

Recipe for Resilience:

Ingredients, Flavors, and Approaches

Jessica C. Whitehead, Ph.D
North Carolina Sea Grant

Southeast N.C. Regional Resilience Workshop
May 14, 2019





COASTAL RESILIENCE

Bouncing back & *building beyond.*

PLAN & BUILD RESILIENCE

Develop and implement plan to become more resilient.



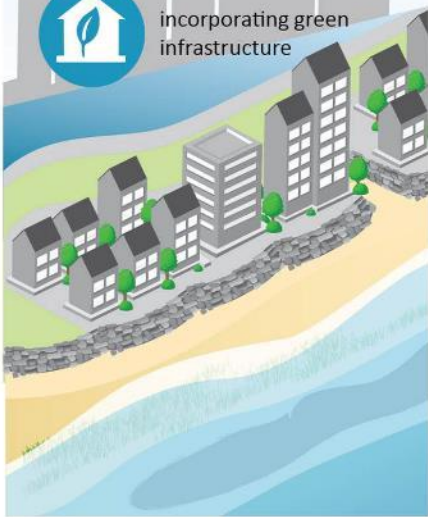
improving forecasts, observation models, computer systems



getting information to decision makers faster



incorporating green infrastructure



DISASTER STRIKES

Disasters can be imminent or strike unexpectedly.



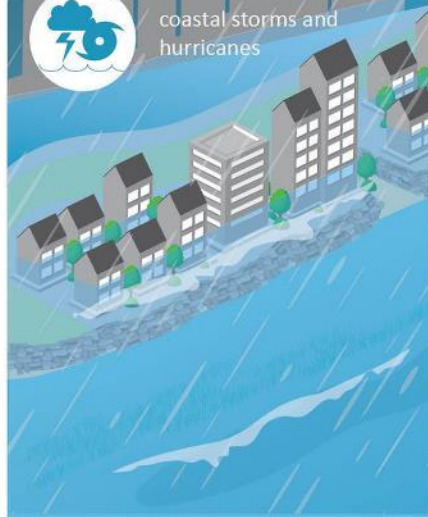
sea level rise



tsunamis



coastal storms and hurricanes



RESPOND

Immediately take action following a disaster.



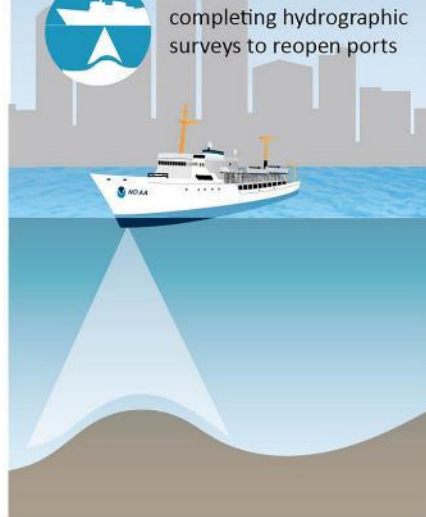
pollution response



damage assessment imagery



completing hydrographic surveys to reopen ports



RECOVER

Assess resilience and manage adaptively.



assessing damage to communities, economy, and environment



issuing grants to rebuild and restore habitat



providing data and tools for analysis



Assess resilience and begin planning for the next disaster.

Building resilience is an iterative process.



portal.ncdenr.org/web/mf/shellfish-sanitation



*Climate change
exacerbates the things
you already manage*



earthobservatory.nasa.gov/NaturalHazards/view.php?id=20059



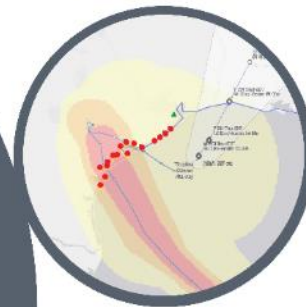
Awareness



Monitoring and Evaluation



Assessment



2018

2014



**Leadership, Partnerships,
Stakeholder Engagement**



Implementation



Planning

([NCA 2018](#))

