CHAPTER 8: CONSERVATION OPPORTUNITY AREAS, ACTIONS, AND MONITORING PROGRAMS

Conservation Opportunity Areas

South Carolina's landscape has a variety of habitats across its ecoregions, all of which are necessary to maintain diversity. However, some portions of the landscape score higher on the diversity scale and are therefore prioritized as Conservation Opportunity Areas (COAs). To create the South Carolina COAs map (Figure 8-1), the South Carolina Department of Natural Resources (SCDNR) instituted the first half of North Carolina Heritage Program's (2021) *Procedures for Rating Natural Areas* as a model. It details how each tracked element of occurrence is assigned a collective value 'score' based on its global (G) or subnational/state (S) rank combination (Tables 8-1a & b). For South Carolina, these element records are housed in SCDNR's Natural Heritage Database. Basically, for any unit of area on the ground, SCDNR can intersect data with it and summarize the relative importance that area has for imperiled/critically imperiled species, by summing the cumulative scores for each unique species found within the area. It is not just a sum of all element occurrence records, rather a sum of any unique species if an element for that species is found there to ensure there is no overrepresentation based on duplicate species records. In this case, SCDNR applied this scoring process using intact habitat cores generated by the Green Infrastructure Center. Any core over 100 acres was intersected with known tracked occurrence records and the score summed to assign that core a Collective Value Rank (C-Rank). Cores that ranked as C1, C2, C3, or C4 were determined to be a priority conservation area.

TABLE 8-1a: Scoring Criteria
The most positive scores are in cooler shades.

Collective Value Rating	Cumulative Element Score	Minimum Number of Elements
C1 (Exceptional)	91 and above	10
C2 (Very High)	61-90	7
C3 (High)	31-60	4
C4 (Moderate)	11-30	2
C5 (General)	2 -10	1

TABLE 8-1b: Scoring Criteria
More positive scores are in cooler shades.

G-Rank	S-Rank	Element Score
G1	S1	10
G2	S1	9
G2	S2	8
G3	S1	7
G3	S2	6
G3	S3	5
G4/G5	S1	4
G4/G5	S2	3
G4/G5	S3	2
G4/G5	S4/S5	1

To supplement this data, SCDNR also integrated hubs for regional connectivity identified within the 2023 Southeast Conservation Blueprint, a spatial plan developed by the Southeast Conservation Adaptation Strategy (SECAS) partnership. Using these hubs, which are large patches (~5,000+ acres) of highest priority Blueprint areas and/or protected lands, represent important areas where even though SCDNR may not have specific data for imperiled species, would nonetheless serve as important areas for population movement, gene flow, migration, etc. In addition, more than 2,000 people from over 600 different organizations within the Southeast region have actively participated in developing the Southeast Blueprint and including this information allows our methodology to take advantage of existing regional data that reflects widespread agreement among the conservation community. It also helps ensure that South Carolina's COAs align with its neighboring states that are also using the Blueprint to inform their COAs and contribute to a

wider regional strategy to connect lands and waters. It is important to note that white spaces on the following COA map do not denote areas where SGCN and their habitats are unimportant; rather, these areas are as yet undefined in significance and lower priority at this time.

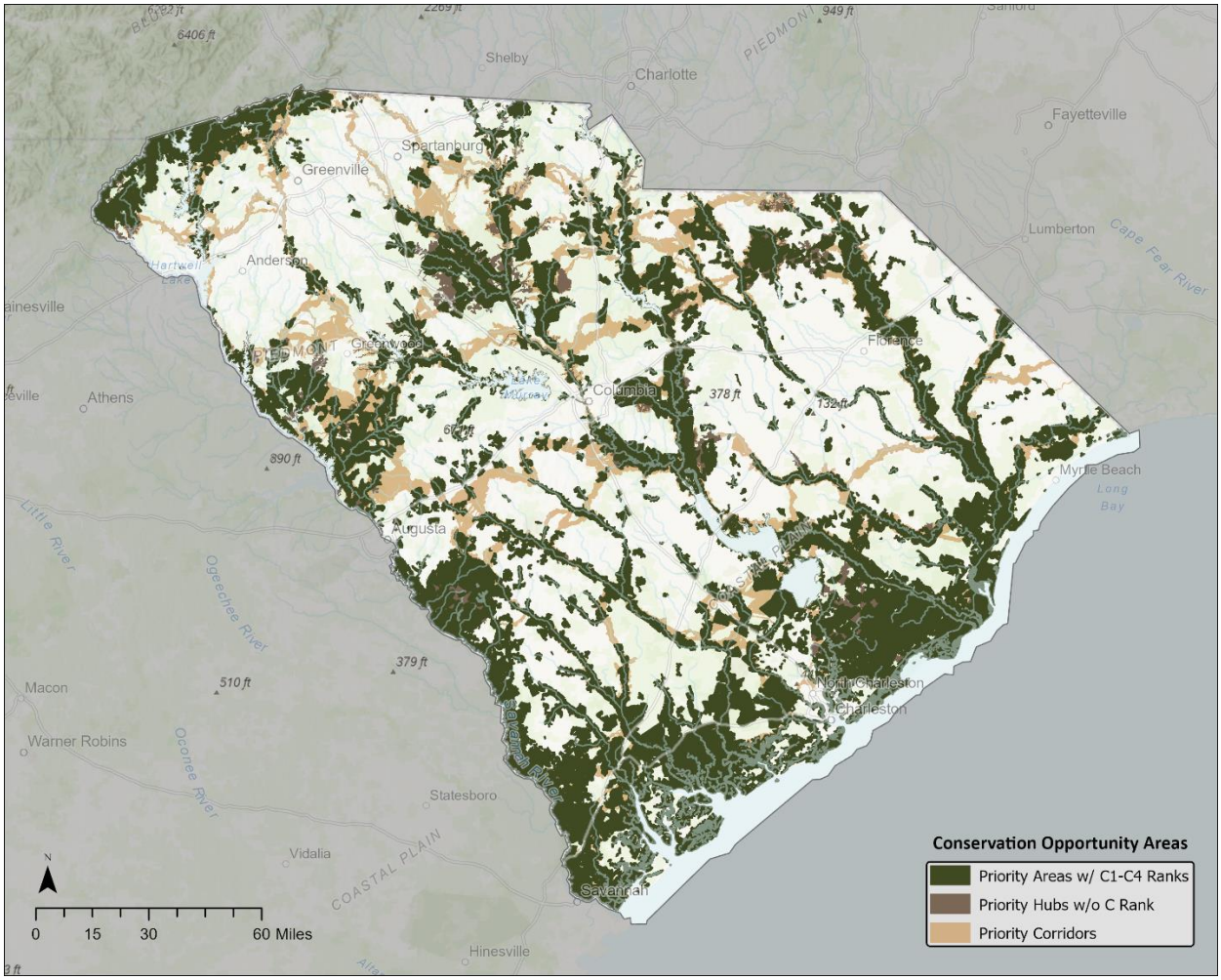


FIGURE 8-1: Conservation Opportunity Areas (COAs) in South Carolina address areas where conservation actions are prioritized to benefit Species of Greatest Conservation Need (SGCN) and their priority habitats. The total percent of the State that is considered any type of COA is slightly under 45%, although the 'core' areas (areas with C1-C4 ranks) are approximately 30% of the State.

