North Carolina Natural and Working Lands Action Plan

2024 Progress Report

Reporting on activities of January 2021 to June 2024

I. Introduction

The 2024 Natural and Working Lands Action Plan Progress Report is guided by Executive Order 305: An Order to Protect and Restore North Carolina's Critical Natural and Working Lands[1] and provides a review of recommendations from the 2020 Natural and Working Lands Action Plan, status updates on implementation of those recommendations, and a path forward for protecting and restoring natural and working lands in North Carolina. This Progress Report is reporting on activities between January 2021 and June 2024.

2020 Natural and Working Lands Action Plan Background

In 2020, the State of North Carolina published the North Carolina Natural and Working Lands Action Plan ("2020 NWL Action Plan") that provided recommendations for North Carolina to both sequester carbon and build resilience by leveraging the land-use sector. The 2020 NWL Action Plan provided twenty-five key recommendations to protect, restore, and enhance North Carolina's key land cover types, including forest lands, floodplains, wetlands, pocosins, coastal habitats, agriculture, and urban lands.

The 2020 NWL Action Plan development began in 2018, when the North Carolina Department of Environmental Quality ("DEQ") convened a NWL Stakeholder Group consisting of private and public landowners and managers, scientists, policymakers, and planners from state and local governments, universities, consulting firms, and nonprofit organizations to discuss potential carbon sequestration opportunities available in the NWL sector. At the end of the December 2018 meeting, the group resolved to build an NWL action plan. Subcommittees met over a nine-month period in 2019 to develop a set of recommendations for actions North Carolina could take to both sequester carbon and build resilience to extreme weather events through the NWL sector while being actionable and pragmatic. The NWL Stakeholder Group developed the plan and recommendations using the guiding principles illustrated in Tables 1 and Table 2.

Table 1: 2020 Natural and Working Lands Action Plan Stakeholder Shared Goals

No.	Shared Core Goal
1.	Enhance the ability of NWL to sequester carbon and mitigate GHG emissions.
2.	Build resilience in ecosystems and communities.
3.	Provide public health and ecosystem co-benefits.
4.	Create economic opportunities for agribusiness, recreation, and tourism.
5.	Ensure implementation of any action is a socially equitable process.

[1] Executive Order No. 305: An Order to Protect and Restore North Carolina's Critical Natural and Working Lands. 2024. https://governor.nc.gov/executive-order-no-305

Table 2: 2020 Natural and Working Lands Action Plan Recommendation Parameters

No.	Recommendation Parameters
1.	Develop actions with large potential for both carbon benefits and resilience.
2.	Focus on realistic options for North Carolina in the near-term by leveraging existing programs, authorities, resources.
3.	Utilize cost-effective and pragmatic solutions.
4.	Investigate long-term actions to create new and larger opportunities for NWL climate mitigation and resilience.

Along with providing recommendations, the 2020 NWL Action Plan included background information on the current academic literature on NWL, the economic value of leveraging NWLs, landcover maps that show future opportunities, and other North Carolina- tailored NWL resources.

Directives and Support for the Natural and Working Lands Action Plan and Progress Report

This 2024 NWL Action Plan Progress Report discusses developments since the 2020 NWL Action Plan publication, status reports on 2020 recommendations, and pathways forward in preparation for the 2027 NWL Action Plan Progress Report as directed by Executive Order 305.

Executive Order 80: North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy

In October of 2018, Governor Roy Cooper issued Executive Order 80.[2] The Executive Order presents Governor Roy Cooper's goals to reduce the impacts and risks of climate change in the state by 2025. Two of the primary goals are 1) to reduce statewide GHG to 40% below 2005 levels and 2) develop the North Carolina Climate Risk Assessment and Resilience Plan.[3] The 2020 NWL Action Plan was developed as an appendix chapter to the North Carolina Climate Risk Assessment and Resilience Plan.

Executive Order 246: North Carolina's Transformation to a Clean, Equitable Economy

2024 Greenhouse Gas Inventory: A Current Status of NWL Emissions and Sequestration

In January 2024, the North Carolina Department of Environmental Quality ("DEQ") published the 2024 North Carolina Greenhouse Gas Inventory ("GHG Inventory") which updated historic and projected models for GHG sources and sinks in MMT CO2e.[4] The historic data measured emission sources and sinks

[2] Executive Order No. 80: North Carolina's Commitment to Address Climate Change and Transition to a Clean Energy Economy. 2018. https://governor.nc.gov/documents/executive-order-no-80-north-carolinas-commitment-address-climate-change-and-transition

[3] NC Climate Risk Assessment and Resilience Plan. https://www.deq.nc.gov/energy-climate/climate-change/nc-climate-change-interagency-council/climate-change-clean-energy-plans-and-progress/nc-climate-risk-assessment-and-resilience-plan

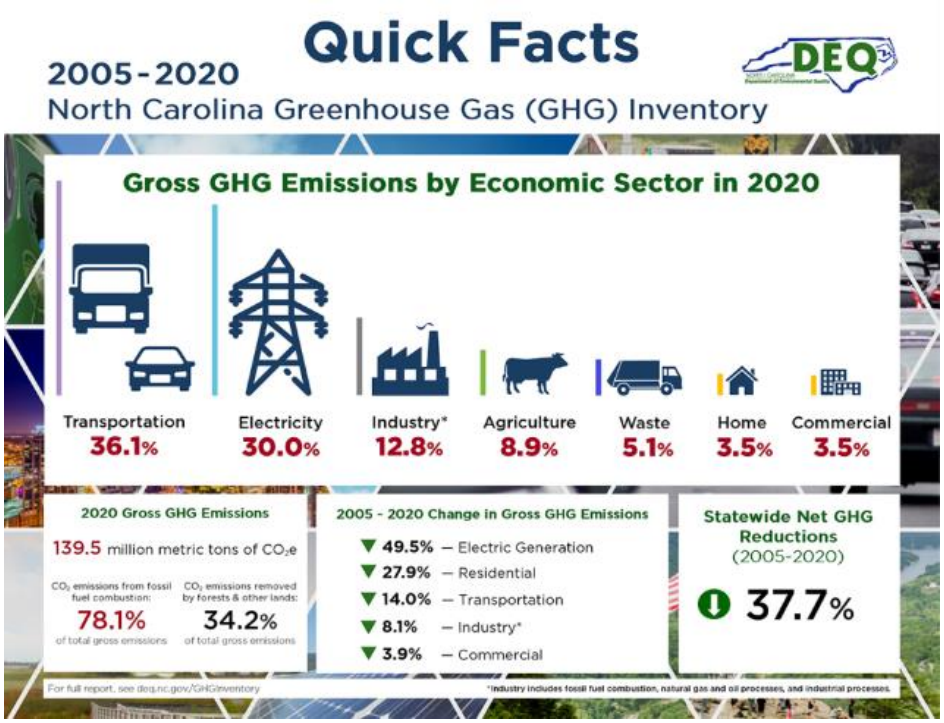
[4] North Carolina Greenhouse Gas Inventory. Department of Environmental Quality, 2024. https://www.deq.nc.gov/energy-climate/climate-change/greenhouse-gas-inventory

from 1990 to 2020 and annual projections of emission sources and sinks from 2021 to 2050. Overall, the GHG Inventory found that Land Use, Land-Use Change, and Forestry (LULUCF) sequestered an estimated 47.68 MMT of CO2e or 34% of total gross emissions in 2020, the most recent year for historical data.

To refine estimates for North Carolina, the North Carolina Coastal Habitats Greenhouse Gas Workgroup was formed to develop a new emissions inventory for coastal wetlands. The Workgroup utilized high-resolution federal land use and land cover data for coastal wetlands that have not yet been integrated into traditional GHG inventory methodologies like the State Inventory and Projection Tool produced by the Environmental Protection Agency ("EPA").

DEQ incorporated Workgroup estimates for estuarine coastal wetlands and estimates of GHG emissions and removals within high-salinity seagrass meadows, which are not inventoried.

Figure 1: North Carolina 2024 GHG Inventory Quick Facts Guide: Information on Greenhouse Gas Emission Sources and Trends in North Carolina



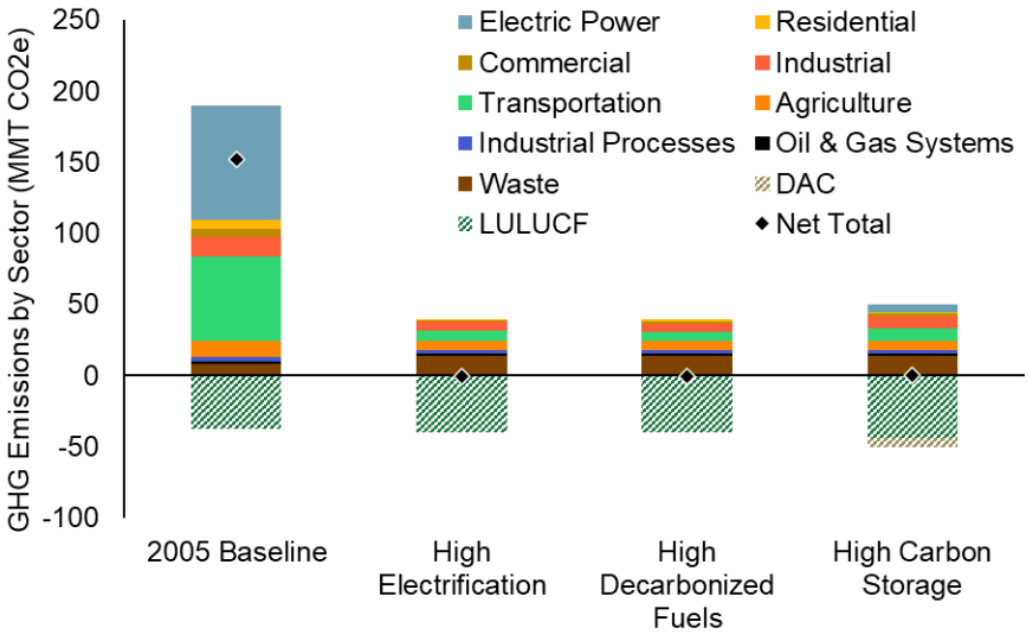
2023 Pathways Analysis: How to Get to Net Zero

Governor Cooper's Executive Order 246 directed the development of a Deep Decarbonization Pathways Analysis[5] ("Pathways Analysis") to help the state better understand viable pathways to achieve net-zero GHG emissions across North Carolina's economy by 2050 and interim targets. By modeling forward-looking pathways to achieve emission targets, the analysis was designed to help policymakers and stakeholders understand the greatest opportunities to reduce emissions and sequester carbon, as well as further explore the tradeoffs between different emissions reduction strategies.

[5] Deep Decarbonization Pathways Analysis. 2023. https://governor.nc.gov/nc-pathways-report/open

Natural carbon sinks (represented in the figure below as Land Use, Land-Use Change, and Forestry – "LULUCF") help offset remaining gross emissions in all carbon reduction scenarios the Pathways Analysis modeled to reach net zero by 2050. Despite a slight decline in habitat due to loss of forest acreage and sea-level rise, the Pathways Analysis shows natural carbon sinks in North Carolina remain large through 2050. In the High Carbon Storage Scenario, natural carbon sinks are supplemented with additional natural carbon sequestration and negative emissions technologies. While North Carolina's natural carbon sinks are critical to achieving net-zero, future carbon fluxes from natural systems are relatively less certain than the emissions reductions achieved through direct decarbonization measures elsewhere in the economy.

Figure 2: Remaining Emissions in 2050 by Scenario, Compared to 2005 Baseline Emissions



**In Figure 2, "DAC" refers to direct air capture.*

While the Reference, High Electrification, and High Decarbonized Fuels Scenarios do not include any mitigation measures for the LULUCF sector, the High Carbon Storage Scenario includes two key measures to increase the size of the LULUCF sink. The first is reforestation, which was estimated using the 2020 NWL Action Plan. The second is restoring tidal flows to impounded coastal areas, which was estimated by E3 in the NC Pathways Analysis to reduce gross emissions from the LULUCF sector by 0.4 MMT CO2e per year, based on estimates provided in Warnell et al., 2022. The combined impact of these two mitigation measures in 2050 is an increase in net sequestration from the LULUCF sector from -39.9 MMT CO2e in the business-as-usual projection, to -43.7 MMT CO2e in the High Carbon Storage Scenario. The Pathways Analysis demonstrated that maintaining and increasing NWLs for carbon storage is essential to reaching North Carolina's long-term climate goals.

Executive Order 305: Protect and Restore North Carolina's Critical Natural and Working Lands

On February 13, 2024, Governor Cooper signed Executive Order 305 (EO 305): An Order to Protect and Restore North Carolina's Critical Natural and Working Lands. This landmark executive order sets bold

goals, policies, and directives to protect and restore NWLs statewide, with emphasis on wetlands and forests. The order is the most comprehensive ecosystem protection executive action taken by a governor in North Carolina in recent memory. Executive Order 305 builds on and elevates the recommendations of the 2020 NWL Action Plan. It also guides the next iteration of NWL planning in policy in North Carolina including this NWL Action Plan Progress Report.

Executive Order 305 established three statewide NWL targets to achieve by 2040 as described in Figure 3 below.

Figure 3: Executive Order 305 Statewide Goals

Executive Order 305 also established NWL research priorities, streamlined conservation efforts within cabinet agencies, and established several new policies related to NWLs in state construction projects. Many of the executive order's directives are included in this report as progress updates to the 2020 NWL Action Plan.

Working Definition of Restoration in NC

Executive Order 305 defines restoration as "the return of an ecosystem to a close approximation of its condition and function prior to disturbance." A more expansive, working definition is below. This definition will continue to be developed and refined before the 2027 Progress Report.

In the context of EO 305, restoration in North Carolina refers to "interventions that have taken place after January 1, 2020, that improve habitat quality and ecosystem function of natural and working lands, encouraging natural ecological processes to re-establish and become self-sustaining in the long-term after a period of short-term active management and stewardship." Full previous function is not necessary for restoration activity to be counted towards one-million-acre goal, but ecosystem should be on a path to be fully on a path toward self-sustaining natural function.

Importance of Natural and Working Lands for Greenhouse Gas Sequestration and Storage, Emissions Reduction, and Climate Resilience

North Carolina's 2024 Priority Climate Action Plan ("NC PCAP"), submitted through the Environmental Protection Agency's (EPA) Climate Pollution Reduction Grant ("CPRG"), identified the state's NWLs as a GHG mitigation sector with major potential to reduce emissions.

Coastal habitats and peatlands act as critical regional carbon sinks, accumulating and storing tons of carbon annually. Peatlands, wetlands with deep layers of rich organic soils, are particularly good at storing carbon due to their deep organic soils. However, drained peatlands release CO_2 from their soils and are more vulnerable to severe peat fires that rapidly emit tons of CO_2. From 2008-2011, wildfires in northern NC and southeastern Virginia peatlands released an estimated 20 million MT CO_2e. Recent research has shown that hydrologic restoration of drained peatlands dramatically reduces their GHG emissions and can return them to net carbon sinks (Richardson et al., 2022).

According to the NC PCAP, conservation and restoration of forests represent NC's largest opportunity to sequester carbon and supports a suite of co-benefits. The state is uniquely positioned to sequester large amounts of carbon in its forests due to its climate and ecosystems. The USDA Forest Inventory Analysis estimated NC's total forest carbon in 2017 at 5.29 billion mtCO2e, which is 3% of the total carbon stored in US forests. Forests cover more than 60% of NC and sequestered 47.52 MMTCO2e in 2020 according to the 2024 North Carolina Greenhouse Gas Inventory. Urban forests not only sequester carbon, but also reduce emissions through potential energy savings from the cooling that shade trees provide.

In addition to carbon sequestration potential, the NC PCAP identified co-benefits of preserving and restoring NWLs including:

- Resilience benefits, such as flood mitigation, protection from coastal erosion and sea level rise (SLR), and enhanced climate readiness.
- Synergistic benefits to ecosystem health, including water quality improvements, wetland migration corridors, and enhanced biodiversity habitat.
- Community benefits, including reduced disaster costs, green space, quality of life, and carbon credit economies, particularly in rural low-income and disadvantaged communities.

In April 2024, the Atlantic Conservation Coalition (ACC), comprised of North Carolina, South Carolina, Maryland, Virginia, and The Nature Conservancy and led by the North Carolina Department of Natural and Cultural Resources, submitted a CPRG implementation proposal to take a regional approach to reduce GHG emissions by leveraging the carbon sequestration power of NWLs. In July 2024, the EPA awarded the ACC a historic $421 million grant, funded through the Inflation Reduction Act, to fight climate change. The shovel-ready implementation projects identified by the grant will lead to an estimated reduction of 28 million metric tons of CO_2e by 2050 within the four-state region by 2050.

II. Recommendations

Table 3 presents the 26 strategies recommended in the 2020 NWL Action Plan (in bold font). Many of the strategies provide multiple benefits, and many of the projects and initiatives described in the report may support multiple strategies. The authors included example projects or initiatives for each strategy. This report was compiled by the NWL Steering Committee with input from stakeholders, and there are likely more projects have been undertaken across North Carolina that support the 2020 NWL Action Plan and were not captured here. This report is intended to report progress and inspire more action and collaboration, resulting in even more participation in future years. The 2020 NWL Action Plan will undergo a more extensive revision in 2027 in which a new stakeholder process will take place and recommendations may be revised.

Table 3: 2020 Natural and Working Lands Action Plan Priority Recommendations
Conservation
1. Protect forests and wetlands within flood prone areas.
2. Conserve forest lands through easements and acquisition.
3. Provide incentives to stakeholders for coastal habitat protection.
4. Facilitate migration of coastal habitats through protection of migration corridors.
5. Protect and restore forested lands in water supply watersheds.
Restoration
6. Restore forests and wetlands within flood prone areas.
7. Expand restoration efforts on publicly owned lands.
8. Encourage restoration and reforestation on private lands.
9. Rewet peatlands to prevent soil loss and catastrophic fire.
10. Restore Atlantic White Cedar forests.
11. Protect peatlands from sea level rise and saltwater intrusion.
12. Prioritize climate change and sea level rise in coastal habitat restoration planning.
Agriculture and Soil Management
13. Encourage adoption of high mitigation agricultural conservation practices on croplands and pasturelands.
14. Enhance soil health and retention on working peatlands via best management practices and drainage management.

Table 3: 2020 Natural and Working Lands Action Plan Priority Recommendations
15. Improve manure management on farms.
16. Encourage food system efficiency through reduced food loss and waste.
17. Improve site preparation and soil amendment during land development.
Government Services and Policies
18. Facilitate voluntary landowner participation in carbon offset and ecosystem services markets.
19. Create a NWL Solutions Toolbox.
20. Modernize forest policy and tax incentives.
21. Increase landowner access to forest management technical and financial assistance.
22. Support the wood products markets.
23. Coordinate floodplain buyout and restoration program.
24. Integrate climate adaptation and resiliency strategies into local government comprehensive plans.
25. Promote urban forest retention and management.
26. Research urban forest baseline canopy and management needs.