Principles of Effective Resilience Plans

Principle	Definition	Components of Principle
Goals	Future desired conditions	Plan purpose, vision, goals, and objectives
Fact Base	Empirical foundation that identifies and prioritizes issues to ensure that strategies are well informed	Data sources; analysis of current conditions; climate change exposure; vulnerability and risk assessment
Strategies	Guide to decision making to assure plan goals are achieved	Capacity building, land use, green infrastructure etc.; cost and co-benefits of strategy options; prioritization of strategies
Public Participation	Recognition of actors engaged in preparing the plan	Description of planning process and techniques to engage stakeholders; Identify individuals involved in preparation of the plan
Coordination	Recognition of the interdependent actions of multiple organizations and the need for coordination	Engagement of local universities, state agencies, businesses, neighboring jurisdictions, etc. in the planning process
Implementation and Monitoring	Guidance to translate plan strategies into action and track progress towards goals	Organizational responsibilities, timelines, and funds for implementation and monitoring
Uncertainty	Plans recognition of and approaches to overcome uncertainty in future climate projections	Recognize sources of uncertainty; consider multiple future scenarios; flexible, robust, or no-regret strategies

(S. Woodruff, 2019, National Adaptation Forum)

Planning to adapt?

It's a bit more like planning a dinner party.



-bear with me here

Mariner's Menu

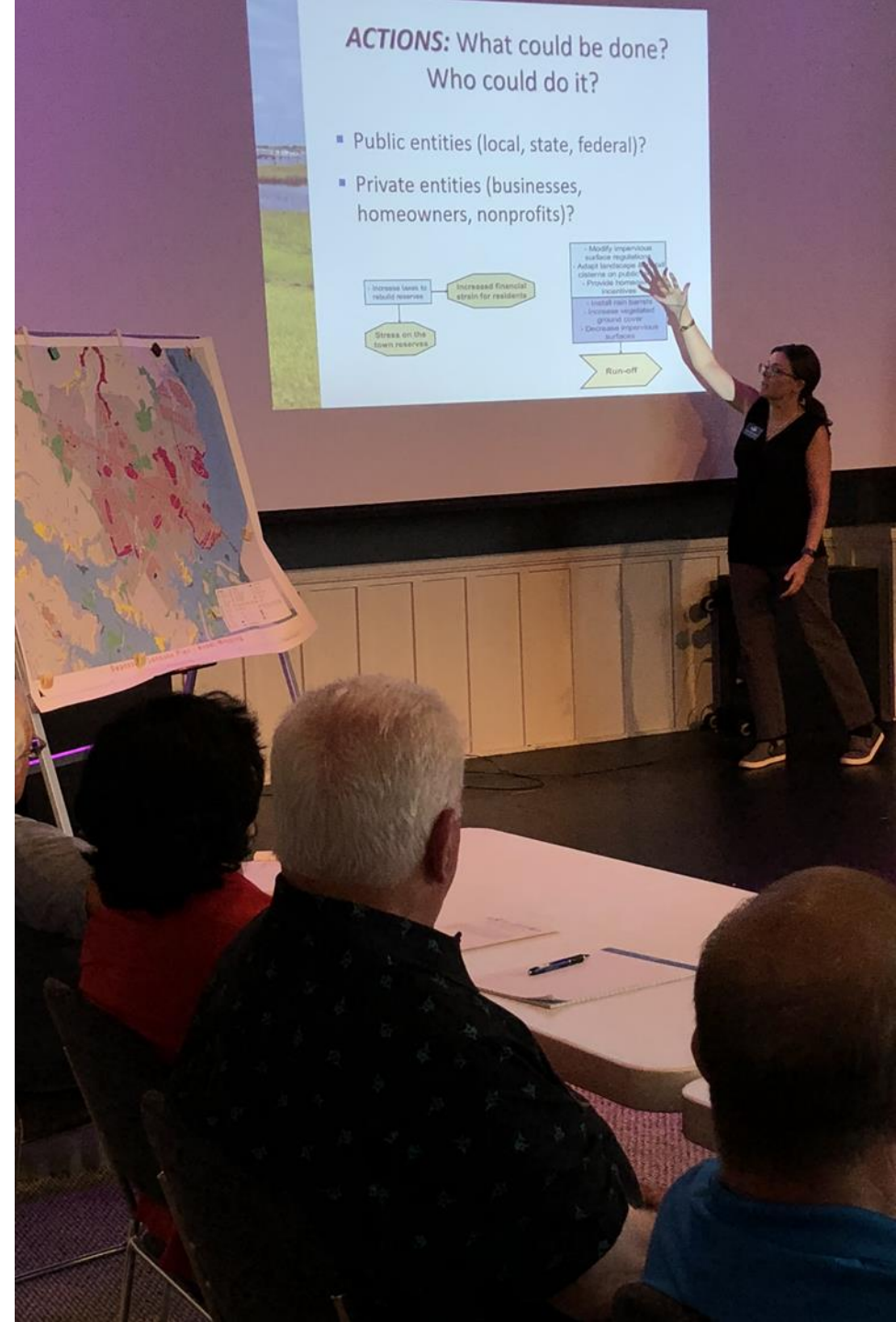
30 YEARS OF FRESH SEAFOOD IDEAS


BY JOYCE TAYLOR

EDITED BY SARAH FRIDAY PETERS • PUBLISHED BY NORTH CAROLINA SEA GRANT
PHOTOGRAPHS BY SCOTT D. TAYLOR • ILLUSTRATIONS BY CONNIE MASON

