and educate residents and coordinate resource distribution.**

EXAMPLES

Green Heart Project (Louisville, KY)

Lumberton Loop wetland restoration and greenway (Lumberton, NC)

Studying and monitoring sunny day flooding (Beaufort, NC)

CASE STUDIES

Southeast Florida counties and municipalities partner to develop a comprehensive sea level rise assessment

*See the case studies from the **Collaboration, Community and Education** and **Equity and Justice** sections.

Establish mutual support agreements

Mutual aid is the two-way exchange of support and resources between entities or within an organization. Mutual aid conserves and extends resources, building resilience by sharing people, equipment, and expertise instead of each entity investing on their own. Mutual aid agreements and organizations also strengthen relationships and create new networks of supporters, bringing unique insight and perspectives to the process.

FOR MORE INFORMATION

North Carolina Mutual Aid System **Participation in this program "enables your city or town to receive or provide assistance to another community."**

EXAMPLE

Interlocal Agreement for Emergency Management Coordination Service (State of NC, Pasquotank County)

Foster peer-to-peer knowledge exchange

Peer-to-peer learning opportunities leverage the experiences and expertise of other people and organizations with similar goals. Peer-to-peer knowledge exchange can take many forms, including email listservs, webinars, seminars, social media groups, workshops, or even informal gatherings like social activities outside of work hours. Peer-to-peer knowledge exchange builds resilience by establishing platforms for posing questions to a group; discussing challenges, opportunities, and best practices; and learning through the practical experiences of other practitioners knowledgeable in resilience topics.

FOR MORE INFORMATION

EXAMPLES

List of National Climate Resilience Networks
North Carolina Association of Floodplain Managers Conference
North Carolina Rural Center's Annual Rural Summit
North Carolina Rural Water Association Events
Triangle Area Water Supply Monitoring Project

Join resilience professional development networks

Local government elected officials and staff can join regional and national networks or form state or local climate collaboratives to share best practices and research, learn from peers, and brainstorm solutions to resilience problems.

FOR MORE INFORMATION

American Society of Adaptation Professionals **This group is a professional networking home for people working on climate change adaptation.**

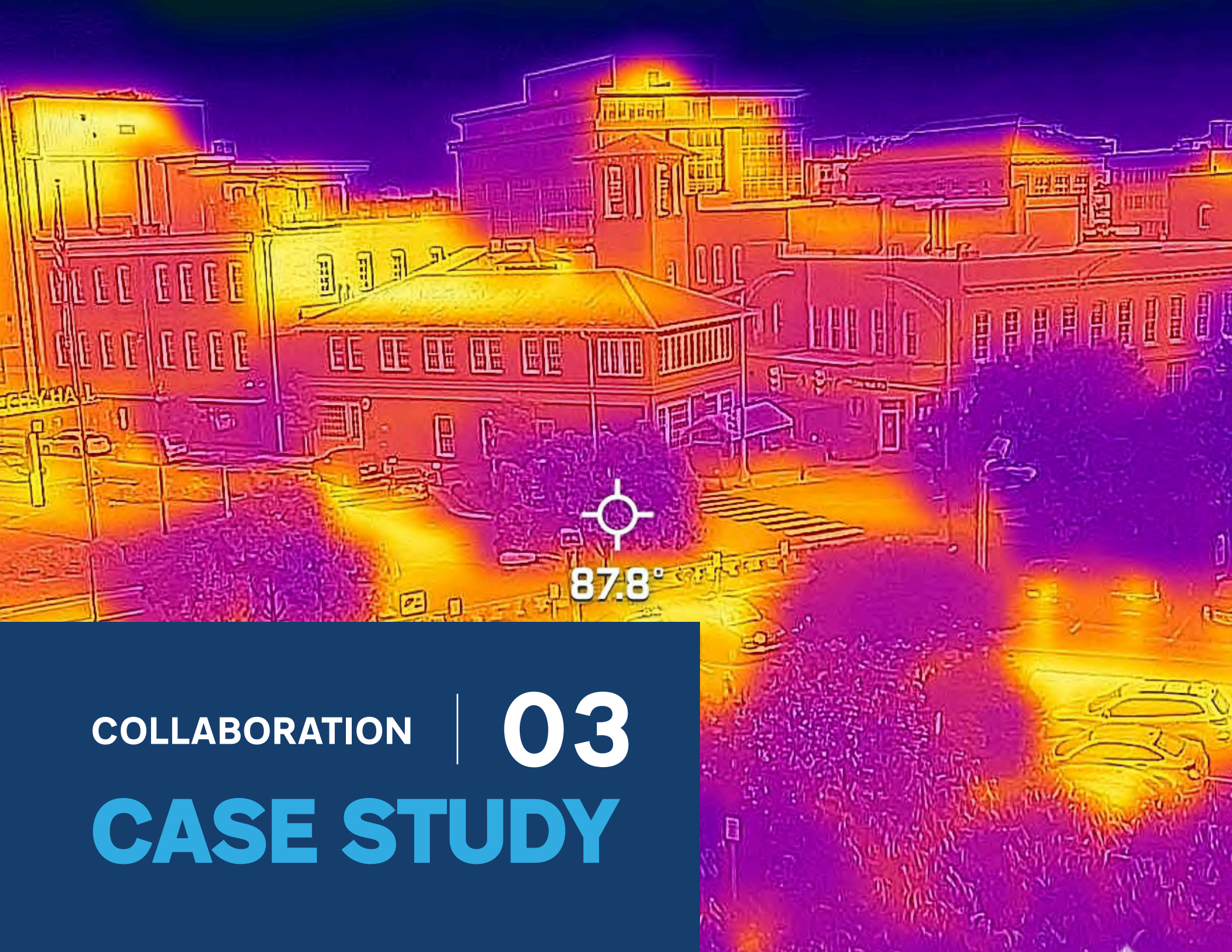
NC Association of Floodplain Managers **This group of local, state, and private sector professionals shares knowledge and disseminates information about the National Flood Insurance Program and state specific guidance on floodplain development.**

Regional Climate Collaboratives **This site lists local and regional resilience networks that exist across the country, all of which can serve as examples for forming a network in North Carolina.**

Urban Sustainability Directors Network **This professional development network brings staff together that work in local government sustainability. A partner network of USDN, the Southeast Sustainability Directors Network, provides a networking home for local government sustainability professionals from across the southeast.**

EXAMPLE

Puget Sound Climate Preparedness Collaborative



COLLABORATION | 03

CASE STUDY

CASE STUDY Raleigh and Durham map neighborhood temperatures

Project Purpose

Unusually high daytime and nighttime temperatures are occurring more often across Raleigh and Durham, NC. These high temperatures affect residents' health and the communities' infrastructure. The cities worked with several partners to measure temperature and related metrics in different areas on a hot day. They used the data to understand how summer temperatures vary across neighborhoods. They wanted to understand how landscape features affect temperature and humidity, and to identify appropriate heat management strategies.

Key Players: Durham County, City of Raleigh, NC Museum of Life and Science, NC Museum of Natural Sciences, North Carolina State Climate Office, National Weather Service Raleigh Office, Activate Good, NIHHIS, NOAA and CAPA Strategies

Quick Facts

1. Several entities in Raleigh and Durham partnered with federal agencies and Climate Adaptation Planning and Analytics (CAPA) Strategies to measure and map temperatures through CAPA Strategies' Heat Watch Campaign.
2. Residents volunteered to measure temperature and other data using sensors provided by CAPA Strategies.
3. Raleigh and Durham used the data to identify areas in need of cooling solutions such as planting trees and installing reflective pavement.

Making It Happen

The National Integrated Heat Health Information System (NIHHIS), the National Oceanic and Atmospheric Administration (NOAA) and CAPA Strategies administer the Heat Watch Campaign each year, if funds are available. The program guides a cohort of communities through an urban heat island mapping project. The NC Museum of Life and Science successfully applied to the program in November 2020 with several partners.

- Once accepted, Durham County and the City of Raleigh, in partnership with the NC Museum of Life and Science, the NC Museum of Natural Sciences and the State Climate Office formed a steering committee. The committee talked with neighborhoods and community groups to better understand what was important to them.
- The steering committee identified the study areas, prioritizing diverse land uses and neighborhoods. CAPA Strategies selected the best data collection routes.
- Activate Good helped recruit 165 volunteers for the Raleigh and Durham campaign, the most recruited by all campaigns nationally in 2021. Activate Good is an organization that connects volunteers to community service projects.
- The project team worked with the National Weather Service to select an appropriate weather day to collect the data.
- In advance of the campaign day, the NC Museum of Life and Science trained volunteers. CAPA Strategies sent the sensor equipment to the project team. The museum provided handheld sensors and infrared cameras.
- On the campaign day, held in July 2021, project managers set up control hubs in Raleigh and Durham. The hubs functioned as central organizing spots for distributing and collecting equipment. Volunteers walked, biked or drove during three times slots—morning, afternoon and evening—on pre-determined routes, collecting data from the provided sensors. They measured ambient temperature, humidity, geographic location and speed.
- Project managers sent the collected data to CAPA Strategies. CAPA returned cleaned data, maps and other analysis in a final report in January 2022.
- The State Climate Office **made campaign maps and data publicly available**.
- Partners offered webinars to review the results of the campaign with the public. Partners continue to engage with local agencies, neighborhoods and interested parties to educate about extreme heat and urban heat island using local data.

Spotlight on Equity

The Raleigh and Durham Heat Watch Campaign prioritized measuring temperatures in neighborhoods experiencing environmental and social injustices and inequities. Low-income, Black communities tend to have less tree cover and fewer air conditioners. Families in these areas often have a smaller budget to pay for growing energy costs. In addition, low-income families are less likely to have good health insurance, which makes it hard for them to access treatment if they experience a heat-related illness (EPA, 2022). For these reasons, project managers included neighborhoods with a high number of Black residents and with affordable housing in the campaign's study area. Learn more at the NIHHIS Heat Equity webpage.

Advice from the project manager

Test the campaign day routes in advance to ensure they are easy to follow. Also have backup equipment and batteries in case of equipment failure.

Collaborate with local volunteer organizations to drive volunteerism and ensure a single voice for communicating with volunteers. Using different volunteers during each collection period—morning, daytime and evening—is helpful in engaging participants but can lead to inconsistent results.

Conduct webinars before and after the campaign to raise awareness and educate community members.

Outcomes

- Results: Durham and Raleigh identified several areas with excessively high temperatures. They found that temperatures in these locations were higher even in the evening and early morning. These locations tended to have more impervious surface. Project partners also found that disadvantaged areas have higher average temperatures throughout the day than other areas.
- The NC Museum of Life and Science hosted several public programs and developed two exhibits based on these data. One program was in collaboration with the Hayti Heritage Cultural Center about how heat and other environmental hazards affect residents.
- The NC Museum of Life and Science worked with Durham Public Schools and the University of North Carolina at Chapel Hill to use these data in public school classrooms. Partners continue to monitor heat with public school students.
- Durham plans to build off the campaign by implementing heat management projects such as green infrastructure in heat island areas.

Continued on next page

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Additional Resources

NIHHIS Heat Island Mapping Campaigns
A map of participating communities since 2017

What you can do to reduce heat islands
A webpage from EPA

Planning for Urban Heat Resilience
A report from the American Planning Association

Related Case Studies

- See **Business and Economy**: Oyster Trail protects oyster habitat and grows economy.
- See **Coastal Management**: Sunset Beach installs a living shoreline.
- See **Communications and Education**: Local partners empower youth action for climate resilience.
- See **Ecosystem Protection and Restoration**: New Bern project grows natural stormwater resilience while improving native ecosystems.
- See **Equity and Justice**: Princeville, public universities and partners facilitate resilience planning that honors town history.

Outcomes *(cont'd)*

- The City of Raleigh Department of Transportation secured $150,000 in supplemental funding in 2022 to apply a coating to streets in areas with high urban heat. The coating increases the roads' reflectivity, which means that the road surface will not absorb as much heat and the air above the road does not get as hot. The coating also extends the life of pavements, absorbs some emissions and reduces pollutants. Treated roads in Raleigh showed a 37% reduction in a common roadway pollutant. Raleigh plans to continue applying the coating to roadways in high heat areas.
- Raleigh's Stormwater Management Division invested $750,000 of the City's American Rescue Plan Act funds toward the installation of green stormwater infrastructure and street trees. In addition, Raleigh's Urban Forestry Group received approval from Raleigh City Council to plant 1,000 trees in the right of way with $750,000. Both projects will address the inequality in the distribution of street trees in racially or ethnically concentrated areas of poverty.
- Raleigh merged the campaign's urban heat data with a 3D map of the city to use as a storytelling tool and to visualize neighborhood-level tree cover and urban heat impacts.
- Durham County Emergency Management updated its hazard mitigation plan with a section on heat informed by the campaign.

Costs and Funding

- If federal funding is available, NOAA pays the Heat Watch fee for participating jurisdictions (National Integrated Heat Health Information System, n.d.).
- The NC Museum of Life and Science provided handheld heat sensors and cameras that took infrared images.
- Local businesses provided food and beverages during the volunteer campaign day.

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TOPIC | 04
COMMUNICATION AND EDUCATION

Overview

Improving communication and education supports a resilient community by ensuring all community members have access to the information and resources they need to prepare and protect themselves against potential hazards. Communication and education efforts build resilience by establishing a two-way exchange of information, empowering community members through information and resources and building a strong foundation of community support for resilience initiatives.

Role in Resilience

Communication and education are key elements of every resilience topic in this guide. These strategies support community leaders' efforts to:

- Share and receive information and feedback.
- Raise awareness of resources, information, opportunities and events.
- Train and educate people and organizations.
- Build support and find champions for plans, projects and initiatives.
- Strengthen existing relationships with residents and key stakeholders.
- Establish new relationships with those who have historically been excluded from public processes.
- Make all the above more accessible and user friendly.

North Carolina's communities can build resilience with campaigns that raise awareness of hazards as well as preparedness efforts. Campaigns can take the form of direct outreach and engagement, distributing educational materials, implementing emergency notification and communication systems, and providing training to staff and residents. Making information, resources and opportunities more accessible to residents through varying formats and languages is also a critical element of building resilience. This section highlights strategies local leaders can use to effectively inform residents about the challenges of climate change and how to address them.

Potential Project Leads, Experts and Stakeholders

- Local government departments focused on communications, community development, emergency management, planning and sustainability
- Nonprofits and other community organizations (e.g., neighborhood associations, advocacy groups, community foundations, tribal governments and faith communities), especially those that can help convene individuals from often overlooked communities (e.g., Association of Mexicans in North Carolina (AMEXCAN), Hispanic Federation, NC Black Alliance, NC Environmental Justice Network and NC Commission on Indian Affairs)

  More North Carolina community-based organizations:

  - NC Conservation Network Affiliates
  - NC Environmental Justice Network member organizations
  - NC Justice Center
  - NC NAACP
  - NC Rural Center
  - NC Tribal Communities
- State government agencies, such as NCORR, NC DEQ Division of Environmental Education and Public Affairs and NCEM
- Federal government agencies, such as the CDC, US EPA, and NOAA
- K-12 schools and higher education institutions
- Regional organizations, such as North Carolina's councils of governments (COGs) and area agencies on aging
- Media outlets
- Residents

FOR MORE INFORMATION

Enhanced Engagement and Risk Communication for Underserved Communities is a compilation of best practices and lessons learned to help local leaders communicate with underserved communities about coastal hazards in a more effective way. This NOAA resource includes related stories and trainings.

Translation Tips: A Guide for Emergency Managers and Public Information Officers details specific tips about preparing materials for translation and working with translators. The document was created by the government of King County, WA.

COMMUNICATION AND EDUCATION | 04 STRATEGIES

Use public outreach and awareness campaigns to educate and inform the community about climate hazards and building resilience

Public outreach and awareness strategies describe one-way exchanges of information using methods like informational posters, notices, exhibits and special signage. These methods build resilience by educating the public and calling attention to issues and opportunities. For example, signs indicating the highwater mark of a past flood help the community visualize the potential level of flood inundation, raising awareness of flood risk.

FOR MORE INFORMATION

Drought Communication Toolkit (CDC) **This site provides materials to educate the public on health effects of drought.**

Communication materials for natural disasters and severe weather (CDC) **This site contains PDF educational materials in multiple languages on returning home after a disaster, heat-related illnesses and more.**

EXAMPLES

Green infrastructure and low impact development educational signage project (Weston & Sampson)

Special flood hazard area notification letter (Orange County, NC)

Flood risk outreach campaign (Dare County, NC)

Engage the community in building resilience

Activity- or event-based engagement methods build resilience by facilitating a two-way exchange of knowledge, information, and resources and by recognizing community efforts to build resilience. Examples might include tree planting days; volunteer-based living shoreline construction; interactive strategies for conducting collaborative, community-based problem-solving; discussing and learning about hazards; and providing feedback.

FOR MORE INFORMATION

Climate Resilience for Frontline Clinics Toolkit (Harvard University School of Public Health) **This guidance is for community health centers and clinics providing free or low-cost healthcare to protect patients from climate risks.**

***Incluye Recursos en Español**

EXAMPLES

Adopt-A-Drain (Durham, NC)

Living shoreline maintenance and clean-up (Carolina Beach, NC)

Public Participation Plan (NC DEQ)

Stormwater community outreach (Carrboro, NC)

Provide tools and resources to help build resilience

Providing tools, guides and other resources can help individuals and businesses build resilience by enhancing the community's capacity to proactively prepare for and respond to hazards. These resources can also encourage the community to implement hazard mitigation strategies.

FOR MORE INFORMATION

EXAMPLES

Climate-Resilient Personal Action Guide (Asheville, NC)

Be Flood Ready handout (King County, WA)

Prepárate NC: Una guía informativa y de recursos para la temporada de huracanes

Only available in Spanish

Implement accessible emergency notification and communication systems

Communities can build resilience by implementing a community warning system or public notification system for climate-related hazards like extreme weather, extreme heat or cold, floods and more. It is critical that communications are provided in multiple languages and formats to ensure equitable access for all community members. For example, consider mechanisms to alert the vision-impaired community when king tides flooding is expected.

FOR MORE INFORMATION

Establishing and Maintaining Inclusive Emergency Management with Immigrant and Refugee Populations (Welcoming America)

This checklist is "designed to help strengthen existing emergency preparedness plan by ensuring immigrants and refugees are part of any emergency response."

EXAMPLES

CodeRED Emergency Notification System (Robeson County, NC)

Community Alert System (Catawba County, NC)

CASE STUDY

How Arcata, CA, is Creating an Inclusive and Equitable Culture of Preparedness

Offer resilience education and training opportunities for staff, businesses and residents

This strategy focuses on providing targeted, formal education and training for local government staff and community members. These efforts enhance community resilience by giving staff and residents the tools to assess, understand and communicate climate-related hazards and opportunities to build resilience.

FOR MORE INFORMATION

Local Government Climate Adaptation Training (US EPA) **Local governments can use this series of videos to train staff on the basics of climate change and the risks climate change poses to government operations and services.**

Preparedness Training for Community Based Organizations (FEMA) **This resource contains a "web-based, self-guided training and a downloadable instructor kit that will guide participants on how to identify risks, locate resources and take preparedness actions" to keep local businesses and organizations open during disasters.**

EXAMPLES

Raleigh Watershed Learning Network (National League of Cities)

CASE STUDY

*See the following **Communication and Education** case study.

Ensure emergency management staff have response protocols for climate hazards

Many local governments have standard operating procedures to ensure the community is adequately preparing for incoming extreme weather such as hurricanes and ice storms. Heat wave protocols are less common and can help reduce morbidity and mortality from high daytime and nighttime temperatures.

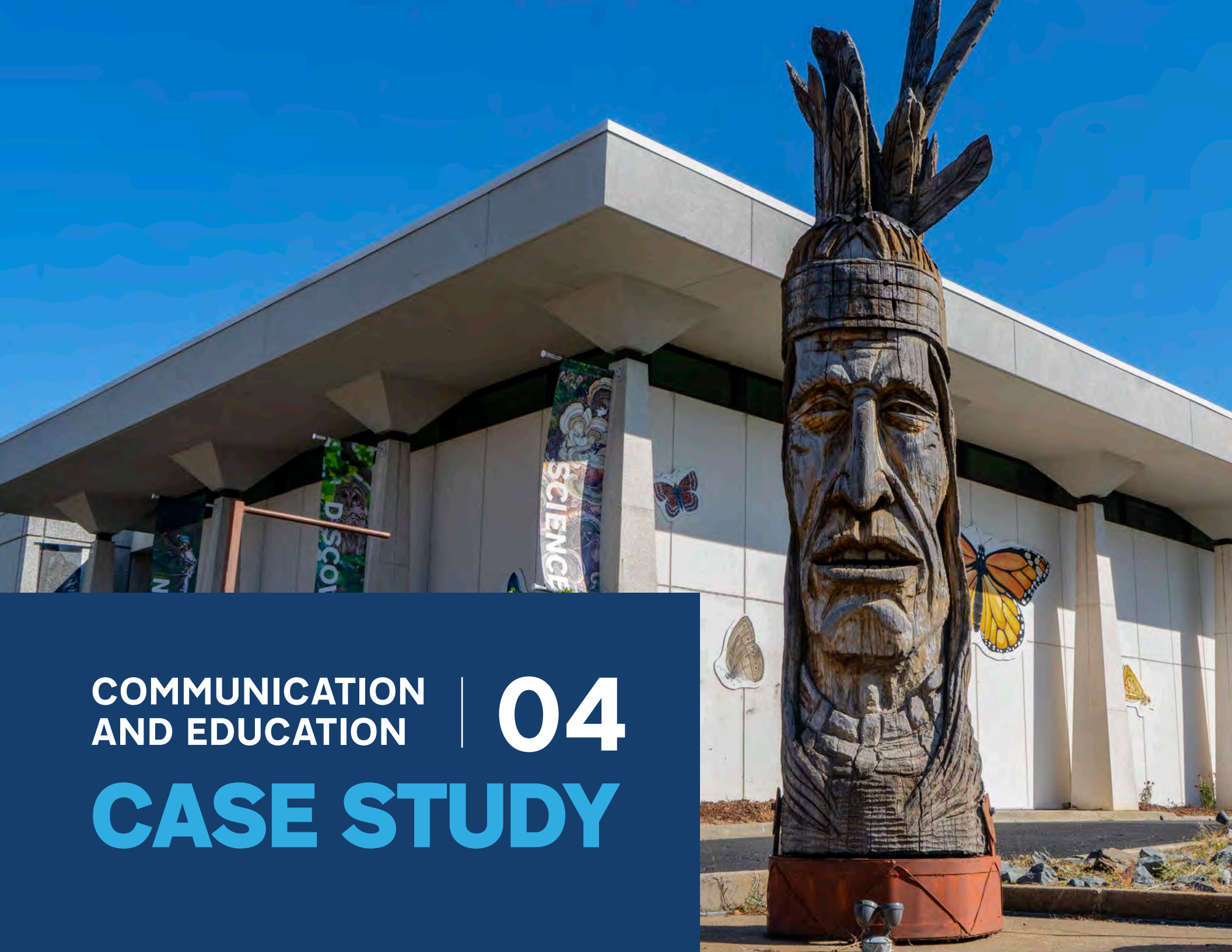
FOR MORE INFORMATION

A guide for building a heat response plan (CDC)
This document describes how to build, implement and monitor a heat response plan.

EXAMPLES

Heat Management Plan and Response Protocol (Richmond, IN)

Regional Inclusive Emergency Communications Plan (King County, WA)



COMMUNICATION AND EDUCATION | 04

CASE STUDY

CASE STUDY Local partners empower youth action for climate resilience

Project Purpose

This science, technology, engineering and math (STEM) enrichment program aims to engage a diverse group of students in developing solutions to health-related climate impacts in their communities. Program organizers designed the curriculum so it could be used by other organizations.

Key Players: University of North Carolina at Chapel Hill Center for Public Engagement with Science, North Carolina Museum of Natural Sciences

Quick Facts

1. The Center for Public Engagement with Science in the UNC Institute for the Environment and the Raleigh and Whiteville branches of the North Carolina Museum of Natural Sciences established **Youth Engaging in the Science of Resilience** (YES-Resilience).
2. Organizers ran a 10-month program during the 2020-2021 pilot year.
3. Through the program, 37 high school students from Whiteville, a rural community, and Raleigh, an urban community, learned about health-related climate impacts in their hometowns.
4. Program organizers facilitated personalized and place-based investigations of climate hazards. Participants explored the role of climate and health justice in building community resilience.

Making It Happen

- Program planning, which included curriculum development, took approximately eight months. Sessions during the pilot program ran from August 2020 until June 2021.
- Program partners obtained a grant to hire youth education specialists, design the STEM curriculum and run the program. The intention was to implement in-person programming in two locations: Raleigh, NC, and Whiteville, NC. However, in response to COVID-19 pandemic restrictions, program partners held one virtual program for most of the year.
- Staff held online training sessions for students once or twice per month over a 10-month period. The program included half-day academies, leadership sessions and a youth action forum, all of which were virtual.
- Each session engaged youth participants in active learning on a range of climate science topics, from wildfires and flooding to extreme precipitation and heat (University of North Carolina at Chapel Hill, 2023).
- Youth participants developed and practiced leadership and communication skills. They worked with one another, with peers outside the program and with a range of professionals addressing climate resilience in the state.
- In each academy session, professionals from a variety of the climate-related fields shared their knowledge and offered insights into their work.
- For the concluding summer event, program organizers hosted in-person sessions at the Raleigh and Whiteville Museum of Natural Sciences locations. Both three-day summer institutes included a variety of indoor and outdoor activities, guest speakers and participant presentations.
- Program staff coached youth participants to complete resilience-focused community action projects. Either individually or in small groups, students worked on their projects using the knowledge and skills they developed during the program.

Spotlight on Equity

Equity and justice are points of emphasis in the YES-Resilience program. To recruit a diverse group of participants, program staff reached out to parent groups, teachers and prospective youth. They used social media, direct email, classroom presentations and webinars. Program staff invited guest speakers whose identities are underrepresented in STEM fields to take part in all sessions. These guests described their educational and career paths. Academy sessions also incorporated discussions about vulnerable populations in participants' own communities. They brainstormed potential solutions that could help those populations become more resilient to climate hazards. Furthermore, students designed strategies to bring their voices into climate resilience conversations.

Advice from the project manager

Most challenges noted by the YES-Resilience program manager had to do with pandemic restrictions. While online sessions allowed the program to operate, access to reliable internet varied among participants. To increase engagement in virtual sessions and reduce "Zoom fatigue," program staff recommend including offline activities that encourage students to go outdoors. Breaks were important online and during the in-person summer institute. Participants recommended having more breaks to allow youth to build connections with one another.

In addition, transportation for rural participants to attend the in-person summer institute was an issue. This challenge could have been much bigger had the program operated fully in-person as originally planned. Program organizers offered a transportation stipend to offset travel expenses.

Outcomes

- Many participants completed action projects. Students coordinated public education efforts, displayed sustainable art at the North Carolina Museum of Natural Sciences, and designed tree planting and ecosystem restoration projects.
- Program evaluation found that participants preferred in-person sessions and hands-on activities. They enjoyed having opportunities to build community with each other and with content experts.
- Staff designed program materials so that interested organizations can choose to modify the sequence of activities to suit their available resources, including personnel. *Youth Engaging in the Science of Resilience: An Activity Guide for Museum and Science Center Educators* is available upon request on the YES-Resilience website.

