2024 Climate Resilience Strategy Report

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

2024 Climate Resilience Strategy Report

North Carolina Wildlife Resources Commission

Executive Summary

The *2024 NC Wildlife Resources Commission (NCWRC) Climate Resilience Strategy Report* is the first iteration of the agency's planning effort to address climate related impacts to our state's fish and wildlife resources. As the largest landholding agency in the state, NCWRC is in a paramount position to support the state's commitment through Executive Orders 80, 246, and 305 to reduce greenhouse gas emissions through the conservation of natural lands. As of 2024, NCWRC currently maintains 2,093,664 acres of game lands, many of which are wetlands - including pocosins, forested floodplains, and upland forests. NCWRC's forested land accounts for an estimated 9,042,368 tons of stored carbon and sequesters an average of 382.89 kg/acre/year.[1] NCWRC is committed to responsibly managing these resources to sustain our natural resources to support our state in becoming climate resilient.

Our approach to this planning effort has considered three goals.

1. How lands under our management support NC's resiliency goals to store and sequester greenhouse gas emissions,

2. Strategies that address shifting ecological regimes and their impact on wildlife distribution, and

3. The impacts that climate change will have on access to state game lands.

The planning effort was led by the Habitat Conservation Division and involved leadership from the Inland Fisheries Division, Wildlife Management Division, Land and Water Access Division, and Habitat Conservation Division. The resulting *2024 NC Wildlife Resources Commission Climate Resilience Strategy Report* is a "living document" that will be periodically updated as more divisions are consulted and as needed. This planning effort has helped our agency frame our work in a new perspective and reveals opportunities for our agency to contribute towards larger state (and international) goals. This report is also in support of the climate resilience priorities of the North Carolina Wildlife Action Plan.

These strategies were identified through the planning process and summarized on the following 5 pages.

- Evaluate the impacts of climate change into NCWRC programs and operations, and
- Integrate climate change adaptation practices and resiliency planning into NCWRC policies and operations

[1] This information was obtained from the NC Conservation Benefits Calculator (Duke University & Conservation Trust for North Carolina, 2023).

Evaluate the impacts of climate change into NCWRC programs and operations	
Species assessment	Re-evaluate aquatic species stocking strategies regularly to ensure that animals are provided suitable habitat
	Assess and update survey techniques and data points as necessary to account for changes in species behavior, distribution, and species' population status
	Collect data specific to habitat status and environmental covariates that can be used for modeling to mitigate the impacts of climate change
	Assess vulnerability of wildlife to climate impacts and use results to inform management decisions on NCWRC and privately owned lands
Planning	Review existing guidelines and management plans to develop and integrate climate change adaptation and resiliency strategies within these documents
	Continue to monitor rule making authority (i.e., state, councils, federal government) for fish and wildlife species that may become more or less abundant in NC
	Review existing game land management plans to develop and integrate climate change adaptation and resiliency strategies within these documents
	Develop and implement the State Wildlife Action Plan (WAP) in collaboration with diverse partners
Game lands management	Assess vulnerability of game lands to climate impacts and use results to inform management decisions
	Use remote sensing-based vegetation change analysis to monitor habitat shifts on game lands over time to inform management
	Use available threat assessment tools and modeling in game land management planning to maintain optimal habitats for species conservation
	Identify needs associated with maintaining and increasing the use of prescribed fire
	Prioritize climate change and sea-level rise in coastal habitat restoration planning on coastal game lands
	Review Game Land Management to protect remnants of high elevation forests and rock outcrops through fire suppression in these areas and support prescribed fire in adjacent lower elevation forests

Evaluate the impacts of climate change into NCWRC programs and operations	
Technical Guidance	Develop and use resiliency criteria in major investments (land, facilities constructions and retrofits, staff)
	Continue to keep up with research on Best Management Practices for stormwater and erosion control to provide recommendations that best protect and/or enhance fish and wildlife benefits
	Continue to keep up with research on Best Management Practices dams to provide recommendations that protect and/or enhance fish benefits
	Collaborate with DEQ in determining stormwater standards for larger storm events
	Assess and update, if needed, Engineering Best Management Practices to ensure best practices and share best practices with external partners

Integrate climate change adaptation practices and resiliency planning into NCWRC policies and operations	
	Keep abreast of funding opportunities related to resiliency
Species protection	Identify and prioritize land acquisition projects that support species and habitat conservation, reintroductions, and migration; land conservation provides carbon sequestration and storage benefits
	Continue to invest and identify vulnerable species in need of Propagation, Augmentations, Reintroductions, Translocations, and Introductions (PARTI)
	Work with non-federal private landowners to implement Safe Harbor Agreements and Candidate Conservation Agreement with Assurances (SHA/CCAA)
	Continue to manage species based on changes in recruitment, growth, survival, and reproductive success

Integrate climate change adaptation practices and resiliency planning into NCWRC policies and operations	
Habitat protection	Continue to protect and maintain critical habitats identified in the NC Natural and Working Lands Action Plan and in Executive Order 305 to support climate resiliency goals of the state
	Monitor spread of aquatic nuisance species (ANS) and disease and mitigate for their impacts
	Continue to identify and protect areas of thermal refuge on NCWRC and privately owned lands and work with partners to encourage their protection
	Continue to participate in collaborations concerning submerged aquatic vegetation (SAV) and encourage the adoption of protective measures where SAV exists
	Identify priority habitats and assess conservation, protection, and management needs across the landscape
	Work closely with partners to identify key corridors and connectivity needs; identify and help pursue funding for wildlife passage and provide technical guidance and encouragement
	Continue to work with partners to promote and restore aquatic habitat
	Facilitate salt marsh migration through protection of migration corridors
	Provide technical guidance to other agencies and private landowners on species life history and habitat needs to identify and conserve thermal refuges and mitigate drought
	Continue to investigate strategies that will result in increased implementation of prescribed burning by private landowners to support ecosystem resiliency and viability
	Support private landowners in converting introduced grass stands and low productivity cropland to native grasses and forbs to enhance wildlife habitat, improve drought resistance in forage production, and increase ecosystem services while strengthening carbon sequestration and storage capacity compared to non-native herbaceous species