ADAPTATION PLANNING:

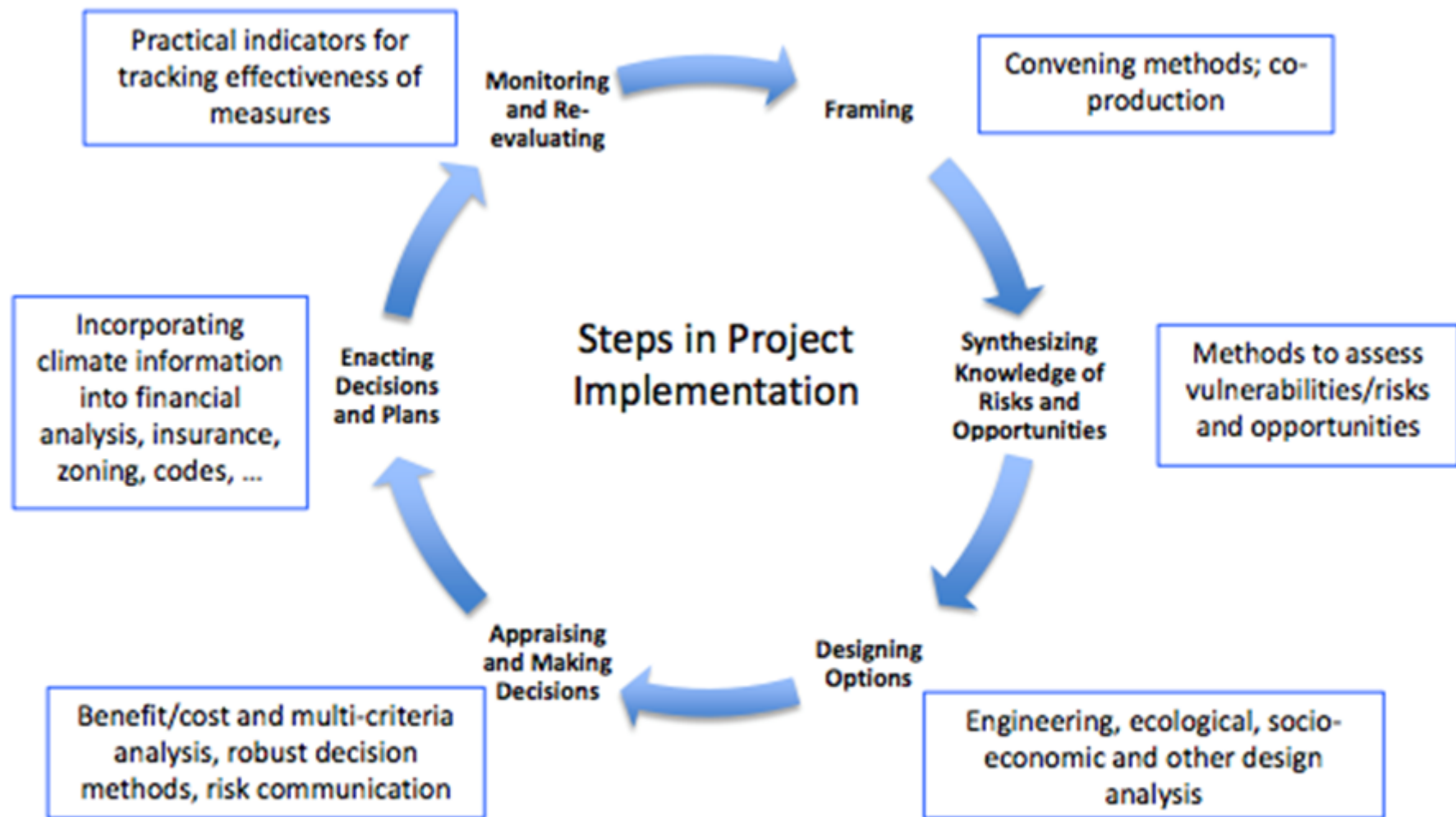
- Setting a goal for the process
- Determining right participants
 - Getting them there
- Think about your menu
 - Add resilience lens to existing grants
 - Prioritize assets available/at risk
 - Prioritize your community will accept
 - How much work you really want to put into it
- Who will monitor, implement, and adjust