Conservation Actions

The magnitude of the threats affecting hundreds of species and their habitats in South Carolina is staggering and constantly increasing. Because time, resources, and funding are limited, not all suggested actions can be initiated, thus making prioritization of conservation actions necessary. Six criteria, developed in 2005 by a steering committee, will still be utilized for this 2025 State Wildlife Action Plan (SWAP) iteration when considering what conservation actions to implement as they are still relevant. These criteria are presented in Box 8-1 in random order. Over the last 20 years, priority conservation actions identified in South Carolina's SWAPs have been attempted and measures of success documented. Ineffective actions have been removed

BOX 8-1: SIX CRITERIA USED FOR DETERMINATION OF CONSERVATION ACTIONS

- **Feasibility:** Challenges can be mitigated, solutions are apparent. SCDNR can feasibly staff and implement the action and the results will be beneficial.
- **Opportunity**: SCDNR can implement the conservation action (i.e. opportunities exist; SCDNR has the authority to carry out the action).
- **Benefit**: Implementation of the action will result in benefits to the natural diversity of South Carolina. Benefits are considered in terms of unit of effort to achieve those benefits; that is, implementation results in multiple benefits to a given species or multiple species are benefited by a single action.
- **Proactive**: Implementation will result in proactive changes to address challenges; actions are more than a reactive response to ongoing challenges.
- **Partnerships**: Partnership opportunities exist for implementation, which provides the ability to leverage other resources.
- **Funding**: Implementation is eligible for SWG funding and/or matching funds exist.

while new technologies and adaptive management have resulted in new action items for 2025. In some cases, actions were combined with others or updated for relevance in 2025. For this current iteration of the SWAP, conservation partners were consulted about these newest objectives and goals that will be priorities to implement based on these same initial six criteria.

BOX 8-2: SEVEN CONSERVATION ACTION AREAS (CAAS)

1. Land Management
2. Invasive and Non-native Species Control
3. Habitat Protection and Restoration
4. Education and Outreach
5. Partnerships and Collaborations
6. Research and Survey
7. Regulatory Actions

In the first iteration of the SWAP in 2005, Conservation Action Committees created nine Conservation Action Areas (CAAs) with subsequent actions identified under each that followed the tenets of the six criteria for determining conservation actions. These original CAAs have been reworked into seven categories for this 2025 SWAP edition and are outlined in Box 8-2. Action items are addressed for each area of concern. Many of the action items overlap with other categories such as management, partnerships, and education. Unlike previous iterations of the South Carolina SWAP, the action items are not listed in order of importance or prioritized as highest, high, or moderate as all are equally necessary to achieve conservation objectives for Species of Greatest Conservation Need (SGCN) and their habitats. Other states' SWAP connectivity conservation actions were consulted (Hance et al. 2024) and incorporated as relevant to South Carolina.

Conservation Action Area 1: Land Management

As previously stated in Chapter 2, 90% of South Carolina's footprint is privately owned so that there is little authority over habitat conservation and wildlife management on those lands. Local, state and federal agencies that manage land in South Carolina, such as the SCDNR, South Carolina Forestry Commission (SCFC), South Carolina Parks and Tourism (SCPRT), United States Fish and Wildlife Service (USFWS), Department of Defense (DoD), and United States Forest Service (USFS), cannot possibly have a big enough impact with the remaining 10% of the land base under government ownership. Therefore, it is important that SCDNR enlists the

cooperation of private landowners to protect priority species and their habitats. Encouragingly, many citizens in South Carolina recognize the importance of natural resources and the value of these resources for our quality of life. Several programs are currently available to landowners through the SCDNR as well as other state and federal agencies and public and private entities. Despite the number of programs available in South Carolina, the changing urban landscape mandates that new programs are likely necessary. Further, many private landowners are not aware of the current programs available to them.

It will take a combined effort on private and public lands to positively impact South Carolina's land management regimes to benefits aquatic and terrestrial plants and animals. The SCDNR has an excellent working relationship with other public land managers throughout the State, but the conservation goals of these separate agencies may differ, resulting in different conservation strategies and efforts. The SCDNR partners with the Natural Resources Conservation Service (NRCS) to promote Farm Bill incentive programs to private landowners and provide technical assistance. The SCDNR also implements the Red-cockaded Woodpecker (RCW) Conservation Benefit Agreement Program (formerly the Safe Harbor Program) to formally enroll qualifying private lands in a management program to enhance Red-cockaded Woodpecker populations. The SCDNR also works with the USFWS to implement the Partners for Fish and Wildlife Program on various restoration projects on private lands. In order to provide the most efficient management of our priority species and their habitats, it is important to continue and strengthen partnerships between the SCDNR and other agencies.

Longleaf Pine restoration on suitable soils within its native range benefits a suite of species that require this habitat type. Photo provided by the SCFC.

Additionally, urban sprawl needs to be addressed as it is an impediment to land management as it fragments core habitats and blocks travel corridors for wildlife. Yale University (2021) defines urban sprawl as "a form of unplanned urban and suburban development that takes place over a

large area…" with negative impacts to the environment, economy of cities, and society. On average, the SCDNR processes 1,500 annual requests through its automated system for environmental reviews for development projects. This represents a five-fold increase since 2017 (Joe Lemeris, pers. comm.). These reviews are used for varying purposes, including due diligence to understand impacts to potential species on proposed development sites; assessing known species found on or near a property for conservation purposes; assessing potential impacts to species on managed/working forestlands; and as supplemental information provided to permitting/regulatory agencies such as the USFWS, United States Army Corp of Engineers, (USACE), and the South Carolina Department of Environmental Services (SCDES).

SCDNR's Office of Environmental Programs (OEP) is involved in reviewing proposed environmental impacts as published in the regulatory arena and providing science-based comments to help avoid and minimize impacts to the State's natural resources. Staff are involved with the review of 401 Water Quality Certifications and 404 Wetland Fill as part of the Clean Water Act, State and Federal Navigable Water Permits, Mining Permits, National Pollution Discharge Elimination System (NPDES) Permits, hydroelectric facilities and natural gas pipelines under the authority of the Federal Energy Regulatory Commission (FERC), Nuclear Regulatory Commission (NRC) projects, National Environmental Policy Act related projects, and Natural Resource Damage Assessments (NRDAs) related to oil spills and hazardous waste sites. OEP serves to provide official SCDNR comments on these various projects, reviewing and providing comments on an average of approximately 350 projects annually. [Lorianne Riggin, SCDNR, pers. comm.]

Partnerships between wildlife resource professionals and municipalities have resulted in more ecologically friendly comprehensive plans that direct development away from sensitive species and their habitats. Photo by Anna Smith, SCDNR

In 2005, an initial SWAP committee targeting urbanization concerns and consisting of municipal leaders, home builders' associations, academia, land trusts, and other non-profit organizations concluded that opportunities existed for land management and protection by strengthening comprehensive planning through research, enforcement, and public education. Additionally, coordinating the development process between the developer and the local-level stakeholders in a one-stop-shop manner would be helpful. Promoting stormwater management regulations and techniques for impervious surfaces was advised as was developing constructive wetlands education and incentives. They also suggested developing a

higher-level coordination and training program for all levels of government and professionals, including appointed and elected officials. These ideas still need implementing and are included in the action items for this section.

Action Items

1. Develop or expand partnerships with other entities to provide landowner assistance programs that focus on the conservation of priority species, including SGCN, and their habitats.
2. Continue to conduct outreach efforts to private landowners to:
    a. Explain to the public the ecological importance of protecting natural resources on private lands and the benefits of protecting those resources for all citizens of South Carolina.
        i. Explain the importance of protecting natural wetlands for wildlife habitat, storm water storage, etc.
        ii. Explain the importance of preserving areas for coastal marshes to migrate as sea levels rise.
    b. Train and encourage landowners to voluntarily participate in natural resource conservation activities on private properties from backyards to large tracts. Encourage multiple landowners to form cooperatives to better coordinate outreach and education efforts and management at larger scales.
    c. Encourage natural resource stewardship by promoting and encouraging forestry Best Management Practices (BMPs) on private lands but wider Streamside Management Zones (SMZ) such as 300 feet each side of a waterway.
    d. Explain the mission of the SCDNR and the programs conducted by the Department through increased marketing/outreach.
    e. Identify and promote cost share and landowner incentives as they are available.
3. Provide key information about management requirements for SGCN species and habitats in South Carolina to partners responsible for public land management.
4. Provide wildlife/habitat research and demonstration projects. These could include:
    a. A buffer demonstration project that provides a win-win for both developers and the environment
    b. Research projects on the impact of wetland buffers and corridors on wildlife and habitat
    c. A storm water demonstration project
    d. Nature-based solutions to coastal erosion, such as living shorelines and salt marsh restoration projects
    e. Supplemental/alternative revenue models for private lands, such as hunting and outdoor recreation, that are compatible with wildlife conservation
5. Educate municipalities on the proper way to do tree ordinances, taking into consideration species selection, spacing, and density.
6. Continue to work with partners to manage and protect priority species and their habitats in South Carolina through other agencies' funding programs.
7. Ensure that priority species and their habitats on SCDNR lands are managed in accordance with the conservation actions provided in the SWAP.