Integrate climate change adaptation practices and resiliency planning into NCWRC policies and operations	
	Utilize the Wildlife Conservation Lands Program (WCLP) to promote green space and diverse plant communities by deferring private landowners' property tax liability
	Continue to support natural infrastructure restoration projects (i.e., living shorelines, oyster reefs, etc.), where appropriate (and design appropriate) through permit review
	Continue to engage and support local governments in incorporating natural area protection in land use planning and policy to support climate resiliency via the Green Growth Toolbox
	Continue to encourage wide riparian, wetland buffers and floodplain protection through permitting and the Green Growth Toolbox
	Provide technical guidance on oyster reef projects to minimize and avoid impacts on fish habitat
	Provide technical guidance on development review to improve site preparation in support of retaining native tree cover
	Continue to prioritize restoration of native habitats and conservation of species of greatest conservation need through technical guidance
Game lands management	Continue to work with partners (i.e., TNC, land trusts, NHP) to support Natural Heritage dedication of nature preserves, land conservation, and restoration
	Protect forested floodplains on game lands
	Continue to identify areas on game lands in need of habitat and stream restoration and replant buffers, as needed
	Continue to support and initiate research and monitoring activities that increase knowledge and understanding of impacts of environmental stressors of change as well as to support continued forest health and resilience using the best available science
	Support and expand utilization of forest management to restore and maintain native forest types that sequester carbon and are more resilient to climate change, disease, and forest pests

Integrate climate change adaptation practices and resiliency planning into NCWRC policies and operations	
	Continue to support the wood products market
	Collaborate with partners to bank seeds for replanting projects on game lands
	Rewet hydrologically altered peatlands, where appropriate, to provide species and habitat improvements, prevent soil loss and catastrophic fire, and increase carbon sequestration
	Continue to monitor game lands for invasive species
	Improve stream connectivity by restoring aquatic organism passage and developing stream crossings that promote aquatic organism passage
	Design bridges and culverts to allow for increased stream flow, i.e., a 500-year flood event
	Continue to limit the impervious surface of new structures and remove existing impervious surface areas when possible
	Work with adjoining landowners to address issues of fire protection, non-native invasive species, and habitat management that extend across boundaries

Introduction

About North Carolina Wildlife Resources Commission

The N.C. Wildlife Resources Commission (NCWRC) is a state government agency created by the General Assembly in 1947 to conserve and sustain the state's fish and wildlife resources through research, scientific management, wise use, and public input. The NCWRC is the regulatory agency responsible for the enforcement of North Carolina's fishing, hunting, trapping, and boating laws.

The mission of the NCWRC is:

> To conserve North Carolina's wildlife resources and their habitats and provide programs and opportunities that allow hunters, anglers, boaters, and other outdoor enthusiasts to enjoy wildlife-associated recreation.

The sale of hunting and fishing licenses, federal grants and other receipts provides financial support for the agency. The agency has an operational budget of approximately $85 million and employs approximately 650 full-time staff and 100 seasonal temporary staff across the state, including wildlife and fisheries biologists and technicians, wildlife law enforcement officers, wildlife educators, communication specialists, and customer service, information technology, and administrative professionals.

North Carolina Wildlife Resources Commission's Vulnerabilities to Climate Change

North Carolina's fish and wildlife resources are and will continue to be impacted by a changing climate. Biologists monitor species distributions and population dynamics to better understand how changing environmental conditions may impact the resiliency of species. For example, monitoring data demonstrates that streams and rivers are warming, resulting in shifts to aquatic species' distributions and the decline of coldwater species (e.g., Brook Trout). The agency also manages over two million acres of public lands, which are already experiencing ecological shifts, such as the transition from freshwater marsh to estuarine marsh in eastern NC game lands. Infrastructure and access to public lands is also vulnerable to climate change, as increased prevalence of flooding, fire, and extreme storm events reduces our ability to provide access to the public on game lands. Management decisions on these lands aim to provide high quality wildlife habitats while also maintaining public access. The consideration of climate vulnerabilities needs to be a part of our decision-making on many fronts.

North Carolina Wildlife Resources Commission's Approach to Fulfilling the Strategies in the Climate Risk Assessment and Resilience Plan

This is the N.C. Wildlife Resources Commission's first internal resiliency planning effort. Our approach has been threefold to consider:

1. How the lands under our management support NC's resiliency goals to store and sequester greenhouse gas emissions,

2. Strategies that address shifting ecological regimes and their impact on wildlife distribution, and

3. The impacts that climate change will have on access to state game lands.

This planning effort has helped our agency frame our work in a new perspective and reveal opportunities for our agency to contribute towards larger state (and international) goals.

Increase statewide resilience to the impacts of climate change

1 Evaluate the impacts of climate change on major investments in programs and operations in the N.C. Wildlife Resources Commission

1.1.1 Use resiliency criteria in major investments (land, facilities constructions and retrofits, staff)

Status: Ongoing

Expected Completion Date: N/A

For new construction, renovation projects, and land acquisition, NCWRC assesses and plans for addressing hazards related to flooding, sea level rise, saltwater intrusion, and increased storm intensity.

NCWRC will update resources to screen projects into the future.

2 Evaluate the impacts of climate change on Inland Fisheries Division's (IFD) programs and operations

2.1.1 Reevaluate aquatic species stocking strategies regularly to ensure that animals are provided suitable habitat

Status: Ongoing

Expected Completion Date: N/A

The North Carolina Wildlife Action Plan (WAP) is periodically reviewed every 5 – 10 years. We are in the process of completing the 2025 revision to the WAP including updating species and habitat management actions. The Aquatic Wildlife Diversity Program within the Inland Fisheries Division completed one Conservation Plan for the Atlantic Pigtoe. Staff have completed the catfish management plan and are working on plans for black bass, temperate bass, and mountain trout. Plans like the WAP and Species Conservation Plans for state listed species identify strategies such as stocking and habitat protection for priority species. Staff collected genetic material from broodstocks and progeny to investigate genetic diversity of source and stocked populations.