Conservation: Strategy Progress

1. Protect forests and wetlands within flood prone areas

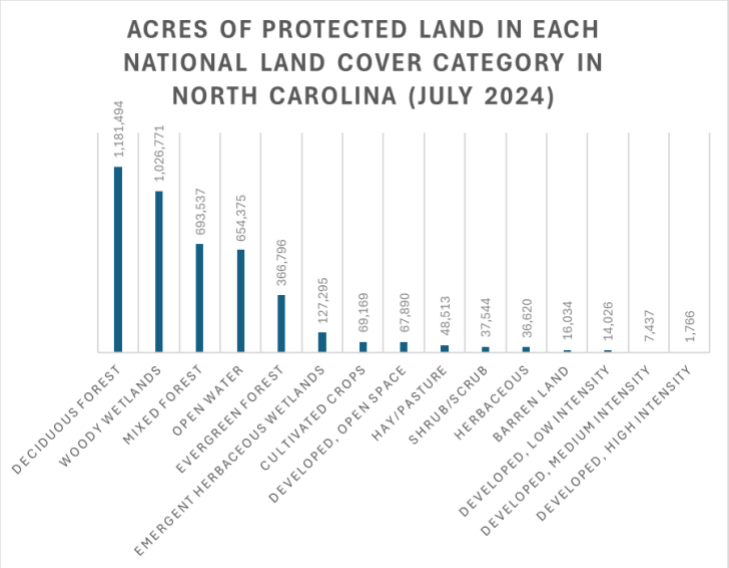
Status: Ongoing

The 2020 NWL Action Plan and Governor Cooper's Executive Order 305 (2024) recommended protection of 1 million more acres of forests and wetlands (above the acreage already protected). From July 2020 to July 2024, 150,396 new acres of land were conserved statewide, bringing the total acreage of land and water protected in North Carolina up to 4,349,267 (NC Natural Heritage Program Biotics Database 2024), as shown in Table 4 and Figure 4. This amounts to 12.8% of the state, and includes lands protected by local, state, federal, and private organizations. The past four years had an annual rate of land protection of 37,599 acres per year. In order to meet the goal of protecting one million new acres by 2040, the statewide rate of protection will need to increase by 35% per year.

Table 4. Acreage of protected land in each National Land Cover Type as of July 2020 and July 2024, based on NC Natural Heritage Program Biotics Database 2020 and 2024, and Dewitz 2023

Land Cover Type	2020 Acres	2024 Acres	2020-24 change
Open Water	643,693	654,375	10,682
Developed, Open Space	66,023	67,890	1,868
Developed, Low Intensity	11,987	14,026	2,039
Developed, Medium Intensity	5,904	7,437	1,533
Developed, High Intensity	1,429	1,766	337
Barren Land	16,028	16,034	6
Deciduous Forest	1,141,745	1,181,494	39,750
Evergreen Forest	354,230	366,796	12,566
Mixed Forest	681,921	693,537	11,616
Shrub/Scrub	34,364	37,544	3,180
Herbaceous	34,576	36,620	2,044
Hay/Pasture	40,523	48,513	7,990
Cultivated Crops	46,843	69,169	22,326
Woody Wetlands	994,372	1,026,771	32,399
Emergent Herbaceous Wetlands	125,235	127,295	2,060
TOTAL	**4,198,872**	**4,349,267**	**150,396**

Figure 4. Acreage of protected land in each National Land Cover category in North Carolina as of July 2024 (Natural Heritage Program Biotics Database 2024 and Dewitz 2023)



The state budget has substantially increased funding for land acquisition; investment in parks, trails, and open space statewide; and resilience planning and floodplain protections.

Table 5: Land Acquired by the North Carolina State Property Office for Conservation Activities July 1, 2020 – June 30, 2024

Department	Division	Acres
Agriculture	Agric. Dev. & Farmland Preservation	16,744
Agriculture	Agriculture and Consumer Services	132
Agriculture	NC Forest Service	1,827
Agriculture	Plant Industry Division	35
Agriculture	Soil and Water Conservation	2,159
Environmental Quality	Division of Mitigation Services	720
Environmental Quality	Environmental Quality General	70
Environmental Quality	Division of Coastal Management	639
Wildlife Resources Commission	Wildlife Resources Commission	16,768
Natural and Cultural Resources	Natural and Cultural Resources General	65
Natural and Cultural Resources	NC Land and Water Fund	10,063.06
Natural and Cultural Resources	Parks and Recreation	11,903.00
TOTAL		**61,130.11**

State Budget highlights:

NC Land and Water Fund (NCLWF), the primary source of grants allowing local governments, state agencies, and conservation nonprofits to protect clean water and conserve or restore ecologically, culturally, or historically significant lands and military buffers.

From its inception through December 2023, through appropriations and receipts, the North Carolina Land and Water Fund ("NCLWF") has partnered with State agencies, local government units, and nonprofit organizations to contribute more than $1 billion to the protection and restoration of the State's natural and cultural resources (NCLWF Annual Report 2023). More than 500,000 acres of high priority North Carolina land have been conserved and more than 3,000 miles of streams protected. The NCLWF has leveraged approximately $1.7 billion in additional funds to support those same efforts to protect and restore our state's resources. These leveraged funds come from private individuals, nonprofits, corporations, and local, State and Federal government agencies, including U.S. Department of Defense/military funds.

The NCLWF Board of Trustees typically meets each fall to award grants. As of publication of this report, the 2024 Annual Report had not yet been released. Therefore, NCLWF reporting for this NWL Action Plan Progress Report includes grant cycle years 2021-2023. During this period, the NCLWF Board of Trustees awarded 198 grants totaling $130,489,956 for land conservation. The funds will conserve more than 64,000 acres including trout waters, coastal habitats, greenways and trails, and buffers around military bases. More than 44,000 acres will be open to the public for hiking, hunting, boating, birding, and other recreational uses (NCLWF Annual Reports 2022 and 2023).

Some NCLWF conservation highlights from 2021-2023 include:

Conserving more than 12,100 acres to be added to N.C. Wildlife Resources Commission game lands in Ashe, Bertie, Bladen, Cherokee, Gates, Graham, Halifax, Jackson, Macon, Madison, Pamlico, Pender, Scotland, Wilkes, and Yancey counties;

Adding more than 9,300 acres to N.C. State Parks in Ashe, Avery, Bladen, Burke, Caldwell, Chatham, Craven, Gaston, Graham, Guilford, Harnett, Henderson, Hyde, Iredell, Macon, Mitchell, Montgomery, New Hanover, Orange, Pender, Polk, Robeson, Rockingham, Transylvania, Wake, Wilkes, and Yancey counties;

Conserving more than 13,000 acres in local parks and preserves in Bertie, Buncombe, Carteret, Cherokee, Durham, Hertford, Johnston, Macon, New Hanover, Orange, Rutherford, and Wake counties;

Protecting 24 sites with historic and cultural resources, including Black Mountain College Historic District, Mount Helen Estates Historic District, Seabreeze Beach Resort site, Worrell's Mill, Trail of Tears National Historical Trail, and multiple archaeological sites, as well as buffering the Blue Ridge Parkway and Walnut Hill Rural Historic District;

Buffering military installations and training areas, supporting a sector that comprises more than 12% of North Carolina's economy, awarding $21,738,246 and protecting more than 12,400 acres near MCAS New River Air Station, USAF Seymour Johnson, MCAS Cherry Point, USMC Camp Lejeune, U.S. Army Camp Mackall, U.S. Army Fort Liberty, and Military Ocean Terminal Sunny Point.

Other notable programs that have received significant funding since 2020 include:

Parks and Recreation Trust Fund (PARTF), supporting land acquisition and improvements within parks. PARTF is the main funding source for local parkland acquisitions, facility improvements, and public beach and estuarine access.

Agriculture Development and Farmland Preservation Trust Fund, supporting agricultural conservation easements; the development and implementation of plans for production of food, fiber, and value-added products, agritourism activities, marketing, and sales; and conservation agreements reinforcing the active production of food, fiber and other agricultural products.

Coastal Storm Damage Mitigation Fund: NWL Steering Committee will provide an update in the following action plan update.

Streamflow Rehabilitation Assistance Program: NWL Steering Committee will provide an update in the following action plan update.

Additional examples of initiatives to protect forests and wetlands in flood prone areas are listed below.

NC Trees & Storms; Readiness, Response & Recovery (3Rs)
In 2021, NC Forest Service partnered with the NC Urban Forest Council and North Carolina State University Extension to provide education and technical assistance to homeowners and municipalities in storm preparedness, response and recovery. Three municipal training webinars drew 173 attendees, and two (2) homeowner webinars drew 333 attendees in 2021. Publications include two storm readiness and response audio/video Public Service Announcements, three municipal "3Rs" best management practices publication, one professional Storm-Damaged Tree Assessment best management practices publication, and two homeowners' best management practices publications. This project is led by the Urban and Community Forestry Program within the N.C. Forest Service, along with NC State University Forestry Extension. More information may be found online.[6]

Nature Based Stormwater Strategies Action Plan 2021
The Action Plan for Nature-based Stormwater Strategies was developed by the North Carolina Coastal Federation with the support of The Pew Charitable Trusts, and input from four expert work groups focusing on opportunities for use of nature-based stormwater strategies in new development, stormwater retrofits, roadways and working lands. Over 60 stakeholders representing state and local government agencies, businesses, universities, nonprofits, and other sectors provided input on the Action Plan. Nature-based Stormwater Strategies for working lands include restoring and replicating wetlands to retain and filter runoff and utilizing buffers and water control techniques to capture, store and infiltrate rain. Nature-based strategies restore the natural hydrology and the capacity of the land to reduce flooding and naturally treat runoff from adjacent farm and forest lands.

[6] NC Trees and Storms: Readiness, Response, Recovery. https://www.ncforestservice.gov/treesandstorms.htm

Newport River Forest and Floodplain Restoration
The NC Coastal Federation and Coastal Land Trust have partnered to acquire and restore ~3,000 acres of timber land on the Newport River. Additionally, 1400 acres have been secured with assistance from the General Assembly and the remaining acreage is pending acquisition.

Hyde County Regional Conservation Partnership Program Funding
In 2024 the NC Coastal Federation and federal and local partners in Hyde County were awarded a $16.86 million grant from the NRCS RCPP to perform several conservation and restoration activities around Lake Mattamuskeet to improve water quality in the Lake. These include wetland restoration, drainage water management, and living shorelines.

Emerging Concepts:

The following initiatives are directed under Section 3 in Executive Order 305 and will provide valuable data and information to shape future NWL policy and planning.

Develop methodology to update wetland mapping to estimate acres of wetlands that lost protection in 2023
Status: Underway
Expected Completion Date: October 2024

The NC Division of Environmental Quality led a multi-agency committee including Department of Natural and Cultural Resources that focused on developing a methodology to update wetland mapping and estimate acres of wetlands that lost protection in 2023, as a result of a provision in the 2023 NC Farm Act that aligned with the U.S. Supreme Court definition of waters of the U.S. ("WOTUS"). The methodology for updating wetland mapping includes acquiring the best wetland mapping available in different parts of the state, combining the regional maps into a single basemap, then applying methods to improve the accuracy of the mapping. In the coastal region subject to Coastal Area Management Act, the wetland mapping done by Division of Coastal Management ("DCM") is the best available. Farther inland, National Wetlands Inventory ("NWI") is the only comprehensive data available, but it is less accurate and less current than DCM maps. NWI data are proposed to be updated, using land cover to detect and remove mapped wetlands that have been converted to incompatible cover. Methods for determining wetlands that have lost protection in 2023 include several approaches for determining connection to surface waters – based on wetland types that tend to be connected or not connected, based on hydrogeomorphic classification of wetland types, and based on proximity to mapped streams classified by streamflow duration. Application of this approach will require additional funding, which is outlined in a DEQ summary memo that will be available in November of 2024.

This methodology is comprehensive across the landscape and applies equally to wetlands in proximity to all populations. Once completed, the resulting data will offer the possibility of analysis for environmental justice inequities in the impact of the loss of wetlands protections, and opportunities for prioritizing wetlands for conservation and restoration.

High-Resolution Land Use/Land Cover Mapping Project (NOAA CCAP)
Status: Underway
Expected Completion Date: December 2025

On behalf of multiple DEQ divisions including Marine Fisheries ("DMF"), Coastal Management ("DCM"), and Water Resources ("DWR"), the Albemarle-Pamlico National Estuary Partnership ("APNEP") is facilitating the acquisition of high-resolution land cover data from NOAA's Coastal Change Analysis Program ("C-CAP") Phase 2 mapping for all of North Carolina watersheds. The deliverables will feature maps with a regional land cover classification scheme of approximately 22 land cover types to produce a Level 2 interpretation of the State of North Carolina at one-meter resolution.

DCM is providing additional funding to NOAA to support mapping high and low salt marsh in the 20 coastal counties that will help to track a variety of environmental indicators and inform management actions. This data will provide a foundation and decision support tool for multiple actions within the CHPP, NWL Action Plan, and EO 305.

APNEP is also coordinating these efforts with the Statewide Mapping Advisory Committee ("SMAC"), a statutory committee of the N.C. Geographic Information Coordinating Council ("GICC"). The SMAC advances the use of geographic information systems technology in North Carolina's decision-making by coordinating statewide geospatial data efforts, and efforts and is primarily responsible for producing data specifications and recommendations for statewide datasets. The SMAC represents a wide GIS community including federal, state, and local governments, universities, and the private sector.

Identify boundaries of pocosins, Carolina Bays, coastal wetlands, mountain bogs, and sea marsh corridors
Status: Underway
Expected Completion Date: December 2024

The NC Division of Environmental Quality is leading a multi-agency committee including Department of Natural and Cultural Resources to map pocosins, Carolina Bays, coastal wetlands, mountain bogs, and sea marsh corridors. These efforts began by identifying existing data sources that might be used. Several potential data sources exist. Individuals or groups outside of the state government have worked on mapping these resources, but the suitability of their methods and applicability to a statewide dataset need to be evaluated. Some may be suitable as is or with refinement based on the Committee's criteria.

This task will map all these special wetlands in the state. The comprehensive picture of their distribution will allow the consideration of equity in any conservation or restoration actions that are implemented.

2. *Conserve forest lands through easements and acquisition*

Status: Ongoing

North Carolina Forest Service Land Acquisitions and Forest Legacy Easements
The North Carolina Forest Service manages state forests primarily for protection of unique natural communities and cultural resources, forestry research and demonstration, wildlife protection and watershed protection. In 2021, NC Forest Service worked with partners to acquire forest lands at:

NC Forest Legacy Program Activity Update - August 2024
The North Carolina Forest Service (NCFS) Forest Legacy Program ("FLP") received Land and Water Conservation Fund ("LWCF") funding in FY18 for Phase Ia of the Balsam Range FEE Forest Legacy project. The Balsam Range project is a partnership with The Conservation Fund ("TCF") and Maggie Valley Sanitary District ("MVSD") to project the headwaters of Campbell Creek and Jonathan's Creek in the Plott Balsam Mountains in North Carolina. In February 2021 TCF and FLP were able to close on and convey to MVSD, Phase Ia of the Balsam Range project. Phase Ia consists of 710 acres with a total tract cost of $2.34 million and the Forest Legacy Program FY18 LWCF grant provided $1.34 million towards this closing.

In 2021 the FLP received a conservation easement ("CE") donation from the Walthour Moss Foundation. This CE consists of 3,947 acres in Moore County. The Walthour Moss CE provides protection of open spaces for public enjoyment allowing horseback riding, hunting, and other non-motorized recreational opportunities for the public.

In 2022, LWCF Forest Legacy received funding for Dark Ridge, a CE Forest Legacy project. This project is in Jackson County along the Blue Ridge Parkway and expands existing FLP CEs (2004-2005 FLP project - Blue Ridge Parkway Buffer). The Dark Ridge project consists of 3,850 acres (2,703 acres of FLP CE and 1,147 acres match tract from Mainspring Conservation Trust ("MCT")). . FLP is expecting to close on this CE in October 2024. The total project cost will be $7 million and the FLP is providing $5 million.

In July of 2023 the FLP closed on Balsam Range's Phase Ib and Phase II. This combined closing consisted of 1,251 additional acres conveyed to the MVSD. This addition to the Balsam Range FLP project is also protecting acreage within the Campbell Creek and Jonathan's Creek watershed. The total tract costs of this combined closing were $5,427,000 and the Forest Legacy Program FY18 and FY19 LWCF grants provided $3,253,000 towards this closing.

In 2023 the FLP received Inflation Reduction Act (IRA) funding which provided a $700 million allocation to the National Program. The influx of funding allowed for an additional funding round from the federal government each year. North Carolina submitted 2 IRA Forest Legacy projects in 2024, Buffalo Creek and Cedar Cliffs. Both projects were submitted under the FY24 Round 2 IRA. Buffalo Creek was submitted for National Panel Review in July 2024 as a Large Landscape IRA project. This project consists of 1,218 acres with a total tract cost of $18 million and a FLP funding request of $13.5 million. Cedar Cliffs was also submitted for National Panel Review in July 2024, but as a Strategic Small IRA project. This project consists of 175 acres with a total tract cost of $580,000 and a FLP funding request of $435,000.

The FY24 Round 2 IRA funded project list has not been released at the time of publication of this report.

In March of 2024 the FLP received funding for the Roanoke River Bottomlands FY24 LWCF Conservation Easement. This project consists of 2,976 acres of species-rich prime forestland in Martin and Bertie Counties. This project will protect habitat for the federally endangered Atlantic Sturgeon and the State endangered Rafinesque's Big Eared Bat. This project will also provide 2 new public access sites along the river as well as a camping platform and opportunities for public waterfowl hunting. The total project cost is $4 million and the FLP is providing $3 million towards this project.

3. *Provide incentives to stakeholders for coastal habitat protection.*

Status: Ongoing

NC Coastal Habitat Protection Plan 2021 Amendment
The NC Coastal Habitat Protection Plan ("CHPP") is a NC DEQ document mandated in legislation to protect and restore fish habitat. The plan was amended in 2021 and included the NWL Action Plan as a collaborative plan. There are many synergistic recommendations in the CHPP that support the NWL action plan, particularly for carbon storing habitats – coastal wetlands and submerged aquatic vegetation (SAV). One priority issue is wetland protection and enhancement with a focus on nature-based solutions. There are several active projects and initiatives that help meet both plans.

Multiple NCDEQ divisions have partnered to acquire high-resolution land cover data from NOAA's Coastal Change Analysis Program ("C-CAP") Phase 2 mapping for all of North Carolina watersheds including the coastal plain, as described previously the protecting forests and wetlands section This data will provide a foundation and decision support tool for multiple actions within the CHPP, NWL Action Plan, and EO305. DEQ is also working with the North Carolina Coastal Federation (NCCF) and others on developing a NC Wetland Protection Plan that builds on the 2024 NC Salt Marsh Action Plan and regional South Atlantic Salt Marsh Initiative.

