

DRAFT SANTEE NATIONAL WILDLIFE REFUGE DRAFT SPATIAL HABITAT AND SPECIES MANAGEMENT PLAN



U.S. Department of Interior

U.S. Fish and Wildlife Service

Southeast Region

June 2026

Table of Contents

Draft Santee National Wildlife Refuge Draft Spatial Habitat and Species Management Plan ...	1
Chapter I. Introduction	3
Chapter II. Background, Inventory, and Description Of Habitat	7
Chapter III. Resources Of Concern	8
Grassland and Upland Croplands	8
Managed Wetlands	10
Oak-Pine Mixed Woodlands	12
Chapter IV. Habitat Goals And Objectives.....	15
Chapter V. Habitat Management Strategies	16

LIST OF MAP SHEETS

This Draft Habitat and Species Management Plan consists of map sheets and this supplemental document for required content. Each map sheet is titled by specific habitat management resources it represents. The map sheets include:

Map Sheet i: Landscape Level Overview

Map Sheet 1.1: Santee NWR Overview

Map Sheet 1.2: Santee NWR Forest Habitat

Map Sheet 1.3: Santee NWR Grassland and Upland Cropland Habitat

Map Sheet 1.4: Santee NWR Managed Wetlands Habitat

Chapter I. Introduction

This Draft Spatial Habitat and Species Management Plan (SHSP) sets the detailed objectives and strategies related to the conservation of priority habitats and priority species that Santee National Wildlife Refuge (NWR) will implement to make progress toward achieving the vision and goals found in our Santee NWR Comprehensive Conservation Plan (CCP); Santee National Wildlife Refuge Comprehensive Conservation Plan 2008 [[link to ServCat Record](#)] (USFWS, 2008). The SHSP provides a strategic focus for conservation efforts to fulfill Santee NWR's purposes and to contribute to the Refuge System's mission and goals, including maintaining the Biological Integrity, Diversity, and Environmental Health (BIDEH) of the refuge and the Refuge System. This SHSP identifies actions to correct or mitigate significant threats or problems that may adversely affect the populations and habitats of fish, wildlife, and plants to achieve long-term refuge vision and goals.

The Refuge System prepares SHSPs concurrently with CCPs or after CCP development and before implementation of new actions for managing habitat and species (see 602 FW 3). We require SHSPs when objectives, strategies, and actions for priority habitats or priority species are not in an existing CCP or other planning documents or need to be updated to address new significant threats.

SCOPE

Through habitat and species planning, we develop the specific objectives and strategies necessary to fulfill the visions and goals identified in CCPs. The following sections describe the scope of this planning effort.

The U.S. Fish and Wildlife Service (Service or We) prepared this Spatial Habitat and Species Management Plan (SHSP): Supplemental Document and accompanying Habitat Map Sheets to serve as the Habitat Management Plan (HMP) for Santee National Wildlife Refuge (NWR) in Clarendon County, South Carolina. The planning unit for this SHSP is Santee NWR's four non-contiguous units, Bluff, Cuddo, Dingle Pond, and Pine Island which comprise the approximately 13,000-acre refuge, along the northern shore of Lake Marion in the southeastern plains of South Carolina.

We developed this SHSP after evaluating current refuge habitat conditions, considering a range of habitat management strategies to meet our specific habitat goals and objectives, and using scientific reports, conservation partners' professional opinions, and Service wildlife management expertise. We will manage, enhance, and restore, where appropriate and feasible, habitats for native fish, wildlife, and plants.

This SHSP is a dynamic working document with a long-term vision that provides guidance for the management of refuge habitats on an annual basis. The plan would provide direction for the next 15 years (2026 – 2041), with subsequent reviews every 5 years, and use of adaptive management principles to assess and modify management activities as required.

We also considered and incorporated the role of refuge habitats in the context of international, national, regional, state, and local ecosystem plans. To the extent practicable, we design our goals and objectives to be consistent with these plans to assist in attaining the goals and objectives of conservation partners and the larger conservation community in addition to achieving refuge objectives.