Staff plan to complete four Conservation Plans for aquatic state-listed species and complete revisions for the 2025 WAP in 2024.

2.1.2 Assess and update survey techniques and data points as necessary to account for changes in aquatic species behavior, distribution, and species' population status

Status: Ongoing

Expected Completion Date: N/A

Staff have completed 450 surveys in 2023 on fish, crustaceans, and mollusks to update ongoing data collection to observe any changes in aquatic species distribution and population status. These surveys include general distribution of species, habitat assessments, habitat enhancements and restoration, and overall health of fish populations.

Over the next 12 months, staff will continue to monitor and assess aquatic organism populations including fish, crustaceans, and mollusks. These surveys will help evaluate ongoing population status and inform the WAP assessments for species of greatest conservation need. These assessments will help identify species that need augmentation and restoration efforts due to anthropogenic impacts including climate change.

2.1.3 Collect data specific to habitat status and environmental covariates that can be used for modeling to mitigate the impacts of climate change

Status: Ongoing

Expected Completion Date: N/A

NCWRC has been awarded three Competitive State Wildlife Grants (C-SWG) focusing on collecting data and modeling habitat use for Robust Redhorse, Sandhills Chub, and fishes in shared drainages between South Carolina and North Carolina. Additionally, staff conducted 450 surveys and collected data on habitat and environmental variables. Also, NCWRC supports the maintenance of multiple USGS gauges to collect environmental covariates.

2.1.4 Review existing guidelines and management plans to develop and integrate climate change adaptation and resiliency strategies within these documents, and continue to monitor rule making authority (i.e., state, councils, federal government) to provide guidance on proposed regulatory changes for fish species that may become more or less abundant in NC

Status: Ongoing

Expected Completion Date: N/A

Staff currently are involved with NGOs, federal agencies, and other governmental bodies to assess populations of animals both within North Carolina and throughout the mid-Atlantic and Southeastern U.S. This involvement allows staff to understand the changes in population status (declines and increases) due to changes in NC's climate. Staff review and comment on rules from other state and federal entities for fish and their habitats.

Staff recommend rule changes, when needed, for management of fish in NC to mitigate the effects of climate (i.e., no fishing in July for trout related to thermal changes in habitat). For example, staff reviewed the state listing for the Pink Heelsplitter and updated the protected species list for aquatic organisms.

Staff are currently developing management plans for black bass, temperate basses, and mountain trout. Staff are also developing conservation plans for Orangefin Madtom, Yellow Lampmussel, Cape Fear Shiner, and Appalachian Elktoe. These plans will integrate population assessments including habitat degradation (including increased water temperature) and survival of stocked animals for restoration.

2.2 Integrate climate change adaptation practices and resiliency planning into Inland Fisheries Division's (IFD) policies and operations

2.2.1 Continue to invest and identify vulnerable species in need of Propagation, Augmentations, Reintroductions, Translocations, and Introductions (PARTI)

Status: Ongoing

Expected Completion Date: N/A

Staff meet annually to identify and prioritize species for PARTI actions. In the last year, staff submitted four new reintroduction proposals for Spotfin Chub, Roanoke Logperch, Magnificent Ramshorn, and Freshwater Drum.

Staff will meet annually during the winter with collaborators and partners to review current species stockings and identify additional species for PARTI actions.

2.2.2 Continue to manage species based on changes in recruitment, growth, survival, and reproductive success

Status: Ongoing

Expected Completion Date: N/A

Staff have established long-term monitoring sites for priority aquatic species. Staff target surveys for stocking and reintroduction sites to establish population trends. In 2023, staff conducted over 400 surveys to collect population level metrics and genetic diversity of wild and stocked priority species.

Staff plan to continue surveys at long-term monitoring sites.

2.2.3 Monitor spread of aquatic nuisance species (ANS) and disease and mitigate for their impacts

Status: Ongoing

Expected Completion Date: N/A

Staff continually monitor aquatic animal populations across the state. Currently, staff are documenting the spread of Alabama Bass, river herring, White Perch, invasive crayfish, whirling disease, gill lice, Asian clam, and others. Staff are certifying trout production facilities to ensure

that trout stocked in NC are free of whirling disease and gill lice. The state has launched a campaign for “Clean, Drain, Dry and Never Move” to slow the spread of these organisms. Staff have created signage at public access areas to reiterate the importance of not moving aquatic organisms. The IFD has reduced the regulatory burden on invasive species so that they may be removed by the public to hopefully reduce their impacts.

Staff plan to create new signage that explains the detrimental effects of Alabama Bass on other black bass species. Staff will continue to monitor the movement and distribution of ANS species throughout NC. These species and their detrimental effects are a management priority within the WAP.

2.2.4 Work with non-federal private landowners to implement Safe Harbor Agreements and Candidate Conservation Agreement with Assurances (SHA/CCAA)

Status: Ongoing

Expected Completion Date: November 2072; Winter, 2072

The NCWRC and U.S. Fish and Wildlife Service finalized a SHA/CCAA for the reintroduction of 21 aquatic species in NC. Staff identified three species, Roanoke Logperch, Magnificent Ramshorn, and Spotfin Chub, and four non-federal landowners for inclusion in the SHA/CCAA in 2023.

Aquatic Wildlife Diversity staff plan to work with two additional species, Carolina Madtom and Tar River Spinymussel, for prioritization in 2024.

2.2.5 Continue to work with partners to remove dams and other barriers to support species ability to move and adapt to changing ecosystems

Status: Ongoing

Expected Completion Date: N/A

Staff have worked with partners to create a database that prioritizes dam removal based on ecological importance. Dam removal is important to many aquatic organisms including coastal anadromous species, coldwater stream assemblages, and many species of greatest conservation need listed in the WAP because dams isolate aquatic communities by creating a barrier to movement and alter riverine habitats. Staff have begun to work with cooperators to remove high priority dams throughout NC.

Staff will continue to work with cooperators to assess and remove high priority dams. Staff will continue to monitor aquatic animal populations both pre- and post- dam removal. Obtaining funding for future dam removals through grants will also be a high priority over the next 12 months.