8. Engage local chambers of commerce and councils of government (COG) to help recover species through conservation efforts before species become state or federally listed, leading to less economic issues and landowner hindrances.
9. Rank available properties and build habitat corridors between isolated populations of plants and animals across private easements and public lands, also utilizing wildlife crossings where applicable.
10. Nature-based solutions such as "green" infrastructure should be encouraged instead of hardscaping ("gray" infrastructure) where appropriate within the estuarine environment. This includes the use of Living Shorelines, oyster reef restoration (SCORE Program), and others to stabilize banks, rebuild marsh, and act as wave abatement structures.
11. Maintain and enhance natural wetlands (green infrastructure) to serve as floodwater storage and wildlife habitat where appropriate.
12. Artificial reef creation and in-stream fish habitat structures should continue to be encouraged and utilized where appropriate.
13. Complete periodic updates of land use and land cover in the State to help translate threats from species to a habitat scale.
14. Continue statewide aquatic species and habitat monitoring to build out the existing database. Temporal trend analyses will become possible as well as supporting species distribution forecasting in the new Aquatic Planning Tool to support conservation decision-making.
15. Encourage responsible land use planning throughout South Carolina that ensures the protection of natural resources and habitat connectivity. To do this, an urban biologist is needed to collaborate with municipalities and communities to reduce the impacts of development. This can be accomplished by assisting local governments in drafting meaningful sections of comprehensive plans and related documents.
    a. Implementing Best Management Practices
    b. Discouraging development in sensitive habitats used by SGCN
    c. Planning development communities using low impact development, infill, and conservation community design principles by Arendt (2003; 2010) – see Box 8-3 and Literature Cited section
    d. Using passive recreation park design and trail systems, especially with minimal stream crossings
    e. Encouraging counties and municipalities to protect crucial areas through local ordinances, including a Wetlands Protection Ordinance
    f. Greenways and "green space" that also function as wildlife corridors
    g. Creation of a "green growth" manual for municipalities including natural

BOX 8-3: SUBDIVISION DESIGN PRINCIPLES

Conservation subdivision design is a principle whereby a considerable about of buildable uplands are conserved when designing a subdivision. With higher open space ratios comes benefits of protecting wildlife habitat and dispersal corridors, protecting cultural resources, and providing low-impact recreational space for subdivision inhabitants. The overall number of buildings is not necessarily decreased from more traditional designs, but the layout is the key, with designs centered around the most important cultural or ecologically significant resources. Next, a four-step process follows in which (1) primary and secondary conservation areas are mapped out; (2) house sites are selected; (3) streets and trails are drawn in; and (4) lot lines are defined. In conservation subdivision design, green space is the priority. [Arendt 2010]

resource-friendly ordinances and incentives for green growth

h. Encouraging regular updates (every 5-10 years) of counties' and municipalities' Stormwater Management Plans, Comprehensive Plans, and other related documents

16. Encourage SCDNR staff and partner agencies to provide wildlife/habitat educational information to communities in an accessible and easy-to-understand format. Inform elected and appointed officials about environmental issues relating to local development and wildlife/habitat issues and disseminate information on the following:
    a. Support the creation of local habitat protection capabilities.
    b. Work with local land trusts on the location of priority habitats.
    c. Promote and educate about conservation easements.
    d. Collaborate with local governments to develop Best Management Practices (BMPs) for storm water run-off (education, incentives, and awards).
    e. Utilize the Aquatic Planning Tool (*in progress*) for estimating species probability of occurrence and the impacts of development within and among connected watersheds.
17. Research existing federal and state agency plans and partner initiatives to find ways to coordinate objectives and efforts.
18. Continue to participate in the environmental review process for development projects throughout South Carolina.
19. Continue to collaborate with the South Carolina Department of Transportation (SCDOT) to protect priority species and their habitats during the planning/development stage of new projects and infrastructure upgrades such as road construction, bridge and culvert replacement, etc. Direct wildlife mortality should be avoided as much as possible and wildlife movements and structure usage considered. Collaboration would continue as after-project monitoring.
20. Create decision support tools for modeling management of resources.
21. Identify, map, and conserve marsh migration corridors using predictive impact modeling.
22. Conduct scenario planning for landscape changes and subsequent adaptive management strategies in South Carolina starting with lands owned by the SCDNR. Incorporate probable future climate conditions and resulting range shifts into existing management plans for these properties, addressing tipping points (see Powell et al. 2017), the RAD (resist-accept-direct) framework, and desired future conditions.
23. Develop native plant seed banks and increase the demand for growers in South Carolina to prioritize native seed stocks.

Conservation Action Area 2: Invasive and Non-native Species Control

Various sources such as the National Wildlife Federation and the United States Fish and Wildlife Service claim that non-native invasive species are one of the main drivers of extinction along with habitat loss. It is estimated that 42% of threatened and endangered species have been impacted in some way with 18% of those having invasive species as the main cause of their decline (Kurth 2017, USFS 2024). Non-

Regulations enacted in 2021 prohibit the unregistered possession of non-native, invasive Argentine Black-and-White Tegu (or hybrid) and none may be bought, sold or transferred. Photo by Dustin Smith, North Carolina Zoo.

native invasive species negatively impact the environment, economy, and human health so that preventing their establishment and removal when found is critical for reducing threats to biodiversity. A recent study by González-Moreno et al. (2024) found that citizen science platforms like iNaturalist can sound the alarm faster than scientific literature about new incursions. Encouraging citizens to report new species to the SCDNR and USFWS will be helpful in the coming years as will data-mining by agencies and academia for new invasion records.

Action Items

1. Prevent the spread of existing invasive and non-native species, eliminating them where possible.
2. Determine the impacts of invasive and non-native species on South Carolina's SGCN and habitats used by those species.
3. Prevent the importation of additional invasive and non-native species to South Carolina through stricter legislation.
4. Develop and conduct an education and outreach campaign to raise awareness of the impacts of introducing non-native species into South Carolina and how to minimize spread.
5. Create decontamination protocol requirements for state agency equipment operators to reduce the risk of invasive plant species contamination and spread. Encourage Forest Stewardship Council™ (FSC) and Sustainable Forestry Initiative™ (SFI) standards to adopt this same protocol.
6. Create a Strike Team to combat invasive species on state-owned lands. This team can also assist dedicated prescribed burning teams during other seasons.
7. Continue to encourage conservation partners and the general public to report invasive species sightings (plants, animals, insects, diseases) on the SCDNR EDDMapS reporting page and other platforms.

An airboat is utilized to treat non-native, invasive Phragmites with herbicide in the Coastal Plain of South Carolina. Photo provided by Jamie Dozier, SCDNR.

8. Continue to data-mine sites such as iNaturalist for new invasion records.
9. Continue and develop new partnerships with other entities in South Carolina to address impacts associated with invasive and non-native species.
10. Continue to actively engage with the Gulf and South Atlantic Regional Panel on Aquatic Invasive Species (AIS), a regional panel covering North Carolina to Texas that reports to the Aquatic Nuisance Species Task Force and which facilitates communicates among states about emerging threats from AIS.
11. Encourage SCDOT to use appropriate native plant seed mixes post-construction where applicable.