SAV is a high priority issue in the 2021 CHPP. Several recommendations related to improving water clarity to enhance SAV growth through implementation of a new water clarity standard, followed by revised chlorophyll a standards and new Nitrogen and Phosphorus standards as deemed necessary to achieve suitable water clarity for SAV. The Division of Marine Fisheries (DMF) has assisted the Division of Water Resources (DWR) and the Environmental Management Commission's (EMC) Scientific Advisory Council in this effort. The proposed water clarity standard is expected to go to the EMC in 2025. Other CHPP recommendations address reducing stormwater runoff using wetland best management practices and nature-based solutions, which supports the NWL action plan.

In summary, multiple recommendations in the CHPP's Wetland and SAV chapters will contribute to the NWLs overarching recommendation to:

- Facilitate increased conservation and restoration of forested wetlands within floodplains through economic incentives, acquisition, easements, and strategic floodplain buyouts to conserve forested wetlands, enhance ecosystem services, and improve coastal community resilience.
- Facilitate the development of specific policies through local, state, and federal pathways that encourage and incentivize the protection of coastal habitats (including SAV).

Submerged Aquatic Vegetation Protection, Monitoring, and Assessment
Since 2004, APNEP has facilitated a SAV partnership that aims to promote the conservation of this key estuarine habitat indicator along the entire coast of North Carolina and southeastern Virginia. Monitoring SAV is vital because among other benefits it serves as an indicator of habitat condition for various aquatic fauna, shoreline resilience to extreme weather events, and overall water quality. The partnership collaborates to achieve the long-term goal of determining the location of the region's SAV and trends in overall extent and spatial cover classes. This partnership later evolved into APNEP's SAV Team, which works to update mapping and monitoring processes, safeguard water quality, and defend against physical disturbances to valuable SAV. While this team initially focused on monitoring trends in overall extent and density of SAV in both low- and high-salinity waterscapes, with the

development of the SAV Monitoring Strategy in 2021, additional metrics such as relative abundance and species composition have been included to gain a more robust tracking of SAV condition. In addition, high-salinity monitoring frequency increased from semi-decadal to bi-seasonal for one of four subregions annually on a rotating basis. Implementation of this strategy occurred during bi-seasonal surveys of the fourth (Pamlico North) subregion in Spring and Fall 2024.

The SAV Team has also successfully facilitated efforts to promote SAV protection including policy development to inform updates to the CHPP, NC Nutrient Criteria Development Plan, direct investments in projects, synthesis of research, and establishing linkages with water quality protection and policy development efforts described further below.

SAV Protection: Water Quality Standards and Policy & Management Initiatives

Assessment of SAV Protection Policies: APNEP has budgeted Bipartisan Infrastructure Law ("BIL") funding to conduct an assessment of SAV protection policies to inform policy and management decisions. The objectives include: 1) compile all existing federal and state laws and regulations regarding the conservation and management of SAV, 2) assess the policies and management practices used to guide and implement rule making pertaining to SAV, and 3) identify and report any regulatory inconsistencies, inadequacies, and inefficiencies, and recommend necessary improvements. SAV is afforded protection primarily through its federal designation as *Essential Fish Habitat* by the Magnuson-Stevens Fishery Conservation and Management Act. In North Carolina, adherence to federal regulations regarding SAV is managed through various state and regional (multi-state) policies, some of which are not specific to SAV conservation initiatives but in some way include management considerations for SAV. These polices may not necessarily align or be sufficient to maximize success in achieving shared SAV conservation goals and objectives. A comprehensive review of these policies, including common and competing policy interests, policy development and implementation practices, and resulting policy outcomes may help to identify regulatory inefficiencies and opportunities for improved coordination and collaboration among partners working to protect SAV.

Economic Valuation: APNEP worked with an interdisciplinary team of researchers at NC State University and Duke University to research and publish a SAV Economic Valuation[7] report in 2021 that estimates the market and nonmarket economic losses from SAV declines in the Albemarle-Pamlico estuary. Focusing on the losses to commercial and recreational fisheries, residential property values, and carbon sequestration, the team conservatively estimated aggregate losses of $1,290 per acre over the next decade. This work builds on previous work contracted with RTI International to conduct an Economic Valuation of the Albemarle-Pamlico Watershed's Natural Resources.[8] The findings should improve policy and decision makers' understanding of the value of ecosystem services provided by natural and working lands in the region including SAV and other coastal habitats, agriculture, forestry, commercial fishing, aquaculture, mining. The report also quantifies carbon storage and sequestration values of forests, wetlands, and SAV. NWL partners and stakeholders

[7] Economic Valuation of Submerged Aquatic Vegetation (SAV) in the Albemarle-Pamlico Region. https://apnep.nc.gov/our-work/identification-and-research/economic-valuation-sav

[8] Economic Valuation of the Albemarle-Pamlico Watershed's Natural Resources. April 2016. https://apnep.nc.gov/documents/files/publications/2016-economic-valuation-ap-watershed-natural-resources/download?attachment

should continue to utilize and build upon this work to incentivize protection of natural and working lands by demonstrating the monetary worth of the ecosystem services they provide.

NC Nutrient Criteria Development Plan Support: APNEP staff and Scientific and Technical ("STAC") members who are experts in water quality issues and SAV are active in the NC Nutrient Criteria Development Plan ("NCDP") process. NCDWR has selected SAV as a biological indicator for the health of the Albemarle Sound and Chowan River. APNEP and partners facilitated workshops to set SAV protection and restoration goals for the Albemarle-Pamlico Estuarine System, demonstrate linkages between water quality and SAV protection, and determine steps needed to support the NCDP process.

As a result, APNEP's STAC and SAV team helped develop three complimentary research and tool development projects that identify water quality requirements for healthy seagrass meadows, making the connection between needed nutrient and sediment load reductions and quantitative linkages between chlorophyll-a concentrations and light requirements needed for these underwater grasses to grow. The projects, led by the UNC Institute for Marine Sciences ("IMS") and funded by APNEP, were used to develop recommendations for scientifically defensible chlorophyll-a standards that are protective of SAV in high- and low-salinity zones: 1) Development of Chlorophyll-a Standards for SAV Protection, Research Study to Support Water Clarity Metrics for SAV Protection, and Calibration of a bio-optical model for low-salinity SAV.

The NCDP Science and Advisory Committee ("SAC") utilized this information to draft a proposed clarity standard for SAV protection and a support document to detail the scientific basis for the proposed standard, which is being considered by NCDWR and the NC Environmental Management Commission. Once submitted to EPA for approval and adopted and implemented, the clarity standard for SAV will satisfy the Recommended Action 4.7 of the North Carolina Coastal Habitat Protection Plan ("CHPP") 2021 Amendment (NCDEQ 2021).

SAV Monitoring: SAV Tier 1 and 2 Surveys in High- and Low-Salinity Waters

- **SAV Integrated Monitoring Strategy:** With the input of APNEP's STAC, staff developed a proof-of-concept Integrated Monitoring Plan whose initial scope focused on coastal SAV and estuarine water quality factors that impact coastal SAV. The plan was accepted by the Leadership Council in March 2021, and implementation began in that year. Resurveying of the entire high salinity seagrass resource in the APNEP region is anticipated to be complete by the end of 2024. The APNEP monitoring and assessment teams[9] are using the SAV monitoring plan as a model to develop monitoring plans for other ecosystem component, with the highest priority of staff being a monitoring plan for estuarine waters (water quality) and bed sediments. An updated SAV Monitoring Strategy will be produced based on knowledge gained during the 2021-2024 field seasons summarized below. Building on this, an expanded survey effort in low-salinity waters will also be created.

- **High-Salinity SAV Monitoring:** APNEP's SAV Team continued to lead collaborative efforts to map and monitor SAV via aerial imagery acquisition and boat-based surveys. The team continued to make progress on implementing the 2021 SAV Monitoring Strategy by conducting bi-seasonal

[9] Monitoring and Assessment Teams. https://apnep.nc.gov/about-apnep/committees-teams/monitoring-and-assessment-teams

high-salinity surveys in the second (Core Sound) subregion during Spring and Fall 2022, the third subregion (Pamlico Sound South) during Spring and Fall 2023, and the fourth (Pamlico North) subregion in Spring 2024. Each seasonal survey has an aerial component (Tier 1) with support from the North Carolina Department of Transportation, and boat-based (Tier 2) component involving multiple partners, including University of North Carolina at Wilmington Center for Marine Science, NC Division of Marine Fisheries, University of North Carolina at Chapel Hill Institute of Marine Sciences, and US Natural Resources Conservation Service, and others. In addition to this information supporting the creation of an updated map of high-salinity SAV (seagrass) for the Albemarle-Pamlico Estuarine System, this effort marked the initial implementation of APNEP's monitoring plan by focusing on several indicator metrics reflecting the condition of the region's coastal SAV resource. More information can be found in the SAV Story Map.[10]

- **Low Salinity SAV Monitoring Protocols Development:** There long has been a recognition that SAV monitoring protocols developed for low-salinity waterscapes within the Albemarle-Pamlico Estuarine System will differ from those developed for high-salinity waterscapes. The primary reason for the difference is water clarity which inhibits the use of aerial imagery as key input for Tier-1 (remote sensing) and Tier-2 (boat-based) efforts. While APNEP funding devoted to protocols testing has been directed to high-salinity Tier 2, there is a parallel need to advance low-salinity Tier-1 and -2 protocols development as well. Funding is budgeted to implement the low-salinity component of the SAV monitoring strategy by developing refined or new sampling methodology that meets data needs while also allowing for greater interest and engagement from existing SAV partners in the region.

  From 2012-2020, with funding support from proceeds of the sales of the NC Coastal Recreational Fishing License ("CRFL"), the National Fish and Wildlife Foundation, and APNEP, the SAV Team developed and implemented standardized boat-based protocols utilizing underwater sonar and cameras that were accompanied by in-water (quadrat-based) protocols to monitor SAV at designated sentinel sites in the Neuse River, Pamlico River, and Albemarle Sound. While the sonar and camera protocols are effective sampling methods for monitoring SAV in low-visibility conditions, they are laborious, require special equipment and training, and are costly to implement. As such, it has been challenging to sustain partner engagement and support of this work. Discussions are ongoing with regional partners including the Currituck Sound Coalition to identify local champions to bolster this work.

- **SAV Assessment:** APNEP published a 2021 SAV Metric Report[11] showing a net loss in the extent of high-salinity SAV habitat in North Carolina's sounds between 2006-2008 and 2013. While the data also confirm that the state possesses the largest acreage of seagrass along the east coast of the United States, around 100,000 acres, the overall extent of seagrass meadows in the Albemarle-Pamlico estuary decreased by 5,686 acres or 5.6% despite the availability of suitable habitat for expansion of the resource. Seagrass is declining worldwide; North Carolina is experiencing annual rates of seagrass loss at or below the global average. The Metric Report will be updated in late 2024 to incorporate the 2019-2020 SAV high-salinity extent by cover class map.

[10] The Albemarle-Pamlico's Underwater Meadows. May 17, 2021. https://storymaps.arcgis.com/stories/12322fb3c13e42eaabda6f6111743e43

[11] APNEP SAV Team Metric Report & Interactive Story Map. 2021. https://apnep.nc.gov/apnep-sav-team-metric-report-interactive-story-map

APNEP and its partners will use this information to develop protection and restoration strategies for SAV and fish species in the region and support future CHPP and NWL updates.

Coastal Habitats GHG Inventory 2024

The NC Coastal Habitats Greenhouse Gas Workgroup ("Workgroup") was convened to identify gaps in EPA modeling of emissions and sinks in the coastal habitats category. The Workgroup used high-resolution spatial data from federal land use and land cover surveys, as well as data collected by state researchers, to develop estimates for a subcategory not estimated by EPA (seagrass) and at a finer level of detail than the methodology of EPA's state-level inventory currently allows. The updated blue carbon inventory estimates carbon stocks and sequestration rates for tidally influenced wetlands and high salinity seagrasses. These updates were incorporated into the 2024 update to the NC GHG Inventory (1990-2050).

The coastal habitats GHG inventory[12] highlighted that the primary GHG impact of coastal habitat protection is maintaining existing carbon stocks. The 2024 NC GHG Inventory estimates carbon stocks in coastal marshes and seagrass at 141.9 MMT CO2e. A subset of North Carolina's coastal habitats also acts as carbon sinks, removing more carbon from the atmosphere than they emit on an ongoing basis. On a broad scale, this ability is determined by sulfate levels within coastal habitats, because sulfate inhibits the production of methane (a potent greenhouse gas). Sulfate is a component of seawater and strongly correlated with salinity; higher-salinity areas generally have low methane production and therefore act as carbon sinks. The 2024 NC GHG Inventory identified high-salinity seagrass habitats as net carbon sinks, sequestering 55.14 kilotons CO2e in 2021. Coastal emergent and scrub-shrub wetlands are net sources of GHG emissions, but at a very small scale relative to the overall LULUCF sector; regardless, their large carbon stocks mean that preserving these wetlands is critical to the overall carbon balance of North Carolina's natural lands.

CPRG Funding

The CPRG ACC funding includes measures that focus on protecting and restoring high-carbon coastal habitats and peatlands to maximize carbon sequestration and coastal resilience benefits as outlined in the NC PCAP. By implementing nature-based solutions to avoid carbon emissions and sequester additional carbon, the initiative will bolster flood resilience, enhance water quality, and support the traditional economies of local communities. The North Carolina Coastal Federation received $30 million to collaborate with partners to spearhead various projects for coastal habitat protection and restoration focusing on enhancing the resilience of coastal habitats such as salt marshes, seagrass beds, and transitional areas where marshes will migrate with future sea level rise.

Currituck Sound Coalition Marsh Conservation Plan

The Currituck Sound Coalition was formed by Audubon in October 2019 to foster collaboration among diverse partners on ecosystem restoration and conservation in Currituck Sound, North Carolina. Composed of non-profit organizations, academic institutions, local governments, and state and federal agencies, members of the Currituck Sound Coalition work together to advance nature-based solutions for challenges facing Currituck Sound. The CSC released a Marsh Conservation Plan in 2021, which was developed to identify threats and offer solutions to protect this globally rare ecosystem

[12] North Carolina Coastal Habitat Greenhouse Gas Inventory. September 2023. https://www.ncnhp.org/nc-blue-carbon-inventory-september-2023/open

that supports communities along the Outer Banks. The plan includes primary targets of protecting and restoring the unique freshwater marshes of the Currituck Sound Watershed, which is located in Currituck and Dare Counties in North Carolina and the cities of Chesapeake and Virginia Beach in Virginia. Primary targets include protecting and restoring marshes and marsh migration corridors, and secondary targets include protection and restoration of water quality, SAV, fisheries, and birds.

North Carolina Salt Marsh Action Plan

The North Carolina Salt Marsh Action Plan ("SMAP") was launched in May 2024 and brings together local, state, and federal stakeholders from academia, governmental agencies, communities and NGOs to prioritize actions to protect, restore, and facilitate the migration of salt marshes. It is meant to further other efforts aimed at protecting the coastal environment and to include strategies and recommendations to increase carbon sequestration and resilience. There are a lot of great opportunities in North Carolina to help protect and restore salt marshes.

- Protection: For example, property owners can choose living shorelines to address shoreline erosion while preserving intertidal habitats.
- Restoration: There are innovative ways to restore sediment elevations where needed for salt marshes to reestablish and keep pace with rising water levels. Potential benefits and impacts to flora and fauna need further study.
- Conservation: Coastal lands can be acquired from willing property owners to create pathways for salt marshes to migrate landward over time.

Emerging Concepts:

- New funding is now available for the United States Geological Survey ("USGS") and collaborating institutions to examine "lateral" aquatic export of dissolved carbon from North Carolina tidal marshes to connected estuaries and coastal ocean. The working hypothesis is that a substantial portion of exported carbon remains dissolved in seawater for extended time, and therefore represents an unmonitored and non-credited form of carbon sequestration. A USGS-led and NASA-supported project has an objective to synthesis lateral flux data from sites across the conterminous U.S., develop a model of marsh carbon cycling and the lateral flux, and implement the model based on mapped and remotely sensed data. North Carolina will be integrated with the national effort to provide results specific to the state, supporting decisions and an update to the GHG inventory.
- Defining coastal habitats and recognizing future changes: This progress report considers all wetland areas with water levels influenced by tides to be coastal habitats. This includes coastal marshes, submerged aquatic vegetation, and forested wetlands with a range of salinity levels from freshwater to saline. It is important to recognize that these habitats are shifting with sea level rise, coastal development, and other changes, so some parts of the coastal plain that are not currently coastal habitats will be in the future. Examples of this include the increase in "ghost forests" throughout the coast where trees are dying due to the increased salinity levels. Recommendations for improved coastal management must account for these future changes. The coastal subgroup recommends using 2050 as an end date for planning to align with modeling for salt marsh migration under the 1.5' SLR scenario. Executive Order 305 goals are measured using 2040 as an end date.

Coastal Habitat Migration Corridors: Strategy Progress

4. Facilitate migration of coastal habitats through protection of migration corridors.

Status: Ongoing

Coastal habitat migration corridors refer to natural areas that are likely to experience habitat conversions over time due to SLR. Keeping these coastal areas in a natural condition allows coastal wetlands to respond to changes in salinity and rising water. When habitat migration corridors are conserved, natural communities respond to environmental changes and animals are allowed to migrate to find suitable habitat. Alternatively, coastal development, pavement, roads, and buildings interrupt these natural migration corridors and prevent the ecological adaptation process from taking place.

Battleship USS North Carolina – Living with Water

In its coastal setting, Battleship North Carolina is a sentinel site for climate change. It has witnessed a 770% increase in tidal flooding over the last decade. Rising sea levels interrupt visitation, create safety and operational hazards and degrade the State's water quality and fragile coastal habitats. The Battleship's Living with Water flood mitigation and resiliency project will: 1) install an intertidal living shoreline at an actively eroding section of the berth to help protect the site, 2) create an estuarine wetland and tidal creek in a portion of the parking lot most subject to chronic flooding to restore a coastal habitat migration corridor, 3) elevate the remaining parking area above the measured tide flood level, and 4) deliver public education messages on building climate change resiliency in response to coastal conditions. Living with Water, a $4M engineered solution to rising sea levels, is supported by $2.3M in state and federal grants, including NC Land and Water Fund, and a $700K contribution in Battleship revenues.

NFWF/NOAA funding ($1.5 M) for South Atlantic Salt Marsh Initiative (inclusive of NC)

The South Atlantic Salt Marsh Initiative (SASMI) is a regional effort and voluntary, non-regulatory partnership that brings together leaders from the Southeast Regional Partnership for Planning and Sustainability (SERPPAS) and other local, state and federal partners, communities and nongovernmental organizations to determine the greatest threats to the salt marsh ecosystem and opportunities to ensure its survival in the four-state region from North Carolina through Brevard County in east-central Florida. SASMI launched a regional salt marsh plan in May 2023 titled, "MARSH FORWARD! A Regional Plan for the Future of the South Atlantic Coast's Million-Acre Salt Marsh Ecosystem." A National Fish and Wildlife Foundation $1.57 million grant was awarded in 2024 which marks the first major infusion of money for the SASMI. The grant will help fund planning for some of the concepts identified in the SASMI Regional Plan which outlined ways to save a one-million-acre expanse of the habitat that absorbs floodwaters, filters upland runoff and is home to fish and other wildlife.