2.2.6 Continue to work with partners to promote and restore aquatic habitat

Status: Ongoing

Expected Completion Date: N/A

Staff have constructed a nursery of native freshwater aquatic plants to establish and augment aquatic habitat in lakes and rivers. Native plants help control erosion and provide habitat for native aquatic species.

2.2.7 Provide technical guidance to other agencies and private landowners on species life history and habitat needs to identify and conserve thermal refuges and mitigate drought

Status: Ongoing

Expected Completion Date: N/A

Staff use expertise to provide guidance on actions to mitigate climate change including coldwater releases below dams, minimum flows, pulses, and recommendations for land conservation.

Staff serve on more than 27 technical committees including universities, land trusts, partnerships, private consultants, USFWS, other state agencies, local governments, NGOs, private companies, lake associations to provide technical guidance on aquatic species.

3 Evaluate the impacts of climate change on Wildlife Management Division's (WMD) programs and operations

3.1.1 Assess vulnerability of wildlife to climate impacts and use results to inform species and habitat management decisions on NCWRC and privately owned lands

Status: Ongoing

Expected Completion Date: N/A

The 2015 NC Wildlife Action Plan has identified species and habitats that are impacted by climate change.

Staff completed species conservation plans for the bog turtle and southern hognose snake in 2023 and are working on species conservation plans for the Virginia big-eared bat, sea turtles, peregrine falcon, black rail, and green salamanders in 2024. We will use existing climate models to inform wildlife species vulnerability and will address this in all upcoming species conservation plans and in the 2025 NC Wildlife Action Plan.

Staff will work with the Land and Water Access Division to update Game Lands Management Plans such that predicted climate change impacts to habitats important to SGCN and game species are accounted for through land management, restoration, enhancement, and acquisition.

3.1.2 Assess and update survey techniques as necessary to account for changes in wildlife species behavior and distribution

Status: Ongoing

Expected Completion Date: N/A

Staff complete surveys on sea turtles, diamond-backed terrapins, colonially-nesting waterbirds, piping plovers, American oystercatchers, gopher frogs and other species of frogs, tiger salamanders and other species of salamanders, rattlesnakes and other snake species, passerines, bald eagles, peregrine falcons, barn owls, bat species, bog turtles, spotted turtles, box turtles, riverine turtles, woodrats, flying squirrels, and small mammals to update ongoing data collection to observe any changes in wildlife species distribution and population status. These surveys include general distribution of species, habitat assessments, habitat enhancements and restoration, and overall health of wildlife populations.

Similar numbers of surveys will continue at pre-determined cycles.

These surveys will help evaluate ongoing population status and will inform the NC Wildlife Action Plan assessments for species of greatest conservation need. These assessments will help identify species that need protection and restoration efforts due to anthropogenic impacts including climate change.

3.1.3 Review existing guidelines and management plans to develop and integrate climate change adaptation and resiliency strategies within these documents and monitor the need to implement regulatory changes for wildlife species that may become more or less abundant in NC

Status: Ongoing

Expected Completion Date: N/A

Staff review the state listing of species annually and update the protected species list for wildlife. Staff currently are involved with NGOs, federal agencies, and other governmental bodies to assess populations of animals both within North Carolina and throughout the mid-Atlantic and Southeastern U.S. This involvement allows staff to understand the changes in population status (declines and increases) due to changes in North Carolina's climate.

Staff will continue to develop conservation plans for at-risk species. These plans already integrate population assessments, including habitat loss and degradation (including changes due to climate change).

3.2 Integrate climate change adaptation practices and resiliency planning into Wildlife Management Division's (WMD) policies and operations

3.2.1 Continue to invest in translocation and propagation of vulnerable species

Status: Ongoing

Expected Completion Date: N/A

The Wildlife Management Division collaborates with other NCWRC divisions, government entities, and private and public landholders to develop techniques and practices consistent with translocation and propagation of at-risk species. Currently, with partners, NCWRC propagates gopher frogs and uses a head-start program to augment existing populations on public land. Additionally, the division is working with Zoo Knoxville, Tennessee to hatch bog turtles and grow to first-year size, then return to their nest site – a head-starting pilot project for bog turtles.

In the coming year, staff will continue this practice to support vulnerable species and to learn more about this management option should it be needed in the future relative to climate change impacts on habitat needs.

3.2.2 Continue to manage species based on changes in recruitment, growth, survival, and population status

Status: Ongoing

Expected Completion Date: N/A

Staff have established long-term monitoring sites for priority wildlife species. In 2023, staff conducted over 400 surveys to collect population level metrics and genetic diversity information for priority species. Additionally, all game species are managed under these parameters. Game species data are collected through hunter harvest, mail, and observation surveys, and trend analyses are conducted. Surveys and monitoring of SGCN are conducted using appropriate methods (counts, cover boards, aural recording units, camera traps, mist nets, etc.) and data are evaluated for long-term trends. These data and influential factors, including climate variables, are collected and analyzed to determine needs for management actions.

Staff plan to continue surveys at long-term monitoring sites and through long-term data collection activities.

3.2.3 Continue to identify and protect areas of thermal refuge on WRC, privately owned lands, and partner agency lands and work with partners to encourage their protection

Status: Ongoing

Expected Completion Date: N/A

Staff identify and protect habitats of thermal refuge, which are under threat from climate change. Winter hibernacula for bats are protected with gates and signage, rock outcrops and

falcon eyries are protected through conservation actions with partners, and spruce-fir habitats are enhanced through plantings. Ephemeral ponds in longleaf pine and native grass habitats are restored, enhanced, and created for important amphibian habitat. Waterbird islands in North Carolina's sounds and the Lower Cape Fear River are enhanced through beneficial use of dredged material and a partnership with the U.S. Army Corps of Engineers.