This SHSP outlines a comprehensive habitat management program including the refuge overview, resources of concern (ROC), habitat management goals and objectives, and habitat management strategies.

RATIONALE AND LEGAL MANDATES

The Santee NWR CCP and this SHSP are the primary tools used to guide refuge staff in achieving refuge objectives and the mission of the National Wildlife Refuge System (Refuge System, U.S. Fish and Wildlife Service [USFWS] 2008). The CCP and associated National Environmental Policy Act (NEPA) Environmental Assessment (EA) for Santee NWR was finalized in 2008 (USFWS 2008) and this SHSP is directly stepped down from the CCP. We have used the most recent refuge biological information and data, scientific literature, and ecological principles in developing this HMP to conserve and protect functional communities of native fish, wildlife, and plants. We view the highest measure of BIDEH as those natural habitats and associated wildlife populations that existed under historic conditions before humans altered the landscape.

The Service administers the Refuge System. The Service is the primary federal agency responsible for conserving, protecting, and enhancing the Nation's fish and wildlife populations and their habitats. The Service's commitment to safeguard the nation's fish, wildlife and their habitats is reflected in its vision statement: "We would continue to be a leader and trusted partner in fish and wildlife conservation, known for our scientific excellence, stewardship of lands and natural resources, dedicated professionals, and commitment to public service. The Service's mission is: "Working with others, to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

These trust resources include migratory birds, federally listed endangered or threatened species, interjurisdictional fish, wetlands, certain marine mammals, and national wildlife refuges. The Service oversees the enforcement of Federal wildlife laws and international treaties on importing and exporting wildlife, management and protection of migratory bird populations, restoration of national fisheries, administration of the Endangered Species Act, and restoration of native plant habitats. The Service also assists states with their fish and wildlife programs and helps other countries develop conservation programs.

The statutory authority for conducting habitat management planning on National Wildlife Refuges is derived from the Refuge System Administration Act of 1966 (Refuge Administration Act), as amended by the National Wildlife Refuge Improvement Act of 1997 (Refuge Improvement Act), 16 U.S.C. 668dd - 668ee. Section 4(a)(3) of the Refuge Improvement Act states:

"With respect to the System, it is the policy of the United States that each refuge shall be managed to fulfill the mission of the System, as well as the specific purposes for which that

refuge was established ...” and Section 4(a)(4) states: “In administering the System, the Secretary shall monitor the status and trends of fish, wildlife, and plants in each refuge.” The Refuge Improvement Act provides the Service the authority to establish policies, regulations, and guidelines governing habitat management planning within the System (Service Manual 620 FW 1).

NEPA mandates our consideration of the impacts of our habitat management on environmental and cultural resources in planning federal actions. This process ensures compliance with NEPA and serves as the basis for development of the SHSP. In conjunction with the preparation of and incorporation herein by reference of:

- Santee NWR CCP and EA, and Finding of No Significant Impact (USFWS 2008)

This Environmental Assessment meets the requirements of NEPA. The SHSP process also includes a Draft Intra-Service Section 7 Consultation to fulfill the requirements of the Endangered Species Act (ESA). The ESA provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. ESA Intra-Service Section 7 Consultation was completed for the CCP and are also incorporated by reference (USFWS 2008).

Federal laws also require the Service to identify and preserve its important historic structures, archaeological sites, and artifacts. NEPA mandates our consideration of cultural resources in planning Federal actions. The National Historic Preservation Act (Pub. L. 102–575; 16 U.S.C. §470) requires Federal agencies to locate and protect historic resources; archaeological sites and historic structures eligible for listing or listed in the National Register of Historic Places and museum property on their land or on land affected by their activities. It also requires agencies to establish a program for those activities and carry them out in consultation with state historic preservation offices. We must also comply with the Archaeological Resources Protection Act (Pub. L. 96–95, 16 U.S.C. §470aa-mm) which requires that we protect our archaeological sites from vandalism or looting, consultation, and issue permits for site excavation.