An aerial photograph showing a two-lane asphalt road with a yellow dashed center line. To the left of the road is a grassy area with a utility pole. To the right is a narrow waterway or canal that winds through a wetland area with green and yellowish vegetation. A yellow diamond-shaped sign is visible on the right side of the road. A semi-transparent white rectangular box is overlaid on the right side of the image, containing the text.

How can you
transform what
you are already
doing for
resilience?

Photo: Baxter Miller/RISING



Moss et al. 2019: Evaluating Knowledge to Support Climate Action: A Framework for Sustained Assessment; Report of an Independent Advisory Committee on Applied Climate Assessment (<https://journals.ametsoc.org/doi/pdf/10.1175/WCAS-D-18-0134.1>)

Building Retrofits & Weatherization

- Retrofitting homes and businesses to have more energy and cost efficient fixtures can help save money to invest in other resilience measures (elevating structure, purchasing a back-up generator, etc.)
- Example: Coastal Community Action – Weatherization Assistance Program

Weatherization Assistance



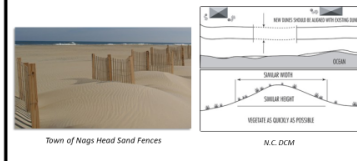
Elevating Water Utility and Transportation Assets

- Changes like elevating critical and vulnerable transportation routes above the level of potential floodwaters, or ensuring access to critical water facilities ensure that these services and public infrastructure are designed for their lifespan and account for future conditions.
- New construction or repairs should consider the future risks of sea level rise and other hazards using scenario planning when possible



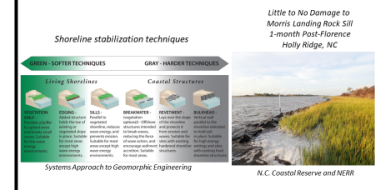
Dune Management

- Sand dunes provide a natural buffer against the erosive forces of wind, water and waves. Sometimes it's necessary to stabilize or strengthen existing sand dunes or build new ones to protect oceanfront buildings and roads.
- Dune establishment and stabilization projects must be thoughtfully planned and carried out to avoid damaging the beach and dune system.



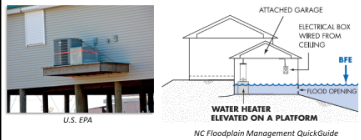
Marsh Sills: A Type of Living Shoreline

- Shoreline stabilization technique using natural habitat elements (e.g. tall grasses and wetlands) that increases resilience to coastal erosion and flooding
- Traps sediment reducing wetland or marsh edge loss, dissipates wave energy and storm surges, provides ecosystem services
- *NEW* Marsh Sill General Permit (15A NCAC 7H .2700)



Elevating Critical Components Above BFE

- Unlike entire buildings or structures, elevating critical components like HVAC, electrical panels, and back-up generators can ensure key assets (e.g. pump station or other) aren't completely compromised during a flood.
- A higher design flood elevation standard may be appropriate for critical facilities rather than for single-family homes.



Low Impact Development (LID) & Green Infrastructure

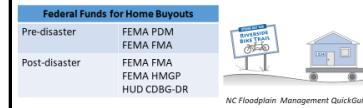
- Replacing impervious surface with natural features allows for more effective water quantity and quality management

- Example measures include:**
- Downspout Disconnection
 - Rainwater Harvesting
 - Rain Gardens
 - Planter Boxes
 - Bioswales
 - Permeable Pavements
 - Green Streets and Alleys
 - Green Parking
 - Green Roofs
 - Urban Tree Canopy
 - Land Conservation



Pre- & Post-disaster Home Buyout Program

- A form of hazard mitigation
- Property owner gets paid fair-market value (pre-storm) to have home demolished and kept as open space in perpetuity falling under the ownerships of the municipality or county (unless a third party is arranged such as a community land trust, or the land is leased for \$1 to a neighboring resident).
- Buyout properties have been: restored as wetlands, reforested, turned into parks, pedestrian or biking trails, Frisbee golf courses, community garden space, or left vacant to be used as temporary excess parking space.