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Additional Resources

National Science Foundation's Advancing Informal STEM Learning Pilot and Feasibility Grant

National Science Foundation's Advancing Informal STEM Learning Innovations in Development Grant

Related Case Studies

- See **Coastal Management**: Sunset Beach installs a living shoreline
- See **Collaboration:** Raleigh and Durham map neighborhood temperatures
- See **Planning and Decision-making Frameworks:** Norfolk, VA, updates zoning regulations to address flooding and sea level rise
- See **Public Health:** Preventing heat-related illness in the Sandhills Region

Costs and Funding

- Program partners received $356,000 from the National Science Foundation (NSF) Advancing Informal STEM Learning Program. They used this funding to develop and pilot the curriculum for the project. Funds covered personnel time, materials, youth stipends, travel and evaluation.
- Following the pilot program, the team received an additional $2,358,000 from the NSF. This funding allowed program staff to further adapt curriculum materials for community-based organizations serving diverse youth in North Carolina and Washington state. In the updated program, Latino and Indigenous youth look at climate data and maps to understand how climate change is impacting their communities. Students can also collect weather and air quality data using personal devices (UNC Institute for the Environment, 2022).

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University of North Carolina at Chapel Hill. (2023, June 29). *Youth Engaging in the Science of Resilience.* Retrieved from University of North Carolina at Chapel Hill Institute for the Environment: https://ie.unc.edu/cpes/yes-resilience/

TOPIC | 05

ECOSYSTEM PROTECTION, RESTORATION AND ENHANCEMENT

Overview

Ecosystems, which are the foundation of the natural world, help protect humans and the built environment from harm and are at risk of impacts from climate change. Ecosystems, including rivers and streams, lakes and ponds, wetlands, forests, grasslands, and oceans, among others, perform critical environmental services like filtering stormwater, forming natural shoreline protection, preventing erosion, and removing excess carbon dioxide from the atmosphere. They protect communities through benefits like wind and flood protection and heat mitigation. And they provide habitat for wildlife and native plants. Furthermore, intact ecosystems can offer economic benefits such as productive farmland, tourism and healthy fisheries.

But climate change and human activity often disrupt natural spaces, damaging and degrading ecosystems in North Carolina. Even seemingly small disruptions to an ecosystem can have a ripple effect resulting in harmful outcomes to both the natural and built environments. Sensitive ecosystems are easily disrupted by development, uncontrolled stormwater runoff, air and water pollution, and resource depletion like fishing and harvesting timber. Hazards resulting from climate change like wildfires, flooding and sea level rise also impact these natural networks. Protecting, restoring, and enhancing ecosystems enables these spaces to support and protect life in North Carolina, building resilience in our state.

Role in Resilience

Ecosystem protection, restoration and management build resilience by ensuring ecosystems are healthy enough to carry out critical functions for both the natural and human environments. North Carolina's communities can build resilience by implementing strategies to protect and restore ecosystems, helping these natural systems perform their important roles without disruption. Developing community plans at the watershed or habitat scale takes a comprehensive approach to protecting and restoring ecosystems. Land use policies can help people coexist with the natural environment in ways that prevent degradation and destruction, particularly in areas sensitive to human impacts. Restoration projects like living shorelines and dune reconstruction provide protection in coastal areas, and tree planting can provide much needed heat reduction in urban spaces. In addition, many ecosystem projects have water and air quality benefits. This section lists strategies that provide habitat for wildlife while improving the quality of life for the people of North Carolina.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on parks, sustainability, public infrastructure, planning, economic development, water and wastewater
- Design and construction professionals (e.g., landscape architects, water resource engineers, environmental scientists) in the private, nonprofit, governmental and academic sectors
- Environmental nonprofits, such as the North Carolina Coastal Federation, North Carolina Sea Grant, The Nature Conservancy, Conservation Trust for North Carolina and Carolina Wetlands Association
- State government agencies, such as NC DEQ, NC DNCR, Wildlife Resources Commission, NCORR and NC DOT
- Federal government agencies, such as US EPA
- Builders and developers
- Residents

FOR MORE INFORMATION

The Green Growth Toolbox, developed by the North Carolina Wildlife Resources Commission, provides tools to help the state's local governments plan for growth in a way that conserves natural habitats and other assets. The guidance provides information to support the strategies listed in the table below.

Ecosystem Protection Strategies for Climate Change, part of the US EPA's Climate Change Adaptation Resource Center (ARC-X), links to adaptation strategies for protecting wetlands, shorelines, habitats, water quality and more.

The Natural and Cultural Resources Natural Heritage Program provides information for communities to weigh the ecological significance of natural areas and to evaluate potential ecological impacts of conservation and development projects.

Natural and Working Lands Action Plan, outlines specific projects for North Carolina's natural and working lands to increase carbon sequestration, build ecosystem and community resilience, provide ecosystem benefits and enhance the economy.

ECOSYSTEM PROTECTION, RESTORATION AND ENHANCEMENT

05 STRATEGIES

Develop plans that take habitat and watershed impacts into consideration

This strategy supports resilience by conducting planning efforts at the habitat or ecosystem level. Planning at this level allows for a more proactive approach to preserving and protecting environmental systems.

FOR MORE INFORMATION

EXAMPLES

Eno River and New Hope Creek Watershed Landscape Plan for Wildlife Habitat Connectivity

Community Floodprint: A landscape planning approach to address flooding, recovery and equity (Lumberton, NC)

Comprehensive and Land Use Plan and Infrastructure Vulnerability Assessment (Duck, NC)

North Carolina Coastal Habitat Protection Plan

Urban Open Space Plan (Durham, NC)

(See **Stormwater Management and Flooding** for additional resources)

Adopt land use and development regulations that support ecosystems

Adopting ecosystem-friendly regulations helps people coexist with the natural environment in ways that prevent degradation and destruction by prohibiting activity and development in places that are too sensitive to bear human impacts.

FOR MORE INFORMATION

Conservation Subdivision Handbook for North Carolina Communities (NCSU) **This resource describes the benefits of conservation subdivisions, "a design strategy that attempts to preserve undivided, buildable tracts of land as communal open space for residents," as well as a model ordinance and case study examples.**

*See the **Green Growth Toolbox** linked in the previous For More Information section on V2-56.

EXAMPLE

Resource Conservation District (Chapel Hill, NC)

Plan and implement ecosystem and habitat restoration projects

Communities with damaged or degraded ecosystems and habitats can consider strategies to restore and strengthen sensitive locations.

FOR MORE INFORMATION

EXAMPLES

Tree Canopy Action Plan (Charlotte, NC)

Grandfather Restoration Project (Pisgah National Forest, NC)

Habitat restoration project for the Muskie fish in (French Broad River, NC)

Rocky Branch Urban Stream Restoration (NC)

(See **Coastal Management** and **Stormwater Management and Flooding** for additional resources)

CASE STUDIES

*See the case studies from the **Coastal Management** and **Ecosystem Protection, Restoration and Enhancement** sections.

Protect existing waterways, green spaces, and sensitive ecosystems

Protecting sensitive habitat and the quality of water and land-based ecosystems preserves native species and spaces along with the benefits they provide.

Strategies can include increasing land and water protection activities, eradicating invasive species, protecting natural infrastructure that provides cooling and flood mitigation services, encouraging continuous blocks of forests to avoid fragmentation, and managing land and aquatic environments for specific climate change impacts.

FOR MORE INFORMATION

North Carolina Conservation Planning Tool (NC DNCR)
This resource provides data and maps that can inform local, regional and statewide conservation and land use planning efforts, including "aquatic and terrestrial habitat and lands preserved for conservation, agriculture and forestry."

EXAMPLE

Lands Legacy Program (Orange County, NC)

ECOSYSTEM PROTECTION, RESTORATION AND ENHANCEMENT

05

CASE STUDY

CASE STUDY

New Bern project grows natural stormwater resilience while improving native ecosystems

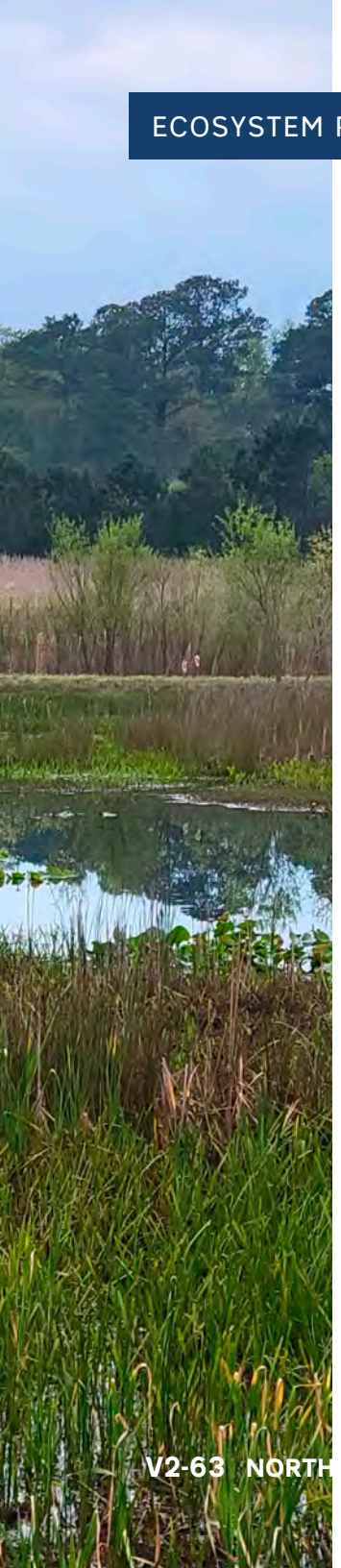
Project Purpose

The City of New Bern wanted to reduce the impact of larger rainfalls that had caused major flood damage. In partnership with the State of North Carolina and NC State University, New Bern completed the Jack Smith Creek Stormwater Wetlands. The project aimed to improve the quality of the water that flows from nearby land into Jack Smith Creek, reduce the impact of nuisance flooding, and protect and preserve existing wetlands along the waterway.

Key Players: City of New Bern, NC DEQ Ecosystem Enhancement Program, NCSU Department of Biological and Agriculture Engineering Stormwater Group

Quick Facts

1. The Jack Smith Creek Stormwater Wetlands project is a multi-use park that helps manage flooding and protect water quality.
2. The project features more than 38 acres of wetland, including 25 acres of planted stormwater wetlands, 10 acres of preserved wetlands, more than two acres of enhanced wetlands and one acre of newly created wetland.
3. The City of New Bern used a conservation easement to gain access to the land.
4. At the time of project completion, the Jack Smith Creek Stormwater Wetlands was the largest artificial wetlands site in North Carolina.
5. The wetlands are designed to capture and treat runoff from over 1,000 acres of commercial and residential land.



Making It Happen

- The City of New Bern contacted the NC Department of Environmental Quality (NC DEQ) about water quality and stormwater issues.
- In 2004, the city and the NC DEQ Division of Mitigation Services, then called the Ecosystem Enhancement Program, began searching for land that experienced frequent flooding to place a project. They found a location with no residents and few structures.
- They used a conservation easement process to access the land.
- In 2007, New Bern engaged other partners, including the Stormwater Engineering Group from the NC State University (NCSU) Department of Biological and Agricultural Engineering. The academic partners informed the design of the 51-acre site by collecting and analyzing wetlands and stormwater data.
- New Bern hired a contractor to construct the stormwater wetland. The contractor began construction in 2009 and completed their work in 2012.
- In 2013, project partners finished the final plantings, marking the project's completion.
- The city kept the public apprised of the project through local media and press releases throughout construction.
- The city assumed all management, monitoring and stewardship functions following project completion.
- In 2018, the regulatory monitoring period closed.

The design applies numerous innovations to maximize capacity. For instance, the wetlands use a "multi-cell, labyrinth approach" that directs stormwater runoff by using small dams, called "weirs," and culverts to maximize water quality improvements that promote biodiversity. A pump moves roughly 1,000 gallons of water per minute (GPM), with emergency activation up to 40,000 GPM. The pumps allow New Bern to use the stormwater wetlands for flood control. In addition, the project was part of the NC DEQ Division of Mitigation Services' Nutrient Offset Program. The site's 140,000 native wetland plants filter excess nutrients from the water before it reaches the Neuse River. Ultimately, the elevation of the wetlands plays a key role in how much river surge the project can control.

Spotlight on Equity

The Jack Smith Creek Stormwater Wetlands is near vulnerable populations. Nearby neighborhoods are home to many Black or African American residents, residents who do not speak English well, families and elders in deep poverty, and households without cars (US Department of Commerce, 2013). The project reduces the risk of street flooding and property flooding for these residents, restores natural habitat in their neighborhood, and provides access to green space.

Advice from the project manager

Project managers mentioned that new regulations require "full delivery" for wetland enhancement projects funded by the NC DEQ Division of Mitigation Services. This means that NC DEQ now requires similar projects to be managed and delivered via a bidding process, so NC DEQ is no longer able to provide project management as the agency did in this case.

Outcomes

- Upon completion, the Jack Smith Creek Stormwater Wetlands were the largest artificial wetlands in North Carolina.
- The site captures stormwater from more than 1,000 acres of residential and commercial properties. The project features more than 38 acres of wetland, including 25 acres of planted stormwater wetlands, 10 acres of preserved wetlands, more than two acres of enhanced wetlands and one acre of newly created wetland.
- Monitoring showed that the project managed water quality and stormwater as intended.
- The site is now a popular park and public recreation area.
- PBS's "AquaKids" show featured the project when discussing the importance of wetlands and the benefits they provide.

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Additional Resources

Jack Smith Creek Stormwater Wetlands Site Map **and** Video

Related Case Studies

- See **Coastal Management:** Sunset Beach installs a living shoreline

Costs and Funding

- The total project cost was $2.6 million (2012 dollars), including $1.4 million for wetland restoration work and $300,000 for the easement.
- The City of New Bern dedicated at least half of one employee's time for project management, ongoing monitoring and maintenance costs.
- The North Carolina Land and Water Fund, then known as the NC Clean Water Management Trust Fund, supported the project financially.

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TOPIC | 06
ENERGY AND UTILITIES

Overview

Access to power and utilities like electricity, gas, drinking water, wastewater removal and treatment, and broadband is foundational to a functional community. Utilities supply the services that keep people comfortable, healthy, connected and moving. Electricity generation and distribution networks provide the energy needed to power medical devices in hospitals, illuminate buildings and streets, warm and cool people and food, and power vehicles. Other utility systems supply clean drinking water, pipe away and treat wastewater, and keep people connected through internet and phone services. North Carolina's communities can build resilience by making buildings more energy efficient, protecting energy and utility infrastructure from harm, and supplying backup options, also known as system redundancy, in the event of a system disruption or damage.

Role in Resilience

Utility networks are very vulnerable to disruption due to their size and complexity. More frequent and severe climate hazards and extreme weather events are increasing this vulnerability (International Energy Agency, 2021). To build resilience, communities must ensure critical systems like utilities are protected and that there are alternative options in place when system disruptions do occur.

Strategies that increase the efficiency of utility systems and reduce wasteful use of valuable resources like water and electricity build resilience. Efficient buildings more easily maintain temperatures during outages and require less energy day to day from the grid or another local source.

Additional strategies that enhance the resilience of utility delivery and availability may include retrofitting or moving vulnerable distribution networks and critical facilities to ensure they work during extreme weather events. Communities can also build resilience by building alternatives for generating critical resources like water and electricity to create redundancy, or duplication, in the system so that if one part fails, other options are available. Examples of this type of redundancy include distributed networks of microgrids for generating electricity, using renewable sources of energy like solar, and increasing the onsite capture and treatment of water. Lastly, it is important that residents receive up-to-date information and emergency communications during times of crisis. North Carolina's communities can support resilience with strategies that supply comprehensive, equitable access to communication networks like broadband internet. This section lists several strategies local leaders can use to build and support resilient utility service delivery.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on building inspections, weatherization, public works, planning, sustainability, emergency management, water, wastewater and other utilities
- State government agencies, such as the Department of Information Technology Division of Broadband and Digital Equity; NCEM; and the NC DEQ State Energy Office, Division of Water Infrastructure, Division of Waste Management and Division of Energy, Mineral and Land Resources
- Federal government agencies, such as US EPA and US DOE

- Energy and utility professionals (e.g., architects, electricians, solar installers, weatherization staff)
- Utility companies and commissions, such as the North Carolina Rural Electric Authority, ElectriCities of North Carolina and the North Carolina Utility Commission
- Higher education institutions, such as the NCSU Clean Energy Technology Center
- Nonprofits and other community organizations (e.g., neighborhood associations, advocacy groups, community foundations, tribal governments and faith communities), especially those that can help convene individuals from often overlooked communities (e.g., Association of Mexicans in North Carolina (AMEXCAN), Hispanic Federation, NC Black Alliance, NC Environmental Justice Network and NC Commission on Indian Affairs)

  More North Carolina community-based organizations:

  - NC Conservation Network Affiliates
  - NC Environmental Justice Network member organizations
  - NC Justice Center
  - NC NAACP
  - NC Rural Center
  - NC Tribal Communities
- Consultants
- Solar and wind energy companies
- Builders and developers
- Residents

FOR MORE INFORMATION

The EPA's Creating Resilient Water Utilities initiative "provides drinking water, wastewater and stormwater utilities with tools, training, and technical assistance to increase resilience to climate change." Utilities and other stakeholders in the early stages of understanding climate risks can start by using the Resilient Strategies Guide, advanced users can employ the Climate Resilience Evaluation and Awareness Tool "to assess risk to utility assets and operations," and all users can review the database of case studies on water sector utilities that are building climate resilience.

The Guide to Expanding Mitigation: Making the Connection to Electric Power, released by FEMA, "shows how community officials can work with the public and private actors in the electric power sector to support hazard mitigation, especially in the planning process and project development."

The Important Role of Energy Codes in Achieving Resilience, released by the International Code Council, details the influence of energy codes on energy efficiency as well as pre- and post-disaster resilience.

The US Climate Resilience Toolkit's energy page describes how climate change threatens energy systems and contains links to tools and additional information on energy resilience.

ENERGY AND UTILITIES | 06 STRATEGIES

Assess and protect utilities and distribution networks

Ensuring utility infrastructure systems are in good working condition and well protected is a critical element of building resilience, particularly given the increasing likelihood of extreme weather. This strategy includes inspecting and monitoring for function and integrity and repairing or relocating damaged or vulnerable utility networks, including backup resources.

FOR MORE INFORMATION

EXAMPLE

Northeast Wastewater Treatment Facility disaster protection (Hickory, NC)

CASE STUDY

Blue Plains Wastewater Facility in Washington, DC Reinforces Against Floods

(See **Infrastructure and Capital Investment** and **Land Use and Development** for additional resources)

Develop clear contingency plans for power outages

Having a clear, set procedure and an established emergency manager are helpful measures to decrease the amount of time without power. These operational directives can be very helpful in the event of a large disaster when help may not arrive immediately.

FOR MORE INFORMATION

Incident Action Checklist Power Outages (EPA)
This document provides activities that drinking water and wastewater utilities can take to prepare for, respond to and recover from power outages.

Diversify utility sources to increase redundancy

Utility disruptions can be limited by diversifying utility networks. For example, a well-maintained emergency generator can automatically supply power to life-saving machines if power goes out at a hospital, but a microgrid with renewable sources might offer more co-benefits. In addition, diverse supplies of clean water, electricity, and broadband build resilience by making it less likely that all networks and services will be disrupted, allowing communities to meet their daily needs.

FOR MORE INFORMATION

Microgrids (NC Electric Cooperatives) **This webpage describes microgrids, energy systems that help diversify energy supply, and gives a brief overview of existing microgrid locations in North Carolina.**

CASE STUDIES

Duke Energy announces McAlpine and Mount Holly, NC, microgrids

Tampa Bay, FL, diversifies water supply sources

*See **Energy and Utilities** case study, below.

Manage demand and reduce use of water, electricity and other resources

Managing the demand and use of utilities like energy and water helps conserve scarce resources.

Managing utility use patterns builds reliance by ensuring the resources are available when needed most and that alternative sources are available if necessary. This strategy primarily includes methods for monitoring and reducing usage through education, awareness, behavior modification, and supportive interventions.

Many utilities, agencies, and organizations across North Carolina offer energy audits, energy efficiency upgrades, and emergency housing rehabilitation services. These services can help make residential structures more energy resilient.

FOR MORE INFORMATION

Benefits of Smart Meters (Advanced Energy) **This page describes the energy efficiency and resilience benefits of smart meters and provides examples of their use.**

Energy Savings Performance Contracting Toolkit (US DOE) **This website is a collection of resources on the best practices and innovative approaches states and cities have used to implement performance contracting for energy efficient buildings.**

"WaterSense" products (EPA) **This website lists products that have been third-party certified for their water efficiency and performance.**

Weatherization Assistance Program (NC DEQ) **This program provides funding for local organizations to offer free energy efficiency and weatherization services to low-income households.**

EXAMPLE

Long Range Water Resources Plan Update (Cary, Morrisville and Apex and Wake County, NC)

CASE STUDIES

Advanced Energy builds Heron's Nest Community in Shallotte, NC, as energy smart neighborhood

Brunswick Electric Membership Corporation in NC uses advanced metering infrastructure to provide better electric service

ENERGY
AND UTILITIES

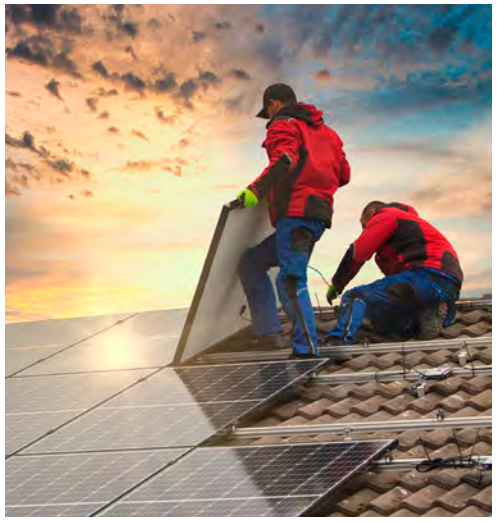
06

CASE STUDY

CASE STUDY

Electric Cooperatives installs microgrid on Ocracoke Island

Project Purpose



NC Electric Cooperatives—an organization that supports North Carolina's 26 nonprofit electric cooperatives—and Tideland EMC—one of those 26 rural electric cooperatives—wanted to increase the reliability of energy on Ocracoke Island. Ocracoke relies on underwater power lines connected to the mainland for electricity. On the island, overhead power lines connect homes and businesses to the grid. Just like any other location, the power can go out on the island on a blue-sky day or when a storm or high winds occur. The two energy utilities installed a microgrid, which allows the cooperatives to provide power to residents and visitors before the main grid can be reconnected.

What is a microgrid?

A microgrid is a small electric system that combines local energy resources and control technologies to provide power to a defined area. Usually, a microgrid is connected to a larger system, but it can function independently when needed. The area served by a microgrid is typically much smaller than what would be served by a utility company (NC Electric Cooperatives, 2024).

Key Players: NC Electric Cooperatives, Tideland EMC

Quick Facts

1. NC Electric Cooperatives and Tideland EMC installed a **microgrid** and in-home energy conservation controls on Ocracoke Island in 2017.
2. Ocracoke's microgrid project features a solar array, diesel power generation and a utility-scale battery storage system. These items supply energy resources year-round to support grid resilience. The system contributes electricity during periods of high demand and can provide power when the main grid is disconnected.
3. The cooperatives also installed over 230 smart thermostats and 40 water heater controls in the homes of Tideland EMC consumer-members on the island. The cooperatives can activate the thermostats and water-heater controls to reduce total load when electricity use is high (NC Electric Cooperatives, n.d.).
4. The **microgrid** and the conservation tools improve Ocracoke Island's resilience to power outages when the mainland grid connection fails. The project also increases the capacity of the island's electrical distribution during peak tourism season when demand is abnormally high.

Making It Happen

- Planning and construction began in 2015. Project managers at NC Electric Cooperatives and Tideland EMC requested bids from vendors.
- The microgrid is connected to a cooperative-owned 3-megawatt diesel generator. An independent contractor installed the roof-mounted 15-kilowatt solar array. Engineers designed the array to withstand winds of up to 140 mph. Another independent contractor conducted the engineering, procurement and construction of the 1-megawatt hour battery bank, transformer and recloser systems. They installed the batteries on a 4-foot concrete base for protection against flooding.
- While the microgrid was being installed, the electric cooperatives developed the behind-the-meter demand response component. Tideland EMC marketed this component to cooperative members on the island. The program offered Ocracoke residents internet-connected thermostats and water heater control devices at discounted prices. Program marketing highlighted the potential for energy and cost savings and the convenience of controlling thermostat settings remotely. The cooperatives gave residents with smart thermostats or water heater controls an annual credit towards their electricity bills. Tideland EMC can use the internet-connected thermostats and water heater controls when electricity is in high demand, i.e., "demand response."
- Project managers installed communications equipment that allows for 24/7 remote monitoring and operation of the site. They also conducted several systems tests before completing the project (NC Electric Cooperatives, n.d.).
- The cooperatives considered the project operational in 2017.

NC Electric Cooperatives and Tideland EMC each have an office on the island, and the NC Electric Cooperatives' plant manager oversees the microgrid's operations. Tideland EMC and NC Electric Cooperatives conduct regular testing. A local electric and solar servicing business conducts quarterly maintenance on the microgrid.

Spotlight on Equity

Energy bills often strain low-income families. These residents spend a higher portion of their income on energy bills than the average household (Drehobl, Ross, & Ayala, 2020). Residents who were able to install smart thermostats and water heater controls received an annual credit that goes towards their electric bill, lessening the burden of utility costs.

Advice from the project manager

A microgrid project's success depends upon committed partners with aligned goals and needs from the project.

Outcomes

- The cooperatives deploy the microgrid's energy resources year-round to support grid resilience. The system contributes electricity during periods of high demand and can provide power when the main grid is disconnected.
- Hurricane Dorian in 2019 was the microgrid's first major test. Both the main grid and microgrid were forced to shut down due to severe wind and significant floodwaters. However, once the floodwaters subsided, the microgrid's diesel generator restored power one day before the main grid was reconnected.
- The microgrid increases the capacity of the island's ability to meet peak electrical demand during tourism season.

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Related Resources

- Ocracoke Island Microgrid Fact Sheet (PDF)
- Ocracoke Island Microgrid Use Cases and Testing Results (PDF)
- NCEMC Ocracoke Island Microgrid Project Implementation Report (PDF)

Costs and Funding

- NC Electric Cooperatives and Tideland EMC funded the project. Total project costs are not available.
- NC Electric Cooperatives noted that communication and control technologies for microgrid projects can cost up to $500,000 (2023 estimate) depending on the size and complexity of the project.