Emerging Concepts:

- Spatial modeling of future changes in the coastal zone due to sea level rise projects widespread habitat conversion (from existing coastal marsh to open water, and from existing forests and agricultural lands to coastal marsh) that has extensive implications for ecosystems, wildlife, and carbon dynamics. In particular, forest conversion to coastal wetlands has the potential to emit large amounts of carbon as trees die and decompose

(Warnell et al. 2022). These changes are already evident in the “ghost forests” along the North Carolina coast (Smart et al. 2021). Management of the coastal zone must account for these ongoing and projected changes to minimize adverse ecological and environmental impacts.

Water Supply Watersheds: Strategy Progress

5. *Protect and restore forested lands in water supply watersheds.*

Status: NWL Steering Committee will provide an update in a future Natural and Working Lands Action Update.

Restoration: Strategy Progress

6. Restore forests and wetlands within flood prone areas.

Research Report: Improving North Carolina's Resilience to Coastal Riverine Flooding

A multidisciplinary team of university faculty, staff and student researchers from North Carolina State University and University of North Carolina at Chapel Hill and nongovernment organization representatives evaluated the potential for natural infrastructure (NI) to mitigate riverine flooding in eastern N.C. The study team conducted geospatial mapping analyses; hydrologic, hydraulic and water quality modeling; economic analyses; landowner and community outreach and a preliminary review of potential programs and measures for implementing a conservation-based NI program. The Middle Neuse River Basin from Johnston to Lenoir County, which has been heavily impacted by recent riverine flooding events, was the focus area of the study. Through a literature review and exploration of 18 conservation, restoration and land management measures, eight key natural infrastructure measures were identified with the greatest potential to help improve flood resilience in Eastern North Carolina. The goals of the study were to determine the extent to which natural infrastructure can mitigate the impacts of flooding and improve water quality in the Neuse River Basin. Eighteen NI measures initially considered were reduced to the three best measures - reforestation, water farming, and flood storage wetlands - based on a literature review, expert opinion, geospatial mapping of opportunity, and ground truthing of three study sub-watersheds. The full report is online.[13]

Division of Mitigation Services 2021-2024 Progress

North Carolina Department of Environmental Quality Division of Mitigation Services ("DMS") provides compensatory and flood mitigation planning and implementation that restores and protects the state's natural resources. Protecting North Carolina's natural resources is critical to maintaining the state's quality of life, its economic growth and the health and well-being of its residents. It's important to note, compensatory mitigation restoration acres or river miles contribute to the state's goals, by replacing those lost due to development. They are in large part not additional conservation or restoration added.

DMS Compensatory Mitigation Program

DMS is a nationally recognized state initiative that restores and protects wetlands and waterways for future generations while offsetting unavoidable environmental impacts from development projects. The Division offers four in-lieu fee mitigation programs designed to assist private and public developers in meeting state and federal compensatory mitigation and nutrient offset requirements. DMS maximizes mitigation investments to restore streams, wetlands and riparian buffer areas using a watershed approach by working with state and local partners and willing landowners to concentrate mitigation resources in areas where they will have the greatest watershed benefit. Since its inception, DMS has implemented 900+ projects across the state, and protected and restored more than four million feet of stream and over 80,000 acres of natural areas.

[13] Improving North Carolina's Resilience to Coastal Riverine Flooding: Project Summary Report. May 26, 2021, https://collaboratory.unc.edu/wp-content/uploads/sites/476/2021/05/improving-resilience-to-coastal-riverine-flooding.pdf

Over the last three fiscal years (July 2021 – June 2024), DMS has accomplished the following:

- Restored and protected 183,738 feet of stream and 222 acres of wetland through the implementation of 26 full delivery projects
- Restored and protected 2,298,526 square feet of buffer, or 53 acres, through the implementation of four full delivery projects
- Offset nutrients for 2,853,373 feet of buffer, or 65 acres, through the implementation of five full delivery projects
- Purchased 3,326 stream credits and 3 wetland credits from four mitigation banks
- Purchased 1,962,604 buffer credits from 22 mitigation banks
- Purchased 1,911 nitrogen offset credits from two mitigation banks

DMS Natural Infrastructure Flood Mitigation Program ("NIFMP")

In 2020, the N.C. General Assembly established a flood capacity program within DMS (Session Law 2020-79). The program's purpose is to use natural infrastructure to mitigate flooding in small, targeted watersheds using DMS full delivery procurement methods. Session Law 2021-180 supports the flood mitigation initiative by allocating $3.5 million to DMS to create pilot projects addressing chronic flooding in the Stoney Creek watershed.

Some NIFMP highlights from 2021 to 2024 include:

- In 2022, DMS received $380,000 in funding through the NC Office of Recovery and Resilience (NCORR) from the Community Development Block Grant ("CDBG") for NIFMP development and modeling of nature-based solutions for flooding.
- As required, DMS established an advisory board and charter in 2022. The advisory board meets quarterly for updates and discussion of relevant program issues and decisions. Its members include flood resiliency stakeholders from across the state.
- In July 2023, DMS began a natural infrastructure and nature-based solutions literature review. The draft review summarizes natural infrastructure and nature-based solutions suitable for different areas of the state. Upon completion, the final document will be accessible and available to the public via the NIFMP webpage.
- In October 2023, DMS contracted with Ecosystem Planning and Restoration, PLLC ("EPR") for a hydrologic and hydraulic modeling study to quantify current DMS compensatory mitigation practices for flood mitigation. This modeling will be used to inform the RFP process, project proposal evaluation and establishment of performance metrics for all flood projects. This modeling is applicable to both NIFMP and the Statewide Flood Resiliency Blueprint ("Blueprint"), a statewide flood planning effort.
- In February 2024, DMS completed the final conceptual framework of the NIFMP strategic plan to serve as a roadmap for program implementation. The plan includes goals, objectives and tasks to implement the program. DMS defined the following NIFMP program goals:
    - Implement nature-based projects in NC that contribute to the statewide effort to improve resilience from flooding hazards and impacts.
    - Measure, demonstrate and communicate the effectiveness of nature-based solutions for flood resilience.

    - Leverage DMS's long-standing expertise and commitment to public-private partnerships to deliver effective nature-based solutions.
    - Identify and prioritize nature-based solutions for flood resilience to address community needs, maintain working lands and provide ecologic benefits.
    - Maintain consistency with complementary resilience initiatives, e.g., the Blueprint, NCORR programs and other state and local programs
- In July 2024, DMS contracted with Resource Environmental Solutions ("RES") to inventory, map and model the Carolina Bays for restoration and flood mitigation potential. This effort supports NIFMP, watershed planning and flood mitigation integration, the Blueprint and Executive Order 305.

The NIFMP and Blueprint efforts are both addressing common flooding issues in the state. NIFMP staff are actively participating in Blueprint meetings and activities to ensure consistency between and across both efforts.

DMS Stoney Creek Watershed Flood Mitigation Pilot Project

Supporting NIFMP's effort, the Stoney Creek Watershed Flood Mitigation Pilot Project will target flooding that impacts businesses, roadways and access to emergency services in Wayne County and Goldsboro. The pilot project, and the NIFMP at large, seek to mitigate flooding using natural infrastructure and constructed systems that mimic natural processes. These systems can include strategies like building wetlands and restoring streams, which help store water and reduce flooding.

The Stoney Creek Pilot Project will also serve as the basis for expanding natural infrastructure flood mitigation projects to additional watersheds. Lessons learned through the Stoney Creek Pilot Project will help develop scaling solutions to enhance community flood resilience across North Carolina.

The 2021-2024 timeline and accomplishments for the Stoney Creek Watershed Flood Mitigation Pilot Project are as follows:

- In 2022, DEQ issued and advertised an RFP for the Stoney Creek Pilot Project and awarded a contract to Ecosystem Planning and Restoration, PLLC ("EPR").
- In January 2024, EPR completed the hydrologic and hydraulic model for the existing conditions of the Stoney Creek Watershed, which sets the baseline models for evaluating potential projects.
- In January 2024, the Wayne Community College ("WCC") board approved the proposed Stoney Creek Pilot Project on the WCC campus. DMS finalized the pilot project mitigation plan in March 2024. The proposed project is a stormwater wetland and detention basin. The proposed wetland basin will be approximately 9.6 acres with an approximate drainage area of 106.2 acres. The design will be based on the future watershed conditions.
- In 2024, DMS met with stakeholders including the public, Wayne County commissioners, Wayne County's planning director, WCC's facility manager, and the NC Department of Transportation to share findings from modeling and receive comment from participants; provide examples of potential practices and realistic expectations; discuss existing limitations and opportunities; and hear from participants experiences to obtain historical perspective and identify potential partnership opportunities.
- DMS received a second project plan in August 2024 and is reviewing the plan for implementation in Stoney Creek.

7. Expand restoration efforts on publicly owned lands.

Status: Ongoing

NC Land and Water Fund Stream Restoration Projects

From 2021-2023, the North Carolina Land and Water Fund ("NCLWF") Board of Trustees granted $39,189,7226 for 85 projects to restore streams, rivers and estuaries, and fund innovative stormwater practices (NCLWF Annual Reports 2022 and 2023). In addition, 32 planning projects were funded to identify key water quality and conservation opportunities in mountain, piedmont, and coastal watersheds, including efforts to identify wetlands and floodplains capable of mitigating flooding, identifying threats to water supplies and fishing spots on the Rocky River near Siler City, reducing nonpoint source pollution to recreation areas of the South Fork Catawba River, and addressing flooding issues in multiple NC towns including Boone, Canton, Smithfield, and Washington.

The NC General Assembly also appropriated $15 million in the FY 21-22 budget to the NCLWF to establish a Flood Risk Reduction Grant Program. The NCLWF Board approved 17 projects including Newport River (Carteret), South Ellerbe Creek (Durham), Pigeon River (Haywood), Mud Creek (Henderson), Adkin Branch (Lenoir), Lumberton (Robeson), and many more.

Some NCLWF restoration project highlights from this time period include:

- Improving more than 54 miles of streams, rivers, and shores via living shoreline construction, stream and floodplain restoration, and dam removal projects, including a project on the Oconaluftee River that will reconnect 478 miles of river and streams, expanding habitat for the North Carolina threatened Sicklefin Redhorse, a species of cultural significance for the Cherokee;

- The Conservation Fund project to remove Jessup Mill Dam in Stokes County. Dam removal and improved fish passage at this site will restore access for the endangered Roanoke logperch to the Dan River headwaters in Virginia. The completed project will restore 2,700 feet of reservoir to flowing stream and result in over 75 miles of connection of the Dan River from the North Carolina border to the dam in Eden.

- The Nature Conservancy restoration of approximately 7,500 acres of drained pocosin wetlands at Angola Bay Game Land. The project scale alone will make it one of the largest, single-owner wetland restorations in NC. Restoration of these wetlands is critical to protect water quality, improve habitat, preserve natural carbon stores, and provide important storm water storage capacity.

- Upper Pigeon River Flood Mitigation Plan to create a flood reduction plan for areas of Cruso, Canton, and Clyde that are at risk for future flooding. The plan will also identify opportunities to preserve natural areas important for flood prevention, prepare projects for implementation, and conduct an economic analysis of properties eligible for flood buyout programs.

North River Wetlands Preserve Restoration

The North Carolina Coastal Federation completed 2,000 acres of wetland restoration at North River Wetlands Preserve in Carteret County through the NRCS Wetland Reserve Easement program.

Case Studies using Natural and Working Lands Information

Researchers at the Duke University Nicholas Institute for Energy, Environment & Sustainability (formerly the Nicholas Institute for Environmental Policy Solutions) have worked with Jordan Lake One Water ("JLOW"), the NC Department of Public Safety ("NCDPS"), and the NC Land and Water Fund ("NCLWF") to develop case studies using information from datasets related to carbon, resilience, and ecosystem services originally developed for the 2020 Action Plan. For JLOW, the research team created a memo summarizing the current and potential ecosystem services (including carbon storage and resilience-related services) of natural lands in the Jordan Lake watershed, including both protected and unprotected lands, to inform ongoing planning for conservation and restoration. For NCLWF, the researchers assessed the ecosystem services provided by properties protected through NCLWF and identified opportunities for future LWF projects to contribute to specific benefits, including urban heat and air pollution reduction, flood attenuation, and water quality protection. For NCDPS, the researchers quantified ecosystem services benefits provided by DPS properties and estimated potential additional benefits that projects such as reforestation on DPS properties could create.

These case studies support organizations working to protect and restore natural lands in NC by providing information about opportunities for conservation or restoration of forests, flood prone areas, and urban areas. Therefore, this work relates to several NWL recommendations across multiple objectives. Case study documents are available on the Nicholas Institute NWL project web page.[14]

[14] Project: North Carolina Natural and Working Lands. https://nicholasinstitute.duke.edu/project/north-carolina-natural-and-working-lands

8. Encourage restoration and reforestation on private lands.

Status: Ongoing

Restoration Through Prescribed Burning in North Carolina

Fire is a natural part of the environment and frequently occurs throughout North Carolina. Many of our forests require fire to remain healthy and thrive. Prescribed fire is the planned use of fire under predetermined weather and fuel parameters to obtain specific management objectives. This is a critical management tool that benefits forests and wildlife and helps reduce the impact of wildfire hazards in North Carolina. Under controlled conditions, prescribed fires burn primarily the finer fuels (e.g. leaves, twigs) of a forest. Prescribed fires are planned to be conducted during weather conditions that allow smoke to disperse quickly. This reduces the probability of catastrophic wildfires, which can consume much greater amounts of fuel, releasing carbon dioxide as biomass and soils are burned, and exposing human communities to potentially harmful quantities of smoke. In State Fiscal Year 2021, the North Carolina Forest Service of the Department of Agriculture and Consumer Services conducted 834 prescribed burns on 88,829 acres of public and private land. Within NCDNCR, the Division of Parks and Recreation (State Parks) conducted 70 prescribed fires on 15 parks and natural areas totaling 5,708 acres.

Between SFY 2021 to SFY 2024, NC Wildlife Resources Commission completed 1,120 burns, totaling 118,395 acres on public game lands and wildlife conservation areas. On private lands, NCWRC promotes prescribed burning to landowners for the purpose of maintaining or enhancing habitat conditions in forest or open fields. NCWRC staff take learnership roles in the Bladen Lakes Area Prescribed Burn Association and are active in other Prescribed Burn Associations to facilitate peer-to-peer learning between landowners. NCWRC also loans equipment (e.g., water pumps) to landowners so they can implement burns on their property. NCWRC staff also actively promote the use of farm bill funding to implement prescribed burning on privately owned property.

In 2021, the N.C. General Assembly allocated additional funds to the NC Forest Service for a prescribed burning matching cost-share program. Time-limited funding is available for this program for approximately 2 years at $1 million per year. Eligible practices include the following types of prescribed burning:

- Silvicultural Burning – The use of prescribed fire to prepare areas for natural pine or oak regeneration, pre-commercial thinning to reduce competing tree density of undesirable species and the use of prescribed fire to manage for insects or disease concerns to promote forest health.
- Hazard Reduction Burning – The use of prescribed fire for the purpose of mitigating forest fuels to reduce the risk from potential damage from wildfires.
- Wildlife Habitat Burning – The use of prescribed fire for the purpose of maintaining or creating improved forest, or open field conditions for desired plants, species, and habitat.

Funds provided by the program must be matched by funds from the landowner or other non-State sources. For more information, contact North Carolina Forest Service Technical Development & Planning Branch.

Forest Establishment - Tree Planting

The NCFS has been dedicated to the protection, conservation and stewardship of North Carolina's forests for more than a century. Through the Forest Development Program, Florence Restoration Fund, and other sources, NCFS allocated $5.81 million in State Fiscal Year (SFY) 2021 and $4.45 million in SFY 2020. In SFY 2021, this investment resulted in 62,681 acres of forest establishment on private lands with NCFS technical and financial assistance. For more information, contact Technical Development & Planning Branch North Carolina Forest Service.

The NC Wildlife Resources Commission aims to restore natural forest conditions on its landholdings. Between SFY 2021 and SFY 2023, the agency established 4,297 acres of longleaf pine in appropriate soils. Staff promote appropriate native tree establishment on private lands in critical areas, i.e., riparian buffers, and for declining tree species, such as hardwoods, shortleaf pine, and longleaf pine.

Emerging Concepts:

Restoration of native warm season grasses

NC Wildlife Resources Commission has a 20-year history of leading the effort to establish native warm season grasses (NWSG) on private lands in North Carolina. NCWRC staff focus on including NWSG in forage production systems as well as managing early seral stage vegetation for wildlife and pollinator habitat. These efforts have enhanced wildlife habitat, improved drought resistance in forage production, and increase ecosystem services while strengthening carbon sequestration and storage capacity compared to non-native herbaceous species. Staff within the Wildlife Management Division Operations Program and Habitat Conservation Division will continue to promote the establishment of native vegetation to meet both production and habitat-oriented objectives. NCWRC maintains specialized seed drills which are required to effectively plant native seeds, as well as sprayers needed for site preparation herbicide treatments. This equipment is available to private landowners who are interested in native vegetation establishment. Efforts are underway to increase machinery available to landowners and increase technical knowledge with on-the-ground trials. Operations Program staff continue to influence financial assistance programs to ensure funds are available to offset costs associated with establishment and management of native herbaceous vegetation.

9. Rewet peatlands to prevent soil loss and catastrophic fire.

Status: Ongoing

Mapping pocosin status and restoration potential

Pocosins are naturally occurring evergreen shrub-dominated freshwater wetlands of the Southeastern Coastal Plain with deep, acidic, sandy, peat soils. North Carolina contains the world's largest acreage of pocosins. Proper management of pocosins has the potential to sequester significant amounts of carbon while decreasing the risk of catastrophic fire on these lands (avoiding additional emissions). According to the 2020 Action Plan, about 250,000 acres of drained pocosins are in public ownership. Researchers at Duke University Nicholas Institute for Energy, Environment & Sustainability have updated maps of NC pocosin status; existing maps were created by NC Division of Coastal Management in 1999 using data from the 1980s-1990s. Updated maps classify pocosin areas by their hydrology (drained or undrained) and vegetation (cleared or intact), based on data currently available. The team received input from members of the pocosins subcommittee and maps were presented for additional feedback during a series of meetings. The updated maps can be used to identify pocosin areas that may be suitable targets for restoration given their hydrologic or vegetation status. Land ownership information is also overlaid to help users identify restorable pocosin areas on state-owned or conservation lands, and soil carbon content from the USDA Soil Survey is available in the web map as well. The maps are available online.[15]

Better maps of peat depth, artificial drainage ditches, more accurate carbon estimates, and additional data could help prioritize restoration and conservation; partners will continue to search for funding to research this information.