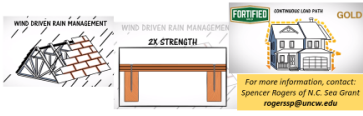
Habitat Conservation

- Public acquisition of undeveloped land lessens or prevents the impacts of flooding, keeps development out of risky areas and protects water resources.
- Communities can purchase land outright or use tools such as land use/regulation or easements to ensure flood prone areas are set aside.
- This strategy is most effective on a large scale with (1) identification or mapping of existing conservation areas and available open space, (2) prioritization of parcels and (3) acquisition of land.



FORTIFIED Roof/Building Construction

- FORTIFIED is a nationally recognized building method and standard (3 levels: Roof, Silver & Gold) based on observations by the Insurance Institute for Business and Home Safety (IBHS)
- It is code-plus and exceeds the vast majority of building codes by improving the performance of buildings against natural hazards and reducing the risk of personal property losses.
- A FORTIFIED Evaluator is the only professional who can help you earn a FORTIFIED Designation and take advantage of all the programs benefits.
- The program starts by focusing on the roof, which is the most important and vulnerable part of every building.
- The FORTIFIED Commercial Program makes new and existing commercial buildings more resistant to damage from severe weather

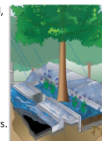


Urban Forest and Tree Management

A single tree may store 100 gallons or more of rainfall, and it is estimated that the urban forest can reduce annual runoff by 2 to 7 percent.

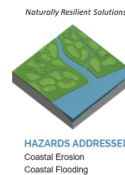
Trees offer many advantages to an urban landscape:

- Raise the attractiveness of an urban area.
- Form part of the ambience of shopping districts.
- Shade a pedestrian walkway or open-air mall.
- Draw businesses, such as shops and street vendors.
- Revive blighted urban areas.
- Keep city streets cooler and reduce indoor air conditioning costs.
- Filter pollutants from the air and provide oxygen.
- Reduce stress and otherwise improve health.
- Offer shade for seating, children's play areas and other recreation sites.
- Reduce stormwater runoff.
- Provide respite from the heat and opportunities for social gathering as pocket parks and squares.
- Provide recreational opportunities and wildlife corridors, such as urban river walks and other tree-lined routes.
- Provide habitat for birds and other wildlife.



Coastal & Wetland Restoration

- Natural features like coastal marsh and wetlands can absorb flood waters and provide a buffer to coastal communities from flooding, erosion and storm surge.
- Coastal marshes provide flood protection, shoreline stabilization, erosion control, and protect water quality by filtering water.
- Wetlands mitigate floods and droughts, purifying and storing surface water.
- Restoring these areas allow for storage of water increasing the overall ability of a system to handle extreme weather.



Other Examples? Insert Sticky Note Below

- Provide description of how it contributes to future resilience, where it occurs, as well as what partners are involved

These types of actions usually fall into one of four categories: **#1. Avoid** (prohibit or discourage putting infrastructure in harm's way); **#2. Accommodate** (build/retrofit so asset can maintain critical function during disruption); **#3. Protect** (installing barriers to reduce hazard exposure) and **#4. Relocate** (retroactively moving critical infrastructure and through voluntary programs, homes and businesses out of harm's way).

Comprehensive/ CAMA Land Use

- Description:** 20- to 30- year planning horizon, tackling broad scope of community goals by guiding future growth, development, and land use; includes significant public engagement
- Requirement:** Yes, for Coastal Area Management Act (CAMA) communities per 15A NCAC 07B
- Resilience Connection:** Can provide fact-base, public engagement/education and policy guidance linking hazard mitigation, floodplain management, sea level rise projections, and long-term recovery to support development of regulations/higher standards and incentive programs



Hazard Mitigation Plan

- Description:** Includes a detailed hazard identification and risk assessment (HIRA) for residential and commercial buildings, critical infrastructure/assets.
- Requirement:** Yes, for FEMA funding eligibility (PDM, FMA, HMGP, etc.)
- Resilience Connection:** Provides analysis to justify investment in pre- and post-disaster mitigation or adaptation actions to reduce risk posed by natural hazards, including those exacerbated by climate change (coastal flooding and sea level rise)



Open Space and Recreation Plan

- Description:** Developed to protect and enhance community open space resources
- Requirement:** No, but can receive FEMA Community Rating System points
- Resilience Connection:** Can absorb and store water with natural features, and coastal open spaces (such as wetlands and marsh) can act as erosion and wave buffers. Equitable access to open spaces/recreation can lead to better public health outcomes thereby reducing vulnerability. May tie into flood buyout or future transfer of development rights program.