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TOPIC | 07
EQUITY AND JUSTICE

Overview

Climate change impacts do not affect all of North Carolina's communities in the same way. People of color, including Black and Indigenous people, and low-income communities are more likely to experience hazards from climate change and are more likely to suffer severe and cumulative impacts (Berberian, Gonzalez, & Cushing, 2022; EPA, 2021). These disproportionate impacts often occur because past and present inequitable policies and systems create higher risks for residents. For example, governments used to release maps outlining areas with high percentages of Black residents, and mortgage companies discriminatorily interpreted these areas as risky investments. Today, residents in these same areas, which were known as "redlined" districts, are often challenged by increased health impacts and decreased access to healthcare, healthy food and economic opportunity, in addition to other struggles (Egede, et al., 2023). People living in low-income, sometimes previously redlined neighborhoods, experience more severe health impacts from extreme heat because they are less likely to have street trees and more likely to be found near major automobile transportation corridors, which contribute to poor air quality (Constantine, 2020; Hoffman, Shandas, & Pendelton, 2020). Underserved and under-resourced residents are also more likely to have underlying health conditions like asthma that make the impacts of these hazards even worse (American Public Health Association, 2023; EPA, 2022). For these reasons and others, people of color, including Black and Indigenous people, and low-income individuals are often on the frontlines of climate change, experiencing its effects first and more severely than better served and more economically advantaged communities.

Moreover, current and historic systems and policies for disaster response and recovery have not equally benefitted all population groups (Sledge & Thomas, 2019). To move towards equitable and just practices in disaster response, recovery and resilience, local decision-makers and leaders can actively look to repair the harms done to people and places by centering and prioritizing the needs and experiences of underserved and under-resourced residents. Equity and justice in resilience also requires recognizing that political, economic, and social institutions have contributed to increased climate-related vulnerabilities and risks for low-income households and individuals, people of color, people with limited English proficiency, seniors, young children, and people with health conditions or impairments.

Role in Resilience

Acknowledging the risks to community members who are already disadvantaged and prioritizing investments that increase their resilience leads to a more just and equitable approach to building community resilience. Often these population groups are also less likely to be engaged in public processes due to decades of mistrust in government. Developing relationships with groups and community leaders who are already trusted by people of color, including Black and Indigenous people, can aid resilience-building efforts. Local leaders can also prioritize projects based on social vulnerability and hazard exposure, strengthen community networks, provide opportunities for participatory governance and commit to an "equity in all policies" framework for public investments and decision-making. This section lists strategies local governments and partners can use to build resilience in a just and equitable manner.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on community development, planning, social services, health and sustainability
- Federal government agencies, such as FEMA, NOAA, EPA and US DOT
- Nonprofits and other community organizations (e.g., neighborhood associations, advocacy groups, community foundations, tribal governments and faith communities), especially those that can help convene individuals from often overlooked communities (e.g., Association of Mexicans in North Carolina (AMEXCAN), Hispanic Federation, NC Black Alliance, NC Environmental Justice Network and NC Commission on Indian Affairs)

  More North Carolina community-based organizations:

  - NC Conservation Network Affiliates
  - NC Environmental Justice Network member organizations
  - NC Justice Center
  - NC NAACP
  - NC Rural Center
  - NC Tribal Communities
- Translators, both written and verbal and for those that are hearing or visually impaired
- Healthcare institutions
- Higher education institutions
- Residents, especially Black, Indigenous, and people of color, and low-income communities

FOR MORE INFORMATION

The Adaptation Equity Portal of the Adaptation Clearinghouse provides links to a variety of equity-focused adaptation resources.

Building Alliances for Equitable Resilience is a report developed by FEMA, NOAA and the Resilient Nation Partnership Network to deliver insights, guidance, perspectives, personal stories and resources for advancing equitable climate resilience through partnerships and diverse voices.

In the Eye of the Storm: A People's Guide to Transforming Crisis and Advancing Equity in the Disaster Continuum is a toolkit designed to guide users "through the process of building equity into the four phases of emergency management: prevent and mitigation, preparedness and resilience building, response and relief, and recovery and redevelopment."

Making Equity Real in Climate Adaptation and Community Resilience Policies and Programs is a guidebook developed by the Greenlining Institute to give "policymakers a blueprint on how to operationalize equity in policies and grant programs to prioritize equitable climate adaptation and community resilience needs of frontline communities and address the historical neglect they have experienced." While this report focuses on California, most recommendations are applicable in a diversity of policy contexts and geographies.

EQUITY AND JUSTICE | 07

STRATEGIES

Strengthen social resilience through community networks

Residents who are vulnerable because of historic inequities rely heavily on social networks and assets. Local governments can support frontline communities by acknowledging and strengthening the social ties that bind communities together.

FOR MORE INFORMATION

Resiliency Organizing Hubs (NC Climate Justice Collective) **This page describes Resiliency Organizing Hubs and how they can support community connections.**

EXAMPLES

Climate Change and Social Resilience: Findings from Community Listening Sessions (State of Oregon Health Authority)

Researchers and Robeson County, NC, residents unite on Project BRIDGE **to inform decisions about recovery with voices of residents**

CASE STUDY

Durham, NC, Equitable Community Engagement Blueprint encourages active participation in neighborhood redevelopment and public policy

(See **Communication and Education, Collaboration and Public Health** for additional resources)

Ensure the equitable implementation of resilience projects and policies

The benefits of public investments in resilience are not always equitably distributed across all community members. This strategy builds resilience by establishing processes for understanding where vulnerable community members are located, prioritizing investments in historically marginalized communities, and monitoring public investments to ensure a more equitable distribution of resilience resources.

FOR MORE INFORMATION

Conversations with Communities: Considerations for Equitable Flooding and Disaster Recovery Policy (American Flood Coalition and Institute for Diversity and Inclusion in Emergency Management) **This report shares takeaways from a 2020 conversation with community-based organizations on how to ensure equitable flood policy.**

Climate and Environmental Justice Screening Tool (White House Council on Environmental Quality) **This map shows information about census tracts that are overburdened and underserved.**

Tree Equity Score (American Forests and EarthDefine) **This site provides scores for places with at least 50,000 residents. "Scores indicate whether there are enough trees in specific neighborhoods or municipalities for everyone to experience the health, economic and climate benefits that trees provide."**

EJ SCREEN (EPA) **This resource maps population demographics, environmental hazards (e.g., toxic waste, ozone), environmental justice indices, climate change data and more. Users can select any geographic area in the country.**

Environmental Justice Transportation Disadvantage Index Tool (NC DOT) **These maps and interactive dashboards help users understand and visualize transportation disadvantage and the disproportionate impact of transportation barriers on communities of color. The tool can also help inform policies, planning, and project development decision-making.**

Continued on next page >

Equity Guide for Green Stormwater Infrastructure Practitioners (Green Infrastructure Leadership Exchange and Greenprint Partners) This guide offers best practices and sample metrics to track progress toward long-term equity goals.

Neighborhoods at Risk (Headwaters Economics) This website offers "interactive maps, charts, and resources to help communities identify neighborhoods that may be more impacted by climate change. It shows where people may experience unequal impacts from hurricanes, flooding, and extreme heat."

North Carolina Community Mapping System (NC DEQ) This tool provides a dashboard of community information, including permitting and incident tracking, flood zones, managed conservation areas and more. The tool also features an environmental justice tool that allows all users to understand the sociodemographic and health characteristics of communities across North Carolina.

North Carolina Environmental Public Health Tracking Program (NC DHHS) This resource allows users to view interactive maps and environmental health data visualizations at the state and county levels by year. The tool will soon include monitoring data and track environmental and climate hazards that can affect human health throughout the state.

Populations at Risk (Headwaters Economics) This tool can be used to "generate reports with socioeconomic information about populations more likely to experience adverse social, health or economic outcomes due to their race, age, gender, poverty status, or other factors."

Social Vulnerability Index Map (CDC) This tool shows how population characteristics relevant to vulnerability to climate change vary by census tract. Users can select North Carolina, zoom into specific communities, and download information.

EXAMPLES

Climate Equity Index (Richmond, VA)

Community-Centered Climate Resilience in Connecticut

Community Reparations Commission (Asheville, NC)

Green and equitable infrastructure in historically Black neighborhoods (Durham, NC)

Santa Ana, CA, and Menominee Nation, WI, *encuentro* (community exchange)

CASE STUDY

Upper Snake River Tribes partner to complete climate change vulnerability assessment

*See **Equity and Justice** case study, below.

Strengthen resilience for vulnerable and marginalized groups (e.g., older populations, people of color, people with limited English proficiency)

Given the disproportionate impacts of climate hazards across population groups, targeted planning efforts help to build resilience by increasing an awareness of unique needs during the planning process. Planners can use this information to tailor desirable outcomes.

(See **Communication and Education**, **Collaboration**, and **Public Health** Resilience Topics for additional strategies designed to support equity for vulnerable populations)

FOR MORE INFORMATION

Cleveland Climate Action Plan: Racial Equity Tool (City of Cleveland, OH) This tool guides decision-makers through the process of recognizing and addressing inequities in climate resilience planning and proposed solutions.

Disaster Resilience Tool Kit (AARP) This guide shows how local leaders can reduce the risks of climate change for older adults.
*Disponible en Español

Establishing and Maintaining Inclusive Emergency Management with Immigrant and Refugee Populations (Welcoming America) This checklist is "designed to help strengthen existing emergency preparedness plans by ensuring immigrants and refugees are part of any emergency response."

Prepárate NC: Una guía informativa y de recursos para la temporada de huracanes Esta guía contiene recursos para las familias hispanas de Carolina del Norte para afrontar la temporada de huracanes.
*Only available in Spanish

EXAMPLE
City of Miami Resolution on Climate Gentrification (Miami, FL)


OLDEST TOWN CHARTERED
1885
TOWN OF
PRINCEVILLE
NORTH
CAROLINA
BY BLACKS IN AMERICA
PRINCEVILLE
TOWN HALL
WELCOME TO OUR
TOWN
STEWARTSIGNS.COM

EQUITY AND JUSTICE | 07

CASE STUDY

CASE STUDY

Princeville, public universities and partners facilitate resilience planning that honors town history

Project Purpose

Princeville, NC, the first town chartered by formerly enslaved African Americans in the United States, has weathered multiple floods since the community's founding. The town was founded in the Tar River floodplain after the Civil War, surrounded by swampy land undesirable to white landowners. A levee completed in 1965 protected the town from flooding for several decades until Hurricane Floyd in 1999, when upwards of 15 feet of floodwater sat in Princeville's town center. Damage to the town's infrastructure was devastating. The community rejected proposals to relocate the entire town and its residents to higher ground. However, the community flooded again after Hurricane Matthew. Princeville partnered with academia and nonprofits to develop a plan to adapt to the reality of flood risk and honor the community's long history of Black self-determination.

What is a floodprinting?

Floodprinting is a form of resilience planning created by the NCSU Coastal Dynamics Design Lab. Floodprinting allows flood-vulnerable communities to explore the relationship between land and water, with a focus on equity and recovery (Cohen, 2022).

Key Players: Workshop: NCSU Coastal Dynamics Design Lab and College of Design, North Carolina Collaboratory, Town of Princeville, Edgecombe County, NCEM, Governor's Recovery Office; Princeville's Homeplace publication: NCSU Coastal Dynamics Design Lab, NCSU College of Design, UNC Chapel Hill Coastal Resilience Center, North Carolina Collaboratory, Design Concepts CLA, Inc., Greenways, Inc.; Floodprint: NCSU Coastal Dynamics Design Lab, Conservation Trust for North Carolina, Town of Princeville, Upper Coastal Plain Council of Governments

Quick Facts

1. Since formerly enslaved African Americans founded Princeville after the Civil War, the town has faced eight devastating floods. In 2016, water from Hurricane Matthew circumvented the levee and left 80% of the town flooded. The water destroyed about 450 homes (NCSU Coastal Dynamics Design Lab, 2020).
2. NC State University (NCSU) and its partners developed a conversation guide for Princeville called "Homeplace," which helps flood survivors navigate community discussions about recovery and resilience efforts.
3. NCSU, along with the Town of Princeville and several interdisciplinary partners, crafted the Princeville Community **Floodprint.** Responding to Princeville residents' desires to adapt in place, the floodprint plan responds to the reality of living with flood risk while honoring the town's Black history and character. The document outlines initiatives to manage stormwater, increase public access to the Tar River and convert previously flooded properties to agricultural land.

Making It Happen

- In 2017, the Town of Princeville, Edgecombe County, universities and state agencies co-sponsored a multi-day community workshop. The workshop aimed to explore designs for a more flood-resilient Princeville. Designers and planners at the community workshop included NCSU Coastal Dynamics Design Lab faculty, staff and students.
- The NCSU Coastal Dynamics Design Lab, in partnership with the University of North Carolina at Chapel Hill, led a team of faculty and students to develop a guide on resilient housing designs for Princeville. NCSU titled Princeville's guide **Homeplace: A Conversation Guide for the Princeville Community, Rebuilding After Hurricane Matthew**. "Homeplace" starts by defining key urban planning and resilience concepts and strategies in plain language. The document also describes Princeville's vulnerabilities and its need for resilience planning. The reader can follow different tracks within the guide for different homeowner decisions, for example, if they chose to relocate or elevate. NCSU also published "Homeplace" guides for Fair Bluff, Kinston, Lumberton, Seven Springs and Windsor, NC.
- The NCSU Coastal Dynamics Design Lab worked with community partners to produce the 2020 **Princeville Community Floodprint**. The document responds to the community's desire to stay in place. It recommends land use strategies that reduce flood risk in addition to acknowledging staffing needs and public safety concerns. The floodprint also aims to improve the long-term function of ecosystems in areas that routinely flood.

Spotlight on Equity

Princeville is a community with a long and important history. It is the oldest town founded by formerly enslaved people. Today, most town residents are Black. Both the floodprint and the Homeplace guide aimed to provide a variety of long-term recovery planning options for the Princeville community to consider and select. Because of its rich history of Black leadership, Princeville sought options from which the town could choose, as opposed to recommendations from outsiders for a particular path forward. Academic and nonprofit partners respected this and deferred to the community's own expertise in developing the Homeplace guide and floodprint.

In partnership with community members, the floodprint process and final document acknowledge and build upon the place-based history. By improving the material safety of the community and offering new channels for economic growth and recreational space, the plans also strive to improve the day-to-day lives of the residents.

Advice from the project manager

When rebuilding in the floodplain is desired by some residents, flood risk minimization is still possible using smart design practices and community-based planning processes.

Community leaders hold essential expertise that technical experts and outsiders do not. Outside groups can partner with communities in a way that advances equity by respecting this expertise and integrating it in plans, committing to the community over several years and helping with the nuts and bolts of project implementation once a plan has been adopted.

Planning efforts that are cross-disciplinary rather than only technically focused help build community capacity and result in quality planning outcomes.

Outcomes

- As of spring 2023, Princeville has generated more than $600,000 in grants for implementing projects in the floodprint.
- Guided by the floodprint, the Town of Princeville, Princeville Elementary and their partners constructed a section of the Heritage Walking Trail, installed rain gardens and other stormwater management features to address water runoff from the school building, built an outdoor classroom for teachers and students to incorporate conservation into their lesson plans, and placed a Resilience Corps NC environmental educator to provide additional capacity to the school staff (Conservation Trust for North Carolina, 2022).

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Additional Resources

- Princeville Community Floodprint video
- UNC Coastal Resilience Center's summary of the initial community design workshop in 2017
- Conservation Trust for North Carolina project summary – Includes video

Related Case Studies

- See **Collaboration**: Raleigh and Durham map neighborhood temperatures.
- See **Housing**: Wilson Housing Authority constructs new affordable housing outside the floodplain.
- See **Public Health**: Preventing heat-related illness in the Sandhills Region.

Costs and Funding

- NC Emergency Management (NCEM) funded the initial community design workshop in Princeville. Funds covered all aspects of preparation and delivery. Leading Black planners, designers and architects from across the state and nation donated tens of thousands of dollars of time.
- The North Carolina Collaboratory funded the Homeplace effort, including all six community documents, with funds upwards of $900,000.
- The $50,000 floodprint project was funded by the Z. Smith Reynolds Foundation of North Carolina through the Common Ground Collaboration, a project of the Conservation Trust for North Carolina, and The Conservation Fund.

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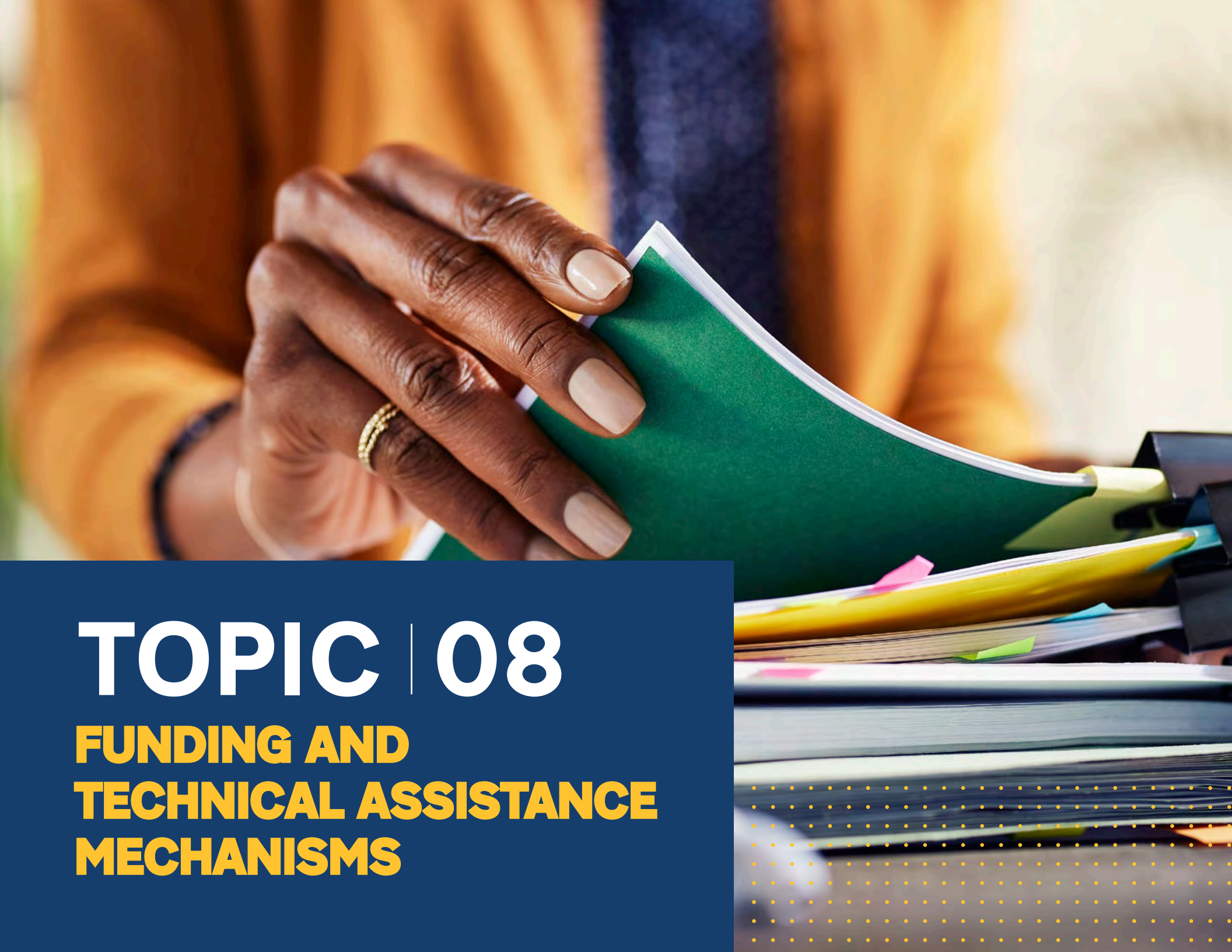


TOPIC | 08

FUNDING AND TECHNICAL ASSISTANCE MECHANISMS

Overview

Many projects and programs that build community resilience require significant funding and subject matter expertise. There are now many sources of technical assistance and funding through federal, state, private-sector and nonprofit entities to implement resilience-building strategies. The challenge for local leaders can be finding the right expertise as well as the right funding source for a project, the staff time to apply, and the capacity to track and complete grant reporting requirements.

Role in Resilience

Identifying appropriate funding streams and technical assistance opportunities early in the planning process are essential elements in successful resilience planning and project implementation. Traditional public funding mechanisms include municipal tax revenues (both general and enterprise funds), user fees, capital improvement budgets, municipal bonds, and grant funding (formula and discretionary). These methods continue to be used, but they can also be supplemented by innovative approaches to raising revenue, including special taxing structures; public-private partnerships; impact bonds including climate, green, social, and environmental; and self-sustaining or revolving loan funds like wetland and land banking schemes. Thinking creatively about funding sources can help forge new opportunities. Prospects for technical assistance also extend beyond hiring consultants. For example, universities are often willing to help, as are nonprofits and state government agencies. This section describes funding and technical assistance strategies and lists resources that can help local leaders take advantage of new opportunities.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on budget management, sustainability and planning (e.g., financial advisors, accountants, grant writers and managers)
- Nonprofits and other community organizations (e.g., neighborhood associations, community foundations)
- State government agencies, such as NCORR and NC DEQ
- Federal government agencies, such as EPA and FEMA, among others
- Higher education institutions, such as the UNC Environmental Finance Center

FOR MORE INFORMATION

The funding section of the NC Resilience Exchange offers a climate-resilience-focused funding database and lists of resources to help North Carolina communities write their own grant application or find someone else to write it for them.

The Federal Funding and Technical Assistance page of the EPA's Climate Change Adaptation Resource Center lists funding strategies, resources and opportunities from the EPA and other federal agencies.

How Cities are Paying for Climate Resilience, a report published by the Innovation Network for Communities, "identifies eight distinct strategies cities are using to pay for large-scale climate resilience projects, mostly to address sea level rise and flooding."

Ready-to-Fund Resilience Toolkit, released by the American Society of Adaptation Professionals, describes how small and mid-sized local governments can "more effectively operate within the resilience funding and finance system," "ensure projects are ready to receive funding" and "create equity through resilience funding and finance." The resource also provides "tips for overcoming challenges such as lack of resources, funding or political will."

The Recovery and Resilience Resource Library, hosted by FEMA, "helps users to find and research federal disaster recovery resources that would be beneficial in pre-disaster recovery planning or in the wake of a disaster." The library contains grants, technical assistance, capacity-adding opportunities, and more.

FUNDING AND TECHNICAL ASSISTANCE MECHANISMS

08 STRATEGIES

Integrate hazard mitigation and resilience in all public projects

In addition to the climate adaptation benefits, integrating resilience and hazard mitigation into ongoing projects can increase financial efficiencies and the lifespan of capital and social investments.

FOR MORE INFORMATION

(See **Infrastructure and Capital Investment** for additional resources)

Take advantage of disaster declaration funds

When a community receives a Presidential Disaster Declaration, funds become available for recovery. Many of those funds can be used to increase resilience to future disasters during reconstruction so the community will experience fewer impacts the next time the disaster strikes.

FOR MORE INFORMATION

Hazard Mitigation Assistance Program and Policy Guide

This Guide "provides helpful information for prospective applicants and subapplicants from state, local, tribal and territorial governments on the application and grant processes for four hazard mitigation grant programs." These four include the Hazard Mitigation Grant Program, Building Resilient Infrastructure and Communities program, the Flood Mitigation Assistance program, and the Hazard Mitigation Grant Program Post Fire.

Use taxes

Taxes offer many avenues for generating revenue for resilience-building initiatives. Strategies include property tax rate increases, special assessments, dedicated occupancy or tourism taxes, real estate transfer tax, and project development financing (more commonly known as tax increment financing, or TIF).

Land transfer taxes assess a fee on the transfer of real property. The State of North Carolina collects this tax for most routine property transfers and can authorize local counties to assess an additional tax of the same type for their own use. In the seven counties already authorized to collect the tax, revenues from the land transfer tax primarily fund capital improvement projects, which could include resilience efforts.

FOR MORE INFORMATION

EXAMPLES

Land transfer tax (Dare County, NC)

Municipal service district funds beach nourishment (Nags Head, NC)

Regional parcel tax for restoration (San Francisco)

Two percent room occupancy and tourism development tax for beach nourishment (Dare County, NC)

Voter-approved climate action tax (Ann Arbor, MI)

CASE STUDY

Woodfin, NC, funds water and sewer extensions, pedestrian walkways and bike trails with Tax Increment Financing

Institute a voluntary surcharge

Voluntary surcharges on retail-, occupancy-, or tourism-related purchases are like nonprofit fundraising campaigns that solicit donations at the supermarket checkout. However, a voluntary surcharge requires the customer to opt out of the fee rather than opting in when making a qualifying purchase. For example, land trusts are using this strategy to fund the purchase and preservation of land.

FOR MORE INFORMATION

EXAMPLES

1% for Open Space funds land protection projects (Gunnison County, CO)

Pennies for Preservation program supports land protection (St. Simons Island, GA)

Implement fees to support specific services

Local governments can raise revenues by adding a fee on top of regular rates, charges or costs of service. Generated revenues can be used to fund improvements and other projects. For example, stormwater service fees are performance- or impact-based, meaning the fee amount is based on the individual's relative use of the service. Regardless of the fee design, communities can use these funds to implement resilience-related projects.

*See note in the next strategy box.

FOR MORE INFORMATION

EXAMPLE

Stormwater services fees (Charlotte, NC)

Support resilience projects through development regulations or compensatory mitigation

Land use regulations can require or incentivize low-impact development approaches. One approach is requiring developers to pay an impact fee, including "fee-in-lieu," to mitigate potential impacts of their project on the community.

*Note – North Carolina's local governments need to be careful about imposing impact fees or fees-in-lieu. Impact fees are only allowed where explicitly authorized by the General Assembly. Encouraging some projects to provide additional funds may be permissible, but most requirements to pay for impacts or resilience programs will be outside of North Carolina local government authority. See this article for additional information.

FOR MORE INFORMATION

Stream and Wetland Mitigation Program Guidance (NC Department of Environmental Quality) **This website provides guidance on the types of compensatory mitigation programs available and permissible in North Carolina.**

EXAMPLES

Compensatory Mitigation (Wilmington, NC)

CASE STUDY

Charlotte-based utility runs a stream and wetland mitigation bank

Pursue public-private partnerships

Local governments can use public-private partnerships to purchase and manage land and to construct, operate, and maintain infrastructure to support climate resilience. Even with limited funding, local governments can pursue public-private partnerships by limiting development fees or offering in-kind support such as volunteer time and topical expertise.

FOR MORE INFORMATION

EXAMPLES

Public-private partnership for stormwater management (Prince George's County, MD)

Watershed Protection Program (Raleigh, NC)

Issue bonds

With the permission of residents, local governments can borrow money to pay for most capital projects demonstrating a public benefit. Residents must demonstrate their permission through a "bond referendum," a question on a ballot asking community members to vote "yes" or "no." If the vote passes, the local government can issue a bond to pay for the project.

Municipal bonds, climate or green bonds, and social and environmental impact bonds can be used to build community resilience. Governments can lower the costs of debt service for bonds funding projects that improve social or environmental circumstances by seeking a "green" or "ESG" (environmental, sustainability goal) certification (see Green Bonds case study on page V2-103).

FOR MORE INFORMATION

EXAMPLES

Green bonds protect water resources (Asheville, NC)

DC Water green bonds finance river clean up (Washington, DC)

CASE STUDIES

Atlanta uses environmental impact bond to manage stormwater in environmentally and economically distressed neighborhoods

Hampton, VA, finances flood management with environmental impact bond

*See the **Funding and Technical Assistance Mechanisms** case study, below.

Establish self-sustaining funds and banks

Revolving loan funds and banks are mechanisms for both creating and allocating revenue and resources. These self-replenishing financial mechanisms can be used to purchase land that is banked or held in trust (for use or conservation); as microloan programs for site-level hazard mitigation, energy efficiency and stormwater management; and for investing in green infrastructure. As loans are repaid, new funding can be loaned out.