The Refuge System must also comply with Appropriate Use (603 FW 1) and Compatibility Policies (603 FW 2; <http://www.fws.gov/policy/603fw2.html>). The refuge manager must first find that a use is appropriate before conducting a Compatibility Determination (CD) for that use. If the proposed use is not appropriate, the refuge manager would not allow the use and would not prepare a CD. A compatible use is one “that would not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge.” The refuge manager may allow or deny any use, even one that is compatible, based on other considerations such as public safety, policy, or available funding. Refuge management economic activities, such as commercial timber harvest, are subject to compatibility. The Timber Harvest CD is included in this SHSP (Appendix A) and would be reviewed upon expiration or if conditions change and warrant review.

SHSPs comply with all applicable laws, regulations, and policies governing the management of the Refuge System. The Service incorporates by reference a complete listing of all relevant legal

mandates, regulations, and policies that apply to this SHSP, located in Chapter 1 and the Appendices of the Refuge CCP (USFWS 2008).

REFUGE PURPOSES

See Overview Map Sheet for the Refuge

REFUGE VISION

See Overview Map Sheet for the Refuge

RELATIONSHIP TO OTHER PLANS

The Service incorporates by reference a complete listing of all relevant international, national, and regional conservation plans from other federal and state agencies, non-governmental organizations, and tribes that are listed in the refuge CCP Chapter I: Background and Chapter II: Overview (USFWS 2008) and associated Map Sheets of this plan.

Chapter II. Background, Inventory, and Description Of Habitat

The Service incorporates by reference the complete and thorough overview found in Chapter II of the CCP for Santee NWR (USFWS 2008). The Refuge also has a corresponding Overview Map Sheet that depicts refuge location, physical and geographic setting including climate, topography and hydrology, habitat, and changes associated with global climate change (where appropriate) (See Landscape Level Map Sheet, Overview Map Sheet as well as individual Refuge Habitat-specific Map Sheets for the Refuge).

Resources of concern (ROCs) include species, species groups, and/or communities that support refuge purposes as well as FWS trust resource responsibilities (including threatened and endangered species and migratory birds). ROCs are also native species and natural, functional communities such as those found under historic conditions that are to be maintained and, where appropriate, restored on a refuge (601 FW 3.10B[1]).

A series of workshops were held with a planning team composed of Inventory & Monitoring Branch, Division of Strategic Resource Management, and Santee NWR staff. Highest priority ROC were identified and discussed using a decision-support tool that documents the prioritization and selection process as defined by the Service (Taylor and Paveglio 2010). Prioritization of plant communities (priority habitats) that represent existing BIDEH was determined by examining which, among all that exist on Santee NWR, offer the greatest conservation benefits to expected priority ROC. Plant communities or cover types described in the Santee NWR CCP (USFWS 2008) were cross-walked with regional Southeast broad ecological systems and groups of ecological systems (Hunter 2020). From a comprehensive list of species known to occur on Santee NWR, a small subset of potential priority ROC (species or, occasionally, guilds or groups of species) were selected and prioritized using six criteria (See USFWS 2023 Appendix B) within a decision support assessment tool (Salas and Prancus 2015). These selected potential priority ROC were scored by consensus of the planning team at the workshops. After scoring, the planning team discussed this subset of resources in depth and informed by the summed scores for each resource and the team's collective expertise, selected their highest priority ROC. This process and the tool provided a standard, structured, and transparent approach to prioritizing ROC as a basis for final decisions. Scores and workshop notes are archived and available (<https://ecos.fws.gov/ServCat/Reference/Profile/148950>). In summary, Santee NWR staff made all decisions regarding the selection and scoring of ROC, selected the highest priority ROC with consideration to Santee NWR purposes, special designations, related conservation plans, and a range of other criteria, and provided the justifications for those selections (See USFWS 2025).