Conservation Action Area 3: Habitat Protection and Restoration

Loss and fragmentation of habitat are major threats to many of the species included in South Carolina's SWAP. Habitat protection has been identified as one of the most important actions to assist in the protection of South Carolina's priority species, including SCGN, and their habitats by SCDNR biologists, species experts, and conservation partners. The importance that the SCDNR places on habitat protection for the benefit of South Carolina's wildlife is evident in the many programs currently in place at the SCDNR and in the partnerships SCDNR has forged with other state and federal agencies, organizations, academic institutions, and industries. It also remains the number one priority of the SCDNR Board per Resolution 101 (updated July 1, 2004). By focusing on whole habitats or ecosystems, SCDNR and its partners can protect species assemblages and in a more cost-effective manner.

The SCDNR is a member of the **SC Land Trust Network** which facilitates the preservation of the natural and cultural character of South Carolina through the exchange of information among land trusts. The network creates awareness and seeks support of the general public to conserve natural resources of the State. Land trusts often act as intermediaries in land transactions which then are transferred to state agencies capable of managing the properties. Land trusts also hold easements on private lands which often provide critical linkages to state-owned conservation lands.

There are many ways to prevent habitat loss and reduce the effects of past losses and fragmentation. One of the most expensive conservation tools is land acquisition but conservation easements are also extremely beneficial for habitat protection. SCDNR continues to implement the national and state versions of the "30 by 30 Initiative" through its conservation land acquisition process and subsequent restoration on those lands. It is imperative that the SCDNR continue to partner with other agencies and organizations to acquire and manage lands that are available for conservation. A 2023 Statewide Sustainability Survey found that 81.3% of respondents supported land conservation with 75.6% supporting using state dollars to match federal and private sector funds to do conservation work (Sustain SC 2024).

Agency management obligations for large financial conservation acquisitions must be evaluated through a process developed and maintained by the Habitat Protection Committee (HPC). Potential properties must be considered suitable for protecting natural resources or meeting the mission and vision of the agency. The SCDNR has an evaluation process through the HPC that uses criteria to rank potential properties. These criteria include, in no rank order, the following:

1. Fish and Wildlife Habitat
2. Rare, Threatened or Endangered Species
3. Archaeological, Cultural and Historic Resources
4. Geologic Features
5. Riparian and Water Values
6. Public Recreation Potential
7. Imminent Threat of Conversion
8. Manageability
9. Forest Revenue Sustainability
10. Other Special Circumstances; Funding Stream Identification

Purchase of property by the SCDNR with public funds are subject to the Uniform

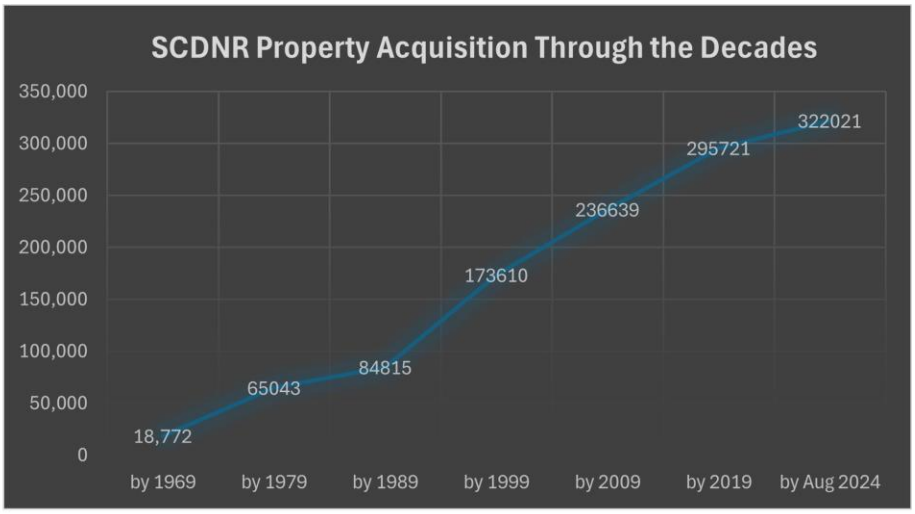


FIGURE: 8-2: Acres acquired by SCDNR from the beginning of active land acquisition to present.

SCDNR has restored wetlands embedded within longleaf pines while simultaneously improving those longleaf stands to benefit species requiring this buffer habitat for various phases in their life history. The left photo shows an isolated wetland in Hampton County, SC pre-restoration, and that same wetland is shown above post-restoration. Photos provided by Andrew Grosse, SCDNR.

Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. § 4601, et seq.) and the South Carolina Relocation Assistance Act (S.C. Code § 28-11-10, et seq. (1976, as amended)). Over the decades, the acreage of state-owned lands has increased dramatically (Figure 8-2), thanks in part to long-standing local, state, and federal grant programs and initiatives, some of which are outlined in Box 8-4. Many other funding sources include time-limited grant initiatives and mitigation assistance.

The 3R's of conservation biology should be considered when evaluating tracts for habitats and SGCN: resiliency, redundancy, and representation. Even if the SCDNR or its partners do not own lands, there are ways of protecting habitats. Coordination of wildlife goals and strategies during land planning processes and the ability of SCDNR to review development and environmental impact plans for relevance to priority species can also assist in protecting habitats. An ever-present theme throughout the SWAP, education and outreach is imperative in the protection of the State's habitats.

A barge carries oyster shells to a Living Shorelines restoration project in South Carolina. Photo by SCDNR-MRD/MRRI staff.

Oyster reef restoration in coastal South Carolina. Photo provided by Michael Hodges, SCDNR.

BOX 8-4: POPULAR FUNDING PROGRAMS UTILIZED FOR LAND PROTECTION & RESTORATION

- **SC Heritage Trust Program**: The purpose of this program is to inventory, evaluate, and protect the elements considered the most outstanding representatives of South Carolina's natural and cultural heritage. Funding for Heritage Trust staff, land purchases, and management activities comes from a small percentage of the State documentary deed stamp fee, the sale of Endangered Species License Tags, limited appropriated funds, plus monetary donations from the public. Land donations are also accepted.
- **US Forest Service Forest Legacy Program**: The purpose of this program is to identify and protect environmentally important forest land from conversion to non-forest uses through the use of conservation easements and fee-simple purchases.
- **Scenic Rivers Program**: The goal of this program is the conservation of South Carolina's river heritage through the proper management of the natural and cultural character of the State's river corridors. This program has the purpose of protecting "unique or outstanding scenic, recreational, geologic, botanical, fish, wildlife, historic or cultural values" of selected rivers or river segments in the State.
- **South Carolina Conservation Bank Act**: This act preserves the most significant natural and historic lands in our state by either purchasing the land outright or buying conservation easements from willing sellers. Dedicated funding is provided for the protection of wildlife habitat, parks, greenways, prime farmlands, historic sites, wildlife habitat, and other biologically sensitive areas in the State. Funds come from a percentage of South Carolina's deed-recording fees, which are collected when real estate is sold in the State. A volunteer board made up of conservationists, sportsmen, scientists, and business leaders from across the State oversee the disbursement of grants to protect land. The SCDNR acts as an advisor to this Board.
- **National Estuarine Research Reserve Grant Programs**: Administered by the National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce, the goals of the programs are to protect and restore ecologically significant habitats, including conserving lands that play a critical role in helping communities become more resilient to natural hazards. The focus is on coastal habitat restoration through planning, engineering, and design and land conservation projects that support the goals and intent of the Coastal Zone Management Act (CZMA), the Coastal and Estuarine Land Conservation Program (CELCP), and the Infrastructure Investment and Jobs Act, Public Law 117-58. Land acquisitions or easements must be within the reserve boundary, but some outside projects are allowed. However, projects outside the reserve boundary must benefit the reserve, its habitats, and its ecosystem.
- **National Coastal Wetlands Conservation Grant Program:** This US Fish and Wildlife Service program aids in acquiring interests in lands or waters that enhance, restore, or manage coastal wetlands ecosystems and associated uplands. The project has to lie within a coastal county (touches the ocean) or one county in from a coastal county as long as there is a hydrological connection. Highest ranked areas are maritime forests and sea islands. The Program is funded by revenues collected from excise taxes on sport fishing equipment, electric motors and sonar, import duties on fishing tackle, yachts and pleasure craft, a portion of the gasoline tax attributable to motorboats and small engines, and interest on the fund, under the authority of the Dingell-Johnson Sport Fish Restoration Act of 1950.
- **North American Wetlands Conservation Act (NAWCA):** Administered by the US Fish and Wildlife Service, this program supports conservation of wetlands and associated habitats for wetland migratory birds, like waterfowl, and other wildlife. Land can either be acquired (protected in perpetuity) or enhanced or restored (20-year life).
- **Pittman-Robertson Restoration Program:** This US Fish and Wildlife Service program supports restoration and management of bird and mammal populations and provides public use opportunities and hunter safety programs including shooting ranges. Eligible projects include those that select, restore, rehabilitate, and improve areas of land or water used as feeding, resting, or breeding habitat.
- **Recovery Land Acquisition Grant Program:** This US Fish and Wildlife Service program supports the acquisition of habitat for endangered and threatened species to secure long-term protection.
- **REPI Program:** This Department of Defense program has Challenge funds available for "land conservation, improvement, or management activities that limit incompatible development in the vicinity of DoD installations and ranges and enhance military installation resilience," among other options.