FOR MORE INFORMATION

How Can Revolving Loan Funds Make Our Coasts More Resilient? (Environmental and Energy Study Institute) **This fact sheet explains how revolving loan funds operate and describes existing programs.**

EXAMPLES

NC Clean Water State Revolving Fund **funds wastewater treatment facilities and projects associated with estuary and nonpoint source programs.**

Southern California Renewable Energy Network Revolving Savings Fund **supports energy efficiency upgrades of public agency facilities.**

Pursue grant funding

Formula and competitive grant funding at both the state and federal levels is available to help communities implement resilience and hazard mitigation projects. Communities can also try to integrate resilience into projects funded through other programs not specifically focused on climate or resilience, like transportation infrastructure grant programs.

FOR MORE INFORMATION

Climate Resilience Toolkit: Funding Opportunities **This resource contains a library of grants from government entities and private foundations, as well as links to other climate resilience-focused funding databases.**

Nature-based Solutions Funding Database (National Wildlife Federation) **This resource is designed for communities interested in pursuing federal funding and technical assistance for nature-based solutions.**

Grants Page (NC DEQ) **This webpage "provides information on all NC DEQ funding programs in one place, along with a searchable list of currently open applications for grant opportunities." The Division of Water Resources also lists water-related funding opportunities on its website.**

EXAMPLE

FY2020 Building Resilience Infrastructure and Communities (BRIC) resilience projects in North Carolina

Pursue technical assistance programs

Many technical assistance programs guide local governments through grant applications and project implementation.

FOR MORE INFORMATION

EXAMPLES

BRIC Direct Technical Assistance

North Carolina Resilient Communities Program

Offer grants to incentivize resilience

Local governments can secure funds from the budget or other sources to offer grants to incentivize resilience-building projects.

FOR MORE INFORMATION

EXAMPLES

Percent for Green grants program funds large-scale green infrastructure projects (Portland, OR)

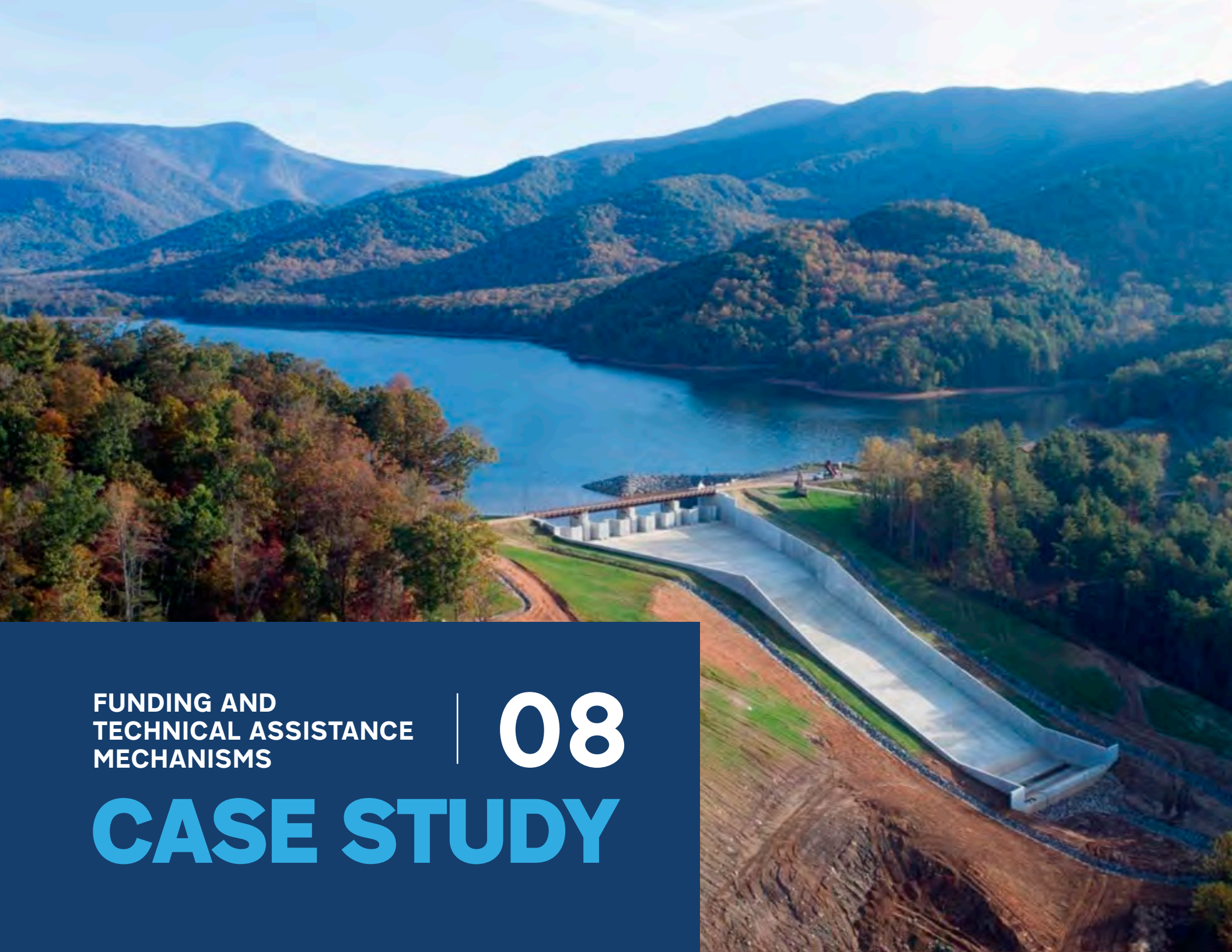
Take advantage of low-interest loans

Some programs offer low-interest loans directly to communities.

FOR MORE INFORMATION

Water Infrastructure Finance and Innovation Act

This program provides low-interest-rate loans for eligible water and wastewater infrastructure projects.



FUNDING AND TECHNICAL ASSISTANCE MECHANISMS

08 CASE STUDY

CASE STUDY

Asheville uses green bonds to improve drinking water infrastructure

Project Purpose

Asheville's mountainous topography makes water pressure higher than in other areas. This pressure stresses water lines, making them more prone to leaks (McDaniel, 2015).

In 2007, when interest rates were high, the City of Asheville Water Resources Department issued a routine water revenue bond to make system upgrades. The upgrades reduced water leaks by replacing failing water lines, enhancing water tanks, and replacing valves. The city also added emergency generators to keep the pump stations online when the power goes out.

When interest rates were lower in 2015, Asheville investigated refinancing options. The city found they could cancel their existing debt and obtain a lower interest rate using a green bond, even though the project had already been constructed.

Green Bonds

Green bonds are like traditional municipal bonds, except they fund projects that meet certain standards for environmental or climate benefits. In 2007, a market began emerging for bonds self-labeled as "green." Within a few years, market- and government-led efforts standardized a set of principles and guidelines to define what projects can and cannot identify as "green." Interest rates for green bonds are lower because the market for green bonds is stronger than for traditional bonds (OECD, 2015). Green bonds can lower the cost of project financing, making projects more affordable.

Debt Ratings

A debt rating is the result of an assessment of the city's ability to meet one or more financial commitments. Credit rating agencies use ratings to issue an opinion on an individual obligation (e.g., a bond) or of an entity's general creditworthiness (Moody's, n.d.). There are three leading agencies that issue debt ratings: Moody's, Standard & Poor's (S&P) and Fitch. Only Moody's and S&P issue ratings to local governments. Moody's highest rating is an Aaa, followed by Aa1, Aa2, Aa3 and lower. Standard and Poor's top rating is an AAA, and continue down with AA+, AA, AA- and down (Finney, Mansa, & Rohrs Schmitt, 2023). Having a high rating from both Moody's and S&P gives a city access to strong financial markets, ultimately lowering borrowing costs and saving the city money (City of Asheville, 2021).

Key Players: City of Asheville Water Resources Department, financial advisors, North Carolina Utilities Commission

Quick Facts

1. The City of Asheville used a **green bond** to refinance water service projects at a lower interest rate.
2. Satisfied with its first green bond issuance, the City of Asheville sought another green bond to fund improvements to the North Fork Dam.
3. In 2021, a second green bond was issued for improvements to the North Fork Dam.
4. Following this second issuance, Moody's and Standard & Poor awarded Asheville with strong **debt ratings** of Aa1 and AA+, respectively.

Making It Happen

- In 2015, the City of Asheville prepared the refinancing of the 2007 bond under the Green Bond standards. To obtain the green bond, Asheville had to demonstrate the environmental benefits of the 2007 project. In North Carolina, the state Utilities Commission must certify municipal green bond instruments by reviewing documentation on the project's environmental benefit. Asheville's first green bond was issued in June 2015.
- The City of Asheville was happy with the interest rate savings associated with the first green bond issuance. In 2020, Asheville decided to pursue another green bond opportunity. The new project would fund $40 million in improvements to the North Fork Dam (Bechel, 2021). The interest rate for this water revenue bond was just under 2.1%. In September 2021, Asheville was issued its second green bond.

Spotlight on Equity

Local governments can use green bonds to finance projects that help residents who experience the worst effects of climate change.

Advice from the project manager

Any time you are issuing a bond or borrowing money, talk to your financial advisors to see if the projects for which you are issuing the debt would allow for a green bond.

Outcomes

- The green bonds issued to the City of Asheville lowered the cost to deliver environmentally friendly projects by lowering the interest rate.
- As of 2015, the City of Asheville had issued $55 million in green bonds to finance both water infrastructure projects (McDaniel, 2015).
- Following the 2021 green bond issuance, Moody's awarded an Aa1 debt rating and Standard & Poor affirmed a debt rating of AA+ for the City of Asheville's water revenue bonds. These high ratings lowered borrowing costs for the city, saving taxpayer dollars (City of Asheville, 2021).

Project Contact

City of Asheville Finance and Management Services Department

Additional Resources

- Green Bond Principles: Voluntary Process Guidelines for Issuing Green Bonds includes list of eligible project categories, including flood mitigation and climate adaptation

Related Case Studies

- See **Stormwater Management and Flooding:** Charlotte-Mecklenburg region runs local floodplain buyouts program.

Costs and Funding

- The only costs for issuing a green bond are staff salaries and financial advisor fees. Local governments in North Carolina use financial advisors to handle all bond applications. Asheville did not experience a difference in cost between a green bond application and a regular bond application.

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TOPIC | 09
HOUSING

Overview

Safe and adequate housing is an essential component of a resilient community. Housing that is structurally unsound, poorly maintained, or unhealthy (moldy, lacking adequate heating and cooling, or having contaminated water) and housing located in vulnerable places puts people and property at risk. People are also at extreme risk when they do not have access to housing at all. These factors, as well as growth pressures, contribute to the housing challenges in North Carolina communities, which makes planning and implementing strategies for housing resilience particularly complex.

Role in Resilience

Building housing resilience requires strategies that protect new and existing residents from more frequent and severe impacts of climate hazards. Local leaders can incentivize housing development in safer locations; promote or require more sustainable housing construction and development; and repair or retrofit the most vulnerable housing. In extreme cases, when housing cannot be retrofitted or strengthened, local governments can purchase residential properties and relocate residents to remove them from risk of harm. This section provides resources and examples of these strategies and more.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on community development, planning, emergency management, building inspections and public health
- Housing authorities
- Design and construction professionals (e.g., architects, landscape architects, civil engineers) in the private, nonprofit, governmental and academic sectors
- Nonprofits and other community organizations (e.g., neighborhood associations, advocacy groups, community foundations, tribal governments and faith communities), especially those that can help convene individuals from often overlooked communities (e.g., Association of Mexicans in North Carolina (AMEXCAN), Hispanic Federation, NC Black Alliance, NC Environmental Justice Network and NC Commission on Indian Affairs)

More North Carolina community-based organizations:

- NC Conservation Network Affiliates
- NC Environmental Justice Network member organizations
- NC Justice Center
- NC NAACP
- NC Rural Center
- NC Tribal Communities

- Builders and developers
- State government agencies, such as NCORR and NCEM, which support post-storm recovery, housing resiliency and affordability options; and the NC DHHS, which promotes healthy indoor air quality
- Federal government agencies, such as HUD and FEMA
- Regional organizations, such as North Carolina's councils of governments (COGs) and area agencies on aging
- Higher education institutions
- Residents

FOR MORE INFORMATION

The Community Resilience Toolkit, developed by the Department of Housing and Urban Development (HUD), helps recipients of its Community Planning and Development funds identify opportunities to mitigate the impacts of natural hazards on housing. In addition to its six sections on specific natural hazards, this resource describes what a resilient community can look like, actions a local government can pursue and additional financing opportunities.

**Disponible en Español*

HOUSING | 09 STRATEGIES

Encourage housing growth in safer locations

Communities should assess all residential areas for current and future climate-related vulnerabilities and identify safe areas to accommodate future growth and development. This strategy enhances resilience by protecting people and property from climate hazards like sea-level rise and flooding.

FOR MORE INFORMATION

National Risk Index Mapper (FEMA) **Allows users to identify areas for housing development in their communities that are at lower risk for natural hazards.**

EXAMPLE

Analyzing future urban growth and flood risk (Pender County, NC)

(See **Land Use and Development** and **Infrastructure and Capital Investment** for additional resources)

Adopt zoning codes, development regulations, building codes, and ordinances to support climate-resilient housing

Development regulations such as zoning codes control development and land use activities. Building codes provide a baseline standard for quality and safety, and additional ordinance requirements can build resilience to specific threats. These strategies can build resilience by incentivizing development in safe locations, prohibiting development in dangerous or vulnerable locations, and requiring structures to use strong, context-appropriate materials. For example, local governments can ensure that newly constructed and renovated houses meet the standards set by the NC DOI for wind load, which varies by county.

FOR MORE INFORMATION

EXAMPLES

Flood damage prevention ordinance Chapter 5, Article 4 (Chapel Hill, NC)

Floodplain Development Regulations (Gaston County, NC)
Requires a minimum of three feet of freeboard (i.e., height added to the Base Flood Elevation for lowest construction elevation).

(See **Energy and Utilities** and **Land Use and Development** for additional resources)

Acceptable Building Code Ordinances in North Carolina
Unless state law specifically prohibits the intent of the ordinance, local governments can adopt ordinances that are more stringent than the North Carolina Building Code. Local governments may need to go through the Building Code Council for a review of the ordinance and should speak with their legal counsel when considering this option. All fire code ordinances must be reviewed by the Building Code Council. See NC General Statutes § 143-138(e) *for more information.*

Retrofit existing housing to be more resilient to current and anticipated climate impacts

A home's location, design, materials, construction techniques and age contribute to its ability to withstand climate impacts. Older, poorly maintained, and poorly constructed housing is more vulnerable than newer housing. Additionally, residents living in manufactured and mobile homes are more vulnerable to impacts, especially if the home was constructed prior to the passage of safety regulations for manufactured homes in 1973. Although local governments cannot directly regulate the age of manufactured homes, they can require that homes comply with the standards set by HUD. Communities can also build resilience by retrofitting existing vulnerable homes to protect them from the impacts of climate hazards and ensure that inhabitants can afford them.

FOR MORE INFORMATION

Appendix G: Flood-resistant construction **The part of the North Carolina Building Code designed "to minimize public and private losses due to flood conditions in specific flood hazard areas."**

EXAMPLES

Home elevations (Currituck County, NC)

Permit requirements for manufactured homes to ensure compliance with wind, flood and other safety standards (Beaufort County, NC)

(See **Land Use and Development** and **Energy and Utilities** for additional resources)

Acquire extremely vulnerable residential properties that cannot be retrofitted

In some situations, it may not be possible to safely retrofit a home to protect people and property against potential hazards. Instead, the community might choose to acquire the properties and demolish structures in high-risk areas. Residential buyout programs build resilience by providing resources to residents in hazardous areas, helping them relocate, and converting the property to open space to accommodate flooding.

FOR MORE INFORMATION

Managed Retreat Toolkit (Georgetown Climate Center)
This resource "combines legal and policy tools, best and emerging practices, and case studies to support peer learning and decision-making around managed retreat and climate adaptation."

Strategic Buyout Program (NCORR) **This program "offers eligible property owners located in flood-prone areas the chance to sell their home and relocate to a safer area." Local governments can contact the program to discuss properties of concern.**

EXAMPLES

Voluntary floodplain buyout program (Charlotte, NC)

Residential property acquisitions (Pender County, NC)

> ***Managed retreat*** *is the purposeful, coordinated movement of people and infrastructure away from places of high and growing risk like extremely vulnerable, eroding beachfront.*

Ensure safe and healthy shelter for all

There are residents in North Carolina without homes. And among those with homes, some buildings are structurally unsound, poorly maintained, or unhealthy (e.g., contain mold or contaminated water, lack adequate heating and cooling). Some homes are in vulnerable places, such as the flood zone, putting people and property at risk. Resilient communities actively support and help provide permanent, short-term, and emergency housing opportunities for residents.

FOR MORE INFORMATION

EXAMPLES

Front porch initiative for under-resourced rural communities (Rural Studio)

(See **Public Health** for additional resources)

CASE STUDY

*See **Housing** case study, below.

HOUSING | 09
CASE STUDY

CASE STUDY

Wilson Housing Authority replaces vulnerable public housing in safer location nearby

Project Purpose

Hurricane Matthew caused flooding that rendered 40 public housing units in two Wilson Housing Authority communities uninhabitable. The impacted homes were in the floodway and had experienced multiple damaging floods in the past. As a more resilient solution, Wilson Housing Authority and the City of Wilson constructed Eatmon Townhomes, an affordable housing project that included 32 new units outside of the floodplain.

Key Players: Wilson Housing Authority, City of Wilson, FEMA, HUD, NCORR, NC Department of Commerce, Stogner Architecture and DanCo Builders

Quick Facts

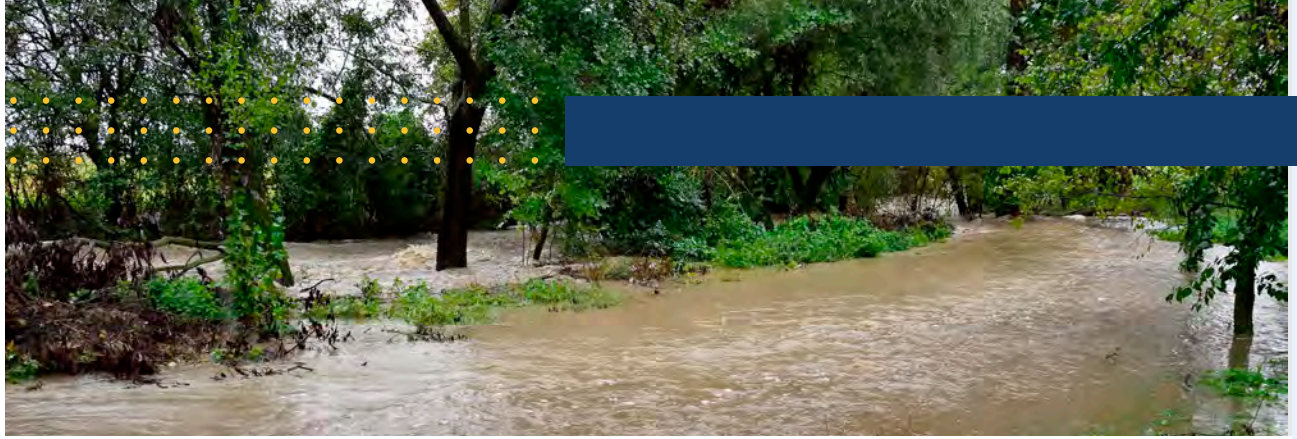
1. The area affected by flooding had a median household income of $16,051 in 2015, the year before Hurricane Matthew. Fifty-seven percent of the families in the census tract were living in poverty. The unemployment rate in the area was 27.5%. The availability of housing affordable to residents at all income levels is a critical element of resiliency.
2. Project managers funded the project through direct allocations instead of loans. They acquired $5.1 million through a mix of federal, state and local sources (Retana, 2022).
3. As of early 2024, Wilson Housing Authority is working with NC Emergency Management to use Federal Emergency Management Agency (FEMA) funds to demolish the damaged, uninhabitable homes. Future plans include a greenway trail and flood retention ponds.

Making It Happen

- In 2017, Wilson County's Hurricane Matthew Resilient Redevelopment Plan listed the Eatmon Townhomes project as high priority.
- In 2018, the Wilson Housing Authority and the City of Wilson secured a Rental Assistance Demonstration Grant from HUD to convert the public housing units into Section 8 affordable housing and construct them outside the floodplain.
- Construction of the new housing units began in 2021.
- In 2023, the first residents moved into the new housing units.

Spotlight on Equity

Preserving affordable housing near its original location is important to support the day-to-day in-person connections in low-income communities where information and support like childcare are often exchanged among neighbors. The Wilson Housing Authority's 32 new housing units are available to applicants with incomes at 80% or below the area median income. Tenants pay no more than 30% of their monthly incomes in rent with a minimum of $50 per month. The Wilson Housing Authority chose its first applicants from an existing waitlist. They prioritized homeless individuals, families and veterans. In addition, the Wilson Housing Authority installed green energy appliances in each unit to increase the energy efficiency of the homes and lower utility costs.



Advice from the project manager

Project managers emphasized the importance of providing quality affordable homes to Wilson residents. Wilson Housing Authority Director of Public Relations Timothy Rogers shared a few tips:

- *Attention to detail when assuring quality construction caused minor delays, but it was worth it to ensure new tenants moved into homes that the Housing Authority was proud of.*
- *When replicating this project, acknowledge that low-income residents have historically been limited to the most flood-exposed areas. Affordable housing projects can provide residents with new, safe and high-quality homes while addressing flood risk in the community.*
- *Consider nature-based solutions during site design to help with flood management.*

Outcomes

- Project partners intentionally located the new housing units outside the floodplain but in the existing community, within the City of Wilson's redevelopment area. The location provides residents with access to urban amenities.
- The 32 new, two-bedroom units include 28 two-story townhomes and four additional one-story homes. Partners designed the one-story homes to be accessible for residents with disabilities.
- Project partners designed and constructed units with the intent of providing quality homes that residents would find comfortable.
- The Wilson Housing Authority deeded the land with the damaged homes to the City of Wilson. As of early 2024, the City of Wilson is working with NC Emergency Management to explore the use of FEMA hazard mitigation funds to demolish the damaged, uninhabitable homes and preserve the land as open space in perpetuity. Future plans include a greenway trail and flood retention ponds.

Project Contact

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Additional Resources

- NC Department of Public Safety Eatmon Townhomes Press Release
- NCORR's Community Development Program

Related Case Study

- See **Stormwater Management and Flooding:** Charlotte-Mecklenburg region runs local floodplain buyouts program.

Costs and Funding

Instead of using loans, project partners funded the $5.1 million project with direct allocations:

- $750,000 – Community Development Block Grant (CBDG) – Neighborhood Grant
- $2,712,905 – Public Housing Restoration Fund administered by the NC Office of Recovery and Resiliency (NCORR) and supported through state CDBG Disaster Recovery funding
- $1,637,095 – HUD Public Housing Operating Reserves and Capital Funds and Public Housing Demolition and Disposition Transitional Funding
- Insurance proceeds from the damaged homes
- A grant from the City of Wilson's Chamber of Commerce
- Funding from the Wilson Housing Authority and the NC Department of Commerce

TOPIC | 10

INFRASTRUCTURE AND CAPITAL INVESTMENT

Overview

Damage or interruptions to infrastructure and public facilities can seriously threaten public safety. For example, if a community or neighborhood has only one road or bridge providing access and it is washed out in a storm, emergency medical services cannot get to that location and residents cannot get in or out. And there is a great deal of aging infrastructure in the state that extreme heat, storms, and precipitation can render unfunctional. Communities can enhance their resilience by investing in flexible and redundant systems, prioritizing public investments in safe locations, and prohibiting public investments in vulnerable locations.

In this section, infrastructure refers to the networks and facilities that allow people to meet daily needs, like traveling between home and work, getting children to school or to the doctor, and accessing safe and healthy natural spaces. Infrastructure includes roadways, bridges, public transportation, parks, recreation facilities and more. Utilities, a type of infrastructure, are covered separately in Topic 6: **Energy and Utilities**.

Capital investment means using public money to build or buy the facilities and networks just described, as well as other public property like town halls, police stations, and the vehicles and equipment needed for a properly functioning public entity.

Role in Resilience

Protecting existing infrastructure and being thoughtful about how and where public money is invested limits interruptions to critical systems. To limit system interruptions, local leaders can assess the likelihood of current and future hazards and use that information to identify appropriate infrastructure solutions. For example, North Carolina's communities can require their budgets and capital improvement plans to account for existing and future hazards and vulnerabilities. This strategy can be expanded to require reassessment of hazards and vulnerabilities at set points over the useful life of the facility and determine if protective measures need to be adopted. Additionally, municipalities can build resilience incrementally when repairing, maintaining, or upgrading infrastructure and facilities. For example, a community could integrate nature-based stormwater strategies when updating sidewalks for Americans with Disabilities Act compliance. Regular coordination across departments and agencies is key to integrating resilience strategies into ongoing maintenance and upkeep of public infrastructure and facilities.

Strategies for increasing the resilience of infrastructure and **capital investments** should address how the various elements of infrastructure networks and public facilities are planned and constructed, when the investments will be made, and where these facilities will be built. This section outlines these strategies and provides resources and examples to help local leaders integrate climate vulnerability and hazards into infrastructure and capital investments.

*Electricity and other service utilities like drinking water, wastewater and internet are discussed in Topic 6: **Energy and Utilities**.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on public infrastructure, planning, finance, water and wastewater, emergency management, economic development, parks and recreation, and building inspections
- Design and construction professionals (e.g., architects, landscape architects, civil and water resource engineers) in the private, nonprofit, governmental and academic sectors
- State government agencies, such as NC DOT, NCEM, NCORR, NC DNCR and the NC DEQ Division of Water Infrastructure and Division of Energy, Mineral and Land Resources
- Federal government agencies, such as HUD and FEMA
- Builders and developers
- Local businesses
- Residents

For More Information

The Future Precipitation for Resilient Design project, a partnership between NC DOT and NCSU, aims to update Intensity Duration Frequency (IDF) curves to help transportation planners and engineers design roads, bridges and ditches for the most intense precipitation events expected in North Carolina in the future. This page describes the project and how those IDF curves are calculated. The anticipated project completion date is December 2024.

INFRASTRUCTURE AND CAPITAL INVENTMENT | 10 STRATEGIES

Assess climate vulnerabilities of existing and proposed capital improvement projects

Understanding how climate change will impact the built environment of a community is the first step to improving local resilience. Vulnerability assessments outline a process to achieve that understanding. Local governments can complete these assessments for an individual structure, a neighborhood, or an entire community.

Refer to Phase 2 of the *Playbook* for more information on performing climate vulnerability assessments.

FOR MORE INFORMATION

Guide to Community Climate Vulnerability Assessments (National Resources Defense Council) **This resource is a "primer for communities and community partners on how to complete a climate vulnerability assessment."**

EXAMPLES

Risk and Resilience Analysis Procedure (Colorado Department of Transportation)

Coastal Hazard Infrastructure Vulnerability Assessment (Duck, NC)

US 17/US 258 Compendium to the I-40/I-95 Flood Resilience Feasibility Study (NC DOT)

CASE STUDY

Fort Collins, CO, assesses regional resilience of buildings and physical infrastructure

Plan for and install protected, adaptive and redundant infrastructure

Capital improvement planning and implementation are a key element of a community's growth and development trajectory. The capital improvement planning process can assess the risk of current and future climate hazards on proposed investments. Resilient decision-making processes prohibit infrastructure and other public facilities in vulnerable locations or areas reserved for open space.