The establishing purposes for Santee NWR were key components considered for decisions made (detailed in USFWS 2023, Appendix B) in this natural resource prioritization process. Resources of concern for Santee NWR were selected after taking into account the conservation needs identified within international, national, regional, or ecosystem goals/plans; state fish and wildlife conservation plans; recovery plans for threatened and endangered species; and

previously approved refuge resource management plans as identified in the Comprehensive Conservation Planning Process policy [602 FW 3.4 C[1][e]] as well as Chapter I of this HMP. The ROC occur in various numbers on the refuge and objectives for each are identified on individual refuge map sheets. The species/communities selected as ROC from these plans support the following NWRS mandates:

- Support refuge purposes and the NWRS mission
- Conserve BIDEH (giving special consideration to rare, declining or unique natural communities, species, and ecological processes within the refuge boundary); and
- Fulfill FWS trust resource responsibilities (see Chapter I)

Based on habitat types identified in the refuge, we developed a table of resources of concern with their associated habitat types (Table 1).

Primary Habitats and ROC identified include:

Table 1. Priority habitats and associated resources of concern for Santee NWR

Priority Habitat	Priority Resource of Concern
Grasslands and Croplands	Eastern Painted Bunting (<i>Passerina ciris ciris</i>) Sandhill Crane (<i>Grus canadensis</i>), Wintering Grassland Birds
Managed Wetlands	Wintering Dabbling Ducks, Green-winged Teal (<i>Anas carolinensis</i>), Wood Duck (<i>Aix sponsa</i>) and, Wood Stork (<i>Mycteria americana</i>)
Oak-Pine Mixed Woodlands	Eastern Painted Bunting Wood Thrush (<i>Hylocichla mustelina</i>)

Chapter III. Resources Of Concern

Grassland and Upland Croplands

SIGNIFICANCE AND HABITAT REQUIREMENTS

Reasons for ranking: Grassland and cropland management is critical for the wildlife at Santee NWR. Refuge staff and cooperative farmers primarily plant rice, but also, periodically, other small grain crops. These crops attract and provide an excellent source of high-energy foods for sandhill cranes and other wildlife. Their maintenance and continued

management are essential components of supporting wintering avian species as well as resident wildlife. Prescribed fire is utilized in grasslands and croplands to help reduce invasive species, crop fungi, and unwanted woody vegetation and improve wildlife habitat.

Problems: Managed croplands require inputs of seed, fertilizer, herbicides, pesticides and equipment to plant and maintain production. Prescribed fire management requires additional funding, support and infrastructure to conduct burns on the refuge. Drought, invasive species, climate change and severe weather can diminish cropland productivity. In summary, climate change, personnel shortages, drought, and invasive species can negatively impact grassland/crops and decrease overall primary productivity.

Southeast Broad Ecological Systems: Prairie (large patch grassland); Introduced Vegetation

Painted bunting (*Passerina ciris ciris*)

Rationale: The eastern painted bunting has been identified as one of the highest priority species in need of conservation in the southeast; South Carolina and Georgia are the most important states to ensure the future security of this species (Hunter 2006). Painted buntings are breeding migrants at Santee NWR. They require early successional habitat that includes grass and shrubs and ecotones between open lands and forested lands. Though painted bunting populations have appeared to decline throughout the southeast, they remain relatively abundant on Santee NWR. They typically return to the refuge from wintering grounds in mid-April and establish nesting territories associated with early successional habitats throughout the refuge. Managing quality habitat for painted buntings also benefits other priority birds.

Overall landscape conditions may become less favorable for eastern painted buntings outside of public lands like Santee National Wildlife Refuge along the inner coastal plain with continued land conversion (U.S. Fish and Wildlife Service 2013). It is therefore critical to preserve and protect those remaining critical habitats under federal control.