Action Items

1. Acquire property for the protection of priority species and to ensure habitat linkage through fee-simple acquisition and conservation easements covering all priority terrestrial, freshwater aquatic, estuarine, and marine habitats.
2. Continue to partner with private entities and other state and federal agencies and tribes to both promote habitat protection (including utilizing private easements) and provide technical support to private landowners.
3. Continue to partner with private entities and other state and federal agencies and tribes to acquire land for habitat protection. Develop additional partnerships for land acquisition.
4. Restore and enhance impaired habitat where feasible and cost-effective. Habitat enhancements include:
    a. Encourage nest/roost site retention/restoration
    b. Employ prescribed burning
    c. Restore natural stream courses and flows through dam removal, culvert modification, etc.
    d. Eliminate or reduce invasive and non-native species from habitats
    e. Replant native plants; encourage Piedmont Prairie and other native grassland projects
    f. Engage in wetland restoration and explore new techniques, such as the beneficial use of dredge material and thin layer placement.
    g. Restore ecotones (contiguous gradients) into adjacent habitats.
    h. Encouraging natural solutions to marine environments such as living shorelines versus man-made hardscaping.
5. Create more conservation incentives for private landowners, like cost share programs and Candidate Conservation Agreements with Assurances (CCAAs), to preserve or restore habitats important for SGCN.
6. Utilize federal and non-federal grant sources to purchase land fee-simple to add to South Carolina's portfolio of quality examples of both common and priority habitats to benefit SGCN and biodiversity in general.
7. Strongly encourage solar farming on brownfields, on building rooftops, near existing infrastructure (powerlines), non-prime farmlands, and in areas that are less environmentally sensitive.
8. Develop and implement protective Best Management Practices (BMPs) for habitats and land uses throughout South Carolina (e.g. pollinator habitat on solar farms) and wide SMZs (300 feet on either side of a waterway).
9. Continue to participate in the development and review of environmental plans (including FERC relicensing projects) to ensure appropriate habitat protection.
10. Educate owners and/or managers of ponds and lakes (e.g. private landowners, homeowner associations, municipalities, hydroelectric power companies, and watershed entities) about pond and lakeshore management utilizing native plants and shrubs and enhancing aquatic habitat through structure placement. Explain the ecosystem services and habitat provided by this natural infrastructure.
11. Educate landowners about proper stream crossings and fencing to keep livestock out of streams.

12. Encourage city, county and state planning entities to consider habitat protection in all comprehensive planning documents and when reviewing development projects and rezoning requests.
13. Where possible, collaborate with neighboring states to manage wildlife species and promote habitat protection on an ecoregions-wide and/or watershed-wide scale.
14. Continue SCDNR participation in Emergency Response training programs to ensure that the SCDNR has the most current information on planning logistics and technology for dealing with coastal oil and hazardous material releases, natural disasters, and emergency disease outbreaks as well as the most effective tools and training to deal with the aftermath.

Conservation Action Area 4: Education and Outreach

Education and outreach programs positively affect conservation activities by involving the broader community in these activities. As such, education and outreach programs are critical to successful wildlife and habitat conservation. As the State's population increases, it is important to remind the public that healthy ecosystems are those with intact biodiversity, and these healthy ecosystems provide environmental services humans need too (Hayes and Kunkel 2025). The concept of One Health (AFWA 2023) can help people envision the interconnectedness of wildlife, habitats, and themselves that also impacts the economy. In times of budgetary crises, when funding, personnel and resources become limited, education and outreach programs are often supplanted by more imminent needs associated with species and habitat protection. However, it may be most critical during such times to ensure that education and outreach programs are functioning; such programs can produce an informed public that can assist in achieving the goals of environmental conservation.

The South Carolina SWAP is an integral part of many grade school presentations, teaching students about the conservation challenges facing many species in the State. Photo by Anna Smith, SCDNR. Wood Stork mount permitted through USFWS. Alligator skull permitted through SCDNR.

Although education and outreach may not directly contribute to the management of natural resources, these programs can assist in garnering support for environmental programs. Also, training workshops and online presentations can train lay persons to be valuable contributors to data collection efforts. Already, the SCDNR encourages the general public to report the tracked species using online Public Survey Forms (Survey123 app): Tracked Species Reporting, Spawning Horseshoe Crab Reporting, Baltimore Oriole Winter Survey, Diamondback Terrapin Reporting, Bald Eagle Nest Sighting, Manatee Sighting, Sea Turtle Observation, Ruffed Grouse

Observation, SCDNR Bat Watch!, Spotted Skunk Observation, Bobwhite Quail Observation, and Black Bear Sighting.

GatorWise

GatorWise is a project intended to promote realistic public perceptions about alligators and to provide guidance on responsible human behavior to minimize conflict between people and alligators. It is a collaborative project with members of 11 different state fish and wildlife agencies across the range of the American Alligator. See www.gatorwise.org.

In educating the general public, SCDNR's social media goals are to build trust in the agency and science, to educate and inform, to promote events and programs, and to instill stewardship and awe in the State's natural resources (Erin Weeks, SCDNR, pers. comm.). SCDNR currently has 50,000 subscribers to its award-winning *South Carolina Wildlife Magazine* which often highlights SWAP species and habitats. The associated 2026 calendar will cover SWAP species from all taxa groups. Recent examples include articles on Gopher Tortoise and Gopher Frog habitat restoration and augmentation. The Coastal Updates Newsletter has 100,000 subscribers while the Jocassee Journal has 3,311 (print and online). SCDNR's YouTube Channel has a variety of educational videos. A current partnership exists with South Carolina Educational Television (SC ETV), state network of the Public Broadcasting System (PBS) member stations, to create short video segments highlighting SGCN and their habitats as well as threats affecting them. For example, the Emmy Award winning series, "What's Wild" showcases native species in South Carolina, especially rare or declining species appearing in the SWAP. Sample episodes include: Four-toed Salamanders, Gopher Frogs , Gopher Tortoises, Carolina Heelsplitters, and Freshwater Fish Assemblages.

These programs, as well as social media posts (i.e. Facebook, You-Tube, and Instagram), are vital outreach components to citizens. SCDNR also has an active Community Engagement Program providing outreach to Hispanic and African American communities that can be expanded to include SWAP/SGCN education and appreciation.