Restoring Peatland Hydrology in the Pasquotank River Headwaters at Great Dismal Swamp NWR

The U.S. Fish and Wildlife Service and The Nature Conservancy partnered to restore the hydrologic conditions across a 12,000-acre Pasquotank River headwater peatland area in Gates, Pasquotank, and Camden Counties, North Carolina. The Great Dismal Swamp National Wildlife Refuge ("NWR") protects a 113,000-acre remnant of a once vast forested peatland on the Atlantic Coastal Plain in southeast Virginia and northeast North Carolina. When the land was transferred to the Service, the agency acquired a peatland with a 200-year history of logging and more than 150 miles of drainage ditches and logging roads. The Pasquotank River Headwaters area was the last large-acreage block of Great Dismal Swamp NWR in need of hydrologic restoration infrastructure. This drainage network has profoundly altered the natural hydrologic flow and storage capacity of the refuge, which in turn exacerbates flooding issues in adjacent communities. The long history of logging and the associated drying of underlying peat soil due to drainage are implicated in the transition from a diverse wetland forest community to one dominated by a monotypic upland-like forest community with reduced wildlife value and more prone to wildfire. Drier conditions have led to peat subsidence (loss of land elevation), elevated carbon dioxide emissions, increased risk of catastrophic peat wildfires, and homogenization of the once diverse wetland forest community of the swamp.

[15] NC Pocosin Map Update. Duke University Nicholas Institute for Energy, Environment & Sustainability. https://dukeuniv.maps.arcgis.com/apps/webappviewer/index.html?id=a52bb5da376f4699adc4f9514a39fb56

This project aimed to help reverse these conditions by building water control infrastructure that gives refuge managers the capability to slow drainage and mimic the pre-disturbance hydrology of the swamp. Seven sheet-pile weir-type water control structures were constructed in the four primary ditches (Cross Canal Ditch, County Line Ditch, Bull Boulevard Ditch, and Insurance Ditch). Adjustable sheet-pile weirs were installed where Service staff need to adaptively manage flow conditions to enhance downgradient flood mitigation. To complement the installation of water control structures, four low water crossings were constructed on Weyerhaeuser Ditch Road, County Line Ditch Road, and Insurance Ditch Road to re-connect historic surface water flow paths disrupted by logging roads. Water control structures are being managed to slow drainage and lengthen the flow paths, mimicking previous wetland conditions favorable for the re-establishment of wetland communities and providing flood mitigation benefits to downgradient communities.

Restoring Pocosin Hydrology to Improve Flood Resiliency and Wildlife Habitat in Southeastern North Carolina

The North Carolina Wildlife Resources Commission and The Nature Conservancy are collaborating on two pocosin restoration projects in southeastern North Carolina. The first is a project to restore pre-drainage conditions to 7,500 acres of ditched and drained pocosin habitat at Angola Bay Game Land. The second is a ~17,000-acre project to restore pre-drainage conditions to pocosin at Holly Shelter Game Lands. The primary purpose of these efforts is to increase environmental resilience to flooding associated with hurricanes that threaten downstream human communities. Secondary benefits include improving quality of pocosin and other associated wetland habitats; arresting the soil subsidence associated with breakdown of dewatered organic soils; mitigating potential negative impacts to the soil profile, plant communities and ambient air quality, as a result of prolonged soil combustion from wildfire events on dewatered organic soils; enhancing ability to apply prescribed fire for habitat and risk management; and, preserving carbon sequestration within organic soils.

Angola Bay: The planning phase of the Angola Bay Game Land pocosin restoration project has been completed, including a pre-implementation hydrology monitoring period to determine baseline conditions. As of the summer of 2024, Phase 1 of implementation has also been completed. This phase consisted of removing multiple stands of plantation loblolly pine and installing twenty-six sheet pile weirs and eleven aluminum flashboard riser water control structures to raise groundwater levels within the pocosin to historic levels. This will reduce the risk for catastrophic wildfires and will return ecologically appropriate moisture levels to the peat soils. Phase 2 of the project is focused on restoring appropriate natural communities to the site. Management strategies for this phase include site prep spraying of 1,300 acres and replanting 1,300 acres with Atlantic White Cedar, Button Bush, and Cypress (Winter 2024-2025). The Angola Bay project is unique for its location in a headwaters section and significant topographical change. Results will serve as a model for future hydrology restoration in similar landscape positions. Funding for this project was awarded from the National Fish and Wildlife Foundation's Emergency Coastal Resilience Fund and America the Beautiful Challenge grants as well as funds from the NC Land and Water Fund.

Holly Shelter: The ~17,000-acre pocosin restoration project at the Holly Shelter Game Lands is the largest pocosin restoration project to date. The area was ditched in the last century and has a recent history of catastrophic wildfire. The Juniper Road fire of 2011, specifically, burned for two and a half months covering over 31,000 acres and resulted in peat soil loss of 3-5 feet in places. This loss resulted in a "bowl"

where drainage has been accelerated and peat soils are losing functionality. Five surface water monitors and eleven ground water monitoring wells have been installed to understand the current hydrologic condition of the project area and aid in restoration designs. Initial design framework calls for eight risers and eight sheet pile weirs to be installed as well as a large amount of road raising. Project final design work is slated to be completed in fall 2024 and TNC has already secured funding for implementation. NCWRC plans to perform long term flora and faunal surveys of the project area to understand the impacts of pocosin restoration on local wildlife and plant communities.

Pocosin Lakes National Wildlife Refuge: A portion of the $27 million Inflation Reduction Act grant that US Fish and Wildlife Service received in April 2024 for nature-based solutions in the Albemarle-Pamlico Region will restore the remaining highly hydrologically altered peatlands by rewetting the peat, to the extent possible, to mimic natural hydrological conditions of healthy pocosin wetlands. This is accomplished by reducing artificial drainage without causing negative impacts to adjacent lands and raising water levels to target levels at water control structures. Restored, healthy pocosin ecosystems provide high quality wildlife habitat, protects water quality, reduces saltwater intrusion at lower elevations, conserves peat and elevation, and protects local communities by reducing wildfire frequency and intensity and lessons flooding from storms. In addition, the refuge continues to maintain the existing 37,000 acres of fully restored pocosin ecosystems.

Pocosin Lakes National Wildlife Refuge also received Coastal Program Funds for a two-part project to serve as a demonstration site for a 2-stage ditch (Grassy Ridge Study) and provide habitat for the threatened Eastern Black Rail. The first phase of the project includes the design and construction of a 2-stage ditch which will include shallow water habitat for threatened Eastern Black Rails. The second phase includes the conversion of a farm field to a shallow water impoundment to provide habitat for threatened Eastern Black Rails and benefits to wintering waterfowl.

10. Restore Atlantic White Cedar.

Status: NWL Stakeholders and partners are currently researching opportunities for restoration of Atlantic White Cedar in appropriate areas. The few remaining naturally occurring Atlantic White Cedar Forests are mapped by the Natural Heritage Program and biologists continue to search for more examples.

11. Protect peatlands from sea level rise and saltwater intrusion.

Status: Ongoing

Implement targeted interventions to protect peatlands from sea level rise and saltwater intrusion guided by scenario-based modeling.

Scuppernong Regional Water Management Study

APNEP has been leading collaborative efforts to conduct a hydrologic study of the northern Albemarle-Pamlico peninsula including the Scuppernong River, Lake Phelps, Pocosin Lakes National Wildlife Refuge, and Buckridge Coastal Preserve since 2018. APNEP facilitated a partnership between the NC Division of Parks and Recreation, NC Soil and Water Conservation Districts, US Fish and Wildlife Service ("USFWS"), the Albemarle Commission ("ACOG"), and Washington and Tyrell Counties and secured funding from the NC Water Resources Development Grant in 2023.

Phase I of the Scuppernong Water Management Study, led by Kris Bass Engineering, a member of the NWL Pocosin Wetland sub-team, was completed in spring 2024 and Phase II is underway. This phase was focused on collecting and generating data necessary to complete the robust hydraulic and hydrologic modeling planned for Phases 2 and 3 of the projects.

The Study has been supported by development of a community Engagement Strategy in partnership with the NC Coastal Reserve, NC Sea Grant, The Nature Conservancy, and SWCA through a grant from NOAA Digital Coasts and the National Estuarine Research Reserve Association ("NERRA"). The grant is geared towards assisting marginalized communities with flooding through equitable engagement. The team developed a steering committee, expanding the regional partnership beyond the grant partners listed above, to ensure development of a product that will help local decision makers with flooding, drainage, and regional water management issues. Throughout 2023 and 2024, the engagement team organized and attended several community events, engaging hundreds of community members in conversations about areas of concern for flooding with the intent to incorporate community feedback and knowledge into Study implementation. The team coordinates closely with other regional resilience projects led by DEQ and NCORR, and an Audubon project to promote nature-based solutions in Tyrrell County to leverage resources, streamline community coordination, and reduce duplication of effort.

The next phase of the study, Phase 2, involves finalizing the watershed-scale models, creating a water budget of the Scuppernong basin, and developing small scale, localized hydraulic models in priority areas of concern identified by the community. These models will provide a tool to evaluate the effect of proposed changes on seasonal and event-based flows.

Alligator River National Wildlife Refuge: As mentioned previously, in April 2024 the US Fish and Wildlife Service received a $27 million grant through the Inflation Reduction Act to support building resiliency on national wildlife refuges and North Carolina game lands in the Albemarle-Pamlico Sound region. Projects at Alligator River National Wildlife Refuge will focus on upgrading water-management infrastructure to reduce the impacts of saltwater intrusion.

Emerging Concepts:

Stakeholder-led publications related to peatlands and carbon

1. Richardson, C. J., Flanagan, N. E., Wang, H., & Ho, M. (2022). Annual carbon sequestration and loss rates under altered hydrology and fire regimes in southeastern USA pocosin peatlands. Global Change Biology, 00, 1–15. https://doi.org/10.1111/gcb.16366

2. Armstrong, L., Peralta, A., Krauss, K.W., Cormler, N., Moss, R.F., Soderholm, E., McCall, A., Pickens, C., Ardon, M. (2022). Hydrologic restoration decreases greenhouse gas emissions from shrub bog peatlands in Southeastern US. Wetlands, 42: 81.

3. Swails, E.E., Ardón, M., Krauss, K.W., Emanuel, R.E., Helton, A.M., Morse, J.L., Gutenberg, L., Cormier, N., Shoch, D., Settlemyer, S., Soderholm, E., Boutin, B.P., Peoples, C. & Ward, S. Response of soil respiration to changes in soil temperature and water table level in drained and restored peatlands of the southeastern United States. Carbon Balance Manage 17, 18 (2022). https://doi.org/10.1186/s13021-022-00219-5

12. Prioritize climate change and sea level rise in coastal habitat restoration planning.

Status: Ongoing

The North Carolina Division of Coastal Management ("DCM") collaborated with partners to develop the 2022-2026 Estuarine Shoreline Strategy for sustainable and effective estuarine shoreline management that promotes resilient coastal communities and healthy ecosystems. The North Carolina Coastal Federation collaborated on strategies focusing on promoting the use of living shorelines for shoreline stabilization, understanding shoreline change through mapping, and exploring implementation of resilience strategies including thin-layer placement and protection of marsh migration pathways. The Federation worked to address the need for projects trying to incorporate living shorelines rather than bulkheads. The Federation collaborated with multiple researchers to help fund research projects to quantify the benefits of living shorelines, made direct connections between living shoreline material companies, contractors, engineers, regulatory agencies, researchers and other living shoreline stakeholders to promote and increase the use of living shorelines in the state, and published yearly statewide living shoreline accomplishments. The Federation is also collaborating with NC State University researchers to complete the first of three phases of the National Science Foundation/Paul G. Allen Foundation study that is investigating the co-benefits of multi-habitat restoration (oysters, mussels, salt marsh, and seagrass). The study aims to provide innovative restoration designs for use in future living shoreline construction to boost ecosystem restoration, biodiversity and climate resilience.

Living Shoreline implementation projects:

From 2021 to 2024, the North Carolina Coastal Federation and its partners collaborated to construct over 36,000 feet (over 6.9 miles) of living shorelines at over 160 sites using various materials. More than 175,000 plugs of salt marsh grasses were planted at over 38 sites. These sites include private properties through the Federation's living shoreline cost-share program as well as living shorelines constructed at public, state and federal properties such as the Town of Pine Knoll Shores, Atlantic Harbor, Carteret Community College, Morris Landing, Whittaker Point, Wanchese Industrial Park, Highway 24 Cedar Point-Swansboro Causeway, Hammocks Beach State Park, Jockeys Ridge State Park, Black Duck Island, NC Aquarium at Pine Knoll Shores, Sugarloaf Island, Fort Macon State Park, Camp Don Lee, Camp Caroline, Marine Corps Air Stations Cherry Point and New River, Marine Corps Base Camp Lejeune, and many others. These restoration efforts have restored more than 25 acres of salt marsh and five acres of oyster reef habitat.

Living Shoreline education, policy and research updates:

From 2021 to 2024, the North Carolina Coastal Federation and its partners collaborated to make great strides to have living shorelines be the go-to natural solution for shoreline stabilization. Through its education program they have worked with their partners to develop and implement technical trainings for marine contractors, engineers, consultants, and various agencies. Additionally, they have educated hundreds of contractors, realtors, engineers, teachers, students, community volunteers and local governments through hands-on coastal habitat restoration programs. Partnering with Carteret County Community College, North Carolina Sea Grant, and East Carolina University, the Federation assisted with the development and implementation of the College's Living Shoreline Academy training course for property owners, contractors and engineers.

Emerging Concepts:

- Thin Layer Application for increasing salt marsh resilience. Increasing salt marsh elevation via the application of dredged material is of increasing interest and may provide the opportunity to protect stored marsh carbon as well as preserve marsh habitat and Carbon sequestration under rising sea levels. A pilot project is being conducted on Piney Island, part of the USMC Cherry Point installation. Test plots will be established to study marsh response to sediment addition, and sediment carbon stocks will be assessed. In Currituck Sound, Audubon North Carolina and partners are developing multiple pilot projects at Pine Island Sanctuary to evaluate the effectiveness and replicability of a range of marsh restoration techniques, including two thin-layer sediment pilot projects totaling approximately 6 acres. The US Army Corps of Engineers is currently developing a plan for beneficially using dredged material for restoration work in North Carolina.

- Regulatory compliance and permitting requirements slow implementation of nature-based solutions including coastal habitat restoration. A proposed new effort would work with federal partners to develop a new federal and state regulatory permitting and review team to coordinate permitting and facilitate implementation. Together, development of a landscape-scale programmatic agreement across federal and state legislators would use categorical bundling of similar projects, emerging technology, technical support, and other approaches to enable more rapid NBS deployment of coastal projects in the Albemarle-Pamlico Sound and work to extend this approach to other parts of North Carolina.

- See emerging concepts under coastal habitat migration corridors and provide incentives to stakeholders for coastal habitat protection recommendations for details related to coastal planning under sea level rise and other anthropogenic changes

Agriculture and Soil Management: Strategy Progress

13. *Encourage adoption of high mitigation agricultural conservation practices on croplands and pasturelands.*

Status: Ongoing

North Carolina Foundation for Soil and Water Conservation is currently focusing their efforts on soil health through farmland preservation (NC Agriculture Development & Farmland Preservation Trust Fund – "NC ADFP"). This year (2024) there are 3,623 acres of farmland that have been moved into the NC ADFP easements, under 242 contracts. This is a significant increase in acres entered into the easements from 2023 with 3,005 acres in easements. All these easements protect carbon storage and sequestration in the form of crops, trees or pastures.

Emerging Concepts:

Multi-Species Cover Crop Initiative

The North Carolina Foundation for Soil and Water Conservation partnered with five Soil and Water Conservation Districts and champion farmers to pilot multi-species cover crops on-farm. This project has also ended. This project helped fund the purchase of no-till drills and roller/crimpers for several district offices to encourage the continued use of cover crops.

14. *Enhance soil health and retention on working peatlands via best management practices and drainage management.*

Status: Ongoing

Chowan River National Water Quality Initiative

The NC Coastal Federation enrolled a portion of the Chowan River watershed in the NRCS National Water Quality Initiative. The National Water Quality Initiative is a partnership among NRCS, state water quality agencies and the U.S. Environmental Protection Agency to identify and address impaired water bodies through voluntary conservation. NRCS provides targeted funding for financial and technical assistance in small watersheds most in need and where farmers can use conservation practices to make a difference.

Conservation systems include practices that promote soil health, reduce erosion and lessen nutrient runoff, such as filter strips, cover crops, reduced tillage and manure management. These practices not only benefit natural resources but enhance agricultural productivity and profitability by improving soil health and optimizing the use of agricultural inputs.

The project is currently in the Planning Phase, and the Federation will bring together stakeholders in the fall of 2024 to discuss steps moving forward.

15. Improve manure management on farms.

Status: Ongoing

Within the Soil & Water Conservation Districts, there are six cost share programs that farmers can participate in and receive funding assistance to help improve manure management practices. These practices are: Retrofit of On-going Animal Operations, Waste Treatment Lagoon/Storage Pond, Constructed Wetland, Dry Stack, Feeding/Waste Storage Structures, and Prescribed Grazing. These activities are practices recommended by the EPA to reduce methane emissions from livestock manure management.[16] In 2022 five of these projects were funded through their local Soil & Water Districts, eight in 2023 and eight for 2024 with five projects pending approval from the Soil & Water Commission.

[16] Practices to Reduce Methane Emissions from Livestock Manure Management. https://www.epa.gov/agstar/practices-reduce-methane-emissions-livestock-manure-management

16. Encourage food system efficiency through reduced food loss and waste.

Status: Ongoing

Through the Department of Environmental Quality, the Division of Environmental Assistance and Customer Service has awarded grants to 11 organizations focused on Food Waste Reduction. The division administers the grants and help local governments reduce the amount of food that goes to landfills across the state.[17] North Carolina State University has two educational programs to help reduce food waste on a smaller scale One program is set up to help on a household scale of teaching citizens to compost their food scraps.[18] Another resource through the extension services focuses on six ways to reduce food waste: 1) prevent food waste, 2) donate food to those in need, 3) compost the unwanted or unusable food, 4) feed local livestock, 5) use the fats, oils and grease to be turned into biofuels, and 6) anaerobic digestion with link where and how this is done.[19]

Emerging Concepts:

The North Carolina Priority Climate Action Plan (PCAP) describes a measure to reduce food waste with additional ideas for implementation. Measure 11 of the PCAP is to "reduce food waste entering the waste management system to reduce the methane emissions from food waste landfilling, direct food to communities in need, and create organic resources through composting or digestion." DEQ may work to secure funding to further pursue implementation of this measure.[20]

[17] Eleven Projects Funded through Inaugural Food Waste Reduction Grant. June 1, 2023. https://www.deq.nc.gov/news/press-releases/2023/06/01/eleven-projects-funded-through-inaugural-food-waste-reduction-grant

[18] Food Waste Management. NC State Extension. https://composting.ces.ncsu.edu/food-waste-management/

[19] Resource & Waste Recovery. NC State Extension. https://localfood.ces.ncsu.edu/local-food-resource-waste-recovery/

[20] Priority Climate Action Plan. NCDEQ. https://www.deq.nc.gov/north-carolina-priority-climate-action-plan-climate-pollution-reduction-grant/open

17. Improve site preparation and soil amendment during land development.

Status: Developing

The Urban Lands Committee is researching mechanisms and construction project best practices for maintaining healthy soils that support landscaping and water and carbon retention.