Other species that may benefit: Loggerhead Shrike (*Lanius ludovicianus*), American woodcock (*Scolopax minor*), Bachman's sparrow (*Peucaea aestivalis*), prairie warbler (*Setophaga discolor*), northern bobwhite (*Colinus virginianus*), eastern towhee (*Pipilo erythrophthalmus*), field sparrow (*Spizella pusilla*), eastern kingbird (*Tyrannus tyrannus*), brown thrasher (*Toxostoma rufum*), grasshopper sparrow (*Ammodramus savannarum*), northern harrier (*Circus hudsonius*), American kestrel (*Falco sparverius*), and eastern meadowlark (*Sturnella magna*).

Southeast Ecological Systems: Coastal Prairies; and/or Coastal Savanna and Wet Prairie; Introduced Upland Vegetation - Annual and Biennial Forbland; and/or Introduced Upland Vegetation - Annual Grassland; and/or Introduced Upland Vegetation - Perennial Grassland and Forbland

Sandhill Crane (*Grus canadensis*)

Sandhill cranes readily utilize harvested and unharvested crop fields for forage and their numbers continue to rise on the refuge. The current population objective for cranes on the Refuge is 300 individuals over the migration and winter period. As many as 200 cranes have been observed at one time since initial sightings on the Refuge in the late 1990s. The increasing number of sandhill cranes on the Refuge is indicative of the value of having a crop field component to support cranes and other avian species that may be seeking similar open, early-succession areas. This is especially important as the sandhill crane population loses traditional foraging and nesting areas and or shift their habitat usage to new areas (U.S. Fish and Wildlife Service 2008)

Southeast Ecological Systems: Coastal Prairies; and/or Coastal Savanna and Wet Prairie; Introduced Upland Vegetation - Annual and Biennial Forbland; and/or

Introduced Upland Vegetation - Annual Grassland; and/or Introduced Upland Vegetation – Perennial Grassland and Forbland.

Wintering Grassland Bird

Rationale: Grasslands on Santee NWR support foraging, nesting, and stopover opportunities for wintering grassland and migratory birds. The grasslands respond well to management activities such as prescribed burning, seeding, irrigation and mowing, and the refuge has the capacity to enact these management practices. The guild of wintering grassland birds supports many other wildlife species that utilize the refuge's various grassland and represents positive trends in broad scale ecological processes on Santee NWR.

Resources of concern to be emphasized: Henslow's (*Centronyx henslowii*) and LeConte's (*Ammospiza leconteii*) sparrows.

Other species that may benefit: Vesper sparrow (*Pooecetes gramineus*), Lincoln's sparrow (*Melospiza lincolnii*), song sparrow (*Melospiza melodia*), savannah sparrow (*Passerculus sandwichensis*) and short-eared owl (*Asio flammeus*).

Southeast Ecological Systems: Coastal Prairies; and/or Coastal Savanna and Wet Prairie; Introduced Upland Vegetation - Annual and Biennial Forbland; and/or Introduced Upland Vegetation - Annual Grassland; and/or Introduced Upland Vegetation - Perennial Grassland and Forbland

Managed Wetlands

SIGNIFICANCE AND HABITAT REQUIREMENTS

Reasons for ranking: Santee NWR is located on the north shore of Lake Marion, the largest lake in South Carolina. It is a major wintering area for ducks and geese, as well as a nesting and stopover area for neo-tropical and migratory songbirds, raptors, shorebirds, and wading birds.

During winter months, over a dozen species of waterfowl can be observed feeding and loafing in Santee NWR's ponds and wetlands. Refuge impoundment management and water delivery systems have been upgraded for waterfowl use during winter and migration. The water level and impoundment management program at Santee NWR is complex and the refuge has made a sizable commitment in resources and funding for water management. Water levels are adjusted to provide maximum benefits for wildlife and to help some types of vegetation to grow while controlling unwanted plants. Periodically flooded woodlands containing nut-producing hardwoods are food-rich and very beneficial to waterfowl (U.S. Fish and Wildlife Service 2008).