FOR MORE INFORMATION

Building Resilience: New Strategies for Strengthening Infrastructure Resilience and Maintenance (Organisation for Economic Cooperation and Development) This document, which includes examples and case studies, provides a framework for governments to "address short-term infrastructure challenges through maintenance spending while building resilient and sustainable infrastructure for the future."

Community Resilience Planning Guide (US Department of Commerce) This resource offers a "six-step process that helps communities think through and plan for their social and economic needs, their particular hazard risks, and recovery of the built environment."

Incorporating Resilience into Transportation Planning and Assessment (RAND Corporation) This publication details how to "increase the resilience of [a community's] entire transportation system." The guide, which also addresses how transportation planners can measure resilience and consider equity in their decision-making, is designed for state transportation departments and metropolitan planning organizations.

A Guide to Assessing Green Infrastructure Costs and Benefits for Flood Reduction (NOAA) This document provides "a process that communities can use to assess the costs and benefits of green infrastructure to reduce flooding."

Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide (US DOT) This document "is designed to help transportation practitioners understand how and where nature-based and hybrid solutions can be used to improve the resilience of coastal roads and bridges."

Continued on next page >

FOR MORE INFORMATION (CONTINUED)

EXAMPLES

Cool pavement program (Phoenix, AZ)

Marc Basnight Bridge (Bodie Island and Hatteras Island, NC)

NC 12 elevation project (Duck, NC)

SR 17 shaded fuel break project (San Jose, CA)

CASE STUDIES

Fayetteville, NC, installs stormwater greenscape downtown

Hillsborough, NC, partnership builds street-side bioswales to manage stormwater runnoff

*See **Infrastructure and Capital Investment** case study, below.

Include resilience criteria as part of capital improvement scoring processes for decision-making and investments

Most communities use a scoring or evaluation process to prioritize their projects. Adding resilience-based criteria to this process ensures selected projects will contribute to reducing community vulnerabilities and mitigating risk. Some communities choose to add weight to resilience criteria, prioritizing projects that strengthen and protect the community's public investments.

FOR MORE INFORMATION

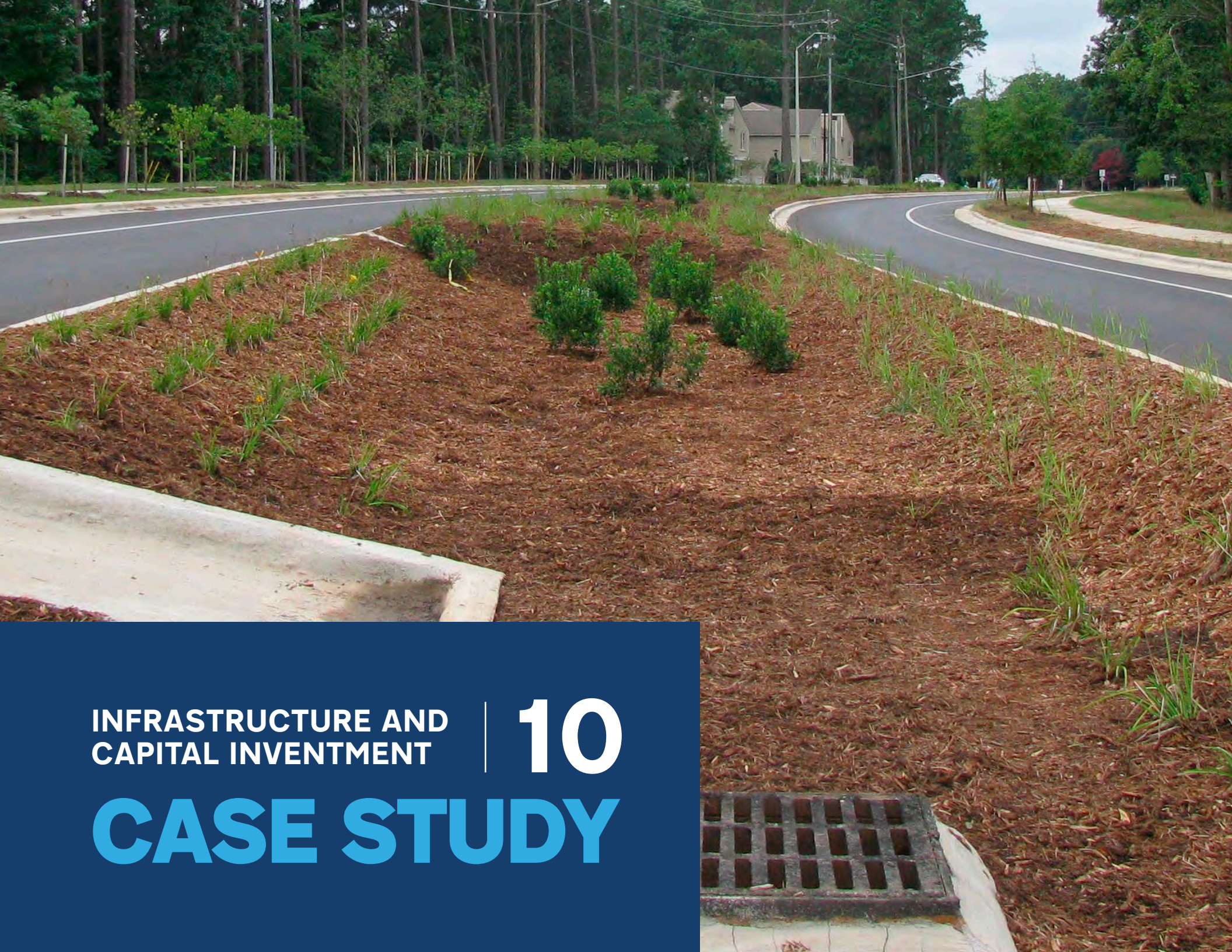
Integrating Resilience into Local Capital Improvement Programs (University of Maryland Environmental Finance Center) This publication "presents best practices for embedding climate risk assessments into capital improvement planning processes at the municipal and county level."

EXAMPLES

Capital Improvement Program Evaluation Criteria and Scoring Guide (Baltimore, MD)

Flood hazard mitigation project prioritization (Maricopa County, AZ)

Required resilience score metric for capital projects (New York, NY)



INFRASTRUCTURE AND CAPITAL INVENTMENT | 10

CASE STUDY

CASE STUDY

Raleigh includes nature-based stormwater solutions in its roadway widening project

Project Purpose

Sandy Forks Road in Raleigh, NC, was a busy, two-lane road showing signs of aging. The road was considered one of the worst in Raleigh due to congestion, roadway disrepair, lack of sidewalks and bike lanes, and environmental degradation from people walking alongside the road and destroying vegetation. Climate hazards like flooding blocked travel along this important route during emergencies, while runoff from the roadway surface affected water quality. The City of Raleigh began the Sandy Forks Road widening project to repair the aging roadway, increase the road's capacity, incorporate sidewalks and bike lanes, reduce water pollution, and improve the road's resilience to flooding and other climate hazards.

> ***Bioretention cells** are depressions in the landscape that capture stormwater and filter it through engineered layers of soil and vegetation, including native plants. As the stormwater passes through the bioretention cell and infiltrates into the earth, pollutants are naturally filtered out rather than running off directly into an engineered stormwater system or other waterbody. (The City of Raleigh, 2023)*

Key Players: City of Raleigh

Quick Facts

1. The project widened the roadway from two lanes to four or six lanes in some areas, resulting in substantial tree removal.
2. The Sandy Forks Road widening is the first, and, as of December 2023, only, road project in Raleigh that applied for Greenroads Certification. The city used the certification requirements as a way to gain knowledge and skills on applying nature-based solutions, including **bioretention cells** and native-planted medians, which can help reduce stormwater run-off from the street and thus reduce erosion, water pollution and flooding. The completed project was awarded silver certification.

Making It Happen

- The City of Raleigh held public meetings to discuss the repair of Sandy Forks Road in 2012 and 2013.
- In 2014, the city held project design meetings. The city selected a 3.4-mile stretch of road between Six Forks Road and Falls of Neuse Road to implement the project.
- The city awarded a project contract in 2015. The initial construction phase finished in fall 2016. The project included a vegetated median that spanned a maximum width of 16.5 feet.
- Final touches on the project wrapped up in 2017, including the installation of public art and educational signage related to water treatment and environmental resilience.
- In 2018, Sandy Forks Road was awarded a Silver Greenroads Certification. A certification signifies that the project successfully incorporated road sustainability features.

Spotlight on Equity

The community where this project was constructed was not considered disadvantaged or socially vulnerable. Instead, this project served as a pilot project for the City of Raleigh in incorporating environmental sustainability into road design. The inclusion of vegetated areas and bioretention cells helps protect residents from flooding. This vegetation, along with newly planted trees, improves water quality and helps cool the area. The city is now considering these types of solutions for other projects in areas with high percentages of disadvantaged and socially vulnerable residents.

Advice from the project manager

City Communications Analyst Tiffanie Mazanek noted that this project would have been an excellent opportunity to consider grant options. "For more and more of our projects, we are finding federal and state funding that can offset some of the costs. There are a lot more opportunities for grant funding when we include sustainably or environmental actions."

She also mentioned that the extra paperwork that goes into the Greenroads Certification can be a challenge for small communities. But overall, it helped the City of Raleigh think about alternatives and find environmentally friendly solutions that they have begun implementing in other road projects.

Mazanek also remarked that bike transportation was a large talking point during the project design phase. The community has been vocal in asking for bike lanes that are separated from the roadway with delineators. While communities love the new lanes, they would prefer a clear separation between lanes and vehicles to make them even safer.

Outcomes

- Sandy Forks Road became a divided two-lane road with a median and extra turning lanes in some places.
- The roadway was repaired to aid traffic flow and increase its lifespan. Road lifespan is generally about 40 years; however, the City of Raleigh added extra pavement that should add an extra ten years.
- The city included nature-based stormwater solutions in the project. The median vegetation and three bioretention cells support flood prevention and water quality improvement. In addition, the city used a more eco-friendly asphalt mixture to minimize the road's impacts to water quality.

Continued on next page

Project Contact

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Additional Resources

- Raleigh Receives Greenroads Silver Certification for Sandy Forks Road Video
- Sandy Forks Road Improvements Corridor Public Meeting Presentation, December 2013

Related Case Studies

- See **Ecosystem Protection, Restoration, and Enhancement:** New Bern project grows natural stormwater resilience while improving native ecosystem.
- See **Energy and Utilities:** Electric Cooperatives install microgrid on Ocracoke Island.
- See **Funding and Technical Assistance Mechanisms:** Asheville uses green bonds to improve drinking water infrastructure.
- See **Stormwater Management and Flooding:** Charlotte-Mecklenburg region runs local floodplain buyouts program.

Outcomes *(cont'd)*

- The project included removing invasive species and planting native species, which has helped support a more natural ecosystem. Educational signage about the sustainable initiatives of the Sandy Forks Road project is helping to keep residents informed.
- Sandy Forks Road was chosen in part for its ability to test the value of bioretention cells. The city placed one of these cells along the road's median. Bioretention cells require infrastructure underneath the roadway. The bioretention cells along Sandy Forks Road were constructed as a pilot project. Raleigh now has many roads with bioretention cells running along the roadside.
- Other improvements in the project included the construction of new sidewalks and bike lanes and the use of energy-saving light fixtures.
- Recycled and reused materials were important aspects of the project. The city recycled trees removed for the project into lumber and stumps into wood chips. The city also crushed asphalt from the previous roadway and used it in the new surface.
- This project featured one of Raleigh's first public art installations as part of a road project. The city now includes art in most of its development initiatives.
- The project earned the highest score globally awarded at the time to achieve its Greenroads Certification. A silver certification was still the highest award given by the global transportation nonprofit, Sustainable Transport Council, as of December 2023.

Costs and Funding

- The total cost of this project was approximately $9.9 million.
- The City of Raleigh used Capital Improvement Plan funds and other city-initiated funding.

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TOPIC 11

LAND USE AND DEVELOPMENT

Overview

Land use and development strategies help communities build resilience by directing growth away from vulnerable and toward safe locations. Along the coast, for example, rapidly changing coastal conditions mean past trends are not enough to predict future changes. Local governments can use land use and development methods that support construction and design that safeguards future inhabitants, ensures that development does not increase risk to nearby properties, and protects natural lands that buffer communities from sea level rise, flood and other risks.

Land use describes the ways humans impact land, including building a house, roads, office park or factory; farming; forestry; setting aside land for a park or open space; and more. Common categories of land use include residential, agricultural and commercial. When more than one land use is combined it's called "mixed use." Communities assign uses to organize their growth and future development, with the goal of ensuring that future development responds to community needs and values.

Role in Resilience

Managing land use and development is one of the most effective ways communities can build resilience. Communities can adopt policies and laws that limit or prohibit new housing or other development in dangerous locations like floodplains. Programs and ordinances can direct or incentivize growth to more suitable locations that are less vulnerable. Communities can also adopt planning codes that require lower impact design features and reduce a project's potential negative effects on the surrounding community. Some examples of planning code requirements would be to require minimizing a project's stormwater run-off to reduce flooding and build resilience or to require a buffer zone around a stream or river. Zoning laws might also require additional construction elements. For example, in vulnerable coastal areas, local zoning ordinances might require elevating structures. These strategies work to protect people, buildings, and the natural environment from unnecessary risk.

Implementing land use and development strategies promoting "smart growth" can also build resilience. Smart growth strategies promote more sustainable development by mixing land uses, providing multimodal transportation options, requiring higher density development in already-developed areas, reducing sprawl, and protecting undeveloped open space (EPA, 2023). These strategies can reduce off-site impacts of a project. This section provides more information on land use and development strategies local governments can use to manage flooding and other risks.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on planning, sustainability, economic development, public works, and parks and recreation
- North Carolina's councils of governments (COGs), which host municipal and regional planning organizations

Development regulations like zoning codes control how properties can be used (meaning what activities are allowed), what can be built, and where structures may be located on a property. Development regulations can include height and size of buildings; parking requirements; minimum or maximum lot sizes; open space requirements; limits on impervious surface; and more. Zoning also controls the density of development, which is the number of houses or apartments that are allowed in an area, often measured in acres.

- Land use planning professionals (e.g., landscape architects, water resource and civil engineers, transportation planners, bike and pedestrian planners, environmental scientists) in the private, nonprofit, governmental and academic sectors, including the North Carolina chapter of the American Planning Association and the North Carolina Association of Floodplain Managers
- Land conservancies and trusts, such as the Tar River Land Conservancy, Carolina Mountain Land Conservancy, Triangle Land Conservancy and North Carolina Coastal Land Trust
- Environmental nonprofits, such as The Nature Conservancy, Conservation Trust for North Carolina, Carolina Wetlands Association, the North Carolina Coastal Federation and North Carolina Sea Grant
- Nonprofits and other community organizations (e.g., neighborhood associations, advocacy groups, community foundations, tribal governments and faith communities), especially those that can help convene individuals from often overlooked communities (e.g., Association of Mexicans in North Carolina (AMEXCAN), Hispanic Federation, NC Black Alliance, NC Environmental Justice Network and NC Commission on Indian Affairs)

  More North Carolina community-based organizations:
  - NC Conservation Network Affiliates
  - NC Environmental Justice Network member organizations
  - NC Justice Center
  - NC NAACP
  - NC Rural Center
  - NC Tribal Communities
- Higher education institutions, such as the NCSU Coastal Dynamics Design Lab and the Duke University Ecosystem Services Program
- State government agencies, such as the NC DEQ Division of Coastal Management, Division of Mitigation Services, Division of Water Infrastructure, and Division of Water Resources; NC DNCR; Wildlife Resources Commission; and NCORR
- Federal government agencies, such as FEMA
- Local utilities
- Builders and developers
- Local businesses
- Residents

For More Information

Climate Resilient Land Use Strategies, a webpage hosted by the Greater Boston Metropolitan Area Planning Council, highlights "regulatory language and policy examples" that communities can replicate to address climate resilience.

Green Growth Toolbox, developed by the North Carolina Wildlife Resources Commission, provides tools to help the state's local governments plan for growth in a way that conserves natural habitats and other assets. The guidance provides information to support the strategies listed in the table below.

In the Guide to Expanding Mitigation: Making the Connection to Codes and Standards, FEMA explains how communities can "benefit from diverse codes and standards, communicate the hidden costs of failing to act and work with departments to adopt and enforce codes that increase community resilience." The resource includes case studies and is targeted toward emergency management officials.

The Planning and Land Use page of the US Climate Resilience Toolkit provides a primer on how land use planning and zoning can be used to manage and prevent climate impacts. The page also includes links to tools and case studies.

In Planning for Community Resilience, Dr. Philip Berke explains how "effective land use planning can reduce vulnerabilities and strengthen community resilience." This 28-minute video is hosted by FEMA.

The Sustainable Development Code "offers best practices for community development." The website contains a database of development code recommendations, case studies, policy briefs, and best practices to "remove obstacles," "create incentives," and "fill regulatory gaps."

LAND USE AND DEVELOPMENT | 11

STRATEGIES

Adopt zoning codes to support resilience

Zoning codes or ordinances can build resilience by directing development to safer locations and regulating new and modified structures to reduce vulnerabilities. Zoning codes can even prohibit certain activities in hazardous locations. Variations of zoning include base zoning districts, special coastal or hazard zones, and overlay zones.

FOR MORE INFORMATION

Model Flood Damage Prevention Ordinance (NCEM) **NCEM designed this model ordinance to help local governments comply with the minimum criteria of the National Flood Insurance Program.** See the instructions for using the model ordinance.

EXAMPLES

Building restrictions for new development in the floodplain (Raleigh, NC)

Coastal resilience overlay district, Section 3.9.18 (Norfolk, VA)

Floodway fringe overlay district (Cedar Falls, IA)

Waterfront mixed use overlay district, Article XVIII (Saugus, MA)

Oceanfront setback lines (NC)

Watershed Protection Districts Overlay (Section 5.5, Durham County, NC)

Wildfire hazard zones (Portland, OR)

CASE STUDY

*See the case study from the **Planning and Decision-Making Frameworks** section.

Adopt or update development regulations to support resilience

Development regulations can build resilience by planning for growth and development away from hazards, incentivizing development in safe locations, and prohibiting development in dangerous or vulnerable locations. One example is increasing oceanfront development setback requirements, either at the state level by working with the NC Coastal Resources Commission or at the local level through zoning codes and ordinances that go beyond the state standard. Another example is reviewing existing municipal codes to ensure that no prior rule was based on historic data and fails to account for changing future conditions.

*See the call out boxes in this topic/section for information about acceptable building code ordinances in North Carolina.

FOR MORE INFORMATION

Coastal Flood Damage Prevention Model Ordinance (NCEM)
This model ordinance was written for North Carolina communities.

Non-Coastal Flood Damage Prevention Model Ordinance (NCEM)
This model ordinance was written for North Carolina communities.

EXAMPLES

Expedited permit review (Santa Rosa, CA)

Incentivize development in smart/safe locations (Atlanta Regional Commission, Livable Cities Initiative)

Resilience or climate change element in Section 5 of Comprehensive Plan (Raleigh, NC)

Rural buffer and urban growth boundary in Comprehensive Plan (Orange County, NC)

Unified Development Ordinance > Subdivision regulations > Ocean frontage lots (Nags Head, NC)

Unified development ordinance that prevents new subdivisions in the floodplain (Section 12.2.4, Tarboro, NC)

CASE STUDY

*See the **Housing** and **Planning and Decision-Making Frameworks** case studies.

Adopt resilient building codes and regulations

In addition to where buildings are located, construction materials and practices are an important component of building resilience. Building codes provide a baseline standard for quality and safety, and additional building code requirements can build resilience to specific threats.

Helpful strategies include elevating homes in flood hazard areas, mitigating extreme temperatures and urban heat islands by requiring building materials that absorb less heat and "Firewise" strategies like promoting the use of non-combustible building materials.

In North Carolina, unless state law specifically prohibits the intent of the ordinance, local governments can adopt ordinances that are more stringent than the North Carolina Building Code. Local governments may need to go through the Building Code Council for a review of the ordinance and should speak with their legal counsel when considering this option. All fire code ordinances must be reviewed by the Building Code Council. See NC General Statutes § 143-138 for more information.

FOR MORE INFORMATION

2021 International Building Code: A Compilation of Wind Resistant Provisions (FEMA) **This document contains "the wind resistant provisions of the 2021 International Building Code."**

Building Community Resilience Through Modern Model Building Codes (International Code Council, Alliance for National and Community Resilience) **This publication details the importance of building codes in the defense against hurricanes, flooding and other natural disasters. The document also contains case studies and a literature review.**

Green Communities Certification **(Enterprise Community Partners) This certification program for green affordable housing techniques offers guides, reports, case studies and recorded trainings on green housing practices.**

CodeMaster for Flood Resistant Design (FEMA) **This guide provides "preliminary considerations and design process, key flood terminology, a 12-step process to incorporate flood resistance in the design of a building, an example showing the 12-step process being executed, and information on additional FEMA mitigation resources related to flood-resistant design." (Purchase is required to access this resource.)**

Continued on next page >

FOR MORE INFORMATION (CONTINUED)

Comparing National Flood Insurance Program Requirements to 2021 International Codes (FEMA) This "checklist guides floodplain managers, building officials, and designers as they compare the requirements."

FORTIFIED resilient construction standard (Insurance Institute for Business and Home Safety) Homeowners and developers can choose to use this "voluntary construction and re-roofing program designed to strengthen homes and commercial buildings against specific types of severe weather such as high winds, hail, hurricanes and even tornados."

International Green Construction Code (International Code Council) This code details construction standards for people-friendly buildings that conserve natural resources and reduce pollution and emissions. The code is drafted to align with the LEED standard.

International Wildland Urban Interface Code (International Code Council) This page provides a model supplemental code that "establishes a set of minimum standards to reduce the loss of property from wildfire. The purpose of these standards is to prevent wildfire spreading from vegetation to a building." Additional North Carolina resources are available via the North Carolina Forest Service.

No Adverse Impact Legal Guide for Flood Risk Management (Association of State Floodplain Managers) This guidebook "provides legal resources to inform the decisions of community representatives and municipal attorneys who design, implement, and defend NAI programs. It includes detailed resources for legal professionals and legal essentials for floodplain managers and community officials."

EXAMPLES

Coastal Flood Resilience Design Guidelines (Boston, MA)

CASE STUDIES

*See the case studies from the **Land Use and Development** and **Planning and Decision-Making Frameworks** sections.

> Some strategies implemented in other states may be outside the scope of authority for North Carolina's local governments. Please consult with your local legal counsel if you have questions about a project you are envisioning.

LAND USE AND DEVELOPMENT | 11

CASE STUDY

CASE STUDY

Brevard manages flood risk with a "No Adverse Impact" development standard

Project Purpose

In 2004, hurricanes Frances and Ivan dropped 33 inches of rain in the Brevard region. The French Broad River flooded, causing immense devastation in the area. Following this disaster, Brevard's City Council decided to update the Flood Damage Prevention Ordinance. The updates aimed to ensure that future development would not worsen the community's flood vulnerability.

What is No Adverse Impact?

No Adverse Impact (NAI) floodplain management requires developers review their proposals for adverse impacts to other property or the natural environment. Example adverse impacts include increased erosion or changes in floodwater speed or volume. Under NAI, developments must include measures to reduce or eliminate those negative effects.

Key Players: Brevard Planning Department, Brevard Public Works, Brevard City Council

Quick Facts

1. Directly east of Brevard is the French Broad River, which is fed by multiple local creeks that run through parts of the city.
2. In 2009, the City Council updated the Flood Damage Prevention Ordinance to include a **No Adverse Impact** (NAI) determination requirement. NAI is a longstanding floodplain management strategy that "ensures the action of any community or property owner, public or private, does not adversely impact the property and rights of others" (ASFPM, 2003). To get approval, builders must demonstrate that their projects will not increase the flood risk faced by downstream property owners and communities (The Pew Charitable Trusts, 2019; City of Brevard, 2023).
3. The ordinance reduces flood risk downstream by limiting new impervious surfaces and structures upstream and within Brevard.
4. The city places the burden of proof on development applicants, so NAI certification requirements have a low cost for the city.

Making It Happen

- In 2009, the City of Brevard updated its Flood Damage Prevention Ordinance to protect residents and educate them about specific risks to their properties. The adopted ordinance also aims to minimize the need for future public spending on flood control and maintain a consistent tax base. The new ordinance includes a No Adverse Impact determination requirement, which mandates that proposed developments not increase danger to residents or other properties in the floodplain. The standards of the NAI regulations are beyond federal minimums.
- The ordinance defines development as "any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials" (City of Brevard, 2023).
- The ordinance lists alterations to the floodplain that must not occur. These include no creation of increased sediments or debris from construction; no increase in the base flood elevation; and no reduction in the size of the floodway. A floodway is the river or stream itself and any land that regularly floods during a 100- or 500-year flood event.
- The ordinance requires that developers address comments from any nearby property owners or tenants who may face potential flooding from the proposed development.
- Developers must provide documentation from professional engineers that determine NAI. Only then can the developer receive project approval.
- The city has continued to update the ordinance since its adoption.

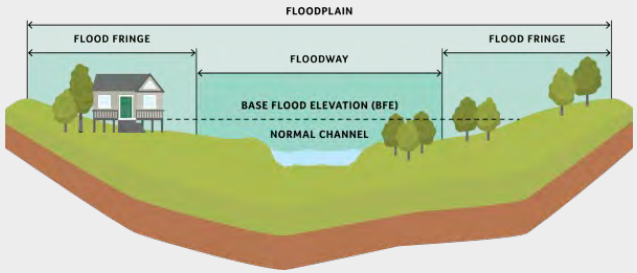
Spotlight on Equity

The policy implemented in Brevard protects those who already live in a floodplain. Land prices are often lower in the floodplain because of flood risk, and lower-income households are often concentrated in these more vulnerable lands. Therefore, NAI requirements may protect socially vulnerable populations that already reside in a community. This policy could help those currently living in floodplains by minimizing increased stormwater impacts.

How is a No Adverse Impact policy different from a No-Rise requirement?

In most cases, communities must prohibit development in the floodway that would increase flood levels during a base flood. In other words, a project must have a "no-rise" or "zero-rise" certification from a qualified professional engineer (FEMA, 2019).

Under a No Adverse Impact policy, developers cannot change the water-carrying capacity of the entire floodplain. When a developer proposes a project that would decrease the amount of water the floodplain can handle, the developer must add a measure to the project that would manage the additional water on-site.



Advice from the project manager

Adopting an NAI ordinance can enhance safety for future development without high ongoing administrative costs. In addition, new regulations should always evaluate the potential to disproportionately affect minority or disadvantaged community members.