3.2.4 Identify priority habitats and assess conservation, protection, and management needs across the landscape

Status: Ongoing

Expected Completion Date: N/A

NCWRC uses a variety of tools to identify and work with landholders to focus conservation efforts on undeveloped lands with an effort towards managing for priority habitats listed in the NC Wildlife Action Plan. Habitat surveys are conducted annually by Wildlife Diversity staff to determine use by species of greatest conservation need and need for conservation, protection, and management. Staff within the WMD Operations Program, especially Wildlife Conservation Biologists, work with private landowners to evaluate habitat conditions and priority species' needs as they develop management recommendations to meet the landowner's goals and objectives for their property. These evaluations will continue into the coming year.

3.2.5 Support private landowners in converting introduced grass stands and low productivity cropland to native grasses and forbs to enhance wildlife habitat, improve drought resistance in forage production, and increase ecosystem services while strengthening carbon sequestration and storage capacity compared to non-native herbaceous species

Status: Ongoing

Expected Completion Date: N/A

Staff within the WMD Operations Program and Habitat Conservation Division will continue to promote the establishment of native vegetation to meet both production and habitat-oriented objectives. The Commission 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.

3.2.6 Continue to investigate strategies that will result in increased implementation of prescribed burning by private landowners to support ecosystem resiliency and viability

Status: Ongoing

Expected Completion Date: N/A

Staff continue to work with other partners to promote and, when possible, facilitate prescribed burning on private lands. This includes taking learnership roles in the Bladen Lakes Area Prescribed Burn Association and being active in other Prescribed Burn Associations to facilitate peer-to-peer learning between landowners. We also loan equipment (e.g., water pumps) to landowners so they can implement burns on their property. Staff also participate in the N.C. Prescribed Fire Council and work cooperatively with the N.C. Forest Service and NGOs to promote fire as a valuable conservation tool.

Our emphasis will be in recommending prescribed burning to enhance species of greatest conservation need in appropriate ecosystems, but we are continuing to explore the ability to conduct or contract burning on private lands. However, liability and personnel demands limit those actions at this time. We will continue exploring options to expand equipment loan opportunities in the future, as well as promote and influence financial assistance options to offset costs associated with conducting prescribed burns on private lands.

3.2.7 Utilize the Wildlife Conservation Lands Program (WCLP) to promote green space and diverse plant communities by deferring private landowners' property tax liability

Status: Ongoing

Expected Completion Date: N/A

Staff will continue to use the WCLP to aid landowners who wish to manage their property for ecological, not economic, goals and objectives. Removing the production-oriented requirements of the Present Use Value Program, WCLP allows 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. A much wider range of ecological services can be realized from these properties, and retaining open lands by reducing some of the financial incentive of development will likely provide a buffer in greenhouse gas emissions.

4 Evaluate the impacts of climate change on Land and Water Access' (LAWA) programs and operations.

4.1.1 Review existing game land management plans to develop and integrate climate change adaptation and resiliency strategies within these documents

Status: Ongoing

Expected Completion Date: N/A

Over the next year, a reference sheet will be developed to support staff in integrating adaptation and resiliency strategies into management planning as the plans come up for review. Game Land Management Plans will begin to be up for review in 2024/25.

4.1.2 Assess vulnerability of game lands to climate impacts and use results to inform management decisions

Status: Ongoing

Expected Completion Date: N/A

Staff regularly assess vulnerabilities of game lands, i.e., rising sea levels, emerging diseases, impeded access, and adjust management decisions to address new vulnerabilities. Staff will also meet within the next year to assess and discuss needed management actions to address emerging or continuous vulnerabilities.

4.1.3 Use remote sensing-based vegetation change analysis to monitor habitat shifts on game lands over time to inform management

Status: Ongoing

Expected Completion Date: N/A

As of 2024, no remote sensing-based vegetation change analysis tools are used in game land management. Over the next year, staff will identify and assess remote sensing-based vegetation change analysis tools available to assist management decisions on game lands.

4.1.4 Use available threat assessment tools and modeling in game land management planning to maintain optimal habitats for species conservation

Status: Ongoing

Expected Completion Date: N/A

Staff are developing a Forest Optimization Tool in collaboration with N.C. State University. This tool considers forest habitat scenarios until 2050. Additionally, NCWRC staff from the Habitat Conservation Division are collaborating with the Southeast Climate Adaptation Strategy to develop a new threat assessment tool to identify Conservation Opportunity Areas.

Staff will use these tools to assist in management planning and decision-making related to game lands. Staff will investigate and utilize new technologies, resources, and methodologies that may assist in land management practices as appropriate.

4.1.5 Identify needs associated with maintaining and increasing the use of prescribed fire

Status: Ongoing

Expected Completion Date: December 2023

The Forest Optimization Tool (mentioned in 2.5.4) will be used to determine an optimal fire interval using two scenarios that can be 1. achieved with existing manpower and equipment, and 2. achieved with increasing manpower and equipment. This tool will be used in coming years to support decision-making on prescribed fire needs on game lands.

4.1.6 Prioritize climate change and sea-level rise in coastal habitat restoration planning on coastal game lands

Status: Ongoing

Expected Completion Date: December 2024

Game land managers on the coast continually evaluate and use mapping tools to prioritize restoration opportunities based on addressing vulnerabilities; examples include addressing flooding issues at game lands and redirecting long leaf pine reforestation efforts to where soils are most suitable. Over the next year, staff will meet to discuss where sea-level rise is expected to occur on game lands and to identify restoration needs and will use available modeling tools to guide discussions.

4.1.7 Review game land management to protect remnants of high elevation forests and rock outcrops through fire suppression in these areas and support prescribed fire in adjacent lower elevation forests

Status: Ongoing

Expected Completion Date: N/A

Staff do not burn high elevation forests or areas of rock outcrops. Prescribed fire is a regular part of management on lower elevation forests. This supports the protection of higher elevation forests, which are important areas of thermal refuge for cold-adapted species. Land and Water Access staff will continue to manage habitats with fire to support vulnerable species.