Government Services and Policies: Strategy Progress

Facilitate carbon offset and ecosystem services markets

18. Facilitate voluntary landowner participation in carbon offset and ecosystem services markets.

Status: Ongoing

The Appalachian Carbon Research Group, led by Dr. Tatyana Ruseva and Dr. Tammy Kowalczyk, takes a multidisciplinary approach to expanding opportunities for landowner participation in voluntary carbon and ecosystem services markets. They study and collaborate with several programs that offer opportunities to landowners in NC who are interested in managing their land for carbon. Among these are the Family Forest Carbon Program, LandYield, Green Assets, Forest Carbon Works, the Climate Trust, and Working Trees.

U.S Endowment Grant

In late 2023 the Appalachian Carbon Research Group completed a Survey of North Carolina Forest Owners and Attitudes about Carbon Programs. The survey was mailed to landowners in six NC counties: two counties in the Mountain region (Mitchell, Watauga), two in the Piedmont region (Stokes, Caswell), and two in Coastal NC (Harnett, Northampton). These counties were selected as having the highest percent of forested land (after excluding public forest lands) based on data from the National Land Cover Database (NLCD).

The questionnaire included 30 questions organized in three sections: 1) ownership characteristics, current land use, and future forest management plans; 2) attitudes about carbon programs; and 3) landowner demographic characteristics. Section 2 included an experimental survey technique, known as conjoint analysis (Hainmueller et al., 2014). The randomized conjoint analysis aims to identify the causal effects of carbon program characteristics, namely contract length, management practice, payment incentive, and expected income on participants' willingness to enroll in a carbon program.

Preliminary analysis was completed on the landowner survey and some of the results were presented at a local conference in experimental economics at Appalachian State university in April 2024. Preliminary findings suggest that the type of management activity does not have a strong effect on landowner willingness to participate. Landowners are hesitant to commit to managing the land in ways that can sequester more carbon. Landowners are less likely to sign on to a carbon program as the contract length increases from 1 to 20 years. Further, landowners are less likely to choose a program that requires a high portion of their land be enrolled, particularly if that involves more than 75% of their land. However, they are more likely to sign on as the compensation per acre increases and more likely to sign on if they get 20% upfront relative to annual payments.

Appalachian Carbon Research Group completed one of two workshops designed to engage with landowners for the purpose of education on forest carbon programs and how to participate. The second workshop will focus on piloting a scenario planning tool to help landowners understand what potential participation options might be. For this workshop, a data analytics student at App State developed a

decision tool for evaluating options to participate based on preferences for contract length, payment options, and forest management practices.

The final part of the activities for this grant is related to soliciting information from the private sector on the propensity to invest in forest carbon programs to help fund their development and growth. Various representatives of the private sector were interviewed to better understand how this perspective can help or hinder the advancement and growth of forest carbon programs that create greater opportunities for small-scale forest landowners to participate in the voluntary carbon market.

US Forest Service - Southern Research Station / Appalachian Carbon Research Group Collaborations

Two collaborative projects with researchers at the US Forest Service - Southern Research Station relate to increasing participation by North Carolina forest owners in forest carbon programs. The first one aims to identify opportunities and barriers for Tribes and tribal members to participate in carbon programs, and the compatibility of existing and proposed carbon programs with the values and needs of Tribal communities. The work relies on a participatory action research approach as a mechanism for engaging stakeholders and co-producing knowledge through collective engagement, and much of the efforts have involved outreach and engagement with Tribes (e.g. attending the 47th Annual InterTribal Timber Symposium in Cherokee, NC in May 2024). Researchers are also completing a systematic review of the literature on forest carbon programs and Tribes, and planning for future discussion-based workshop where stakeholders may share their knowledge, perceptions, and preferences related to carbon programs.

The second project is interested in better understanding barriers to participation among underrepresented groups. A specific barrier to participation in forest carbon programs by landowners is the concept of “additionality” where the project activities the landowner completes are “additional” to what they would be or have been doing regardless of participation in the project. To enrich the review of additionality and better understand how it is being applied across different types of forest carbon programs, researchers met with representatives from several forest carbon project developers, professional foresters, and landowner representatives. The goal for these conversations is to gain knowledge on real-world experiences with applying additionality requirements and understanding how it can create barriers to participating in different types of forest carbon programs. Ultimately, this helped inform the development of a decision-making support tool for landowners by defining the pathways for which additionality is likely not a barrier. This decision-tool will be piloted at the second workshop described above. Tools for navigating the different opportunities and making decisions to participate are being developed for the purpose of expanding education and increasing engagement.

North Carolina Forest Carbon Community of Interest

Beginning in 2020 and inspired by the NC NWL Action Plan, members of the NWL Forest subcommittee and other North Carolina based researchers created the Forest Carbon Community of Interest. The purpose of the group was to work together and engage experts outside of North Carolina to help identify strategies that could be used to implement the forest carbon-related 2020 Action Plan recommendations. During 2021-2022, the group held several meetings with NC stakeholders and consulted with external organizations. Based on these efforts, Duke University’s Nicholas Institute for Energy, Environment & Sustainability (formerly the Nicholas Institute for Environmental Policy Solutions) published a policy brief

entitled “A Menu of State Actions to Promote Carbon Sequestration and Storage.” This report presents policy and program options, that decision makers can leverage to promote forest carbon solutions.

19. Create a NWL Solutions Toolbox.

Status: Complete

NC Resilience Exchange

In May 2024, with the support of several state and non-state government partners, the North Carolina Office of Recovery and Resiliency ("NCORR") launched the NC Resilience Exchange.[21] The new site organizes state and federal resources, as well as solution guides, funding opportunities and grant writing assistance from nonprofits and academic institutions. With an emphasis on equity, the Exchange helps users understand their exposure to climate change impacts, see how other communities are managing nature-based emergencies, find grants and support for accessing funding, and more. The site also emphasizes connecting users to real people. Three resource centers on the site – the Experts Database, the Funding Database, and the Success Stories Database – list contact information for individuals willing to assist.

The NC Resilience Exchange has a strong focus on protecting, enhancing and preserving the state's natural and working landscapes. Users of the Vulnerability Maps can overlay wildfire, landslide, flood and extreme heat risks with layers displaying the state's impervious surfaces, tree canopy, animal and crop farms, wetlands and natural areas with important species. They can also filter for nature-based solutions, land conservation, shifting species, changing seasons and more using the databases hosting actions, success stories, funding opportunities, experts and reports and tools. Furthermore, individuals working in North Carolina can pick from a suite of model ordinances focused on watershed protection, conservation districts, conservation subdivisions, steep slope protection and more.

In addition to maintaining the NC Resilience Exchange and adding new resources as they become available, NCORR staff meet with local governments and their partners to facilitate use of the tool, respond to questions and offer webinars to dig deeper into what the Exchange has to offer.

Using Natural and Nature-Based Features to Build Resilience to Storm-Driven Flooding

APNEP and Wetlands Watch completed the North Carolina portion of the Natural and Nature Based Features ("NNBF") project,[22] which is designed to incentivize the use of NNBFs by identifying co-benefits of coastal habitats, natural infrastructure, and nature-based solutions to mitigate storm driven flooding.

Wetlands Watch evaluated the tool's applicability in North Carolina to support implementation of the North Carolina Climate Risk Assessment and Resilience Plan, NWL Action Plan, and Virginia Coastal Resilience Master Plan in consideration of APNEP's Memorandum of Understanding to collaborate in our shared waterways with Virginia. The project team conducted a needs assessment of local governments and resilience practitioners through the Outer Banks Community Rating System ("CRS") Users Group, NC Coastal Resilience Community of Practice, and NCDEQ Water Resources Interagency Team. The project culminated in development of a resilience tool and database tailored to meet identified needs.

[21] NC Resilience Exchange. https://www.resilienceexchange.nc.gov/
[22] Using Natural and Nature-Based Features to Build Resilience to Storm-Driven Flooding. https://apnep.nc.gov/our-work/protection/using-natural-and-nature-based-features-build-resilience-storm-driven-flooding

This project is an extension of a NOAA-funded project led by the Virginia Institute of Marine Sciences to develop tools and outreach materials for local governments highlighting the co-benefits of NNBFs that also generate credits in water quality (total maximum daily load – "TMDL") and hazard mitigation programs such as FEMA's CRS. The project team developed a spatial analysis tool for Virginia local governments which is housed on ADAPTVA. As a member of the Statewide Resilience Clearinghouse Steering Committee, APNEP is working to incorporate the tool in the new NC Resilience Exchange, as it may be beneficial for regional resilience planning being conducted in our shared waterways in both states.

20. Modernize forest policy and tax incentives.

Status: Ongoing

Conservation Tax Credit

Conservation tax credits are a powerful incentive for private landowners to conserve farm and forest land and expand our state's parks, trails, and wildlife areas. In 2024, the NC Farm Act (SB 355) included a tax credit for land conservation. The conservation tax credit is a time-limited NC tax policy that allows landowners to receive a tax credit based on the value of real estate donated to a qualified nonprofit or government entity for farmland preservation, public trails, fish and wildlife, and other conservation-related purposes. The property must be donated within between January 1, 2025, and December 31, 2026. There are other limitations on the tax credit. Providing incentives like the Conservation Income Tax Credit to private landowners will increase the number of conservation projects and reduce acquisition costs for state, local, and private agencies.

Wildlife Conservation Lands Program

The Wildlife Conservation Land Program ("WCLP") offers a property tax deferment for private landowners who enter into a habitat conservation agreement with NC Wildlife Resources Commission to manage their property for ecological, not economic, goals and objectives. Unlike other Present Use Value tax deferment programs, WCLP does not have economic production requirements, thus allowing landowners to manage for more diverse plant communities that favor a wider range of wildlife species. Diversification of vegetation on WCLP enrolled lands, compared to the monoculture stands often associated with timber or crop production, results in overall ecosystem resiliency. While the tax deferment does not compete with the financial incentives associated with development, WCLP does allow a landowner to manage their property for a wider range of ecological services without facing increased property taxes. Between 2020 and 2023, 220 landowners enrolled into the WCLP across the state, accounting for 17,584 acres.

Emerging Concepts:

Executive Order 305 directs DEQ to engage with academic partners to deliver a report or reports to the Governor and the General Assembly that investigates the social, economic, and environmental value of conserving NWLs in North Carolina. Among other topics, the report most explore the estimate social, resilience, economic, and environmental benefits of conservation policies, such as the reinstitution of the conservation tax credit. As of the publication of this report, DEQ is soliciting statements of interest from organizations to complete this work the North Carolina Office of Strategic Partnership's Project Portal.[23]

[23] EO 305 Project Solicitation. NC Project Portal. https://projectportal.nc.gov/project/deq-natural-and-working-lands/

21. Increase landowner access to forest management technical and financial assistance.

Status: Ongoing

NC Forest Service Forest Management Program

NC Forest Service offers a wide variety of forest management programs and services that can help landowners become more knowledgeable about their forests as well as their options. NC Forest Service Foresters and Rangers work one-on-one with landowners to prepare woodland plans that are tailored to the landowner's unique management goals and the features of the property. Highlights from 2021 include:

- 4,662 Woodland Management Plans prepared on 227,964 acres
- 1,696 forest protection/forest health technical assists on 83,783 acres
- 587 landowners implemented forest stand improvement on 16,829 acres
- 7,128 water quality inspections were conducted on 161,191 acres
- Forestry cost-share funding allocated to landowners in SFY 2021:
  - Forest Development Program: $2.21 million
  - Florence Reforestation Program: $3.6 million
  - Southern Pine Beetle Prevention Program: $196,901

North Carolina Forest Service and American Forests Carbon Sequestration Partnership

The NCFS and American Forests entered a memorandum of understanding in September 2021 to work together for planting trees to sequester carbon on public and private lands in NC; improving NCFS-managed State Forests and Educational State Forests; and strengthening/expanding NCFS tree seedling nursery capacity. A notable outcome will include the planting of at least 750,000 tree seedlings on public and private lands in NC. Details of this 3-year $375,000 agreement, made possible by an anonymous donation, include:

- Years 1 & 2 - $100,000 tree planting cost-share to private landowners and $25,000 for tree planting and forest stand improvements on state forests, each year.
- Year 3 - $100,000 for NCFS tree seedling nursery capacity investments and $25,000 for tree planting and forest stand improvements on state forests.

For more information, contact North Carolina Forest Service Technical Development & Planning Branch.

Emerging Concepts:

The NCFS will be receiving $5 million over five years as a part of the CPRG Atlantic Conservation Coalition award to establish new high-carbon forestry cost-share program. This program will be modeled after the existing cost-share program but will focus on trees that rapidly grow and sequester program.

Through the same CPRG grant, the Sustainable Forestry Land Retention Project and the Black Family Land Trust will be receiving $3 million for climate-smart forestry funding and technical assistance for low-income and historically disadvantaged forest landowners.

22. Support the wood products markets.

Status: Ongoing

North Carolina Forestry Best Management Practices Manual Update

The North Carolina Forestry Best Management Practices ("BMP") Manual describes measures and actions that should be implemented to protect water quality and conserve soil when conducting forestry/silviculture operations. Using BMPs can help to comply with the N.C. Forest Practices guidelines Related to Water Quality and other required standards. The manual was revised by the North Carolina Forest Service in 2021, including new chapters on Connecting Resilience and Forestry BMPs and Threatened and Endangered Species. The corresponding BMP field guide will be revised in 2022. Information in the Manual may be used to support many of the recommendations in the 2020 Action Plan, including all the Forest-related topics. More information about the manual is available online.[24]

North Carolina Forest Service Forest Inventory & Analysis (FIA) and Timber Product Output Programs

Through a partnership with the US Forest Service, NCFS collects field data on more than 5,000 permanent plots across the state on a 5-year cycle. FIA data has been collected in NC since the 1930s. This data provides information on the status and trends of North Carolina's forests: how much forest exists, where it exists, who owns it, and how it is changing, as well as how the trees and other forest vegetation are growing and how much has died or has been removed in recent years. This information can be used in many ways, such as in evaluating wildlife habitat conditions, assessing the sustainability of ecosystem management practices, and supporting planning and decision-making activities undertaken by public and private enterprises.

NCFS also conducts an annual Timber Product Output ("TPO") survey of the primary forest products industry in NC to estimate industrial and non-industrial uses of roundwood. Questionnaires are designed to determine location, size and types of mills, and the volume of roundwood received by product, species and geographic origin. TPO is also used to determine the volume, type and disposition of wood residues generated during primary processing. FIA and TPO data form the foundation for determining existing forest carbon stocks, sequestration rates and carbon stored in harvested wood products, and is used in Greenhouse Gas Inventory monitoring and reporting.

North Carolina Forest Service Forest Markets & Utilization Program

The NCFS maintains databases of primary and secondary forest product manufacturers in the state as well as buyers of standing timber, log exporters and specialty wood processors. NCFS also assists in forest-based economic development efforts to support new forest industry investments in NC. NCFS also

[24] Best Management Practices Manual. https://www.ncforestservice.gov/water_quality/bmp_manual.htm

conducts timber supply and forest sustainability assessments which are used in forest industry recruitment/expansion.

23. Coordinate floodplain buyout and restoration program.

Status: Ongoing

ReBuild NC Strategic Buyout Program

The North Carolina Office of Recovery and Resiliency ("NCORR") administers the ReBuild NC Strategic Buyout Program. This voluntary program opened in January 2020. Through the program, NCORR purchases properties at risk of flooding and transfers them to municipalities as deed-restricted greenspace. The Strategic Buyout Program engages closely with local governments and communities to identify areas that meet strategic objectives. For individual homeowners, the program offers financial incentives to encourage applicants to move out of flood-prone locations. Properties are also identified by local governments that will be used to facilitate nature-based flood control measures and utility access to support the wider community.

As of August 2024, the program has 192 active applications with approximately 100 additional under review. The program purchased its first properties in 2023. A majority of the active files are in title closing processes or have moved into the final clearing of parcels. For the upcoming year, the program will finalize its cooperation with several cities and counties, as well as coordinating with NC Emergency Management.

Swine Floodplain Buyout Program

The State of North Carolina established the Program to Acquire Conservation Easements on Swine Operations in the 100-Year Floodplain in November 1999 in the wake of devastation from Hurricanes Dennis, Floyd, and Irene. The Land and Water Conservation Fund (formerly Clean Water Management Trust Fund) Board of Trustees approved four grants totaling $18,669,500 for the North Carolina Department of Agriculture and Consumer Services ("NCDA&CS") Division of Soil and Water Conservation to run the first four rounds of the program. This Division, housed within the NCDA&CS, uses the grants to acquire conservation easements on swine operations in the 100-year floodplain. Recently, the Division was awarded a $2.5 million Regional Conservation Partnership Program grant from USDA and an additional $719,342 grant from the Land and Water Fund to offer a fifth round of the program. The objective of the program is to reduce the risk to water quality from future flood events.

To recruit program participants, the Division solicits bids from interested on-going swine operations. A bid represents the amount the producer is willing to accept to relinquish their permit and certification to operate a concentrated animal feeding operation in the 100-year floodplain and to allow the state to establish a conservation easement on the property. A total of 149 swine operations have submitted bids in at least one of the five solicitations.

The Division assembled an advisory panel to evaluate the bids. Evaluation criteria consider the structural condition of the facility's waste storage lagoons, the elevation of the top of the lagoon dike relative to the 100-year flood elevation for the site, and more. Using the criteria-based ranking and available funding, the advisory panel selected 48 farms to participate in the first four rounds of the program. To date, the program has closed on 45 of these farms. The remaining three are in process. Bid selection for the fifth

round is also in process. In the fifth round, the Division selected four of 23 applicant operations as finalists, pending appraisal results and USDA concurrence.

The conservation easements on each of the finalized 45 farms:

- Prohibit operation of a feedlot and associated animal waste management systems (e.g., lagoons) within the 100-year floodplain,
- Prohibit use of the easement area as a spray field for swine waste,
- Prohibit non-agricultural development of the easement area,
- Require the implementation of a soil and water conservation plan to cover the easement area within two years of the contract date,
- Restrict the location of hazardous materials, including fuel and fertilizer, storage and mixing areas to minimize water pollution potential from leaks, spills, and flooding, and
- Require implementation and maintenance of a minimum 35-foot-wide forested riparian buffer adjacent to all perennial and intermittent streams in the easement area (vegetated buffers are substituted adjacent to ditches).

The land can continue to be used for low-intensity agriculture (e.g., row crops, pasture-based beef production).

As part of the program, NCDA&CS pays the cooperating farmer to hire contractors to remove the lagoon contents and apply them to available cropland at agronomic rates. The producer is responsible for assuring availability of sufficient cropland. Lagoons must be closed in accordance with National Resource Conservation Service ("NRCS") standards. Closed lagoons can remain for use as irrigation ponds or fishponds, but not for waste management. Production houses can continue to be used for storing hay, equipment, etc.