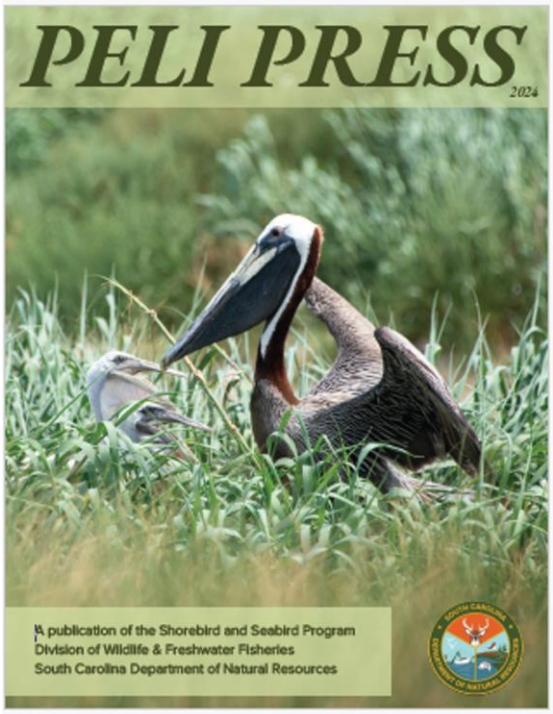
Outreach with interns showing them freshwater mussel propagation. Photo by Ericah Beason, SCDNR.

In educating developers, regulatory agencies, and environmental consultants, SCDNR created the South Carolina Department of Natural Resources State Listed Species Protection Guidance (2024). The purpose of this living document is to provide clarity for the avoidance of a take of a state listed species and what may be needed from permit applicants.

Private forest landowners benefit from workshops and demonstration areas. A recent example is the November 2024 “Managing Isolated Wetlands for Wildlife” workshop at Webb Wildlife Center in Hampton County, SC. Conservation partners including The Longleaf Alliance, SCDNR, USFWS, UGA Savannah River Ecology Lab, and the Amphibian and Reptile Conservancy provided a field tour to educate landowners on the benefits of isolated wetlands for wildlife, using prescribed fire to manage isolated wetlands in upland pine forests, how to do midstory control, and how to implement other restoration techniques.

Action Items

1. Develop and enhance education and outreach programs to the public and partners that highlight the importance and value of the species on South Carolina’s Priority Species List and their contribution to the unique natural resource diversity of the State. Highlight threats and opportunities. Programs could be in the form of seminar series, workshops, and training opportunities in the field.
2. Dispel misinformation and ensure that accurate information about priority species and their habitats is made available, both within the SCDNR and to any interested parties outside of the department. (Interested parties can include state and federal agencies, academic institutions, private landowners, local municipalities, organizations and industry.)



One of the publications SCDNR produces for education and outreach purposes, explaining what the agency does for SGCN.

3. Develop and enhance education and outreach programs that encourage land stewardship values, particularly to private landowners in priority habitats on private lands. Program components should include forestry and wildlife best management practices and the importance of using prescribed fire on pyric landscapes.
4. Introduce conservation partners to the SWAP and train them on the identification of SGCN and their habitat requirements. These partners can integrate this knowledge into their knowledge toolbox when working on their own lands and projects and when providing consultation services to private landowners and the general public.
5. In consultation with SCDNR biologists, identify “poster species” and habitats that will highlight conservation messages in each ecoregion of South Carolina. Enhance existing education and outreach programs in SCDNR to include priority species and their habitats.
6. Provide seminar series, workshops, and other training opportunities for citizen scientists and volunteers to implement elements of the SWAP such as data collection

of presence/absence of species (including non-natives) and status and trends monitoring.

7. Create fact sheets ("mini-plans") and summaries to target user groups of the SWAP.
8. Support "Bat Week" and other taxa group highlights in South Carolina.
9. Provide lesson plans or updates to education curricula for K-12 students on SGCN life histories, threats, and ways to mitigate for those threats.
10. Continue to reach out to underserved communities with relevant messaging about natural resource conservation concepts; expand to include SWAP/SGCN education and appreciation.
11. Educate motor vehicle operators of the negative effects of crossing streams at multiple locations and using stream bottoms as trails.
12. Educate the public and lawmakers on the illegal wildlife trade and its implications for conservation (AFWA 2025).
13. Continue to develop and enhance programs that educate fishermen about employing correct techniques for capture and release of marine mammals, fish, and invertebrates and programs that emphasize the importance of reporting ship strikes and entanglements to authorities.
14. Using education, outreach, and regulatory actions, mitigate habitat and species threats that are caused by human practices—albeit sometimes unintentional—such as entanglement in fishing gear, by-catch, boat strikes, dredging, chemical exposure, tower strikes, electrocutions, window strikes, nest disturbance, boat wakes, artificial light sources, and dewatering of streams.
15. Provide workshops and demonstrations of freshwater stream, lake, and pond stabilization and erosion control techniques.
16. Develop planned coordination and response protocols among agencies and organizations for emergency disease outbreak preparedness, response, and prevention.
17. Educate the public and lawmakers on the many benefits that salt marshes and other wetlands provide and best practices for enhancing existing marshes and future marsh migration areas.

Coordination with state museums for voucher freshwater mussel storage. From left to right: Jeff Smola (SCDNR), Dr. Art Bogan (North Carolina Museum of Natural Science), Briana Cairco (SCDNR), and Braxton Elms (SCDNR). Photo by Ericah Beason, SCDNR.

Conservation Action Area 5: Partnerships and Collaborations

As previously discussed, 90% of South Carolina is privately owned, making cooperation with private landowners critical to accomplish large conservation management objectives at a landscape scale. Also as important is collaborations with partners from other agencies, non-governmental organizations (NGOs), wildlife clubs, and other groups that can assist with surveys, procuring land acquisitions and conservation easements, and affecting political change to benefit SGCN and their habitats. SCDNR and its conservation partners benefit from knowledge sharing and leveraging resources to accomplish more than any single entity could alone. Sometimes NGOs can act as mediators between stakeholder groups, reconciling differences and facilitating changes on a larger scale and more quickly than SCDNR could as a state agency. New alliances should always be sought while continuing to strengthen existing relationships. A list of SCDNR's current conservation partners can be found in Appendix 2.

Action Items

1. Coordinate monitoring efforts across scales and jurisdictions through partnerships, considering incorporating international conservation in order to capture full life cycles.
2. Maintain participation in monitoring networks as established between states and other agencies.
3. Partner with SCDOT in the use of signage and caution lights to warn motorists to reduce speeds or use caution in areas where wildlife may be crossing, especially during specific times of the year.
4. Create a working group of agencies that identify priority areas for fish and wildlife crossing improvements based on crash data, roadkill counts, aquatic and terrestrial habitat connectivity priorities, barriers to marsh migration, etc. Include the SC Office of Resilience for priority areas where floodwaters may necessitate road/bridge/culvert improvements.
5. Partner with SCDOT to design and construct warning systems and wildlife and fish crossings/overpasses or underpasses/tunnels/culverts with fencing and native habitat components to guide fish wildlife and fish over and under roads to avoid mortality, to promote terrestrial and aquatic connectivity, and to maintain biodiversity across the landscape.
6. Partner with SCDOT and utility companies to implement no-mowing during critical growing and seeding phases for native plants along transportation corridors and roadsides.
7. Partner with the South Carolina Department of Environmental Services (SCDES) to update mining reclamation guidelines to better provide for wildlife habitat, especially grassland-dependent species.
8. Develop a network of partners and a corresponding confiscation response plan which identifies funding sources, protocols, and holding facilities for wildlife confiscations. Disease testing, genetic testing, and post-release monitoring should be part of this network. [AFWA 2025]
9. Maintain participation in monitoring networks as established between states and internationally for wide-ranging and migratory species.

10. Partner with climate science centers to identify ways to collect data that tracks local effects and impacts (downscaling of global climate models). Climate modeling and data-gathering methodologies should be standardized. Additionally, a centralized climate repository should be created with data and tools to support decision making by the SCDNR and its conservation partners.
11. Collaborate with neighboring states to address species and habitat range shifts due to climate change.
12. Continue to participate in national workshops and meetings that discuss adaptive management techniques as it relates to our changing world and network with colleagues and partners.
13. Foster partnerships within the State, region, and nationwide to address climate change in South Carolina.
14. Reinvigorate the South Carolina Plant Conservation Alliance.
15. Continue to engage in regional partnerships (e.g. the South Atlantic Salt Marsh Initiative) to share lessons learned and expand and increase the efficiency of habitat protection and restoration efforts.