4.2 Integrate climate change adaptation practices and resiliency planning into Land and Water Access' (LAWA) policies and operations

4.2.1 Identify and prioritize land acquisition projects that support species and habitat conservation, reintroductions, and migration; land conservation provides carbon sequestration and storage benefits

Status: Ongoing

Expected Completion Date: N/A

Over the last year, land acquisition efforts have supported species and habitat conservation, as well as migration. Land acquisition priorities are guided by the NC Wildlife Action Plan, species conservation plans, and game land management plans. Specifically, last year's acquisitions

benefited the gopher frog, red-cockaded woodpecker, bog turtle, Littlewing Pearlymussel, Spotfin Chub, Appalachian Elktoe, as well as a suite of game species.

Land acquisition efforts will continue to prioritize species and habitat conservation using the most up-to-date science available, including sea level rise models. Internal land team meetings are held by staff, in addition to Land and Property Committee Board meetings, which continue to inform land acquisition strategy and communication between agency staff and leadership within the NCWRC.

4.2.2 Continue to protect and maintain critical habitats identified in the NC Natural and Working Lands Action Plan and in Executive Order 305 to support climate resiliency goals of the state

Status: Ongoing

Expected Completion Date: N/A

NCWRC currently maintains 2,093,664 acres of game lands, many of which are wetlands - including pocosins, forested floodplains, and upland forests. NCWRC's forested land accounts for an estimated 9,042,368 tons of stored carbon and sequesters an average of 382.89 kg/acre/year.[2]

These habitats are priority habitats identified in the NC Wildlife Action Plan and will have potentially higher priority for land acquisition than other habitat types through the agency's internal scoring processes. Over the next year, NCWRC staff will review scoring criteria and identify needs for addressing climate resilience considerations in land acquisition scoring criteria.

4.2.3 Facilitate salt marsh migration through protection of migration corridors

Status: Ongoing

Expected Completion Date: N/A

Land acquisitions in the coastal region continue to protect migration corridors. NCWRC partners with the NC Coastal Land Trust and The Nature Conservancy to identify priority acquisition opportunities. These partnerships are enduring and NCWRC will continue to acquire land for conservation in marsh migration areas.

Over the next year, NCWRC staff will review scoring criteria and identify needs for addressing climate resilience considerations in land acquisition scoring criteria.

[2] This information was obtained from the NC Conservation Benefits Calculator (Duke University & Conservation Trust for North Carolina, 2023).

4.2.4 Continue to support and initiate research and monitoring activities that increase knowledge and understanding of impacts of environmental stressors of change as well as to support continued forest health and resilience using the best available science

Status: Ongoing

Expected Completion Date: N/A

Forest stands managed by staff are monitored to keep track of their growth, health, and management needs. A Forest Optimization Tool is in development in collaboration with N.C. State University; this tool will identify management needs to address optimal forest health. Additionally, NCWRC facilitates research by universities to identify emerging forest health threats; previous research includes projects on wooly adelgid (mountains), oak regeneration (mountains), and a fire needs assessment (statewide).

In the coming year, NCWRC will facilitate research on an upcoming smoke and prescribed fire study, directed by N.C. State University.

4.2.5 Support and expand utilization of forest management to restore and maintain native forest types that sequester carbon and are more resilient to climate change, disease, and forest pests

Status: Ongoing

Expected Completion Date: N/A

In addition to the Forest Optimization Tool referenced in strategies 2.5.4, 2.5.5, and 2.6.4, LAWA also supports forest resiliency through planting and appropriate management of native forest types, including longleaf pine restoration on appropriate soils, oak regeneration, and shortleaf pine restoration. Staff are also working with partners to replant red spruce and Frasier fir at high elevations.

4.2.6 Continue to support the wood products markets

Status: Ongoing

Expected Completion Date: N/A

In 2022, NCWRC completed 33 timber sales for 2022, equaling 4,595 acres. The completion of the Forest Optimization Tool, mentioned in previous strategies, will help determine forests most suitable for harvest.

4.2.7 Continue to identify areas on game lands in need of habitat and stream restoration and replant buffers, as needed

Status: Ongoing

Expected Completion Date: N/A

Over the past few years, NCWRC has been partnering with The Nature Conservancy to identify and implement habitat and stream restoration projects on Angola Bay Game Lands, Holly Shelter Game Lands, and the Upper Roanoke Game Lands.

In the next year and beyond, NCWRC is committed to working with partners to develop, implement, and maintain stream and wetland restoration projects on these and other game lands, as opportunities arise.

4.2.8 Improve stream connectivity by restoring aquatic organism passage and developing stream crossings that promote aquatic organism passage

Status: Ongoing

Expected Completion Date: June 2025

In the past year, staff have completed a culvert inventory on streams with anadromous fish. Additionally, NCWRC staff have from LAWA, Habitat Conservation, and IFD coordinated to identify opportunities on western game lands to address stream restoration and aquatic organism passage needs.

In the coming year, NCWRC is partnering with The Nature Conservancy to replace two culverts and one bridge on the Pollock's Ferry tract of the Upper Roanoke River Game Land to restore fish passage.

4.2.9 Rewet hydrologically altered peatlands, where appropriate, to provide species and habitat improvements, prevent soil loss and catastrophic fire, and increase carbon sequestration

Status: Underway

Expected Completion Date: June 2025

Since 2020, NCWRC has partnered with The Nature Conservancy to rewet drained peatlands on Angola Bay Game Lands. 6,037 acres of peatland will be restored while still maintaining public access. The Nature Conservancy has completed a hydrologic study to determine compatibility to implement similar pocosin on Holly Shelter Game Lands. Funding for further work has been applied for from NFWF America the Beautiful and the NC Land and Water Fund.

Over the next year, staff and partners will continue the implementation phase of Angola Bay work and analyze and review results of Holly Shelter hydrologic study. Staff will continue working with partners to assess and evaluate hydrologically altered peatlands and identify opportunities for restoration.