To date, NCDA&CS has acquired 1,288 acres of easements on 45 of the 48 operations selected in Rounds 1 - 4. These 45 farms had been permitted to host 62,300 hogs in the floodplain. The farms included 108 animal waste lagoons that have now been decommissioned and closed in accordance with USDA-NRCS technical standards. Local Soil and Water Conservation Districts are developing and implementing conservation plans for each location.

USDA has contributed over $1 million to support lagoon closure activities on participating farms for Rounds 2 - 5. These funds have enabled the Division to include five additional operations in the program.

The Division has received excellent cooperation from the NC Pork Council, Cooperative Extension, the Farm Bureau, the Conservation Council, and the Land and Water Fund. Members of the General Assembly have expressed interest and support for this voluntary initiative.

Emerging Concepts:

Statewide Flood Resiliency Blueprint

In 2021, the N.C. General Assembly directed the DMS to contract with an organization to develop a Statewide Flood Resiliency Blueprint ("Blueprint") (NC Session Law 2021-180). The Blueprint is a statewide flood resilience planning effort to serve as the backbone of NC's flood resiliency planning and project decision-making. The Blueprint's outcomes will meet the legislative requirements based on the best available science, stakeholder engagement and sound decision-making. A key objective is to produce products that will be implementable, understandable and sustainable and close the technical resource gaps among communities. It will result in decision tools for targeted audiences (i.e., local, state, and regional stakeholders and decision-makers) that are interactive, easy to understand and use, and dynamic over time.

DMS is implementing the Blueprint in three phases:

- Phase I of the Blueprint included nine months of comprehensive research and analysis, community outreach, stakeholder engagement and feedback provided by the Principal and Technical Advisory Groups. This resulted in the Draft Blueprint, published in March 2024, a pilot Neuse River Basin Flood Resiliency Action Strategy and over 30 technical documents describing results and recommendations from the Gap Analysis.
- Phase II of the Blueprint is ongoing and focuses on developing a web-based decision support tool known as the NC Flood Resiliency Blueprint Tool (Blueprint Tool). This Tool will be a publicly accessible, data- and model-driven, GIS-enabled web application designed to aid flood planning and implementation statewide.
- Phase III applies the online support tool, developed in Phase II, and the Draft Flood Resiliency Blueprint, developed in Phase I, to river basins statewide. Phase III will work with state, federal and local stakeholders to develop river-basin-specific action strategies, similar to the Draft Neuse Basin Action Strategy developed in Phase I, for five additional targeted river basins: Cape Fear, Yadkin, Tar-Pamlico, White Oak and French Broad basins.

In 2021, the General Assembly also allocated $96 million to implement priority resilience projects. These funds became available in Spring 2024, and as a first step in administering the funds, DMS partnered with fellow state agencies and programs with overlapping resilience priorities to identify $15 million in projects. The Blueprint is partnering with the Department of Agriculture's Streamflow Rehabilitation Assistance Program ("StRAP"), N.C. Land and Water Fund and N.C. Emergency Management for projects. Leveraging existing state programs and resources provides an opportunity to increase collaboration across agencies and more efficiently spend state dollars. As this is an ongoing effort, the Blueprint team is continuing to develop projects by evaluating existing plans (e.g. Hazard Mitigation Plans) and contacting state and local stakeholders to develop and prioritize projects for implementation. Among other criteria, the Blueprint team is prioritizing projects based on:

- Their ability to reduce flood damage to infrastructure, homes, businesses, etc.;
- Whether the project has been identified in a Hazard Mitigation or other Resilience Planning efforts;
- Whether the project is in a high-risk area;
- Their likelihood of reducing flood risk to underserved communities; and

- Whether the projects serve additional public benefit (e.g. parks, trails, etc.).

Updated State Uniform Floodplain Management Policy

In July 2022, Governor Cooper issued Executive Order No. 266 to improve the resilience of state buildings against flooding. The Order directs the North Carolina Department of Administration ("NC DOA") to work with stakeholders to update the state's Uniform Floodplain Management Policy, which sets construction standards for state-owned buildings located in the floodplain. The policy was last updated in 1990 by then-Governor James Martin. In January 2024, DOA finalized the updated policy after extensive internal and external stakeholder engagement. The new policy forbids state construction in the 100 to 500-year floodplain with few exceptions. It also requires state buildings to be built two feet higher than the minimum flooding elevation requirement and away from areas anticipated to experience sea level rise. Finally, the policy requires new construction to integrate nature-based solutions into designs for all major projects.

Threatened Oceanfront Structures Workgroup

In 2023, an interagency workgroup made up of local, state and federal partners chaired by the Division of Coastal Management and the National Park Service hosted a series of workshops to discuss potential solutions to the imminently threatened oceanfront homes falling into the ocean in the Outer Banks. Potential tools discussed by the workgroup included buyouts and conversion to public beach access, relocation, changes in flood insurance programs, and enhanced authority for government to address the issue due to public safety concerns. In 2024, DEQ and the National Park Service published a report summarizing the workgroup's ideas toward short and long-term solutions.[25]

[25] Managing Threatened Oceanfront Structures: Ideas from An Interagency Work Group. https://www.deq.nc.gov/managing-threatened-oceanfront-structures-ideas-interagency-work-group/open

24. Integrate climate adaptation and resiliency strategies into local government comprehensive plans.

Status: Ongoing

Although the North Carolina Legislature has not required counties and municipalities to incorporate climate adaptation and resilience strategies into their comprehensive plans, many communities are integrating resilient practices into their planning documents on their own or with the help of state and regional partners.

As one example, Raleigh adopted a comprehensive plan[26] in 2019 that incorporates climate resilience. Chapter 5 discusses the importance of cities actively adapting to climate change and provides resilient goals for the city to meet in nine sectors including energy, natural resources and wildlife preservation.

Efforts taking place beyond comprehensive plans are described under "Emerging Concepts."

NC Wildlife Resources Commission's Green Growth Toolbox

Since 2010, the NC Wildlife Resources Commission Green Growth Toolbox Program ("GGT") has provided technical assistance and training to local government planning departments on integrating conservation priorities into land use and transportation planning, policy, ordinances, and site design. NCWRC staff have trained over 760 professionals from over 125 local governments, 13 regional councils of government, 37 planning and landscape architecture consulting firms, and over 30 other conservation organizations in the state on how to use land use planning tools to protect high priority natural areas and maintain working lands within planning jurisdictions. The GGT has been used in nearly 100 land use plans, in updates to ordinances, and in development review and design. In 2022, the GGT resources were updated to include the latest data and tools available related to climate resilience and recommendations on how to incorporate these tools into local and regional government planning.

Emerging Concepts:

Local governments across North Carolina are including climate resilience goals and projects in various planning processes and resulting documents. In some cases, jurisdictions are publishing resilience-specific plans. For example, Asheville, Raleigh and Orange County have climate action plans. In other cases, communities are identifying projects to address their climate change vulnerabilities in existing planning processes, such as Coastal Area Management Act ("CAMA") certified land use plans, comprehensive economic development strategies, hazard mitigation plans and more. For instance, following Hurricane Florence's 11-foot storm surge, New Bern published a "Resiliency and Hazard Mitigation Plan." The NC Resilience Exchange lists more plans on the State and Local Plans page.[27]

In addition to efforts made by individual jurisdictions on their own, the following programs support communities' efforts to weave climate adaptation and resilience strategies into planning documents.

[26] 2030 Comprehensive Plan. https://raleighnc.gov/planning/services/2030-comprehensive-plan
[27] Find Resources: State and Local Plans. https://www.resilienceexchange.nc.gov/find-resources/find-resources-state-and-local-plans

Resilient Communities Program

North Carolina's Resilient Communities Program supports local governments' resilience planning and implementation efforts. The overarching program offers access to expertise, technical support for analysis and planning, and funding to implement measures that advance long-term resilience. The program offers these resources through three agency-led programs:

- Regions Innovating for Strong Economies and Environment, led by the North Carolina Office of Recovery and Resiliency ("NCORR")
- Resilient Coastal Communities Program, led by the North Carolina Department of Environmental Quality's Division of Coastal Management
- Community Disaster Resilience Zones Support Program, led by NCORR

NCORR and the Division of Coastal Management also hosted a North Carolina Resilient Communities Funding Forum[28] in 2023 to connect project managers with funding entities.

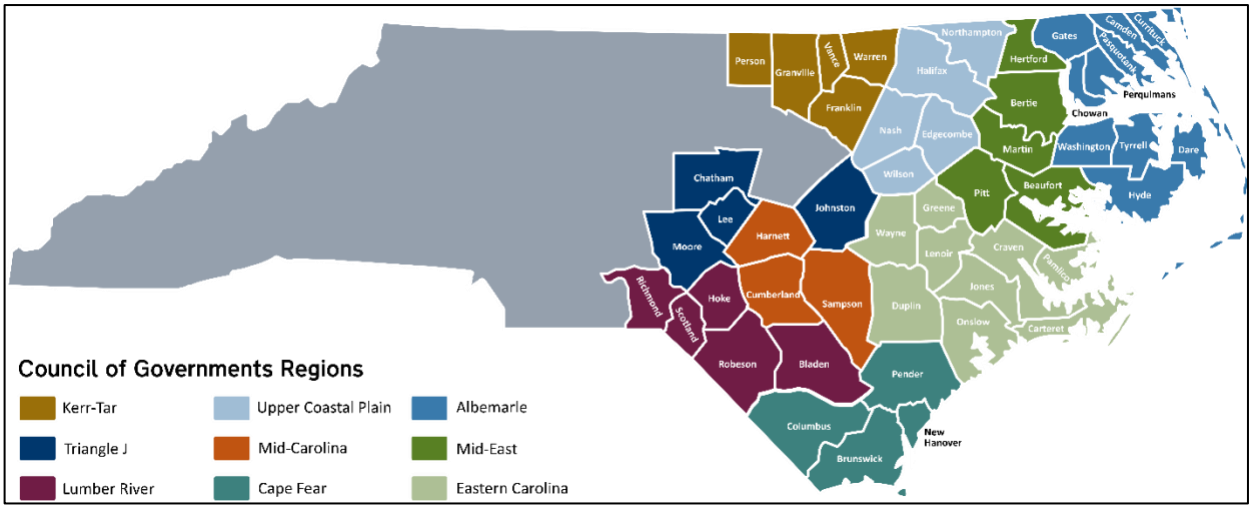
Regions Innovating for Strong Economies and Environment

The NCORR Regions Innovating for Strong Economies and Environment ("RISE") program supports the development of regional vulnerability assessments, priority project identification and project build-out. NCORR defines regions by Council of Government coverage areas. Participants include the Council of Government and the local governments, businesses, nonprofits and residents within the grouped counties. Following their completion of vulnerability assessments and project portfolios, the Councils of Governments and other local partners continue to work with NCORR on funding identification, project planning and implementation.

Figure 5 depicts the nine regions that participated in the RISE program in 2022 and 2023. Each region identified between five and 10 priority projects, for a total of 55 efforts designed to address climate change vulnerabilities. Many of these projects help build resilience for the populations most vulnerable to the impacts of climate change and multiple efforts have a strong focus on nature-based solutions. Since the RISE program and nine Councils of Governments published their Portfolios of Priority Projects[29] in Spring 2023, NCORR and its partners have secured funding to support 34 projects with over $2.3 million in funding. In one example, NCORR secured a partnership with Duke Energy Foundation to provide more than $600,000 in financial assistance to the nine regional RISE partners to kick-start 10 projects.[30] NCORR continues to look for funding to expand the RISE program to the western half of the state.

[28] Funding Resilience. https://www.rebuild.nc.gov/resiliency/funding-resilience
[29] Regional Resilience Portfolios. https://www.rebuild.nc.gov/resiliency/resilient-communities/rise/portfolio
[30] Ten eastern NC resilience projects awarded funding. June 2, 2023. https://www.ncdps.gov/news/press-releases/2023/06/02/ten-eastern-nc-resilience-projects-awarded-funding

Figure 5. North Carolina Council of Government Regions Supported by the RISE Program as of July 2024



Resilient Coastal Communities Program

The Resilient Coastal Communities Program ("RCCP") provides financial grants and technical assistance to coastal local governments to support a proactive, equitable and locally driven approach to coastal resilience planning and project implementation. Goals include:

1. Strengthen coastal communities through resilience planning and projects that increase local capacity, overcome economic constraints, and foster diverse and inclusive decision-making.
2. Assist local communities in conducting comprehensive risk and vulnerability assessments to develop a portfolio of prioritized resilience projects tailored to the community's needs.
3. Advance identified resilience projects to "shovel-ready" status, meaning ready for implementation.
4. Provide competitive funding opportunities for project identification and implementation and link communities to additional financial resources to sustain long-term resilience efforts.

Accomplishments from 2020-2023 include:

- $1.86 million awarded to conduct vulnerability assessments and identify projects in 41 communities
- $1.14M awarded to design and engineer 20 top-priority resilience projects
- $1.16M awarded to implement 5 shovel-ready projects with nature-based components

Of these projects, 95% address stormwater management and flooding, 80% include natural & nature-based components, and 30% involve policy and planning initiatives.

In addition, RCCP recently announced funding for the Town of Beaufort and Elizabeth City to develop resilience-related ordinances. Beaufort plans to merge zoning, subdivision, minimum housing and flood damage prevention ordinances into a new Unified Development Ordinance. This update ensures alignment with the town's recently adopted Comprehensive and CAMA Land Use Plan and Resilient

Beaufort Strategy. Elizabeth City will use the funding to propose updates to its stormwater ordinance and create a best practices handbook for developers, among other projects.

Community Disaster Resilience Zones Support Program

NCORR is helping to plan and implement resilience projects in high-risk census tracts called Community Disaster Resilience Zones ("CDRZ").[31] The CDRZ designation was created by Congress[32] in 2022 to identify areas most physically and socially vulnerable to natural hazards. Several federal grant programs offer specific advantages to projects that benefit CDRZ. NCORR is connecting the North Carolina CDRZ communities to training, funding, capacity building and technical support to advance their resilience priorities.

NCORR launched the CDRZ Support Program in March 2024. As of August 2024, the program has:

- Established formal relationships with nine local governments.
- Worked with those local governments to identify 77 potential resilience projects. Projects either address an issue already causing problems in the community or address complex issues that communities are dealing with today that will worsen significantly in the coming years as conditions change.
- Helped local governments apply for six grants and supported applications for many other funding opportunities. CDRZ communities have received funding for five projects.
- Held over 100 collaborative meetings with CDRZ communities, partner organizations, subject matter experts, academic and research institutes, and potential funding partners.

This work is made possible by grant funding facilitated by the Geos Institute's Climate Ready America Southeast Navigator Network Program.[33]

State and Regional Hazard Mitigation Plans

North Carolina Emergency Management ("NCEM") is facilitating the integration of resilience strategies into hazard mitigation planning processes across the state.

North Carolina's Enhanced State Hazard Mitigation Plan, adopted in 2023, includes the projected impacts of climate change and suggestions actions to lessen those impacts. The Plan assesses vulnerabilities from the anticipated changes in the frequency and intensity of drought, extreme heat, flooding, severe storms, wildfire and landslides. The document includes several mitigation actions focused on addressing these climate change vulnerabilities, some of which support healthy ecosystems in our natural and working lands and include nature-based solutions. The next revision of this plan is expected in 2027. NCEM will complete the 2027 plan using updated guidelines from FEMA that call for a thorough analysis of the impacts of climate change on each identified natural hazard.

[31] Community Disaster Resilience Zones. FEMA. https://www.fema.gov/partnerships/community-disaster-resilience-zones

[32] S.3875 - Community Disaster Resilience Zones Act of 2022. https://www.congress.gov/bill/117th-congress/senate-bill/3875

[33] Climate Ready America: Climate services for every community regardless of their location, size, or wealth. https://geosinstitute.org/climate-ready-america/

NCEM is also supporting the integration of resilience strategies in local hazard mitigation planning processes across North Carolina. Throughout 2024 and 2025, NCEM is supporting the federally required update of 17 regional multi-jurisdictional hazard mitigation plans. For each planning process, consultants are working with local leaders to present the future conditions—due to climate change—expected for each hazard and identify potential hazard mitigation strategies, with an emphasis on nature-based solutions.

APNEP Tribal Coastal Resilience Connections

APNEP Tribal Coastal Resilience Connections ("TCRC") project aims to build capacity to support Tribal communities in the Albemarle-Pamlico region with climate resilience and adaptation planning and increase engagement between Tribal organizations, government agencies, and universities. Phase I, launched in 2020, was a collaboration between APNEP, the NC Commission of Indian Affairs, NC State University (principal investigator now at Duke University), and the former Virginia Coastal Policy Center at William and Mary Law School.

The TCRC team released its Phase I report in 2023, which documents the launch of the work, research on Tribal climate adaptation plans, experimentation with social media engagement, field work, partnership and network development, conducting outreach at conferences and events, and building the groundwork for a sustainable program. Recommendations include educating resilience practitioners from agencies, universities, and other organizations on best practices for engaging with Tribes, and ensuring all communities, regardless of recognition status, are included in resilience and adaptation planning processes. A major recommendation involves the need to update outdated or inaccurate information that currently exists on Tribal communities in the Southeast, including commonly used climate planning, Environmental Justice, and other popular tools used by non-Indigenous people and organizations to identify Tribal territories for purposes ranging from grant writing, distribution of funds and resources, to developing land acknowledgements. Most readily available sources are not inclusive and do not factor in the complicated landscape of history, displacement from ancestral homelands, recognition status, and other considerations unique to our region.

Phase II will include efforts towards building a Tribal Resilience toolbox, which will utilize community directed mapping to develop the basis for a regional adaptation framework to assist with future resilience planning. Mapping is needed not only to update inaccurate information, but also as a as strategy to engage Tribal communities on issues of concern, raise awareness about climate impacts, and establish a basis for understanding Tribal perspectives on protection, restoration, and conservation issues. The information will also provide a platform for educating agency staff on considerations, perspectives, and Traditional Ecological Knowledge unique to Native communities.

Current focused projects include historical research and updating mapping of Tribal communities with ancestral and present-day ties to the Albemarle-Pamlico region and southeast coastal plain, inter-Tribal coalition building, and community engagement. The TCRC team will also build upon the findings and recommendations in the Environmental Justice Chapter developed by the Sierra Club, with an emphasis on wetland protection. Beyond this, the team hopes to ensure that products like the Tribal Resilience toolbox will be utilized in both statewide and regional conservation and restoration planning, while also continuing to seek opportunities for Indigenous Tribes to meaningfully engage in policy development.

Efforts extend across state lines, supporting APNEP's MOU with Virginia and emerging efforts through the multi-state CPRG Atlantic Conservation Coalition. The TCRC team was included as a partner on VA-DCR Natural Heritage Program led project funded through NOAA Coastal Zone Management Habitat Protection and Restoration BIL funds in Suffolk County, Virginia. The TCRC team will act in an advisory capacity, assisting with historical research, mapping, and coordination with Tribal communities in both VA and NC for a project to acquire 1,900 acres of contiguous forest in the Chowan watershed for climate resilience, biodiversity conservation, and public access.