Problems: The limiting factors for managed wetlands at Santee NWR include climate change, invasive species, hydrologic alteration, changes in disturbance regimes, lack of funding, shortages in refuge personnel, and logistical limitations.

Southeast Broad Ecological Systems: Flooded Cropland, Green-Tree Reservoir (Artificially Flooded Forest), Moist Soil, Mudflats in Impoundments/Reservoir

Wintering Dabbling Ducks

Rationale: During winter months, over a dozen species of waterfowl can be observed feeding and loafing in Santee NWR's ponds and wetlands. Wood ducks (*Aix sponsa*), northern pintail (*Anas acuta*), green-winged teal (*Anas carolinensis*), northern shovelers (*Spatula clypeata*), Mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), and American wigeon (*Mareca americana*) utilize the Refuge from November through February. Refuge impoundment management and water delivery systems have been upgraded for waterfowl use during winter and migration and the refuge supplies a sizable population of wintering waterfowl for recreational hunting at locations near the refuge.

Resources of concern to be emphasized: Wood ducks (*Aix sponsa*), green-winged teal (*Anas carolinensis*)

The wood duck is a representative resource of concern species for green tree reservoirs on Santee NWR. Wood ducks can be found in large numbers year-round with breeding populations on the refuge. Wood ducks utilize both Refuge impoundments and forest wetlands (bottomland hardwoods/green tree reservoirs) on the refuge. The Refuge invests time and resources in providing nest boxes for wood ducks to utilize as artificial nesting cavities. Fewer natural cavities are available today due to human activity and development. Wood ducks are not currently listed as threatened or endangered, but the species still faces threats in the wild, including wetland loss, habitat loss, and deforestation. The Refuge, by supporting a healthy wood duck population, also supports a healthy green tree reservoir that can be utilized by other species.

A mixed wetland habitat encourages healthy ecosystem functioning and diversity overall on Santee NWR. The green-winged teal (*Anas crecca*) feeds in shallow water bodies and in

flooded fields and therefore serves as a representative resource of concern for moist soil impoundments on Santee NWR. They are an important species for hunters in South Carolina, and the continued abundance of their numbers supports the recreational function of the reservoir while providing habitat for other migratory birds. Wetland impoundment maintenance and protection enhance the Refuge's ability to provide waterfowl habitat for foraging and loafing.

Other species that may benefit: American alligator (*Alligator mississippiensis*), American coot (*Fulica americana*), common gallinule (*Gallinula galeata*), pied-bill grebe (*Podilymbus podiceps*), Mallard (*Anas platyrhynchos*), American black duck (*Anas rubripes*), northern pintail (*Anas acuta*), northern shovelers (*Spatula clypeata*), American wigeon (*Mareca americana*), ring-necked duck (*Aythya collaris*), redhead (*Aythya americana*), lesser scaup (*Aythya affinis*) and other wintering waterfowl.

Southeast Ecological Systems: Green-Tree Reservoir (Artificially Flooded Forest), Moist Soil Wood stork (*Mycteria americana*)

Rationale: Wood stork populations have declined in recent years from habitat loss and destruction in areas such as southern Florida, making South Carolina and in particular, Santee NWR an attractive area for the species. South Carolina has become an important population source for wood storks offering the required post-nesting forage areas during the summer and fall months. Santee NWR provides foraging and loafing habitat for wood storks in flooded croplands, mudflats, and managed impoundments. Wood storks are typically attracted to shallow open ponds on the Refuge where seasonally fluctuating wetlands provide feeding opportunities for them and other wading species and shorebirds. The species is seen mostly during the summer/fall at Santee NWR, with a few observed in the winter, but no documented breeding recorded to date (U.S. Fish and Wildlife Service 2014).