4.2.10 Continue to work with partners (i.e., TNC, land trusts, NHP) to support Natural Heritage dedication of nature preserves, land conservation, and restoration

Status: Ongoing

Expected Completion Date: N/A

Staff will continue to work with partners to support restoration of conserved lands. This includes enrollment of conserved lands as Natural Heritage dedications, US Forest Service stewardship projects in the mountains, and partnering with The Nature Conservancy to increase our ability to manage with prescribed fire, replant riparian buffers, enhance fish passage, and restore hydrologic functioning of drained peatland soils. These activities and partnerships will continue in the coming year, including projects mentioned in strategies 2.6.7, 2.6.8, and 2.6.9.

4.2.11 Collaborate with partners to bank seeds for replanting projects on game lands

Status: Ongoing

Expected Completion Date: N/A

Staff collect native warm season grasses and tree seeds to enhance nursery stock and support habitat restoration projects, as requested.

4.2.12 Continue to monitor game lands for invasive species

Status: Ongoing

Expected Completion Date: N/A

Staff continuously monitor game lands for non-native invasive species as part of their regular monitoring activities, problem areas are treated as time permits.

4.2.13 Work with adjoining landowners to address issues of fire protection, non-native invasive species, and habitat management that extend across boundaries

Status: Ongoing

Expected Completion Date: N/A

Staff work with adjoining landowners to support species and habitat needs as opportunities arise.

5 Evaluate the impacts of climate change on Habitat Conservation Division technical guidance programs and operations

5.1.1 Develop and implement the State Wildlife Action Plan (WAP) in collaboration with diverse partners

Status: Ongoing

Expected Completion Date: N/A

The NC Wildlife Action Plan (WAP) identifies fish and wildlife species of greatest conservation need (SGCN) and other species for which there are research or management priorities. The

WAP's priority recommendations can be used to specifically target conservation or management options for SGCN and their essential habitats. The goal is to strategically target declining populations and imperiled animals and their required habitats early, thereby reducing the risk of extinction and precluding the need for listing under the Endangered Species Act.

The WAP will continue to reflect statewide conservation concerns by ensuring collaboration with diverse partners that includes federal and state agencies, local governments and communities, conservation organizations, businesses, American Indians, and individuals interested in the Plan's conservation strategies. Habitat Conservation will continue to update and maintain the WAP and work with internal and external groups to implement the Plan's priority conservation actions.

5.1.2 Continue to keep up with research on Best Management Practices for stormwater and erosion control to provide recommendations that best protect and/or enhance fish and wildlife benefits

Status: Ongoing

Expected Completion Date: N/A

Potentially increasing storm intensities and frequencies may require changes to post construction stormwater management designs, particularly in situations that now focus on requirements for outfall protection versus treatment of stormwater quantity. Staff attend trainings and conferences related to stormwater management and water quality to keep up with the latest science and engineering.

In the coming year, staff will informally assess BMP performance on completed projects, coordinate with DEQ staff, and apply those observations with comparable research in future project recommendations. Additionally, staff will update Green Growth Toolbox resources to include the most current BMP design information beneficial for wildlife and aquatic habitats. These updates will provide local governments with additional information to consider for their own stormwater design standards.

5.1.3 Collaborate with DEQ in determining stormwater standards for larger storm events

Status: Proposed

Expected Completion Date: December 2024

Due to changes in Waters of the United States rules, many acres of wetlands will lose protection and there will be reduced capacity on the landscape to treat stormwater. Additionally, larger storm events are impacting the ability of existing stormwater standards to work. In the next year, staff will engage with DEQ to identify how to enhance stormwater standards to address increasing needs. Staff will also recommend the use of higher standards in flood prone areas through technical guidance.

5.1.4 Continue to keep up with research on Best Management Practices for dams to provide recommendations that protect and/or enhance fish benefits

Status: Ongoing

Expected Completion Date: N/A

Climate change heightens the need to provide connectivity for aquatic organisms. Staff provide guidance to dam operators to maintain ecological flows, minimize impacts of drought events on the aquatic environment, and work to track and control aquatic nuisance species. To increase habitat connectivity, NCWRC has focused on dam removals to reconnect aquatic habitats. Staff attend trainings to keep up with the latest science on dam operation and removal projects.

5.1.5 Assess and update, if needed, Engineering Best Management Practices to ensure best practices and share best practices with external partners

Status: Ongoing

Expected Completion Date: N/A

Staff provide recommendations on engineering best management practices for reducing environmental impacts to other state agencies and external partners. The Division of Energy, Mineral, and Land Resources' plans for stream stabilization often require riprap which can block aquatic organism passage. Staff provides recommendations on how to design projects to reduce impacts to aquatic ecosystems as well recommendations on best materials to use for reducing environmental impacts. Staff also provide recommendations on culvert designs that allow for non-erosive velocities and increase streambank stability, as well as allow for aquatic organism passage.

Staff will informally assess the environmental performance of culvert designs (aquatic life passage, bedload retention, channel stability) on completed projects and collaborate with DEQ and other agencies on future modifications of hydraulic design criteria (e.g., NCDOT Guidelines for Hydraulic Studies).

5.2 Integrate climate change adaptation practices and resiliency planning into Habitat Conservation Division technical guidance policies and operations

5.2.1 Continue to support natural infrastructure restoration projects (i.e., living shorelines, oyster reefs, etc.), where appropriate (and design appropriate) through permit review

Status: Ongoing

Expected Completion Date: N/A

Staff review projects and provide recommendations to encourage projects that minimize wildlife habitat impacts and encourages designs that are truly 'nature-based,' with minimal hardened structures. Staff also encourage the use of native vegetation wherever plantings are to be

installed, they provide comments to minimize loss of SAV, natural shorelines, and public trust waters.

Technical guidance will continue into the coming year.

5.2.2 Keep abreast of funding opportunities related to resiliency

Status: Proposed

Expected Completion Date: October 2024

NCWRC staff recognize opportunities when they are available and send to appropriate staff within the agency.

In the next 12 months, staff will develop and maintain a list of potential projects and partnerships that could be implemented as funding opportunities become available (e.g., list of locations where installation of new USGS monitoring gauges will be beneficial for aquatic species monitoring and surveys).