Beach/Shore Protection Management Plan

- Description:** Up to 50-yr planning horizon, outlining strategies for actual and potential coastal erosion and its relation to planned or existing development activities on the coast. Plans focus on projects with minimal environmental harm; ideally regional & self-sustaining.
- Requirement:** Yes, to be eligible for FEMA Public Assistance per 44 CFR 206.225(j)(2)
- Resilience Connection:** Often the primary strategy for reducing risks to beach communities associated with ocean-front erosion caused by storms; projected elevation profile should account for sea level rise scenarios; an important example of pre-disaster recovery planning



Capital Improvements Plan (CIP)

- Description:** 4- to 6-year plan identifying capital projects (stormwater, transportation, water supply, and other infrastructure) and forecasting funding.
- Requirement:**
- Resilience Connection:** Can leverage funding to implement hazard mitigation measures that take future conditions into account and provides opportunity to review and consider the impact of proposed improvements on hazard vulnerability (e.g. guide new growth to safer areas); legal question of abandoning or not repairing vulnerable infrastructure post-disaster.



Pre- or Post-Disaster Recovery Plan

- Description:** Ideally done during 'blue-sky' conditions, this type of plan identifies policies, operational strategies, and roles and responsibilities for implementation that will guide decisions that affect long-term recovery and redevelopment of the community after a disaster
- Requirement:** No
- Resilience Connection:** Planning for recovery before a disaster can lead to a faster, more efficient and more equitable recovery, allow a community to 'build back better', and provides more local control over the lengthy and complicated recovery process.



Watershed Restoration Plan

- Description:** aims to identify causes of impairment and pollutant sources, necessary nutrient load reduction levels and management measures and other components to increase favorable water quality and quantity outcomes that support a healthy environment and economy
- Requirement:** Yes, to be eligible for 319(h) grant funding
- Resilience Connection:** maintaining and restoring the natural functions of watersheds and their floodplains can reduce flood risks and, enhance natural habitat and protect a variety of economic interests (aquaculture, beaches, etc.)



Floodplain Management Plan

- A localized floodplain management plan that goes beyond a regional hazard mitigation plan to conduct a risk assessment that identifies and profiles flood hazards that pose a risk to the community, assesses community vulnerability to these hazards, and examines the capabilities in place to mitigate them. The flood hazards typically profiled in this type of plan include:
 - Climate Change and Sea Level Rise (1-3 ft)
 - Dam/Levee Failure
 - Flood: 100-/500-year
 - Flood: Stormwater/Localized Flooding
 - Hurricane and Tropical Storm
 - Stream Bank Erosion
- Results and recommendations from this type of effort should account for future conditions (more extreme rainfall events, higher sea levels & storm surge, etc.) and inform updates to other plans and ordinances guiding development or investment.



Other Examples? Insert Sticky Note Below

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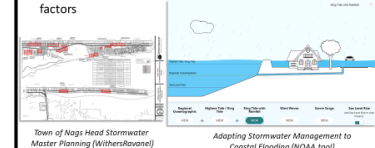
Economic Development or Waterfront Master Plan

- Economic prosperity and opportunities are key to building a community's resilience to disruptions caused by major events or slow-onset stressors
- Ensuring that goals, policies, and incentives used for economic development purposes are aligned and do not conflict entirely with hazard mitigation or disaster recovery activities
- Strategic placement, relocation, reinvestment, and infrastructure retrofits of key assets can help achieve multiple resilience goals



Stormwater Master Plan

- Description:** a long-term strategy to reduce flood damages and water quality issues associated with outdated or inadequate stormwater drainage systems
- Requirement:** No, unless an MS4 community
- Resilience connection:** increasing extreme rainfall events, higher sea levels, and storms put stress on stormwater infrastructure built before there was a clear picture of flood risks. New investments should try to take into account these factors



A successful approach to resilience depends on incorporating *future* conditions/scenarios as well as *integrating across plans* where feasible to maximize *co-beneficial* policies/actions and staff capacity and minimize conflicting actions.

Set the table for adaptation

- Set goals that incorporate local knowledge and values
- Create a climate for conversation
- Use an adaptation lens on existing funding proposals
- Tailor data to local needs
- Make implementation feasible through prioritizing steps





Questions?

Jessica Whitehead, Ph.D.

j_whitehead@ncsu.edu

@JCWClimate

(NCORR Contact Email TBD)



Photo: Baxter Miller/RISING