25. Promote urban forest retention and management.

Status: Ongoing

Promote urban forests through statewide programs to foster the retention of urban trees and their proper management

The NCFS Urban and Community Forestry Program ("U&CF") continues to lead this effort with positive outcomes guided by the 2020 North Carolina Forest Action Plan and largely through securing additional USDA Forest Service and Environmental Protection Agency federal funding. This includes $200K in Bipartisan Infrastructure Law funding, $6.375M of IRA funding and annual increases of Consolidated Program Grant funding that will increases capacity, education and outreach efforts, and U&CF project grant funding for local governments, public schools, and not-for-profit organizations. In addition, the CPRG Atlantic Conservation Coalition will be funding $800K for local tree planting projects.

A Community Forestry Coordinator has been added to meet administrative and finance, program coordination, and communications and outreach needs. Two additional Urban Forestry Specialists are being added bring the total to three. Each will be assigned to service one of the three NCFS Regions (Coastal, Piedmont, Mountain) to provide U&CF technical assistance to communities.

Funding has been dedicated, and work has begun or been completed, on the development of best management practices publications for urban forestry practices, tree ordinances and readiness, response and recovery from tree damaging events. In addition, a statewide, web-based application is in development to share U&CF activities across the state and tree inventory and canopy cover assessment data.

The balance of the federal funding (currently ~$6.5M) is offered through the NCFS U&CF Financial Assistance program to local governments, public schools, and not-for-profit organizations to fund U&CF projects. There are two requests for applications a year, January and July, offering cost share, match share and no match share funding.

Emerging Concepts:

The NCFS Urban & Community Forestry Program, staff, operating and financial assistance program are 100% federally funded which has limited the historical effectiveness of the program and is not sustainable. Recurring state funding to for the program could sustainably meet the growing U&CF management needs in NC.

Development continues to claim North Carolina's urban forests. In 2018, North Carolina's urban forest tree canopy cover was estimated to be 54% and it was estimated that ~4,500 acres of urban tree canopy cover were being lost each year (Nowak et al. 2018). An analysis of 40 municipal tree canopy cover assessments completed over the last five years by the NCFS revealed the average tree canopy cover is 47%, 22% is impervious surface land cover, and there was an average canopy cover loss of 1% in these municipalities. State and local legislation could help provide an acceptable balance of continued development and urban forest conservation.

26. Research urban forest baseline canopy and management needs.

Status: Ongoing

NCFS U&CF has secured federal funding to develop a statewide, web-based application to share U&CF activities across the state including municipal tree inventory and canopy cover assessment data. In addition, these federal dollars have funded completion of 13 tree canopy cover assessments and 3 sample tree inventories over the last 24 months and funding is available to complete additional assessments through the NCFS U&CF Financial Assistance program. These data will be loaded into the statewide application to share with all and build a statewide picture of urban tree canopy cover, trends and management needs. The anticipated completion of the application build is July 2025.

Literature Review on the Ecological Functions and Human Benefits of Urban Forests

NC Forest Service Urban & Community Forestry ("U&CF") Program partnered with Alliance for Cape Fear Trees, University of North Carolina Wilmington, and the Wilmington Tree Commission under a grant to complete a literature review on the ecological functions and human benefits of urban forests and share with stakeholders.

Emerging Concepts:

Urbanization, loss of tree canopy and the addition of impervious surfaces in particular, lead to an increase in stormwater runoff into North Carolina watersheds. This can lead to downstream flooding. However, more scientific research is needed to test this theory for urban watersheds in North Carolina. A research project that analyzes historical water flow of North Carolina's major watersheds and historical urban tree canopy cover and impervious land cover in these watersheds would provide trend data to quantify the potential flood impacts due to urbanization and guide the development of land use and conservation policies.

III. Environmental Justice and Equity

Although environmental justice recommendations were not included in the 2020 NWL Action Plan, the Steering Committee felt including environmental justice work related to NWL policy and programming was an important component to include in this report. Natural and working lands provide green spaces, recreation, economic opportunity and cultural heritage to people in urban and rural areas across the state. NWL resources should benefit all North Carolinians. This section includes updates on recent initiatives related to NWL environmental justice and equity, and the NWL Steering Committee looks forward to further integrating environmental justice and equity principles in future reports and stakeholder processes.

Governor's Environmental Justice Advisory Council

Executive Order 292 established the Governor's Environmental Justice Advisory Council made up of public members and state government officials. The board seeks to advise the governor and guide cabinet agencies on issues of environmental justice, which can include principles such as equitable access to green space in both urban and rural environments. The board met several times in 2024 across the state. In October, the board published several deliverables including a recommendations report, an environmental justice hub website, and an environmental justice mapping tool.[34] [35] The mapping tool allows the user to overlay visual data such as climate stressors, demographic information, environmental hazards, and managed conservation areas.

DNCR Environmental Justice Goals

In compliance with Executive Order 292, DNCR published three measurable goals to improve environmental justice within agency programs and operations.[36] The environmental justice goals received feedback from the public and feedback from the Governor's Environmental Justice Council before being finalized by DNCR.

- Goal1: Ensure minority, low-income, and tribal populations are provided with the opportunity to engage in meaningful involvement in the Department's efforts to increase access to parks, recreation, and open spaces.
- Goal 2: Identify and address environmental policies and practices that may result in disproportionately high and adverse human health or environmental effects on minority, low-income, or tribal populations.
- Goal 3: Use existing NC Land and Water Fund and Parks and Recreation Trust Fund opportunities to assist and empower aging, disabled, minority, low-income, and tribal populations in their efforts to build and sustain environmentally safe and economically sound communities.

[34] Governor's Environmental Justice Council Report. https://governor.nc.gov/governors-environmental-justice-advisory-council-final-report-0/open

[35] NC Environmental Justice Hub. https://experience.arcgis.com/experience/4c9561f7a1a7415d86201a785753e56f/page/Page/?views=CLIMATE-STRESSORS&org=nconemap

[36] DNCR Environmental Justice Goals. https://governor.nc.gov/dncr-environmental-justice-goals/download?attachment

Cabinet Agency Public Participation Plans

Executive Order 246 directed all cabinet agencies to develop and maintain public participation plans to enhance meaningful engagement of agency programs and activities with the public. Agencies like DNCR and DEQ which have many programs in the NWL space now have specific guidance on ensuring public engagement and feedback are integrated into decision-making and outreach. The Parks and Recreation Trust fund and the Land and Water Fund housed in DNCR are also subject to the DNCR public participation plan.[37]

Sierra Club Tribal Connections to Wetlands Research Project

During the summer of 2024, fellows from the North Carolina chapter of the Sierra Club conducted a research project on the relationships between tribal communities and wetlands in North Carolina. Many of North Carolina's tribes have lived on and with wetlands for generations, and the NWL Steering Committee seeks to better include tribal perspectives into current and future NWL work. This research project explored the cultural and historical connections with North Carolina's indigenous people and wetlands, policy and legal considerations of wetland protections on tribal lands and offered recommendations for meaningful involvement of tribes into executive decision making. The NWL Steering Committee plans to consider the recommendations of this project to better integrate tribal perspectives into future NWL Action Plan stakeholder processes. More details can be found in the Appendix.

APNEP Equity Strategy and Spatial Decision Support

In 2023, APNEP completed an Equity Strategy to guide the use of Bipartisan Infrastructure Law ("BIL") funds through the lens of equitable and fair access to the benefits from environmental programs for all communities. The Strategy describes how APNEP will contribute to requirements under the Justice 40 Initiative, meet policies in both Virginia and North Carolina including NC Executive Order 246, and identify synergies amongst the various resilience programs including RISE, RCPP, and this NWL action plan. The Strategy discusses equity considerations relative to implementing APNEP's Conservation and Comprehensive Management Plan ("CCMP") and current focus areas of Submerged Aquatic Vegetation, Wetlands, Water Quality and Community Resilience. It considers challenges associated with tracking funds for ecosystem-based management objectives including monitoring and assessment, conservation and restoration projects aimed at benefiting natural and working lands that may not be designed to directly benefit human communities. The Strategy highlights environmental justice and equity considerations in APNEP led efforts including the Tribal Coastal Resilience Connections project and Scuppernong Study described elsewhere in this report. The Strategy was approved by EPA Headquarters in October 2023 and incorporated into APNEP's FY22-FY27 Work Plan & Budget Bipartisan Infrastructure Law Cooperative Agreement.[38]

An interactive, GIS based web tool was created that combines the six tools identified in the Equity Strategy to assist with ensuring BIL funds benefit disadvantaged, underserved, underrepresented, vulnerable communities in the AP region. The Equity Strategy Mapper[39] integrates screening tools and data including geographic areas: a) Census blocks identified by EPA's Environmental Justice Screening Tool ("EJScreen"),

[37] Public Participation Plan. https://www.dncr.nc.gov/about/public-participation-plan
[38] Bipartisan Infrastructure Law. https://apnep.nc.gov/BIL
[39] Equity Strategy Mapper. https://apnep.nc.gov/BIL/equity-strategy-mapper

b) Census tracts identified by Justice40 Initiative Climate & Economic Justice Screening Tool ("CEJST"), census blocks identified by NC-DEQ's Community Mapping System, and economic designations identified by the NC Department of Commerce and Southeast Crescent Regional Commission.

In addition, APNEP has contracted with the NC Center for Geographic Information and Analysis to develop 1) a spatial targeting strategy whose findings will guide both near term and long-term decision making on CCMP implementation and allocation of Bipartisan Infrastructure Law ("BIL") funds toward restoration and protection of priority resources, and 2) conduct an estuarine spatial planning assessment to assess the uses of estuarine waterscapes and associated interactions with natural resources, including those of CCMP priority.

Spatial analysis completed will provide guidance for strategic siting of projects based on 1) suitability for conservation and management actions relative CCMP foci and 2) likelihood to support environmental improvements or resilience of disadvantaged communities as defined in APNEP's Equity Strategy. Both interim and final drafts of a spatial targeting strategy will inform how (and where) APNEP invests in environmental and ecological improvements.

NC Forest Service Urban & Community Forestry Inflation Reduction Act Program

In August 2022, Congress approved the IRA which has unprecedented funding specifically designated for urban and community forestry projects as well as other program areas. In June 2023, the NCFS U&CF program applied for and received a five-year USDA Forest Service Urban and Community Forestry grant[40] in the amount of $5.5 million to assist communities in the completion of U&CF projects in disadvantaged communities as defined by the Climate and Economic Justice Screening Tool.[41] Requests for Applications will be offered in January and July each year through NCFS U&CF Financial Assistance Program[42] until the funding is exhausted.

[40] Urban and Community Forestry Grants - 2023 Grant Awards. https://www.fs.usda.gov/managing-land/urban-forests/ucf/2023-grant-funding
[41] Climate and Economic Justice Screening Tool. https://screeningtool.geoplatform.gov/en/#6/35.201/-80.136
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V. Appendix: Tribal Communities and Natural and Working Lands

NC Sierra Club Fellows
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The cultural and historical use of wetlands by NC tribes

Wetlands hold significant cultural importance to the Indigenous peoples of North Carolina, represented by the federally recognized tribe of the Eastern Band of Cherokee, and the state recognized tribes of the Coharie, Haliwa-Saponi, Lumbee, Meherrin, Occaneechi, Sappony, and Waccamaw Siouan. Water is critical to life and thus sacred to most Native American tribes.[1] The cultural significance of wetlands for Indigenous people vary in specifics, but contain the following shared elements across tribes:

1. Sacred Spaces: Wetlands are often viewed as holy places where communities engage in spiritual practices, ceremonies, and rituals that connect them with their ancestors and the natural world. These areas are considered vital for maintaining cultural identity and traditional knowledge. The Lumbee people, for example, have a strong spiritual connection to the Lumber River, which has served as a Christian baptismal site for centuries.[2]

2. Sustenance and Resources: The wetlands of North Carolina have historically sustained the Indigenous population, providing, among other things, a source of food through fishing and hunting of aquatic species such as fish, turtles, and waterfowl. Wetlands also offer medicinal plants and materials for crafting tools and shelter. Additionally, the wetlands served as transportation routes for Indigenous peoples, enabling trades and communication between different communities. Overall, the wetlands of North Carolina play a crucial role in sustaining the livelihoods and cultural practices of the Indigenous population.

3. Traditional Knowledge: Indigenous communities have accumulated deep knowledge of wetlands over generations, understanding the seasonal cycles, ecological relationships, and sustainable practices for harvesting resources without depleting them. This knowledge is integral to their cultural heritage and survival. Recent examples of traditional knowledge can be found in individual tribal members like the late Mrs. Mary Woods Locklear (Lumbee), known widely as the Herb Lady of Robeson County. She used her traditional knowledge of medicinal plants to help community members find relief from illnesses ranging from the mundane to the spiritual. Her knowledge was passed down from her mother, who learned from her mother and so on.[3] This continuity of knowledge, or oral history, is common in Indigenous

communities, and critical to the preservation of history and culture. The protection and preservation of wetlands is essential for safeguarding this knowledge. Wetlands serve as important cultural landscapes where traditional stories, practices, and beliefs are shared and preserved. By conserving wetlands, Indigenous communities may continue to access these spaces for cultural activities, ceremonies, and storytelling, ensuring that their oral history and traditional knowledge are passed down to future generations. The protection of wetlands helps to maintain the ecological balance and biodiversity that are integral to Indigenous cultural practices and spiritual beliefs, further reinforcing the connection between Indigenous communities and their ancestral lands. [4]

4. Community Gathering and Education: Wetlands serve as gathering places for the community to pass down oral histories, stories, and teachings to younger generations. Each North Carolina American Indian tribe is situated near or on a river that holds cultural, spiritual, historical, and contemporary meaning and importance to their people. "Indigenous waters" not only includes rivers, but Carolina Bays, swamps, and ocean shores that also hold the same significance.

Differences between state, federal, and unrecognized tribes: protections and policy

A tribal community's recognition status determines the level of legal engagement and consultation that is available to them. The distinctions between state, federal, and unrecognized tribes in the United States primarily revolve around the levels of sovereignty, legal recognition, and the consequent protections and policies that apply to them.

State recognized: In North Carolina, being recognized by the state allows the tribe to be a member of the Commission of Indian Affairs. There are 8 state-recognized tribes in NC: The Coharie Tribe, Eastern Band of Cherokee, Haliwa-Saponi Indian Tribe, Lumbee Tribe of North Carolina, Meherrin Indian Tribe, Occaneechi Band of the Saponi Nation, Sappony, and Waccamaw Siouan Tribe.

Federally recognized: There are 574 federally recognized tribes in the United States, and only one, the Eastern Band of Cherokee, in North Carolina.

Federally recognized tribes are privy to a government-to-government relationship with the United States. With the responsibilities, powers, limitations, and obligations attached to that designation, these tribes are eligible for funding and services from the Bureau of Indian Affairs (BIA). Federally recognized tribes have inherent rights to self-government and the right to impose taxes as states do, make and enforce laws, and regulate activities. They are also eligible for additional federal funding, including Inflation Reduction Act (IRA) tribal climate funding, which provides more than $720 million for environmental programs dedicated to Tribal lands and Native communities.

The Natural and Working Lands Action Plan and collaboration with tribal communities

The Natural and Working Lands action plan could include cases of collaboration with tribal communities, *i.e.* Great Coharie River Initiative. They have collaborated with the USDA NRCS office for their national water quality initiative as well as with the NC Office of Recovery and Resilience.

The Great Coharie River Initiative is a project dedicated to restoring the river's environmental, educational and cultural significance. This initiative focuses on improving water quality and public access to the river by a collaboration between many North Carolina tribes: Coharie Tribe, Waccamaw Siouan, Lumbee, Haliwa-Saponi, Eastern Band of Cherokee, and others. Historically, the Coharie River was a fun place to recreate and a significant source of subsistence for the Coharie people. However, the hurricanes of the 1990's impacted the river's natural flow with fallen trees, leaves and debris. The Great Coharie River Initiative began in 2015 with the permission from the North Carolina Department of Environment and Natural Resources (now NC Department of Environmental Quality and NC Department of Natural and Cultural Resources) to clear logs and implement beaver mitigation practices. The Coharie Tribe secured a grant from the NC Forest Service to start a river restoration project.

Today, there are many partners involved in this initiative including the American Indian Center at UNC Chapel Hill, The Conservation Fund's Resourceful Communities (main contributor), Friends of Sampson Co. Waterways, NC Growth, Conservation Trust for North Carolina, and more. The Initiative has expanded to become part of a local resilience plan in collaboration with the NC Office of Recovery and Resilience and led by the N.C. State Coastal Dynamics Design Lab (CDDL). The initiative, now in its eighth year, has a goal to clear even more of the river to return water access to the Coharie people. The goal is to clear a 13 mile stretch for public access. "The Mission of the Great Coharie River Initiative is to restore a lost tradition and return access of the river to the people."

This project is the first state partnership for Indigenous land management. It consists of developing a flood print which focuses on land and water relationship and will be used to bolster community resilience. According to the press release, the project will last 16-months where CDDL staff will provide technical assistance to tribal staff to accelerate ongoing community recovery from hurricanes Matthew and Florence. This is a perfect example of a collaboration that exists beyond grants. Government experts help the community with more specialized measurements and scientific data collection that will inform a resilience plan for the future.

Another good example can be found through Tribal Coastal Resilience Connections, a project formed in 2020 in response to an invitation from the Albemarle-Pamlico National Estuary Partnership (APNEP) to examine ways in which agencies involved in coastal climate resilience planning might better engage and coordinate with tribal nations in the region. The team's overarching goal is to increase awareness among tribal communities around the risks and threats of climate change, and to foster discussions about adapting to these changes. Project activities have raised awareness about coastal resilience planning among tribal communities in North Carolina and Virginia, and they have strengthened networks and relationships between federal and state agencies, tribal governments and non-tribal entities such as the North Carolina Commission of Indian Affairs. These networks and relationships are important conduits for information-sharing, decision-making, and other activities related to climate resilience planning.

In the future, the team will announce a series of virtual workshops involving Tribal communities, government organizations, and academic groups with the overarching goal of promoting information sharing between Tribal communities and resilience practitioners to protect the environmental health of the Albemarle-Pamlico region's waterways and beyond. [5]

Considerations

There is an opportunity for Indigenous tribes to provide stewardship for North Carolina wetlands located in traditional territories.

Work with the incoming Governor to issue Executive Order to agencies to prioritize tribal co-stewardship similar to Model State Tribal Relations with Federal Department of Interior guidance: The Federal Department of Interior and the Biden Administration have been creating a path for increasing co-stewardship opportunities across the U.S.[6] The department defines co-stewardship as "collaborative or cooperative arrangements between Department bureaus and offices and Tribes and Native Hawaiian Organizations related to shared interests in managing, conserving, and preserving Federal lands and waters."[7] This situates the Indigenous knowledge of the land as the guiding principle to protecting and strengthening the natural environment. North Carolina could model this approach for state recognized tribes through the following actions

- Establish a state committee for Native land conservation/ recovery in partnership with local tribes without federal recognition.
- Create a stewardship plan within the NC Department of Administration Commission on Indian Affairs. Use the Coharie River Initiative as a model, create opportunities for tribes to participate in the co-stewardship of traditional lands.

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