Conservation Action Area 6: Research and Surveys

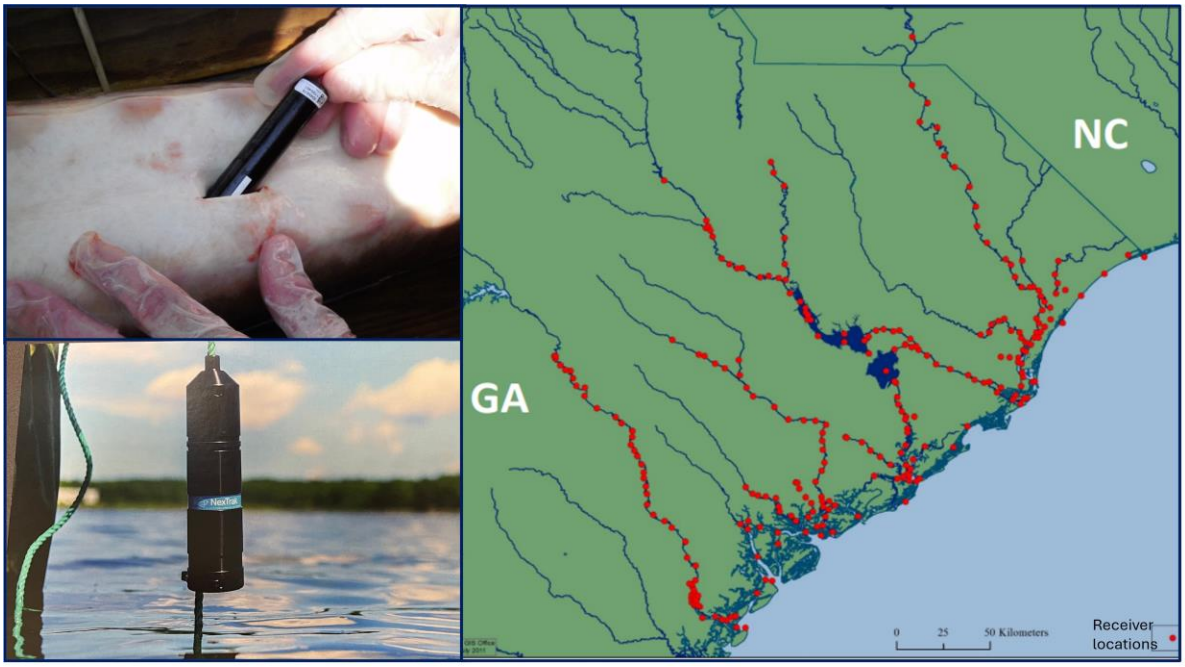
When preparation of South Carolina's first SWAP was initiated in 2004, it quickly became apparent that SCDNR and other entities were lacking data for many of the priority species and their habitats. It is still that way in 2025 with some species. Historically, research and survey activities have focused on managed species, federally or state listed species, and activities funded through grants and private dollars. In order to adequately manage for priority species in South Carolina, it is imperative that baseline research continue to be conducted for these species in partnership with academic institutions (e.g. Masters and PhD student projects), other state and federal agencies, non-profit organizations, and private consultants. Within this chapter of the SWAP, the monitoring section specifically addresses survey and research needs as they apply to SGCN. The conservation actions items below in bullet form, however, are presented to illustrate the type of information that needs to be gathered.

Collecting Gopher Frog (SGCN Highest) eggs for a cooperative head-start program with Riverbanks Zoo. Photo by Anna Smith, SCDNR

<u>Action Items</u>

1. Conduct field studies to inventory all plant and animal species on SCDNR-owned lands as well as collect abiotic information relevant to the species' aquatic and terrestrial ecosystems. Determine population presence and stability.

2. Partner with private landowners, Tribal entities, timber investment management organizations (TIMOs), and timber companies with substantial landholdings in South Carolina to survey for SGCN through biological inventories.
3. Work with academic and other partners to address emerging diseases through surveillance and research, including determining causes of death and/or population declines in SGCN.
4. Train partners to assist with element occurrence documentation for SGCN and other tracked species for entry into South Carolina's Natural Heritage Database.
5. Develop and implement DNA studies on new and previously identified species to clarify taxonomy of SGCN (species assignment and evolutionary lineage), distinct population segments, and gene flow.
6. Contribute to genetic databases and gene libraries for identifying SGCN' origination and to improve accuracy and reduce costs and time associated with repatriating confiscated animals and identifying poaching hotspots (AFWA 2025).
7. Museum records and online databases should be mined for relevant species data to incorporate into the South Carolina Natural Heritage Database.
8. Monitor the condition of SGCN populations and their choice habitat as discovered.
9. Determine the impacts of threats and stressors identified in Chapter 5 on South Carolina's SGCN.
10. Conduct research to identify the habitat requirements for South Carolina's priority species and determine whether existing habitats meet those requirements.



Atlantic and Shortnose Sturgeon (SGCN Highest) research using data-logging receivers in acoustic telemetry arrays in South Carolina rivers. Photos provided by Bill Post, SCDNR.

11. Add to the State's MOTUS tower array to track migratory birds and bats.
12. Determine the effects of plant and animal invasive and non-native species (including diseases) on South Carolina's priority species and their habitats.

13. Monitor the impacts of hunting/fishing on South Carolina's priority species to ensure that populations are being harvested sustainably and impact to non-hunted species are minimized.
14. Identify ways to collect data that tracts local effects and impacts from climate change (downscaling of global climate models).
15. Conduct climate-related monitoring of species and habitats as needed. Run species- or habitat-based vulnerability index assessments as needed for SGCN.
16. Mobilize citizen scientists to gather data by conducting surveys and reporting sightings.
17. Acquire better special data through remote sensing and ground-truthing to identify priority habitats/natural communities.
18. Continue to and increase mapping long distance migratory movements and habitat use by SGCN.

Conservation Action Area 7: Regulatory Actions

Within South Carolina, there are several state and federal entities with regulatory authority over certain aspects of wildlife and habitat conservation. State and federal regulations in South Carolina govern the conservation of rare, threatened, and endangered species; protection of natural areas and specific natural habitats; take of game and nongame wildlife species; monitoring and protection of water and air quality; review and permitting of mining, dam construction, surface water discharge, and groundwater withdrawal; dock and pier construction; and other project developments.

New laws, such as those addressing the regulation of harvest limits (e.g. Blue Crab), prohibition of take (e.g. Robust Redhorse), and native species ownership (e.g. see Turtle Registration), have all helped protect SGCN within South Carolina. However, more laws are needed to protect other vulnerable species. As SCDNR biologists and other experts prepared species accounts for this edition of the SWAP, they identified areas where existing laws and regulations may need to be changed in order to protect additional priority species and habitats (e.g. see current SC Code §16-11-590 on Sea Oat and Venus Flytrap protections). They also identified areas for which no laws or regulatory authority exists to protect these species.

On September 28, 2020, bill H.4831 was signed into law by SC Governor Henry McMaster establishing possession limits for native turtles in South Carolina and restricting transfers and sale. Photo by SCDNR media staff.

In addition, our Law Enforcement Division undergoes basic wildlife management training as it relates to their job. Course instruction covers upland game and fish rules and regulations as well

as non-game regulatory authority; wildlife diseases; snake, tree, and grain identification; depredation permitting; trapper education; marine regulations (i.e. TEDs for shrimp trawl nets); and why certain practices are illegal as well as the biological basis behind South Carolina's Title 50 laws.