Wood storks serve as an indicator species for successful wetland management at Santee NWR because they have become attracted to the high-quality habitats the Refuge is providing. Maintaining and protecting wood stork habitat also provides habitat for a host of other avian species that rely on wetlands for survival.

Other species that may benefit: Wading birds and shorebirds; examples include great egret (*Ardea alba*), great blue heron (*Ardea herodias*), little blue heron (*Egretta caerulea*), white ibis (*Eudocimus albus*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nyctanassa violacea*), and lesser yellowlegs (*Tringa flavipes*).

Southeast Ecological Systems: Flooded Cropland and Mudflats in Impoundments/Reservoirs

Oak-Pine Mixed Woodlands

Reasons for ranking: Upland oak hardwood and pine mixed forests are declining across the

Southeast. All forested habitats including bottomland hardwoods on Santee NWR are important for neotropical and migratory songbirds. Refuge upland forests are maintained with management techniques ranging from prescribed burning to selective thinning. Habitat management on the refuge is a complicated process but well worth the effort since it provides an abundant amount of food, cover, and shelter for a wide range of animals. Healthy and age diverse stands of upland mixed forests provide the critical habitat necessary to maintain healthy populations of wildlife and support proper ecosystem functioning.

Problems: Personnel and funding limitations at the refuge factor into the number of forest acres that can be mechanically or chemically treated at one time, making it difficult to enact broad treatment regimes. Prescribed burning can be limited by resources, weather, and funding. Invasive species threaten upland forests by increasing competition with native species and by reducing overall species diversity and environmental health. Climatic changes, forest pests, severe weather, hurricanes, and drought are all factors that could decrease the viability of upland forests.

Southeast Broad Ecological Systems: Upland Hardwoods & Mixed Hardwood-Pine Woodlands & Forest

Painted bunting

Rationale: The eastern painted bunting has been identified as one of the highest priority species in need of conservation in the southeast; South Carolina and Georgia are the most important states to ensure the future security of this species (U.S. Fish and Wildlife Service 2008). Painted buntings are breeding migrants at Santee NWR. They require early successional habitat that include grass and shrubs and ecotones between open lands and forested lands. Though painted bunting populations have appeared to decline throughout the southeast, they remain relatively abundant on Santee NWR. They typically return to the Refuge from wintering grounds in mid- April and establish nesting territories associated with early succession habitats throughout the refuge. Managing for quality habitat for painted buntings also provides habitat for other priority birds. Overall landscape conditions may become less favorable for eastern painted buntings outside of public lands like Santee National Wildlife Refuge along the inner coastal plain with continued land conversion (U.S. Fish and Wildlife Service 2008).

Other species that may benefit: Bachman's Sparrow (*Peucaea aestivalis*), prothonotary warbler (*Protonotaria citrea*), yellow-billed cuckoo (*Coccyzus americanus*), wood duck, rusty blackbird (*Euphagus carolinus*), wild turkey (*Meleagris gallopavo*), eastern red bat (*Peucaea aestivalis*), tri-colored bat (*Perimyotis subflavus*), and evening bat (*Nycticeius humeralis*) along with various amphibians and reptiles.

Southeast Ecological Systems: Upland Hardwoods & Mixed Hardwood-Pine Woodlands & Forest

Wood thrush (*Hylocichla mustelina*)

Rationale: The wood thrush is listed as a bird of conservation concern and a migratory bird of management priority by the U. S. Fish and Wildlife Service. Partner organizations, including Partners in Flight and the South Atlantic Joint Venture have also included the wood thrush as a high priority species in need of management action (U.S. Fish and Wildlife Service 2008). The wood thrush requires contiguous tracts of mixed hardwood-pine forests for breeding and protection. As the wood thrush loses more wintering habitat in the tropics, mixed forests such as those provided at Santee NWR become more important for nesting. The wood thrush breeds mainly in the interior woodlands of mostly deciduous but sometimes mixed forests within areas that support tall, mature trees. Numbers have declined in recent decades due to nest parasitism by brown-headed cowbirds (*Molothrus ater*). As forests are cut into smaller fragments, it apparently becomes easier for cowbirds to penetrate these small woodlots and locate thrush nests. High forest density is therefore essential for wood thrush nesting success to prevent nest parasitism. The Refuge also benefits many other interior neotropical bird migrants through its protection of dense mixed forests for wood thrush.