Outcomes

- For the community, ongoing costs of limiting and mitigating unsafe development in the floodplain has positive safety and economic effects long-term because it protects life and property from new or increased flooding impacts.
- The ordinance also helps maintain a natural floodplain with minimal disturbance, which benefits waterways, fish habitat and other native ecosystems.
- The ordinance reduced the costs of flood insurance for residents, thanks to incentives in FEMA's National Flood Insurance Program (NFIP). The ordinance made the city eligible for a voluntary rating under the NFIP, "which insures property owners and renters at risk of flooding. The Community Rating System (CRS) discounts insurance premiums for communities that take measures to reduce flooding. To participate, a community's flood prevention ordinance must meet certain standards for mitigation, flood plain management and outreach activities, which Brevard's certification requirement exceeds" (The Pew Charitable Trusts, 2019).
- After more than 10 years since its adoption, city staff believe the regulation has been effective in protecting life and property and returning parts of the city to more sustainable environmental states. For example, the city had relatively few substantially damaged structures from Tropical Storm Fred in 2021. In addition, all structures elevated because of the flood ordinance survived without incident.

Project Contact

City of Brevard Planning and Zoning Department

Additional Resources

- City of Brevard webpage for the ordinance
- No Adverse Impact Floodplain Management resource page from the Association of State Floodplain Managers
- No Adverse Impact Legal Guide for Flood Risk Management
- Pew Charitable Trusts article on the floodplain ordinance

Related Case Studies

- See **Ecosystem Protection and Restoration**: New Bern project grows natural stormwater resilience while improving native ecosystems.
- See **Equity and Justice**: Princeville, public universities and partners facilitate resilience planning that honors town history.
- See **Housing**: Wilson Housing Authority constructs new affordable housing outside the floodplain.
- See **Infrastructure and Capital Investments**: Raleigh includes nature-based stormwater solutions in its roadway widening project.
- See **Planning and Decision-Making Frameworks**: Norfolk, VA, updates zoning regulations to address flooding and sea level rise.

Costs and Funding

- Costs, covered by the City of Brevard's budget, included staff time to draft the ordinance and carry it through adoption.
- Because the burden of proof of NAI lies upon the property developer and not the city, the cost of maintaining the ordinance is low. Brevard estimates costs at less than $5,000 annually.

References

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City of Brevard. (2023). Chapter 34. *Flood Damage Prevention.* Retrieved from City Code of Ordinances: https://online.encodeplus.com/regs/brevard-nc/doc-viewer.aspx#secid-992

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TOPIC | 12

PLANNING AND DECISION-MAKING FRAMEWORKS

Overview

Planning and decision-making frameworks are the tools communities use to develop solutions based on identified needs, opportunities and challenges. To be more resilient, planning and decision-making frameworks must be forward-looking, proactive, flexible and adaptive. In addition, incorporating future projections and community input will contribute to the efforts' successes. By following the guidance in this section and the *Playbook*, plans and policies can be created with the flexibility needed to respond to changing conditions and circumstances.

Role in Resilience

Planning and decision-making frameworks describe the way communities approach preparing for the future. Historically, planning and decision-making processes have relied on the assumption that past trends will be accurate predictors of the future. Local leaders often adopt goals, objectives and policies based on this assumption. Now, the unpredictable and increasingly significant impacts of climate change mean that past trends no longer define future conditions, invalidating this formerly tried-and-true approach. Local leaders must integrate climate projections into planning and decision-making processes to understand how to prepare their community for the coming decades.

Communities can build resilience by recognizing uncertainty and improving coordination to react to anticipated and unanticipated challenges.

For example, local leaders and residents can develop flexible plans that reinforce one another. If multiple plans (e.g., comprehensive plan, economic development plan and/or transportation plan), address climate change within their existing area of focus, the community will become more resilient as the plans are implemented. Plans can also build in checkpoints to enable goal and priority changes as the impacts of climate change become better understood. This flexibility increases resilience.

By including uncertainty as part of the process, these approaches consider a range of potential outcomes, rather than closing out options in favor of a single course of action. When multiple plans come together to guide actions, the potential for haphazard or stalled implementation is replaced with self- and mutually supporting solutions. This section lists several strategies local governments and partners can use to facilitate forward-looking, proactive, flexible and adaptive planning and decision-making efforts.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on long-range and short-term planning, sustainability, economic development and public infrastructure
- North Carolina's councils of governments (COGs), which host municipal and regional planning organizations
- North Carolina State Climate Office
- State government agencies, such as NCORR and the NC DEQ Albemarle-Pamlico National Estuary Partnership, Division of Mitigation Services, Division of Water Resources and Division of Coastal Management
- Federal government agencies, such as FEMA
- Higher education institutions
- Environmental nonprofits, such as the North Carolina Coastal Federation, North Carolina Sea Grant, The Nature Conservancy and Conservation Trust for North Carolina
- Nonprofits and other community organizations (e.g., neighborhood associations, advocacy groups, community foundations, tribal governments and faith communities), especially those that can help convene individuals from often overlooked communities (e.g., Association of Mexicans in North Carolina (AMEXCAN), Hispanic Federation, NC Black Alliance, NC Environmental Justice Network and NC Commission on Indian Affairs)

  More North Carolina community-based organizations:
  - NC Conservation Network Affiliates
  - NC Environmental Justice Network member organizations
  - NC Justice Center
  - NC NAACP
  - NC Rural Center
  - NC Tribal Communities
- Residents

For More Information

The *Idea Book's* companion, the *North Carolina Resilient Communities Planning Guide – Volume 1: Playbook*, provides step-by-step guidance on the process of building a resilience plan and implementing it.

For a landscape design perspective and focus on rural communities, the North Carolina State University's Coastal Dynamics Design Lab offers the Rural Resilience Framework: Disaster Adaptation Strategies for Building Rural Resilience. The second half of this report provides a time-tested framework for design and planning professionals to help rural communities with disaster recovery and resilience.

From federal partners, the Practitioner's Guidance for Implementing the Steps to Resilience provides additional detail on procedures to plan and implement resilience using the US Climate Resilience Toolkit.

PLANNING AND DECISION-MAKING FRAMEWORKS

12 STRATEGIES

Use historical data and projections to inform decisions and plans

In addition to looking at historical data, local governments can use science-based forecasting data and projections to guide planning and decision-making. Future-looking data can include projected population changes, projected changes in the number of high temperature days and nights, projected changes in extreme precipitation days and more.

Taking climate change into account will increase your community's chances at being prepared for increases in heavy rain, landslides, wildfires, daytime and nighttime temperatures, sea level rise and the many cascading effects.

FOR MORE INFORMATION

Defining Extreme Heat as a Hazard: A Review of Current State Hazard Mitigation Plans (Duke University) Among other topics, this report includes recommendations for how to incorporate climate change projections into heat-focused health plans.

Future Precipitation for Resilient Design (NC DOT, NCSU) This project will update Intensity Duration Frequency (IDF) curves to help transportation planners and engineers design roads, bridges, and ditches for the most intense precipitation events expected in North Carolina in the future. The anticipated project completion date is December 2024.

North Carolina Climate Science Report, released by the North Carolina Institute for Climate Studies' Climate Science Advisory Panel, provides observed and projected changes in statewide averages for North Carolina's temperature and precipitation averages and extremes, droughts, hurricanes, winter storms and other severe weather events. The document also includes regional changes in temperature, precipitation and storms for the Coastal Plain, Piedmont and Western Mountains regions; past and future sea level rise and coastal water level; and information on compound events such as inland flooding, wildfire, urban heat islands and more. Local planners can use this document to inform planning efforts.

Continued on next page >

FOR MORE INFORMATION (CONTINUED)

Sea Level Rise Viewer (NOAA) Decision-makers can "use this web mapping tool to visualize community-level impacts from coastal flooding or sea level rise (up to 10 feet above average high tides)." The resource includes photo simulations and "data related to water depth, connectivity, flood frequency, socio-economic vulnerability, wetland loss, and migration and mapping confidence."

EXAMPLES

Floodplain Management Plan (Morehead City, NC)

Planning for Rising Waters: Final Report of the City of Kingston Tidal Waterfront Flooding Task Force (Kingston, NY)

Use scenario planning and metrics tracking to prepare for various outcomes

Incorporating future-looking data into decision-making may require scenario planning, a way of acknowledging that a community needs to plan for alternative paths to be prepared for various outcomes. Furthermore, establishing and tracking metrics and identifying benchmarks for achieving defined goals can help you adjust policy and planning directions once the goals are met or if they are delayed or cannot be met after all.

FOR MORE INFORMATION

Climate Adaptation Through a "Pathways" Approach (ICF) **This webpage provides a detailed overview of using flexible adaptation pathways in planning for climate resilience.**

Climate Change Scenario Planning Showcase (US National Park Service) **This resource contains a "framework for working with uncertainty and preparing for a wide range of plausible future conditions." The page links to additional guidance documents.**

Next Generation Scenario Planning: A Transportation Practitioner's Guide (FHA) **This guide outlines a six-phase basic scenario planning process and "profiles recent examples of scenario planning in action."**

EXAMPLES

Flexible Adaptation Pathway for the Los Angeles Metro (LA Metro)

East Coast Climate Change Scenario Planning (Mid-Atlantic Fishery Management Council)

Develop processes to respond to needs as they arise

Building out a government that can quickly respond to emerging needs and adapt to new information enables communities to adapt to changing climate conditions and to understandings of impacts on residents. Features of a nimble institution include decentralized decision-making, increased participation from residents, and regular periods of procedural review to understand where and how existing policies are failing. For example, governments that intentionally solicit community feedback on emerging climate-related needs or problems are much better at reacting to emerging or foreseeable problems.

FOR MORE INFORMATION

EXAMPLES

Adaptive Governance Initiative (Louisiana)

Climate Change Element (Broward County, FL)
See Policy CC3.2.

CASE STUDY

South Bend, IN, uses Smart Sewer Technology to Monitor and Manage Increased Water Levels

Develop mutually supporting plans

This strategy speaks to the importance of adopting plans, codes and policies that work well together and build on each other. Alignment and integration of plans and policies builds resilience by reducing conflicting policies and goals and identifying opportunities to build efficiencies. For example, communities can identify opportunities to integrate green infrastructure into roadway upgrades or maintenance projects.

FOR MORE INFORMATION

Climate Action Planning Vertical Integration Guide (C40)
This guide explains the principles of enabling climate action by aligning local, state, and national plans (i.e., "vertical integration"). The document provides examples from around the world as well as tools and resources to help city governments.

Integrate Climate Adaptation: A toolkit for urban planners and adaptation practitioners (C40) **This toolkit "is designed to help planners build a case for including adaptation measures when developing projects and engaging decision-makers."**

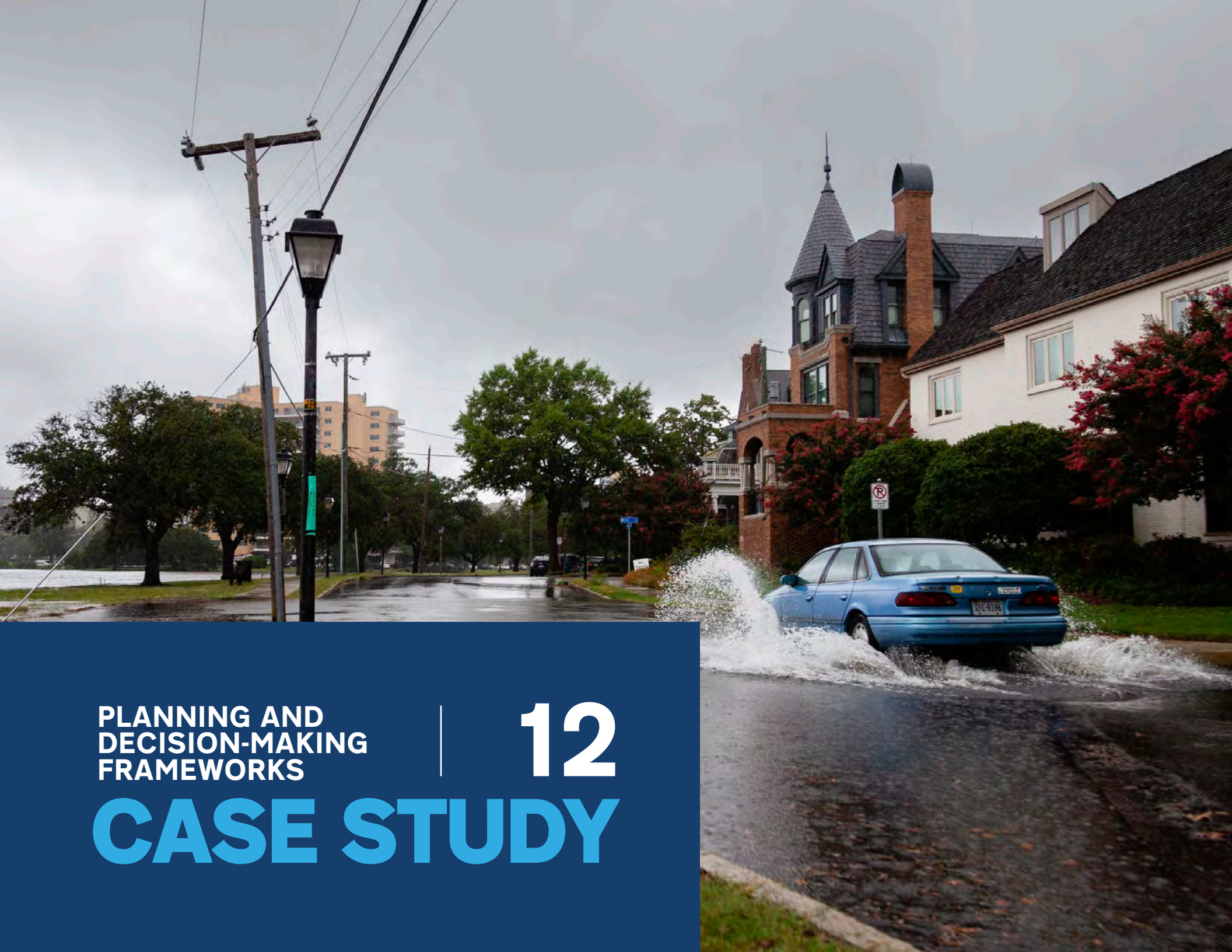
Plan Integration: Linking Local Planning Efforts (FEMA)
This tool is "developed to help your community analyze local plans to document existing integration and further integrate hazard mitigation principles into local planning mechanisms and vice versa."

Plan Integration for Resilience Scorecard V2.0 (Texas A&M University) **This guidebook helps communities "understand and discuss inconsistencies across their networks of plans by spatially evaluating their plan documents and existing vulnerabilities."**

EXAMPLE
Coastal Hazard Resilience Plan Alignment in California (multiple partners)

CASE STUDY

*See **Planning and Decision-Making Frameworks** case study, below.



PLANNING AND DECISION-MAKING FRAMEWORKS

12 CASE STUDY

CASE STUDY

Norfolk, VA, updates zoning regulations to address flooding and sea level rise

Project Purpose

Between 1930 and 2010, relative sea level in Norfolk rose more than one foot. Half of that amount was from sinking land. This change in sea level combined with more frequent heavy precipitation causes recurrent coastal flooding. In response, the City of Norfolk updated its zoning ordinance to manage flooding and promote safer development (The Pew Charitable Trusts, 2019).

What are Dutch Dialogues?

Dutch Dialogues are a partnership between the Netherlands and the United States to offer workshops on addressing water issues in flood-prone coastal cities. The workshops combine Dutch approaches to water management with American expertise on water problems in US cities. Water problems addressed through the Norfolk process included flooding, poor water quality, sea level rise and sinking land (The City of Norfolk, n.d.). Many flood-prone coastal places in the US have used the Dutch Dialogues approach.

Key Players: Norfolk Planning Department, Rockefeller Foundation, Old Dominion University, Norfolk City Council

Quick Facts

1. The City of Norfolk used the **"Dutch Dialogues"** approach to educate and engage residents in envisioning what the region could be if it adapted to flooding.
2. The Dutch Dialogues prompted the community to include flood management goals in its short-range and long-range plans. Residents called for an overhaul of the zoning ordinances to try to avoid impacts from more frequent heavy rainfall events, sea level rise, and sinking land (The City of Norfolk, n.d.).
3. The newly adopted zoning ordinance:
   - Requires landscaping to be exclusively salt-tolerant and native species (The Pew Charitable Trusts, 2019);
   - Implements a Coastal Resilience Overlay Zone and an Upland Resilience Overlay, the latter of which encourages new development to locate on higher ground while supporting preservation of low-ground areas (The Pew Charitable Trusts, 2019;
   - Uses a scoring system for approving projects that evaluates the project's vulnerability to flood and impact on nearby flooding; and
   - Requires development in the 1% annual chance flood zone (referred to as the 100-year flood zone) to be elevated three feet above the base flood elevation.

Making It Happen

- The Virginia Institute of Marine Sciences published a report in 2013 on state adaptation to recurring coastal flooding. After reading the report, the City of Norfolk began integrating flood management goals in its general plan, plaNorfolk2030. The plan called for a zoning ordinance overhaul to address flooding and sea level rise.
- To build public support for a new zoning ordinance, the city hosted Dutch Dialogues workshops. The process educated residents, the real estate community and developers on floodplain dangers and management opportunities. The Dialogues, which happened in 2015, also helped participants envision a flood resilient future (The City of Norfolk, n.d.).
- City staff involved developers and real estate agents in drafting the new zoning regulations. As a result, these community members understood the changes and considered them worthwhile.
- The Rockefeller Foundation provided additional technical assistance for community outreach.
- Old Dominion University, among others, helped with ordinance development by analyzing floodplain data.
- In 2016, Norfolk published Norfolk Vision 2100, a long-term strategy to address flooding challenges.
- In 2018, Norfolk adopted new zoning regulations. These new regulations implement part of Norfolk Vision 2100. They attempt to avoid impacts from more frequent heavy rainfall events, sea level rise and sinking land. The planning department advertised the new regulations by conducting outreach through postcards, virtual meetings and open houses.

More information on the new zoning regulations

The zoning ordinance creates an Upland Resilience Overlay Zone. The Upland Resilience Overlay encourages development on higher ground and preserving undeveloped, flood-prone properties. To do so, the overlay awards resilience quotient points to projects on high ground and to those that use a conservation easement or other legal instrument to preserve at-risk properties.

Resilience quotient points

The zoning scoring system requires new development and redevelopment applications to meet a minimum point threshold, or quotient, for approval. The system awards points for meeting standards for flood and energy resilience, as well as stormwater management. The ordinance includes pre-drafted resilient standards a developer can use to avoid going through the typical site plan review process. Developers may choose not to use the scoring system and instead meet a greater stormwater standard to obtain site plan approval (The Pew Charitable Trusts, 2019).

The new zoning ordinance also creates a Coastal Resilience Overlay Zone. Proposed developments in the Coastal Resilience Overlay Zone must be elevated three feet above the mapped base flood level (called a “freeboard” requirement). This requirement is a two-foot increase over the previous freeboard regulation.

Advice from the project manager

Make adhering to new standards easy. Dedicate resources to educating residents on the need for the standards and how they protect the community.

Outcomes

- The resilience quotient offers a flexible, points-based system. The system gives points to new development for techniques of their choosing, so long as they reduce flood risks, conserve energy and manage stormwater.
- About half of new developments are using the new scoring system, while the other half are still adhering to older, more standard approaches in the ordinance.

Spotlight on Equity

Regulations have the power to improve communities for generations to come. However, they must be tailored to ensure that the costs of redevelopment and new development do not overburden vulnerable members of the community. The same is true in Norfolk, a diverse city with more than 54% of the population made up of people of color (US Department of Commerce, 2013). The median income is below the national average and many low-income residents live in public housing. Norfolk's Dutch Dialogues discussed Tidewater Gardens, an impoverished Norfolk neighborhood with one of the highest rates of sea level rise in the country—six inches since 1992. The city's flood resilience strategy, **Norfolk Vision 2100** *(2016) identifies Tidewater Gardens as an area of dense development in need of protection. Residents are concerned, however, that the approach will lead to gentrification (Kusnetz, 2018).*

Project Contact

- **City of Norfolk Office of Resilience – norfolkrc@norfolk.gov**

Additional Resources

- Norfolk's Revised Zoning Ordinance Aims to Improve Flood Resilience
- Dutch Dialogues Virginia: Life at Sea Level

Related Case Studies

- See **Equity and Justice**: Princeville, public universities and partners facilitate resilience planning that acknowledges town history.
- See **Land Use and Development**: Brevard manages flood risk with a "No Adverse Impact" development standard.

Costs and Funding

- The Hampton Roads Planning District Commission sponsored the Dutch Dialogues process.
- The project received technical assistance from the Rockefeller Foundation, Old Dominion University and additional local environmental groups.

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TOPIC | 13
PUBLIC HEALTH

Overview

Protecting the health of residents is a vital goal of resilience initiatives. Public health programs provide mass vaccinations, health care screenings for chronic diseases, and many other individual-level benefits. However, the inequitable availability of public health resources has harmed historically under-resourced communities. These same communities often have the worst air and water pollution, as well, which directly contributes to chronic health issues (American Lung Association, 2023; Schaider, Swetschinski, Campbell, & Rubel, 2019). Local governments can work with their county health departments and local medical staff to ensure all residents have equitable access to reliable water, shelter, healthcare and other resources that protect them from the impacts of climate change.

Role in Resilience

Extreme weather events have both immediate and long-term impacts on the health of people and places. For example, extreme temperatures (both high and low) trigger a range of impacts on human health, which often disproportionately affects aging populations, young children, and people with underlying health conditions like asthma (American Public Health Association, 2023; EPA, 2022). Poor air quality caused by wildfires is harmful to people living with respiratory challenges, and hazards like drought impact the availability of fresh food, especially for people who already live with food insecurity. Furthermore, experiencing disasters and the long-term consequences of a changing climate can cause depression and anxiety, negatively impacting mental health (World Health Organization, 2022).

Communities can build resilience by investing in strategies that improve the physical and mental health of people and places. Healthier people have an easier time responding to stressors and unexpected events, and a healthier overall population needs less care, reducing the strain on the healthcare system and requiring less special intervention in times of crisis. Communities can implement strategies that provide access to public open space, fresh food, and safe options for active multimodal transportation, such as biking and walking, for all. They can also ensure all community members have safe and healthy places to live, a mix of job opportunities paying a living wage, access to education and workforce development, clean drinking water, functioning wastewater systems, and healthcare services. This section lists resources to help communities adopt resilience-building public health strategies.

Potential Project Leads, Experts and Stakeholders

- Local government departments and commissions focused on public health, community services, sustainability, and emergency management
- State government agencies, such as NC DHHS and NCEM
- Federal government agencies, such as HHS
- North Carolina State Climate Office
- Local and regional healthcare institutions
- Nonprofits and other community organizations (e.g., neighborhood associations, advocacy groups, community foundations, tribal governments and faith communities), especially those that can help convene individuals from often overlooked communities (e.g., Association of Mexicans in North Carolina (AMEXCAN), Hispanic Federation, NC Black Alliance, NC Environmental Justice Network and NC Commission on Indian Affairs)

  More North Carolina community-based organizations:
  - NC Conservation Network Affiliates
  - NC Environmental Justice Network member organizations
  - NC Justice Center
  - NC NAACP
  - NC Rural Center
  - NC Tribal Communities
  - Western North Carolina Health Network
- Housing authorities
- K-12 schools
- Residents

For More Information

North Carolina Community Mapping System, hosted by NC DEQ, provides a dashboard of community information and locations of potentially hazardous pollutant sites. The tool also features an environmental justice tool that allows all users to understand the sociodemographic and health characteristics of communities across North Carolina.

The Environmental Health Data Dashboard allows "users to view interactive maps and environmental health data visualizations at the state and county levels." NC DHHS monitors and reports "environmental and climate hazards that can affect human health throughout the state" on this page. Additional North Carolina public health data and resources related to climate change are also linked on the page.

The Environmental Justice Index, hosted by the CDC, uses data from the Census Bureau, the EPA, the US Mine Safety and Health Administration and the CDC "to rank the cumulative impacts of environmental injustice on health for every census tract."

Mental Health and Our Changing Climate: Impacts, Implications and Guidance, published by the American Psychological Association, Climate for Health and ecoAmerica, explains how climate change impacts mental health. "The report provides climate communicators, planners, policymakers, public health professionals, and other leaders the tools and tips needed to respond to these impacts and bolster public engagement on climate solutions."

Public Health Adaptation Strategies for Climate Change, part of the EPA's Climate Change Adaptation Resource Center (ARC-X), contains descriptions of public health adaptation strategies and relevant case studies.

The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment, hosted by the US Global Change Research Program, details findings that examine how climate change is already affecting human health globally and the changes that may occur in the future.

PUBLIC HEALTH | 13 STRATEGIES

Conduct community climate and health assessments

A community health assessment is a thorough examination of the health status for different population groups in a community. Assessing and monitoring community health builds resilience to the impacts of climate change by proactively providing people with the resources needed for improved physical and mental health during natural and climate disasters.

FOR MORE INFORMATION

EXAMPLES

Sandhills Community Readiness: Determining Pilot Groups for Heat Safety Programming (NC DHHS)

North Carolina Climate and Health Implementation and Monitoring Strategy for Heat-Related Illness (NC DHHS)

Measuring the Human Dimensions of Resilience, Health and Well-Being in the Gulf Coast (Gulf Research Program)

CASE STUDY

*See **Collaboration** case study.

Develop plans to achieve climate and health goals

Using climate projections to understand the future health needs of different communities within a jurisdiction can help public health departments set goals and identify appropriate interventions. Combining these goals and interventions into a planning document will assist local leaders in planning and prioritizing implementation.

FOR MORE INFORMATION

Heat Action Plan Toolkit (NCORR) This North Carolina resources provides a template heat action plan for communities, sample messaging and graphics, example community surveys and heat thresholds for specific regions across the state.
*Incluye Recursos en Español

Building Resilience Against Climate Effects (BRACE) (CDC) This framework "is a five-step process that allows health officials to develop strategies and programs to help communities prepare for the health effects of climate change." In particular, refer to the BRACE Resources page, which contains templates, data, and more.

Climate Change and Health Playbook: Adaptation Planning for Justice, Equity, Diversity and Inclusion (JEDI) (American Public Health Association) This resource, which serves as a supplement to BRACE, guides communities wanting to embed JEDI "into their climate and resilience initiatives, programs and operations."

Defining Extreme Heat as a Hazard: A Review of Current State Hazard Mitigation Plans (Duke University) This report "assesses the treatment and definition of heat as a hazard in each state's plan" and offers recommendations for states and local governments to understand and address the effects of extreme heat on their residents.

Use public awareness campaigns to educate the community about climate hazards and building resilience

Public awareness campaigns use methods like informational posters, notices, exhibits, radio announcements, social media and special signage. This strategy builds resilience by educating the public and calling attention to issues, hazards, or opportunities. For example, social media posts during heat waves can educate residents about how to avoid heat related illnesses.

FOR MORE INFORMATION

Heat Health Alert System (NC DHHS) **All NC residents can sign up to receive an alert when extreme heat conditions in their county are forecasted to reach levels that cause impacts to human health.**

***Se puede registrar en Español**

CASE STUDY

*See **Public Health** case study, below.

(See **Communication and Education** for additional resources)

Actively support safe and healthy shelter for all

Resilient communities actively support and help provide permanent, short-term, and emergency housing for residents. Safe and secure shelter means housing or other shelter structures are free of harmful environmental contaminants like lead, mold, and air pollution; free from pests and insects; heated and cooled; well-maintained and up-to-code; not located in hazardous areas; and appropriately sized for the number of residents. It also means residents have access to clean, healthy water for drinking, cooking, and bathing, and it means that sanitary systems are functioning and maintained. This strategy also ensures that all people, especially a community's most vulnerable residents, can access safe, healthy shelter during extreme weather and have the resources needed to repair and restore their homes following disasters.