Action Items

1. Enhance SCDNR Law Enforcement capability to address priority wildlife species law enforcement needs through:
    a. Increase support, capacity, and training (workshops) for new hires and current staff on SGCN and their habitat requirements and how to protect them.
    b. Provide law enforcement training on handling, identification, biosecurity, and other best practices to more effectively respond to illegal collection and trade cases of SGCN (AFWA 2025).
    c. Providing financial and capacity support to Law Enforcement for monitoring sensitive sites.
2. Pass legislation making it illegal to import, sell, stock, release, and transplant specific non-native animal and plant species throughout South Carolina without a permit issued by the SCDNR.
3. Pass legislation to encompass more SGCN protected from collection from the wild.
4. Pass legislation that allows for managing/monitoring captive wildlife in South Carolina.

Illegal collecting and poaching of wildlife and plants are threats to SGCN in South Carolina, often requiring intervention by law enforcement. Photo by SCW Staff.

5. Pass legislation at the state and local levels for the protection of wetlands which would limit such practices as "fill and build" in wetland habitats.
6. Increase restrictions for sensitive ecological sites (e.g. public closures, no pets allowed, etc. on shorebird nesting beaches).
7. Encourage the adoption by the State of South Carolina of a circular economy in state government where waste is reduced, reused, and recycled to decrease waste of resources to protect the environment and drive the economy (Sustain SC 2025).
8. Continue to develop State of the Resource Reports for marine species that are not currently targeted in commercial or recreational fisheries and for species that are targeted, but for which no plan currently exists. This will inform limits and other protection measures for priority species, including SGCN.
9. Investigate the need to amend existing SCDNR regulations and/or develop additional SCDNR regulations to address the conservation status of South Carolina's priority species.

10. Work with the SCDES on permitting regulations in favor of priority species and habitats.
11. Continue to assist the USFWS with data gathering to make informed, science-based decisions on listings, down-listings, and de-listings.
12. Educate members of the South Carolina Legislature and Congressional delegates on the plight of SGCN and their habitats and the importance of increased, dedicated, permanent funding for SWAP implementation through workshops, presentations, and field trips.

> "South Carolina's future prosperity requires us to enhance our efforts to respect and protect our land, our history, our culture and our environment."
> – SC Governor Henry McMaster

In summary, to sustain South Carolina's diverse wildlife resources in the future, the following actions are critical: (1) increase baseline biological inventories with emphasis on natural history, distribution, and status of native species; (2) increase commitment by natural resource agencies, conservation organizations, and academia toward establishing effective conservation strategies; (3) increase financial support and technological resources for planning and implementation of these strategies; and (4) create public-private partnerships and educational outreach programs for broad-scale conservation efforts.

Native wildlife are not pets! Photo by Anna Smith, SCDNR.

Monitoring Programs

Throughout most of the history of natural resource conservation, single species management has been the focus. Threatened and endangered species, especially, have been the subject of intensive management. However, the literature provides testament to the effects of missed indices and unanticipated events on successful conservation. Although sometimes individual species need targeted management approaches, the majority of species would benefit from a broader strategy aimed at their shared ecosystems. The animals included on South Carolina's Priority Species List each have individual ecological roles connected in myriad ways to others. From this perspective, multi-species and systems approaches to conservation are the preferred methods for meeting the goals and strategies of the South Carolina SWAP.

It seems apparent that this view of management will require constant and consistent adaptation to change. Single alterations in community function—such as the loss of a keystone species—can produce ripple effects that confound the most complete systems model. Despite imperfect knowledge, however, management must still move forward if conservation is to succeed. Likewise, as the system evolves, so does the method of management. Adaptive management cannot proceed without vigilant attention to these changes. Monitoring and evaluation then

become the essential tools for detecting, measuring, interpreting, and responding to these changes over time.

Assessing changes in populations and habitats over time, especially in response to applied conservation actions, requires monitoring at multiple levels (species, guilds, natural communities, and implementation activities) and across multiple scales (local, statewide, regional, and national). Through varying styles of monitoring, SCDNR can detect species-specific trends from estimates of population size, relative abundance, or distributional shifts. Feedback loops can be observed as well as tipping points that trigger new management regimes. Similarly, by measuring species associations such as Longleaf Pine-associated reptiles, we can assess habitat-level responses. Monitoring of habitats leads to identification of challenges or impacts of management activities or landscape alterations. Finally, monitoring simply helps us understand the effects, intended or otherwise, of any management approach.

Monitoring programs are not a novel approach in successful conservation. International and domestic efforts to monitor migratory bird species provide excellent resources for developing species-level monitoring programs. The North American Breeding Bird Survey (BBS) is a well-known, long-term, continental sentinel monitoring program. The Christmas Bird Count similarly provides documentation of winter distribution and abundance for bird species. Such efforts set precedents in data collection and distribution which other taxa monitoring programs might find beneficial to emulate. Other bird surveys established in South Carolina include the International Migratory Bird Day and Backyard Feeder Watch. Of important note is the consistent, effective use of volunteers and citizen scientists to conduct these assessments.

The SCDNR and its partners use peer-reviewed protocols when conducting current monitoring programs. The following four types of monitoring programs are commonly implemented:

1) **Targeted species or habitat status and trends.** This type of monitoring tracks the status and trends of selected species, habitats, and communities and how they respond to management.
2) **Multi-species context or habitat condition.** Context or condition monitoring for either species or habitats allows us to track change at the ecosystem level to understand patterns of change.
3) **Cause and effect or response.** Cause and effect or response monitoring, in reality, mimics traditional research on the underlying explanation of observed events.
4) **Management action effectiveness.** Effectiveness monitoring relates directly to adaptive management as it assesses how well management actions undertaken achieve desired results.

Additionally, Box 8-5 defines the elements important to consider when designing new monitoring programs. More generally, the outcomes of research and survey projects affecting SGCN and their habitats, as well as the effectiveness of SWAP action items implemented, are also regularly monitored by the SCDNR. Management decisions and methods are thus informed by such research. Table 8-2 lists all current long-term monitoring programs in progress within the State of South Carolina for which SCDNR participates. There are other short-term monitoring programs in progress at SCDNR and with conservation partners, but these are not discussed here as they often end with the conclusion of a project. As an example of being adaptive, SCDNR conducted over 1,250 Furbearer Scent Station Routes statewide annually from 1984-2014 until research uncovered that these survey routes could be biased, especially since they were opportunistic along roadways. As rural landscapes became urbanized, routes became compromised and unusable. Other similar

BOX 8-5: BASIC ELEMENTS OF A MONITORING PROJECT AND PROGRAM

- Identification of monitoring goals and objectives
  - What is the question and why; identify existing information; conceptual model
- Identification of targets to monitor
  - Selection based on above results and availability of resources (fiscal/human)
- Establishing monitoring protocol (peer reviewed)
  - All elements documented (question; sampling design; methodology; anticipated analysis/analytic tools; data management and reporting strategy; schedule)
- Quality assurance and quality control
  - Assuring and controlling quality; training and potential certification of users
- Data management and archiving
  - Scheme to ensure data are documented, maintained, archived, and accessible
- Data analysis and assessment
  - Anticipated analysis including estimates of confidence
- Reporting
  - Reporting formats and schedule (useable, understandable, responsive) to user
- Periodic review and evaluation
  - Ensure project is responsive to the need and reflects the best available science

studies have been discontinued as methodologies and needs have become obsolete or have been incorporated into other monitoring regimes. A long-term study example includes the comprehensive hunter harvest surveys that have been conducted for all species in South Carolina periodically since 1963, 15 surveys span 55 years.

Measuring conservation outcomes is extremely important to make sure the species intended to prosper under restoration regimes are actually responding and thriving (Binley et al. 2025). Measuring such outcomes as changes in average physical fitness or population growth are much-needed follow-up metrics that should be gathered (Binley et al. 2025). However, sometimes it takes decades to see results so that researchers must have the funds and capacity to collect trend data over time. Examples of conservation practices that are typically used to elicit positive responses by threatened or endangered species include modified agricultural practices (leaving wild edges along crop edges) and alternative forestry and prescribed fire regimes. Often, less charismatic species are not followed as diligently (Binley et al. 2025), but this is where SWAP-related research and surveys are so important in following these lesser known or appreciated plants and animals.

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