5.2.3 Continue to engage and support local governments in incorporating natural area protection in land use planning and policy to support climate resiliency via the Green Growth Toolbox

Status: Ongoing

Completion Date: N/A

The Green Growth Toolbox handbook and associated educational materials were updated in 2023 to provide information and resources on the latest climate science and related community resiliency strategies. These resources are intended to assist local governments in developing plans and ordinances to protect their natural resources.

Over the next year, staff will integrate natural areas-related climate resiliency strategies into their technical guidance work with local governments. They will also continue to partner with organizations that support climate resiliency planning with local and regional governments, such as NCORR and Sea Grant.

5.2.4 Continue to encourage wide riparian, wetland buffers and floodplain protection through permitting and the Green Growth Toolbox

Status: Ongoing

Expected Completion Date: N/A

Staff continue to recommend protection of the widest riparian buffers and the minimum of the 100-year floodplain, as practical, in our recommendations for habitat conservation. In 2022, we reviewed over 1500 environmental documents and permit applications to identify opportunities to enhance these protections.

Water of the United States rule changes will impact our ability to make recommendations regarding wetland protection and stream buffers, especially related to isolated wetlands. Staff may need to identify new strategies to address diminishing protections on isolated wetlands, including those that would also support flood attenuation, water quality/quantity, and wildlife habitat.

5.2.5 Continue to participate in collaborations concerning submerged aquatic vegetation (SAV) and encourage the adoption of protective measures where SAV exists

Status: Ongoing

Expected Completion Date: N/A

NCWRC is a signatory to the Albemarle Pamlico National Estuarine Partnership Memorandum of Understanding; staff continue to support SAV mapping work and provide technical guidance on projects that may impact SAV.

Technical guidance work will continue as opportunities arise.

5.2.6 Provide technical guidance on oyster reef projects to minimize and avoid impacts on fish habitat

Status: Ongoing

Expected Completion Date: N/A

Staff provide recommendations on where oyster reef projects will provide the most benefit and where these projects should be avoided to reduce impacts to fish and wildlife habitats.

Technical guidance work will continue as opportunities arise.

5.2.7 Provide technical guidance on development review to improve site preparation in support of retaining native tree cover

Status: Ongoing

Expected Completion Date: N/A

Staff review projects and provide recommendations to reduce mass grading and clear-cutting; staff encourage retention of native tree canopy, adequate marking of native trees to avoid damage during construction, and offer on-site assistance. Staff meet with developers to discuss the Wildlife Friendly Development Certification, as opportunities arise.

In the coming year, staff will learn more about soil amendment guidance to ensure natural areas are adequately marked so construction activities do not damage native trees and habitats.

5.2.8 Continue to prioritize restoration of native habitats and conservation of species of greatest conservation need through technical guidance

Status: Ongoing

Expected Completion Date: N/A

Staff provide technical guidance to partners on native habitat restoration and conservation to support wildlife, including pollinator and native grass habitat restoration on private lands and on solar farms, aquatic and wildlife passage projects across road projects and through developed landscapes. Native grass restoration supports carbon sequestration and storage, in addition to providing pollinator habitat. In 2019 and 2020, staff worked with a solar farm in Rowan County to plant a 15-species forb and grass mix in the buffer area of the farm, as well as underneath the tall edge of the solar panels. Not only was this a benefit to the insect community – which insect diversity increased quite a bit with the addition of that vegetation – but it allowed the maintenance division of that solar company to make less frequent trips to the farm for mowing. Staff are conducting a long-term, multi-taxa wildlife study at a stream and wetland mitigation site in Guilford County. The data from this study will help guide compensatory mitigation providers in improving terrestrial and aquatic wildlife habitats, including for SGCN species.

Technical guidance work with continue as opportunities arise.

5.2.9 Work closely with partners to identify key corridors and connectivity needs; identify and help pursue funding for wildlife passage and provide technical guidance and encouragement

Status: Ongoing

Expected Completion Date: N/A

Staff helped NC Department of Transportation apply for a grant that would improve culvert capacity and add fencing in an area I-40 near the Tennessee state line to increase habitat connectivity for wildlife, particularly meso-mammals. The location was identified as a key opportunity based on research conducted by non-governmental organizations. Staff also coordinate efforts to bring together conservation and local government partners in the Triangle to identify and prioritize the conservation and restoration of habitat connectivity. These coordination efforts are important in maintaining connectivity in rapidly developing landscapes.

Technical guidance and coordination efforts will continue into the coming year.

5.2.10 Provide recommendations that protect and/or enhance fish benefits on dam projects

Status: Ongoing

Expected Completion Date: N/A

Climate change heightens the need to provide connectivity for aquatic organisms. Staff provide guidance to dam operators to maintain ecological flows, minimize impacts of drought events on the aquatic environment, and work to track and control aquatic nuisance species. To increase habitat connectivity, NCWRC has focused on dam removals to reconnect aquatic habitats. During the year, significant work has been done on proposed dam removals in the Cape Fear,

Little Tennessee, and French Broad drainages. WRC is providing technical guidance to NRCS and private landowners on restoring stream buffers on a dam improvement project in Yadkin County. The stream contains a relic native mussel population, including a state threatened species.

This technical guidance will continue into the coming year.

5.2.11 Provide recommendations that protect and/or enhance aquatic resources on stormwater and erosion control projects

Status: Ongoing

Expected Completion Date: N/A

Staff provide technical guidance on stormwater and erosion control projects, such as native seed mixes for soil stabilization.

This technical guidance will continue into the coming year.

6 Integrate climate change adaptation practices and resiliency planning into Engineering policies and operations

6.1.1 Continue to limit the impervious surface of new structures and remove existing impervious surface areas when possible

Status: Ongoing

Expected Completion Date: N/A

As renovations and new construction require new paving or repaving, we are working to implement the use of pervious paving grid systems where stormwater permitting limits development. These have been installed at multiple access areas already.

6.1.2 Design bridges and culverts to allow for increased stream flow, i.e., a 500-year flood event

Status: Ongoing

Expected Completion Date: N/A

As bridges and culverts require replacement, inundation mapping is done to evaluate the proper sizing for adequate flood events. Floodplain/way requirements also continue to evolve and become more stringent.