FOR MORE INFORMATION

Plan. Prepare. Stay Informed. (ReadyNC) **NC residents can use this webpage to find open shelters during emergencies and apply for disaster recovery assistance.**

EXAMPLES

Equitable Weatherization Clinic in South Florida (Miami Law Environmental Justice Clinic)

Maycroft Apartments "resiliency room" (Washington, DC)

CASE STUDY

State Acquisition and Relocation Fund for buyout relocation assistance supports post-disaster community investments in Lumberton, NC

(See **Housing** for additional resources)

Provide and promote equitable and accessible physical and mental health resources and services

This strategy focuses on connecting all community members with the information and resources needed to protect and maintain their physical and mental health. This builds resilience by reducing the impacts of climate hazards intersecting with underlying health issues; supports the physical and mental stamina needed to prepare for, respond to, and recover from extreme events; and reduces strains on the community healthcare system.

FOR MORE INFORMATION

Healthy Places NC (Kate B. Reynolds Foundation) **This program works to improve the health of residents in some of NC's most rural and vibrant yet under-resourced counties.**

EXAMPLES

Community plants trees to reduce air pollution and health risks (Louisville, KY)

Healthy Opportunities Pilots (three NC areas)

Mobile Health Program (Forsyth County, NC)

Psychiatry access line for health care providers (NC)

Mobile dental unit for special needs populations (NC)

Trauma informed systems initiative (San Francisco, CA)

Local Motive Mobile Farmers' Market (Southeastern NC)

***Disponible en Español**

(See **Communication and Education** and **Equity and Justice** for additional resources)

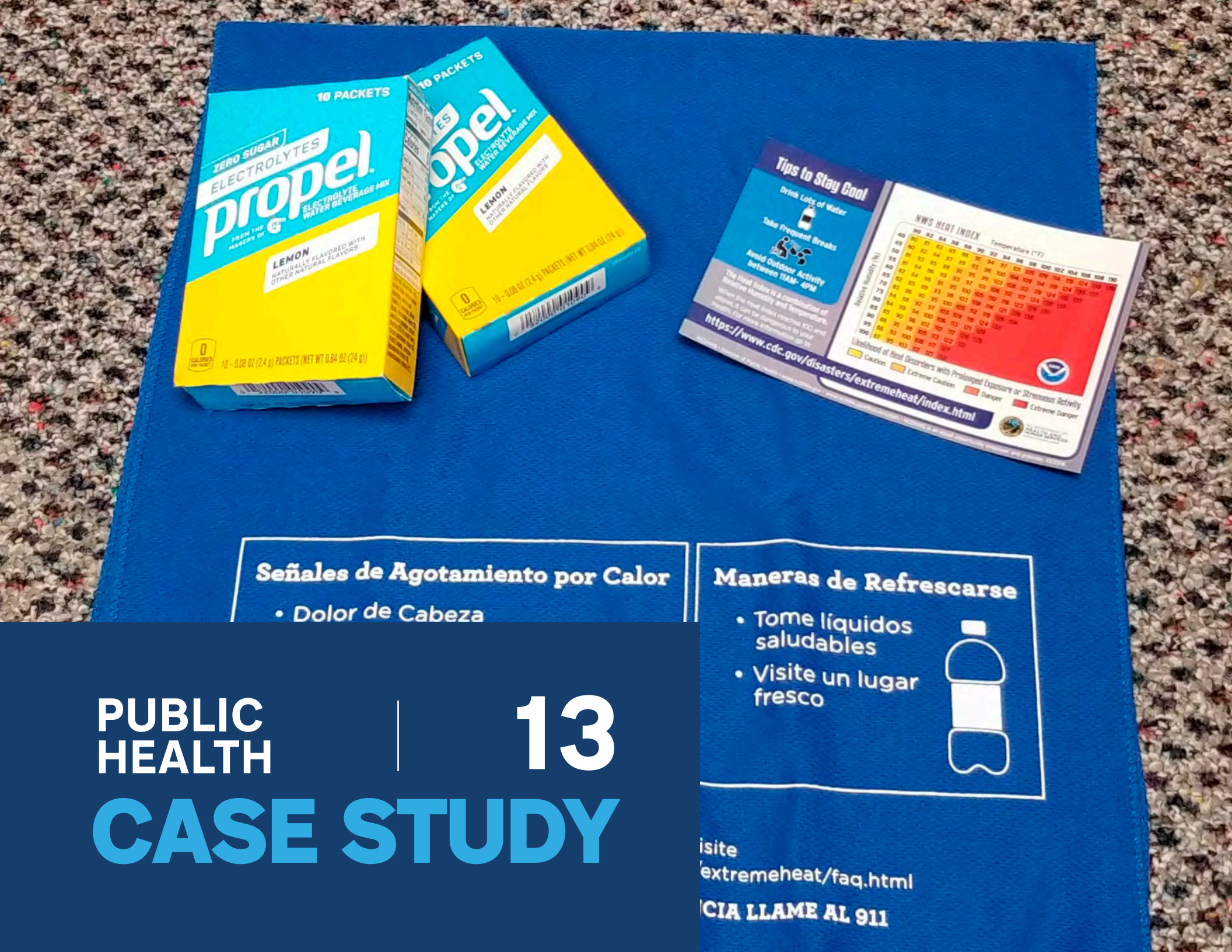
Support community networks

Social networks are many families' first points of outreach for assistance. Local governments can support these networks with outreach campaigns, funding and other resources.

FOR MORE INFORMATION

EXAMPLE

Neighborhood Buddy Initiative (Princeton, NJ)



PUBLIC HEALTH | 13

CASE STUDY

CASE STUDY

Preventing heat-related illness in the Sandhills Region

Project Purpose

Compared to the rest of the state, communities in North Carolina's Sandhills region—Bladen, Robeson, Hoke, Sampson and Scotland Counties—experience an elevated number of extreme heat days. Residents in the Sandhills region are particularly vulnerable to the impacts of rising temperatures due to high exposure and existing health vulnerabilities. To help prevent heat-related illness in the Sandhills, the NC Department of Health and Human Services (NC DHHS) Climate and Health Program worked with local heat-related illness prevention specialists in the region to implement a heat-health alert system and a summertime educational and informational campaign (NC DHHS, 2017).

Key Players: NC DHHS, Sustainable Sandhills, Scotland County Health Department, North Carolina Farmworkers' Project, Robeson County Health Department, Manos Unidas

Quick Facts

1. Most parts of North Carolina are projected to see at least two to three additional weeks of very hot days (maximum temperature of 95 degrees F or higher) for 2021-2040 (Kunkel, et al., 2020). On average since 2020, there are about 3,500 emergency department visits for heat-related illness each year during the heat season, which runs May 1 to Sept. 30 (NC DHHS, 2017).
2. Following interviews with community members, program partners developed a heat alert system and multilingual educational materials. As of spring 2023, partners used social media, multilingual trainings, heat stress kit distribution and heat messaging in farmworker health assessments to issue heat wave notifications and inform vulnerable residents about healthy heat management strategies.
3. The programming in the Sandhills helps build resilience against public health impacts of extreme heat by increasing awareness of heat risks, promoting positive health protective behaviors and increasing access to resources.

Making It Happen

- In 2017, NC DHHS conducted qualitative interviews with relevant stakeholders in Bladen, Robeson, Sampson and Scotland Counties to assess community readiness for heat health programming. NC DHHS reported interview results and intervention strategies in the Sandhills Heat Community Readiness Report.
- During interviews, local stakeholders reported concern about vulnerability to heat-related illness among farmworkers, individuals living in poverty, older adults, outdoor workers and children. Some of these groups are more exposed to extreme heat, such as outdoor workers and individuals who cannot afford air conditioning. Others are more sensitive to extreme heat, such as aging populations and individuals who have not yet acclimatized to the heat. Those who experience high exposure and high sensitivity are particularly vulnerable, such as farmworkers who have recently immigrated. Exposure to extreme heat during working hours is dangerous for populations that are traditionally underserved due to transportation and language barriers.
- In response to the interview results, NC DHHS outlined two prevention strategies—a heat alert system and multilingual educational materials—in the North Carolina Climate and Health Implementation and Monitoring Strategy for Heat-Related Illness, published in 2018. These programs and partnerships enable NC DHHS to reach the most heat-vulnerable populations in the region.
- To help implement these interventions, the NC DHHS Climate and Health Program established a Heat-Illness Prevention Specialists Task Force in 2018 (now known as the Sandhills Climate Resilience Task Force). The group is composed of representatives from local health departments and community-based organizations that can speak for the needs of their target populations: agricultural workers, low-income residents that cannot afford adequate cooling, older adults and youth athletes that practice outside during the summer.
- NC DHHS and Sustainable Sandhills developed heat wave announcements, designed educational messaging and trained the prevention specialists on the Task Force on how to interpret heat data.
- Each prevention specialist identified appropriate communication channels for heat alerts to reach the populations with which they have trusted relationships. For example, the NC Farmworkers' Project, which works with migrant and seasonal farmworkers to maintain and improve their health, conducted multilingual trainings and distributed heat stress kits, electrolytes, cooling towels, water bottles with heat health messaging and personal protective equipment such as hats. In another example, Manos Unidas incorporates heat messaging into their existing health assessments offered to farmworkers. They also do some specific heat health trainings and provide heat stress kits, educational materials and water bottles. As of spring 2023, Task Force members issued heat alerts via social media, but there was interest in expanding the approach to issue communications through more formal channels.
- The Task Force began issuing heat alerts in 2018 in Bladen, Robeson, Sampson and Scotland Counties. The group also distributed educational materials and health protective resources during heat season (May to September).
- In 2019, NC DHHS and the Task Force expanded heat health programming to Hoke County.

Advice from the project manager

Heat health interventions can be more effective if coordinators can build on current local efforts, utilize local expertise and work through existing channels of health and social service provision.

Gathering information, making it accessible to those that need it and developing systems that monitor impacts that affect vulnerable members of the community are necessary steps for addressing inequality and inequity.

Outcomes

- In the Sandhills region, vulnerable populations, including farm workers, now have increased access to resources they can understand to help them learn about and address impacts from heat.
- NC DHHS expects to see an increase in protective actions to prevent heat-related illness among vulnerable populations within target Sandhills counties, as well as reduced heat-related illnesses among vulnerable populations in the region.

Project Contact

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Related Resources

- View the interview results and intervention strategies in the Sandhills Heat Community Readiness Report.
- The 2018 North Carolina Climate and Health Implementation and Monitoring Strategy for Heat-Related Illness describes the Sandhills programming in detail.
- NC DHHS Climate and Health Program Summer Heat Data Emergency Data and Prevention Tips

Related Case Studies

- See **Collaboration**: Raleigh and Durham map neighborhood temperatures.

Costs and Funding

- NC DHHS allocates about $125,000 per year toward heat management programs. Funding comes from the Centers for Disease Control and Prevention Building Resilience Against Climate Effects (BRACE) cooperative agreement, a five-year agreement funded at $500,000 per year from 2021-2026, as of spring 2024.

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Spotlight on Equity

The impacts of rising temperatures are higher in underserved communities, especially those living in poorly insulated mobile homes, those with limited access to adequate cooling, and individuals who experience disparate asthma and cardiovascular disease. Several Sandhills counties have a high concentration of potentially underserved populations. Concentrating heat safety programming in the Sandhills region places a spotlight on equity by prioritizing the communities that face the highest exposure to heat with the lowest capacity to adapt. For example, as the number of extreme heat days is projected to increase, many households in the Sandhills region that already struggle with energy bills may not be able to adequately cool their homes.

Additionally, North Carolina's farmworkers, a heavily migrant population, are at a disadvantage when it comes to accessing health care. They often do not speak English or they speak English as a second language. Many farmworkers do not have easy access to transportation, typically have lower incomes, are unfamiliar with the local health care services available and are often scared to visit a doctor who might tell them they are unable to work. The Climate and Health Program has historically supported farmworker organizations by integrating heat health educational materials into farmworker outreach staff's existing health promotion activities. Moving forward, the program is coordinating with the NC DHHS Office of Rural Health's Farmworker Health Program to provide critical extreme heat education and health promotion resources to those who care for farmworkers, like migrant health clinic community health workers and clinicians.

TOPIC | 14

STORMWATER MANAGEMENT AND FLOODING

Overview

Precipitation and snowmelt generate stormwater and can cause flooding (Kunkel, et al., 2020). Communities use stormwater management techniques to control, collect and sometimes use excess water. These strategies build resilience by reducing or eliminating flooding hazards, improving water quality, and promoting options for recycling and reusing stormwater.

Role in Resilience

As North Carolina's communities grow and develop land that may have previously absorbed excess water, good stormwater management becomes increasingly important. If not effectively managed, excess stormwater, also called stormwater runoff, can overwhelm sewer and drainage systems causing flooding and pollution. Increased stormwater velocity and volume from **impervious surfaces** can also make soil erosion worse and lead to sedimentation of nearby water bodies, particularly in heavily developed areas (USGS, 2018). Stormwater runoff can also damage infrastructure by washing out roads, for example. If not slowed or retained, runoff directly flows into water bodies, carrying excess nutrients, bacteria, debris and other pollutants that can damage water quality, supplies, habitats and ecosystems (EPA, 2023).

Stormwater management reduces the amount and speed of water flowing into ditches, sewers and other drainage systems. Resilient stormwater management also promotes options for recycling stormwater for nonpotable uses such as crop and garden irrigation. Stormwater management solutions can also build resilience by promoting or requiring solutions that mimic nature, such as nature-based solutions or green infrastructure. **Nature-based and green infrastructure solutions** for stormwater management may also provide additional economic, public health and social benefits to communities, including recreational opportunities.

Impervious and pervious surfaces

Impervious surfaces, such as rooftops, roads and parking lots covered by impenetrable materials such as concrete and asphalt, cannot absorb stormwater. Instead, they cause water to run off at greater rate of flow than if the water were able to infiltrate the ground naturally. Pervious surfaces allow water to absorb into the ground naturally and include parks, forests, gardens and other vegetated areas.

Grey infrastructure

Grey infrastructure refers to human-engineered water sources such as stormwater drains, pipes and sea walls.

Natural-based solutions, green infrastructure and low-impact development

Green infrastructure, also called low-impact development, is a type of nature-based solution. It replicates natural processes by using vegetation or enhancement and restoration of natural land and water flow patterns to slow, retain and absorb runoff rather than channeling and piping it into a waterway. Many people use these terms interchangeably, while others interpret nature-based solutions to refer to the broader protection or restoration of ecosystems for the purpose of benefiting people and the environment. Examples of green infrastructure for stormwater management include rain gardens, wetlands, bioswales and green roofs.

Robust, resilient stormwater management systems can operate at different scales—from large-scale municipal sewer systems to small rain gardens that capture stormwater. Regional or watershed-scale activities require a comprehensive approach to stormwater management, necessitating cooperation between localities and aligning with the geography of how water flows. Local government strategies typically increase the capacity and redundancy of **hard, or grey, and nature-based, or green, stormwater infrastructure**. Both types of strategies can hold water on land where flooding will not carry pollutants and sediment into nearby streams and lakes or impact buildings or infrastructure. Grey and green approaches can be designed to divert water flow to other locations, remove impediments to flows (e.g., raising and widening bridges) and enhance stream channels to accommodate more flow. Another large-scale option is to use dams as dry detention facilities or to store additional water during heavy rain. Neighborhood- or site-level strategies

provide more targeted options for managing stormwater through approaches such as shared open space and personal rain gardens. A key component for all strategies is raising awareness through education and training to the community, including local leadership, on approaches and funding opportunities. This section provides more information to help local governments increase the resilience of stormwater management systems, no matter their size.

Potential Project Leads, Experts and Stakeholders

- Local government departments focused on stormwater, public infrastructure, planning and sustainability
- State government agencies, such as US DOT; NCEM; NCORR; and NC DEQ Albemarle-Pamlico National Estuary Partnership, Division of Water Infrastructure, Division of Mitigation Services, Division of Coastal Management and Division of Energy, Mineral, and Land Resources
- Federal government agencies, such as FEMA and the EPA
- Stormwater and floodplain professionals (e.g., landscape architects, water resource and civil engineers, and floodplain managers) in the private, nonprofit, governmental and academic sectors
- Environmental nonprofits, such as the North Carolina Coastal Federation, North Carolina Sea Grant, The Nature Conservancy, Conservation Trust for North Carolina, and Carolina Wetland Association
- Higher education institutions
- Builders and developers
- Local businesses
- Residents

For More Information

FEMA offers two guides focused on Building Community Resilience with Nature-Based Solutions: A Guide for Local Communities and Strategies for Success. The Guide for Local Communities "provides foundational information on the benefits associated with using nature-based solutions to advance natural hazard mitigation and climate adaptation." The second guide, Strategies for Success, "builds upon the first and highlights five key strategies for implementing successful nature-based solution projects."

The Green Growth Toolbox, developed by the North Carolina Wildlife Resources Commission, provides tools to help the state's local governments plan for growth in a way that conserves natural habitats and other assets. The guidance provides information to support the strategies listed in the table below.

The Green Streets Handbook, published by the EPA, "is intended to help state and local transportation agencies, municipal officials, designers, stakeholders, and others to select, design and implement site design strategies and green infrastructure practices for roads, alleys, and parking lots." The handbook includes a chapter on green street stormwater design practices.

The Nature-Based Stormwater Strategies webpage, hosted by the North Carolina Coastal Federation, focuses on an action plan report that discusses opportunities in North Carolina for nature-based stormwater strategies in new development, stormwater retrofits, roadways and working lands. The site also includes example projects, fact sheets and more.

The NC DEQ Division of Water Resources hosts a webpage that lists several resources on green infrastructure.

The Low Impact Development Barrier Buster Fact Sheet Series, released by the EPA, discusses the benefits of low impact development strategies, construction techniques on specific slopes, soils and small spaces, and how to use incentives, planning techniques and codes to facilitate low impact development projects. Low impact development is the use of natural processes to manage stormwater and protect water quality.

The Stormwater Management Practices at EPA Facilities webpage, hosted by the EPA, reviews green infrastructure and low impact development practices to reduce stormwater runoff and pollution.

STORMWATER MANAGEMENT AND FLOODING | 14 STRATEGIES

Develop plans at the watershed or regional scale

Planning for flood and stormwater management at the watershed scale supports resilience by planning in a way that respects geography rather than political boundaries. This scale of planning involves coordination between local and regional governing entities. This more comprehensive approach to managing stormwater mitigates downstream impacts and protects the health of critical watersheds that provide invaluable ecosystem services.

FOR MORE INFORMATION

Flood Resiliency Blueprint (NC DEQ) **This statewide initiative will produce an online decision-support tool and river-basin-scale planning efforts to address flooding in North Carolina.**

Examples

North Carolina River Basin Restoration Priorities

Statewide Watershed Planning Initiative (Florida)

Watershed Master Plan (Fayetteville, NC)

Watershed Restoration and Stormwater Resilience Plan (Atlantic Beach, NC)

Watershed Restoration Plan (Central Asheville, NC)

Watershed Restoration Plan (Swansboro, NC)

Conduct a stormwater study and adopt a stormwater management plan and/or regulations

The first step in adopting a plan or pursuing stormwater management projects is to conduct a stormwater study to map and understand the current system. A stormwater plan or regulations can be based on this study. Effectively managing stormwater reduces potential flooding and erosion as well as pollution of waterways by slowing and filtering stormwater. Stormwater regulations like performance standards ensure that new development does not result in more stormwater runoff.

Strategies supporting the adequate operation of stormwater infrastructure include ensuring that stormwater plans include costs for system maintenance and for providing education, training, and other resources to private property owners on the importance of inspecting and maintaining stormwater infrastructure.

FOR MORE INFORMATION

Green Infrastructure Design and Implementation (EPA)
This webpage lists many states' green infrastructure design manuals, links to modeling tools and describes solutions to design challenges.

EXAMPLES

Stormwater Management Plan (Black Mountain, NC)

Stormwater Management Plan (Raleigh, NC)

Stormwater Drainage Manual (Harrisburg, NC)

Stormwater Ordinance (Fayetteville, NC)

CASE STUDIES

DC Utilizes Green Infrastructure to Manage Stormwater

Yancey County, NC, addresses nonpoint source pollution mitigation in the Bald Creek Watershed

Promote or require green infrastructure

Green infrastructure, also called low impact development, manages stormwater runoff by mimicking natural processes, e.g., retaining and absorbing stormwater runoff on-site rather than channeling it away. This development practice reduces the impact of stormwater on nearby properties. Local leaders can promote green infrastructure in their permitting process. They can also partner with organizations in North Carolina to provide project review and permitting education and training courses for city staff; assist with operation and maintenance; and compare costs of conventional gray stormwater infrastructure to green infrastructure.

FOR MORE INFORMATION

Bioretention Design Handbook (EPA) **This document contains the latest trends and approaches for bioretention design, construction, inspection, and maintenance. The handbook also features numerous photographs of bioretention facilities that showcase the diversity of design techniques.**

Equity Guide for Green Stormwater Infrastructure Practitioners (Green Infrastructure Leadership Exchange and Greenprint Partners) **This guide offers best practices and sample metrics to track progress toward long-term equity goals.**

Green Infrastructure Toolkit (Georgetown Climate Center) **This resource "is intended to aid local governments nationwide in comparing best practices across cities, drawing lessons from different approaches and crafting similar policies for their own jurisdictions."**

EXAMPLES

Developer incentives for low-impact development stormwater practices within planned unit developments (Charlottesville, VA)

Green Area Ratio (Washington, DC)

Green Infrastructure (Charleston, SC)

Green Infrastructure Planning and Design Handbook (Boston, MA)

Green Roof Tax Credit (Philadelphia, PA)

Green stormwater retrofits (Swansboro, NC)

Infographic: Green Stormwater Management Options for Various Land Uses (Raleigh, NC)

Low Impact Development Manual (Columbia, NC)

Model Green Streets Policy (New Jersey)

Residential Rain Catchers Program (Durham, NC)

Maintain and enlarge existing stormwater infrastructure

Inspecting and maintaining existing stormwater infrastructure ensures that facilities operate at their design capacity. Cleaning bridge openings, culverts, and ditches in advance of heavy rain can reduce flooding. Properly functioning stormwater infrastructure supports on-site and downstream stormwater management.

As existing stormwater infrastructure needs to be replaced and development prompts stormwater system expansions, local governments can size infrastructure to accommodate expected higher volumes of water.

FOR MORE INFORMATION

Bioretention Performance, Design, Construction and Maintenance (Urban Waterways) This document reviews research conducted by NCSU to examine the performance of bioretention cells in North Carolina.

Mosquito Control for Stormwater Facilities (Urban Waterways) Climate change is increasing the likelihood of disease-carrying mosquitoes. This webpage provides guidance on how to design stormwater infrastructure to limit their numbers.

Stormwater Design Manual (NC DEQ) This webpage links to design guidance for many types of small-scale stormwater management practices.

EXAMPLES

Culvert assistance program (St. Lucie County, FL)

Homeowner's Watershed and Stormwater Handbook (Carrboro, NC)

Report system for broken or clogged storm infrastructure, flooding issues and street sweeping (Black Mountain, NC)

Stormwater Education for Homeowners video (Hendersonville, TN)

Conserve open space for floodwater storage

Conserving open space makes or leaves room for stormwater retention within communities. This is accomplished by prohibiting or removing development in locations that accommodate floodwater or by ensuring complementary land uses in locations that collect and retain stormwater, like parks. Zoning can be used to require green space to absorb stormwater, provide respite from heat, and capture carbon.

FOR MORE INFORMATION

Conservation Subdivisions Handbook (NC Cooperative Extension Service) This document is a guide for North Carolina communities in the use of conservation design for land use planning.

EXAMPLES

Recreation Conservation District (p. 18, Stow, MA)

Residential Conservation District (p. 18, Fairfax County, VA)

South Ellerbe Restoration Project (Durham, NC)

Stormwater parks (Puget Sound Regional Council)

CASE STUDIES

*See the case studies from the **Stormwater and Flooding** and the **Ecosystem Protection, Restoration and Enhancement** sections.

Participate in the National Flood Insurance Program (NFIP) Community Rating System (CRS)

The CRS is a voluntary program that incentivizes flood risk reduction strategies that exceed minimum NFIP requirements. Participating communities earn credit for flood mitigation activities. These credits can generate flood insurance premium reductions for community members. Any community can apply to join the CRS if they are fully compliant with the NFIP floodplain management requirements. CRS classes are rated from Class 9 to Class 1, with Class 1 having the greatest reduction in flood insurance premiums.

FOR MORE INFORMATION

Community Rating System (FEMA) **The CRS homepage contains the CRS Coordinator's Manual, case studies, a list of participating communities and more.**

STORMWATER MANAGEMENT AND FLOODING

14 CASE STUDY

CASE STUDY

Charlotte-Mecklenburg region runs local floodplain buyouts program

Project Purpose

In the 1980s and 1990s, repetitive flooding in Mecklenburg County caused millions of dollars in damages to personal and public property. In 1997, Hurricane Danny killed two people in Charlotte and caused a large petroleum spill into a local creek. Furthermore, the consolidated city-county government lacked floodplain development restrictions. In response, local governments in the Charlotte region established a merged city-county stormwater utility. The merged utility reduced flood risk in the region using floodplain buyouts.

Key Players: Elected officials and municipal and county stormwater utilities from the City of Charlotte; Towns of Cornelius, Davidson, Huntersville, Matthews, Mint Hill and Pineville; and Mecklenburg County

Quick Facts

1. The floodplain buyout program "undevelops" floodplains.
2. The program is funded with stormwater fees and grant funds.
3. The program is voluntary for property owners.
4. In the first 23 years of the program, Charlotte-Mecklenburg Storm Water Services purchased more than 450 floodplain properties. The program created 185 acres of undeveloped public space.

Making It Happen

- In the early 1990s, the City of Charlotte; Towns of Cornelius, Davidson, Huntersville, Matthews, Mint Hill, and Pineville; and Mecklenburg County established the Charlotte-Mecklenburg Storm Water Services. The new utility became responsible for managing stormwater and restoring floodplains. The entity developed a more extensive approach to stormwater management.
- In 1999, the utility launched its Floodplain Buyout Program. The program purchases and removes buildings in the floodplain, returning the properties to open space.
- Program staff focus on a few neighborhoods each year, coordinating acquisitions and other flood management projects.
- The utility offers a grant program for retrofitting at-risk properties when buyouts are not feasible.
- The utility's "damages avoided" newsletter covers the successes of the buyout program. The newsletter illustrates what could have happened to local properties in a major flooding event if they were not bought out.

Spotlight on Equity

The utility noticed that the number of flooding complaints was lower in low-income neighborhoods. So, staff conducted special outreach to those areas. They helped make low-income residents aware of their reporting abilities, as well as their buyout and retrofit options.

Advice from the project manager

Program Manager Tim Trautman emphasizes the value of planning buyouts holistically. He suggests designing a buyout program in a way that respects public interests and benefits (Urban Land Institute, 2021). For example, converting purchased properties into well-maintained local parks is beneficial to the community.

One challenge with the program is agreeing to a fair price for the flood-prone businesses and housing. About 75% of participating property owners are relieved to walk away from high-risk properties, but each participant has a different perception of a fair price (Urban Land Institute, 2021). To help ease the transition for all sellers, staff try to complete the land's open space conversion quickly, so previous residents can enjoy the new open space.

Outcomes

- Between 1999 and 2022, Charlotte-Mecklenburg Storm Water Services purchased more than 450 floodplain properties. These purchases allowed for the transition of over 185 acres of developed properties to undeveloped public space. In addition, the program relocated more than 700 residents out of harm's way. Eligible residents received relocation assistance (Urban Land Institute, 2021).
- The utility estimates that buyouts have avoided $25 million in losses and will ultimately avoid over $300 million in future losses (Urban Land Institute, 2021).
- The buyout program and other flood reduction measures earned Mecklenburg County a Class 3 rating through the National Flood Insurance Program's Community Rating System. Class ratings range from 9 to 1, with 1 being best. The rating allows the program to provide a 35% discount on flood insurance, which saves residents $1 million each year.

Project Contact

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Charlotte-Mecklenburg Storm Water Services
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Additional Resource

- Property Buyouts Can be an Effective Solution for Flood-Prone Communities Report from the Pew Charitable Trusts

Related Case Studies

- See **Land Use and Development**: Brevard manages flood risk with a "No Adverse Impact" development standard.
- See **Planning and Decision-Making Frameworks:** Norfolk, VA, updates zoning regulations to address flooding and sea level rise.

Costs and Funding

- The Floodplain Buyout Program began with two full-time equivalent planners.
- Charlotte-Mecklenburg Storm Water Services funds buyouts with stormwater fees, hazard mitigation funds from the Federal Emergency Management Agency, stormwater mitigation funds from state government and local funds.

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GLOSSARY

GLOSSARY

Glossary of Terms

Adaptation The process of adjusting to new conditions to reduce risks to valued assets.

Adaptive capacity The ability of a person, asset, community or other system (such as a natural environment) to adjust to a hazard (including climate variability and extremes), take advantage of new opportunities, or cope with change through changes in characteristics or behavior.

Assets The tangible and intangible things people or communities value. Assets may include people, buildings, resources, ecosystems, infrastructure and the services they provide.

Base Flood Elevation (BFE) The elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year (sometimes referred to as a 100-year flood event). The BFE is shown on the Flood Insurance Rate Map (FIRM) for zones AE, AH, A1–A30, AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO, V1–V30 and VE.

Baseline analysis A study of current conditions (e.g., environmental, social, economic) to identify the starting point for a given activity such as a plan or project so that future progress can be measured and compared to the starting point.

Capital improvement or investment Major, non-recurring physical expenditures such as land, buildings, public infrastructure and equipment.

Capital Improvement Plan (CIP) A community planning and fiscal management tool used to coordinate the location, timing and financing of capital improvements over a multiyear period.

Climate change The long-term pattern of oceanic and atmospheric conditions at a location. Climate is described by statistics, rather than single events or even single seasons. These statistics include: means and extremes of temperature, precipitation and other variables; and the intensity, frequency and duration of weather events such as hurricanes. Over Earth's history, indications of climate change have been recorded in fossils and ice core samples. At one extreme, climate change can result in extended periods of heat and drought; at the other, an ice age. Currently, our planet's global surface temperature is rising. This change is linked to human activities that increase the amount of greenhouse gases (e.g., carbon dioxide and methane) in the atmosphere.

Climate-related hazards A process, phenomenon or event related to changes in weather and climate that may cause disruption, degradation, damage or other impacts to people, infrastructure, systems, the environment, organizations or activities. We have always had hurricanes, floods, landslides, wildfires, drought and diseases, but climate change can increase the intensity, frequency, and duration of these events.

Climate Risk Assessment and Resilience Plan The 2020 North Carolina Climate Risk Assessment and Resilience Plan is the state's most comprehensive effort to date, based on science and stakeholder input, to address North Carolina's vulnerability to climate change. Governor Roy Cooper's Executive Order 80 directed the NC Department of Environmental Quality to draft the plan, which describes the projected change in North Carolina's climate; climate justice impacts; state infrastructure, assets, programs, and services within critical sectors that are vulnerable and at risk to climate and non-climate stressors; actions currently underway; and recommendations for nature-based solutions to enhance ecosystem resiliency and sequester carbon in the state's natural and working lands.

Climate stressor A condition, event or trend related to climate variability and change that can exacerbate hazards.

Co-benefits Multiple positive outcomes arising from one action or group of actions. An example of co-benefits in the resilience context would be planting trees to reduce an urban heat island effect, which has the co-benefits of also reducing energy costs and stormwater runoff and beautification.

Community health assessment An examination of the health status of different population groups in a community. Assessing and monitoring community health builds resilience to the impacts of climate change by proactively providing people with the resources needed for improved physical and mental health during natural and climate disasters.

Community resilience The capacity of a community or business to prevent, withstand, respond to and recover from a disruption.

Compound flooding High water levels caused by more than one driver, such as when the effects of storm surge and riverine flooding due to high rainfall combine.

Comprehensive Economic Development Strategy (CEDS) A regional economic development plan required by the US Economic Development Administration (EDA) for an area to be designated as an Economic Development District and be eligible for certain types of federal funding. CEDS must be updated every five years and must incorporate the concept of economic resilience, defined as the ability of regions to anticipate, withstand, and bounce back from any type of shock, disruption, or stress that it may experience.

Consequence A result (usually negative) that follows from damage to or loss of an asset. Understanding potential consequences is an important part of determining risk.

Cooling degree days (CDDs) A measure of how hot the temperature was on a given day or during a period of days. A degree day compares the mean (the average of the high and low) outdoor temperatures recorded for a location to a standard temperature, usually 65° Fahrenheit (F) in the United States. The more extreme the outside temperature, the higher the number of degree days. A high number of cooling degree days generally results in higher energy use for cooling/air conditioning. A day with a mean temperature of 80°F is worth 15 CDDs. If the next day has a mean temperature of 83°F, it is worth 18 CDDs. The total CDDs for the two days is 33 CDDs.

Critical Facility Structures from which services and functions essential for victim survival, public safety and disaster recovery are performed or provided. Examples of critical facilities include shelters, emergency operation centers, hospitals, water and wastewater treatment facilities, and electric utility infrastructure.

Ecosystem A community or group of living organisms that live in and interact with each other in a specific environment.

Equity Fair access to livelihood, education and resources; full participation in the political and cultural life of the community; and self-determination in meeting fundamental needs.

Estuarine Relating to an estuary, which is a partially enclosed coastal body of brackish (slightly salty) water with one or more rivers or streams flowing into it, and with a free connection to the open sea.

Exposure The presence of people, assets and ecosystems in places where they could be adversely affected by hazards.

Freeboard The number of feet above the base flood elevation that a structure's lowest floor must be elevated or floodproofed to comply with state or community floodplain management regulations.

Floodplain Any land area susceptible to being inundated by floodwaters from any source.

Green bond A type of debt issued by public or private institutions to finance themselves. Green bonds commit the use of the funds obtained to an environmental project or one related to climate change.

Greenway A strip of undeveloped land near an urban area, set aside for recreational use or environmental protection.

Green infrastructure A type of nature-based solution, also sometimes referred to as low impact development, that replicates natural processes by using vegetation or enhancement and restoration of natural land and water flow patterns to slow, retain and absorb runoff rather than channeling and piping it into a waterway. Examples of green infrastructure for stormwater management include rain gardens, wetlands, bioswales and green roofs.

Grey infrastructure Human-made, engineered assets that provide one or multiple services required by society, such as transportation or wastewater treatment. Examples of grey infrastructure used for stormwater management include gutters, drains, pipes and retention basins.

Hazard An event or condition that may cause injury, illness or death to people or damage to assets.

Hazard mitigation plan Mitigation planning is the process of understanding the risks from natural or human-created hazards and developing long-term strategies to reduce the impacts of future events on people, property and the environment. Federal law requires states, local governments and tribes to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance through the Hazard Mitigation Assistance Programs.

Heat island effect Higher temperatures experienced by developed and urban areas compared to rural and undeveloped areas due to heating of human-made surfaces.

High water mark The point that represents the maximum rise of a body of water over land.

Hot spot A place of significant activity or danger.

Impacts Effects on natural and human systems that result from hazards. Evaluating potential impacts is a critical step in assessing vulnerability.

Impervious surface A hard surface on a property that does not allow rain to soak into the ground. Examples include roofs or poured concrete sidewalks.

Land use A term used to describe the ways humans affect land. Common categories of land use include residential, agricultural, commercial and mixed use (when more than one land use is combined).

Living shorelines Human constructed areas along the edges of waterbodies and waterways made of natural materials such as plants, sand and rock that are designed to protect and stabilize the area. Living shorelines assist in erosion control, restore coastal habitat, mitigate coastal flooding, improve water quality and serve as an education tool. Living shorelines grow over time and tend to experience less damage during storms than hardened shorelines because they reduce the intensity of waves.

Mitigation The action of reducing the severity, seriousness or painfulness of something. In the climate context, migitation refers to processes that can reduce the amount and speed of future climate change by reducing emissions of heat-trapping gases or removing them from the atmosphere.

Natural and working lands Lands that are managed for natural purposes or to support food, fiber or forestry production. Examples include public and private forests, cropland, pastureland, grassland, wetlands, salt marsh, recreational areas and natural and managed lands within urban and rural communities.

Nature-based solutions Sustainable planning, design, environmental management and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience. Examples include wetland restoration and protection; living shorelines; green roofs; rainwater harvesting with cisterns; suspended and other permeable pavement for plazas, parking areas, and sidewalks; rain gardens; and vegetated swales.

No Adverse Impact (NAI) determination or certification A floodplain management strategy that ensures the action of a community or property owner does not adversely affect the property and rights of others, which, in the floodplain management context, means that the proposed action will not increase flood risk for downstream property owners or communities.

No-rise certification A requirement that any project in a floodway must be reviewed to determine if the project will increase flood heights. An engineering analysis must be conducted before a permit can be issued, and the no-rise certification must be supported by technical data and signed by a registered professional engineer.

Non-climate stressor A change or trend unrelated to climate that can exacerbate hazards, such as population growth.

Physical vulnerability The likelihood of structures, infrastructure and natural environmental features to be negatively affected by a hazard.

Probability The chance of something happening. Probabilities have traditionally been determined from the historic frequency of events. With changing climate and the introduction of non-climate stressors the probability of hazard events also changes.

Projections Potential future climate conditions calculated by computer-based models of the Earth systems. Projections are based on sets of assumptions about the future (scenarios) that may or may not be realized.

Qualitative Describes the qualities or characteristics of something using words and images.

Quantitative Describes the nature of something using numbers, statistics, modeling or other numerically-measurable factors.

Resilience The capacity of individuals, a community, business or natural environment to prevent, withstand, respond to and recover from a disruption.

Repetitive Loss property A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978.

Risk The potential total cost if something of value is damaged or lost, considered together with the likelihood of that loss occurring. Risk is often evaluated as the probability of a hazard occurring multiplied by the consequence that would result if it did happen.

Sea level rise The average increase in the water level of the Earth's oceans due to melting ice sheets and glaciers and the expansion of seawater due to higher temperatures; both of which are caused by climate change.

Social vulnerability The likelihood of communities to be negatively impacted when confronted by external stresses on human health, housing or livelihood from natural or human-caused disasters or from disease outbreaks.

Special flood hazard area A term used by the Federal Emergency Management Agency and in Flood Insurance Rate Maps to define the area that will be inundated by a flood event having a 1% chance of occurring in any given year (this is sometimes referred to as the 100-year flood zone).

Stakeholder Decision-makers who would be involved in assessing vulnerability or implementing adaptation strategies.

Storm surge An abnormal rise in water level during a storm, over and above the predicted astronomical tide. The surge is primarily caused by winds pushing water onshore.

Uncertainty A state of incomplete knowledge. Uncertainty about future climate conditions arises from the complexity of the climate system and the ability of models to represent it, as well as the inability to predict the decisions that society will make.

Vulnerability The likelihood or predisposition of assets to be negatively affected by hazards. The concept of vulnerability combines exposure, sensitivity, potential impacts and adaptive capacity.

Vulnerability assessment An analysis of the likelihood and extent of climate hazard impacts to negatively affect people, places, and infrastructure in a given community or place. This analysis usually considers both the location and condition of people, places, and infrastructure.

Vulnerable communities Urban and rural populations that are particularly threatened by extreme weather events, such as flooding and wildfire, or long-term ecosystem changes, such as saltwater intrusion or coastal erosion.

Watershed Area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.

Wildland-urban interface The area of transition between unoccupied land and human development.

ACRONYMS

ACRONYMS

Acronym	Full Name
CIP	Capital Improvement Plan
CFM	Certified Floodplain Manager
CDC	Centers for Disease Control and Prevention
CEJST	Climate and Economic Justice Screening Tool
CAMA	Coastal Area Management Act
CEDS	Comprehensive Economic Development Strategy
CRS	Community Rating System
COG	Council of Governments
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FRIS	Flood Risk Information System
GIS	Geographic Information Systems
THIRA	Threat and Hazard Identification and Risk Assessment
NFIP	National Flood Insurance Program
NC DEQ	North Carolina Department of Environmental Quality
NC DHHS	North Carolina Department of Health and Human Services
NC DOI	North Carolina Department of Insurance
NC DPS	North Carolina Department of Public Safety
NC DNCR	North Carolina Department of Natural and Cultural Resources
NC DOT	North Carolina Department of Transportation
DCM	North Carolina Division of Coastal Management (a division of NC DEQ)
NCEM	North Carolina Emergency Management (a division of NC DPS)
NCORR	North Carolina Office of Recovery and Resiliency (a division of NC DPS)
NCSU	North Carolina State University
NOAA	National Oceanic and Atmospheric Administration
RISE	Regions Innovating for Strong Economies and Environment
STEM	Science, technology, engineering, and math
SLOSH	Sea, Lake, and Overland Surges from Hurricanes
SVI	Social Vulnerability Index (CDC)
SFHA	Special Flood Hazard Area
UNC	University of North Carolina
US DOE	US Department of Energy
US DOT	US Department of Transportation
US EDA	US Economic Development Administration
US EPA	US Environmental Protection Agency
US HHS	US Department of Health and Human Services
US HUD	US Department of Housing and Urban Development
USGS	US Geological Survey
WUI	Wildland-urban interface

PHOTO CREDITS

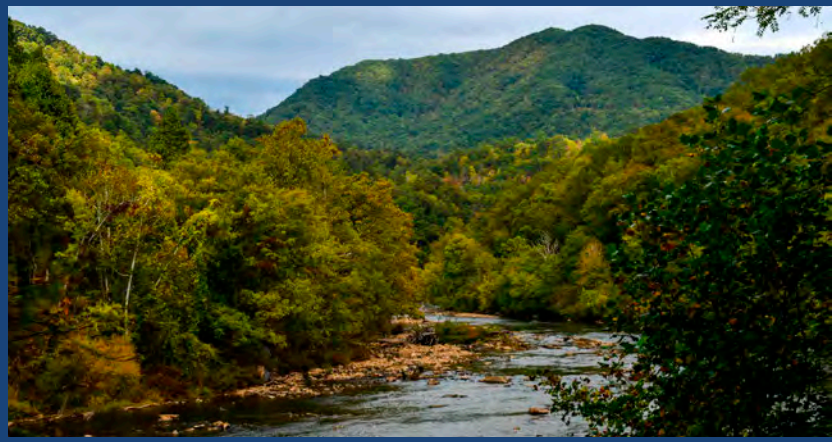

PHOTO CREDITS

Cover far left: Photo of Currituck County farm field, courtesy of Holly White.

Cover, second from left: Photo of downtown Durham, courtesy of Discover Durham.

Pg. I: Photo of families swimming in Haywood County, courtesy of Visit NC Smokies.

Pg. IV: Photo of paddlers on the Coharie River, courtesy of NC Coastal Dynamics Design Lab.

Pg. VI: Photo of a farm in Haywood County, courtesy of Visit NC Smokies.

Playbook

Playbook cover page: Photo of Strategic Buyout Program Community Information meeting in Canetuck, Pender County (July 2023).

Pg. V1-4: Photo of Coquina Beach, Cape Hatteras National Seashore, courtesy of The Outer Banks Visitors Bureau.

Pg. V1-13: Photo of swimming in Haywood County, courtesy of Visit NC Smokies.

Pg. V1-17: Photo of downtown Edenton, courtesy of Visit Edenton.

Pg. V1-20: Photo of Harmful Algal Bloom Summit (Nov. 2023).

Pg. V1-27: Photo of Washington County Resilient Coastal Communities meeting (March 2024), courtesy of Holly White.

Pg. V1-29: Photo of Maggie Valley trail riding, courtesy of Visit NC Smokies.

Pg. V1-34: Photo of motorcycles traveling on mountain bridge, courtesy of Visit NC Smokies.

Pg. V1-37: Photo of debris pile up in Deep River during flood stage, courtesy of Marlena Byrne.

Pg. V1-45: Photo of Lake Jordan ghost forest, courtesy of Marlena Byrne.

Pg. V1-56: Photo of a handmade sign at Surf City, courtesy of Janet Kelly-Scholle.

Pg. V1-58: Photo of downtown Waynesville, courtesy of Visit NC Smokies.

Pg. V1-61: Photo of Jockey's Ridge living shoreline, courtesy of Nita Coleman.

Pg. V1-66: Photo of New Bern festival scene, courtesy of Visit New Bern.

Pg. V1-75: Photo of Corolla beach during winter, courtesy of Holly White.

Pg. V1-77: Photo of Elizabeth City panoramic view, courtesy of Holly White.

Pg. V1-83: Photo of Buxton ocean erosion and sandbags (April 2024), courtesy of Holly White.

Pg. V1-85: Photo of Croatan National Forest wetlands, courtesy of Marlena Byrne.

Pg. V1-86: Aerial photo of Bodie Island lighthouse, courtesy of Outer Banks Tourism.

Pg. V1-88: Photo of downtown Hendersonville, courtesy of Sam Dean for Henderson County Tourism.

Pg. V1-91: Photo of Heat Management Protocol Workshop in Fayetteville (2023), courtesy of Holly White.

Pg. V1-93: Photo of boats in Oriental, courtesy of Holly White.

Pg. V1-94: Aerial photo of New Bern, courtesy of Visit New Bern.

Appendices

Appendices cover page: Photo of snowy mountain road, courtesy of Visit NC Smokies.

Pg. A-1: Photo of picnic area in Elizabeth City, courtesy of Elizabeth City.

Pg. B-1: Photo of the Pigeon River in Canton, courtesy of Visit NC Smokies.

Pg. B-12: Photo of Yeopim River moonrise, courtesy of Holly White.

Pg. B-18: Photo of Bridge over Deep River, courtesy of Marlena Byrne.

Pg. C-1: Photo of Bike MS event in New Bern, courtesy of Visit New Bern.

Idea Book

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Pg. V2-11: Photo of visitors enjoying oysters straight from the source, a NC Oyster Trail member and local aquaculture farm, courtesy of Justin Kase Conder.

Pg. V2-14: Photo of the Theodore Roosevelt Nature Area at the NC Aquarium at Pine Knoll Shores, courtesy of Dr. Amanda Martin.

Pg. V2-17: Photo of Nags Head Beach in Summer, courtesy of Holly White.

Pg. V2-23: Photo of the living shoreline at Sunset Beach three years after construction, courtesy of North Carolina Coastal Federation.

Pg. V2-24: Aerial photo of the living shoreline under construction, courtesy of Mark Evans, Eye in the Sky Drone Photography.

Pg. V2-26: Photo of volunteers passing bags of gravel for the base layer of the Sunset Beach living shoreline, courtesy of North Carolina Coastal Federation.

Pg. V2-28: Photo of the coordinating team posing at the central organizing hub on campaign day in Raleigh, courtesy of Nicole Goddard.

Pg. V2-29: Photo of State Climatologist Kathie Dello instructing Raleigh volunteer on how to attach sensor to car window, courtesy of Nicole Goddard.

Pg. V2-30: Photo of UHI campaign organizers preparing volunteer for data collection, courtesy of Tobin Freid.

Pg. V2-31: Photo of Raleigh volunteer attaching bike sensor to collect data on ambient temperature, humidity, longitude, latitude, speed and course, courtesy of Nicole Goddard.

Pg. V2-35: Photo of a streetscape in downtown Durham, taken with the FLIR camera, courtesy of Rachel Mutschler.

Pg. V2-36: Photo of Raleigh volunteers signing in for 6 a.m. data collection route, courtesy of Nicole Goddard.

Pg. V2-38: Photo of a streetscape in downtown Durham, courtesy of Reid Haithcock.

Pg. V2-49: Photo of NC Museum of Natural Sciences at Whiteville, courtesy of NC Museum of Natural Sciences.

Pg. V2-50: Photo of youth at the NC Museum of Natural Sciences in Raleigh working together to build a model climate resilient city, courtesy of Elise Mahon, UNC Office of Research Communications.

Pg. V2-54–V2-64: Spring views of the Jack Smith Creek Stormwater Wetlands, courtesy of Avery Smith.

Idea Book (cont'd)

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Pg. V2-81: Photo of community members participating in a 2020 listening session to understand what projects were included in the Floodprint and providing input on the specifics of each project (2020), courtesy of Claire Henkel.

Pg. V2-87: Photo of a rain garden, which was installed as a recommendation of the Princeville Community Floodprint to help manage stormwater runoff from the Princeville Elementary School building, courtesy of Conservation Trust for North Carolina.

Pg. V2-88: Photo of a Princeville student learning about pollinators from the Princeville Elementary School rain garden signage, installed as part of the environmental education goals of the Floodprint, courtesy of Conservation Trust of North Carolina.

Pg. V2-90: Photo of community members participating in a 2020 listening session, courtesy of NC State Coastal Dynamics Design Lab.

Pg. V2-104: Photo of the North Fork water dam after improvements financed with a green bond (2021), courtesy of City of Asheville (used with permission).

Pg. V2-117: Photo of Eatmon Townhomes, located in an area that suffered severe damage from Hurricanes Matthew and Florence. The townhome community was strategically built outside the 100-year floodplain, which will decrease the risk of future flooding, courtesy of NCORR.

Pg. V2-118: Photo of ribbon cutting ceremony for Wilson Housing Authority's Eatmon Townhomes Community project that includes 32 newly constructed two-story homes located outside of the floodplain, courtesy of Wilson Housing Authority.

Pg. V2-119: Photo of Eatmon Townhomes sign on the site of the development, courtesy of Wilson Housing Authority.

Pg. V2-122: Photo of a bike lane and three bioretention areas along Sandy Forks Road added by the City of Raleigh, courtesy of Tiffanie Mazanek, City of Raleigh.

Pg. V2-125: Photo of the plants and soil in the bioretention areas along Sandy Forks Road, which slow down the water and filter out pollution before it reaches a storm drain or creek, courtesy of Tiffanie Mazanek, City of Raleigh.

Pg. V2-129 and V-2-131 left: Photo of low maintenance plants in the median bioretention area on Sandy Forks Road, planted by the City of Raleigh, courtesy of Tiffanie Mazanek, City of Raleigh.

Pg. V2-130: Photo of the construction process of the median bioretention area along Sandy Forks Road, documented by the City of Raleigh, courtesy of Tiffanie Mazanek, City of Raleigh.

Pg. V2-131, right: Photo of the construction process of a large bioretention area along Sandy Forks Road, documented by the City of Raleigh, courtesy of Tiffanie Mazanek, City of Raleigh.

Pg. V2-132: Photo of the planted median along Sandy Forks Road collecting and cleaning stormwater runoff from the nearby road and sidewalks, courtesy of Tiffanie Mazanek, City of Raleigh.

Pg. V2-137: Photo of damage to Wilson Road in Brevard following heavy rains and flooding of the French Broad River in May 2018, courtesy of Aaron Bland.

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Pg. V2-143: Photo of the elevation of mobile homes in Brevard to come into compliance with the updated Flood Damage Prevention Ordinance, courtesy of Brad Burton.

Pg. V2-157: Photo of the Elizabeth River spilling over its hardened shoreline onto Mowbray Arch in Norfolk, Va., during a storm. Norfolk is the second largest population center at risk from sea level rise, behind New Orleans. (July 2017), courtesy of Skyler Ballard/Chesapeake Bay Program.

Pg. V2-171: Photo of examples of summer heat educational and promotional items distributed by the NC DHHS Climate and Health Program. Items pictured include electrolyte packets, a cooling towel and a National Weather Service Heat Index Magnet, courtesy of Dr. Virginia Guidry.

Pg. V2-174: Photo of a graphic of the five-step Building Resilience Against Climate Effects (BRACE) framework that guides health practitioners as they "develop strategies and programs to help communities prepare for the health effects of climate change," courtesy of Centers for Disease Control and Prevention.

Pg. V2-176: Photo of the rain garden at the Roanoke Island Aquarium, courtesy of Dare County Soil and Water.

Pg. V2-179: Photo of the Cavalier Apartments in Charlotte during the 2008 flood from Tropical Storm Fay, courtesy of Charlotte-Mecklenburg Storm Water Services.

Pg. V2-185: Aerial photo of the Hidden Valley Community where Charlotte-Mecklenburg Storm Water Services purchased eight homes through the local floodplain buyout program, courtesy of Charlotte-Mecklenburg Storm Water Services.

Pg. V2-186: Photo of rescuers from at Cavalier Apartments in Charlotte during the 2008 flood from Tropical Storm Fay (2008), courtesy of Charlotte-Mecklenburg Storm Water Services.

Pg. V2-187: Photo of Charlotte-Mecklenburg Storm Water Services team member showing off an educational kiosk installed at the Chantilly Ecological Sanctuary, which was established on the land where the Cavalier Apartments were located prior to the Charlotte-Mecklenburg Storm Water Services' purchase of the property, courtesy of Charlotte-Mecklenburg Storm Water Services.

Glossary

Glossary cover page: Photo of Edenton Bay tour boat, courtesy of Visit Edenton.

Acronyms

Acronym cover page: Photo of flooding at Nags Head, courtesy of Holly White.

RESILIENT COMMUNITIES PLANNING GUIDE

NORTH CAROLINA OFFICE
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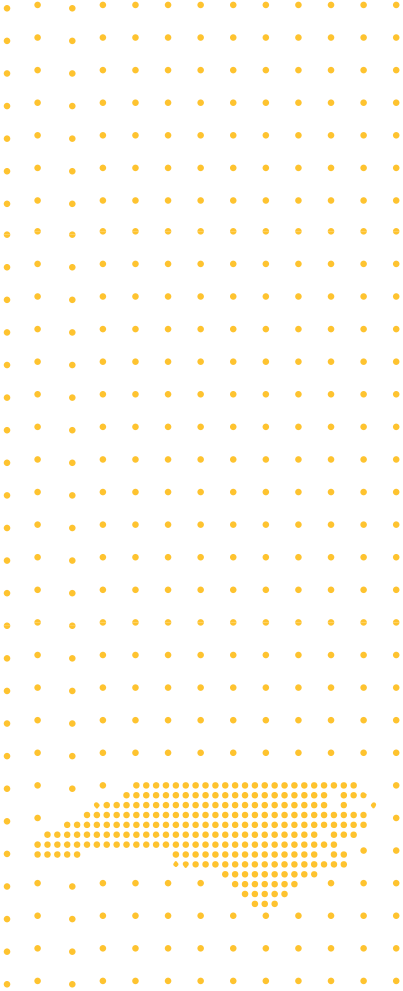

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