Other species that may benefit: Bachman's Sparrow (*Peucaea aestivalis*), painted bunting, eastern wood-pewee (*Contopus virens*), black-throated blue warbler (*Setophaga caerulescens*), worm-eating warbler (*Helmitheros vermivorum*), scarlet tanager (*Piranga olivacea*), Eastern red bat (*Peucaea aestivalis*), tricolored bat (*Perimyotis subflavus*), and evening bat (*Nycticeius humeralis*) along with various amphibians and reptiles.

Southeast Ecological Systems: Upland Hardwoods & Mixed Hardwood-Pine Woodlands & Forest

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

See Refuge Specific Map Sheets for specific habitat characteristics and acreage objectives for each habitat type.

Problems: Reconciling Conflicting Needs

Multiple ROC are likely to have competing needs or other refuge programs may conflict with habitat needs of ROC. Recognizing when and how these occur, and how they would be resolved may require prioritizing species needs. Prioritization would be resolved by considering refuge purpose(s), NWRS mission, applicable laws and plans. The delicate balance required to meet the ecological needs of various species, while maintaining the integrity of their habitats, demands a nuanced approach. Strategies such as habitat restoration, invasive species management, and adaptive management play crucial roles in minimizing these conflicts. To address these conflicting needs the Refuge can implement management actions in a mosaic to maintain and enhance a variety of habitats within the same region, supporting a wider diversity of species. This could include actions such as mosaic burning, or mosaic water level management. Ultimately, the success of conservation efforts depends on understanding the

complex interaction between species and their environments and continuously adjusting strategies to promote ecological health and biodiversity.

Conflicts may arise from differing desired habitat conditions among grassland bird species in grasslands or in migrating landbirds in forested habitats. In grasslands, while some species such as Painted Buntings have desired habitat conditions of shrubby grasslands and benefit from moderate intervals of management activities, others like Henslow's and LeConte's sparrows prefer early seral stage grasslands and benefit from shorter intervals of management activities. Additionally, land managers may adjust the timing and intensity of management activities to cater to the specific needs of different resources of concern. For example, burning in late winter or early spring can create more suitable habitat for species with preferred habitat conditions of tall grasses, while growing season burns may better suit species that need sparse vegetation. The timing and intensity of management activities like mowing or tree harvesting may also be adjusted to cater to needs of different ROCs such as nesting season for migrating land birds or pupping season for tree roosting bats. To address these conflicting needs, managers often implement management in a mosaic across their landscape, where different areas are managed at different intervals. This allows for the creation of a variety of habitats within the same region, supporting a wider diversity of species. Monitoring populations of ROCs and the vegetative conditions of their habitats is crucial to determining the effectiveness of management practices, and informing adjustments over time.

The recent programmatic biological opinion for the implementation of forested habitat management practices for tree roosting bats, prescribed fire and forestry practices would be utilized to minimize impacts, including reducing fire intensity within forest units and avoiding known bat roosts and retaining or creating snags during mulching/ thinning operations, would be utilized to address conflicting management actions. Additionally, habitat enhancements through these forestry practices are likely to benefit tree roosting bats long term.

Chapter IV. Habitat Goals And Objectives

This SHSP lays out objectives and strategies designed to work towards the following high-level goals laid out in Santee NWR CCP, 2008.

For habitats that require active management, goals and objectives were developed in the Refuge CCP, which are directly stepped-down to specific, measurable, achievable, results-oriented, and time-fixed (SMART) SHSP objectives that fulfill the refuges' purposes. The CCP habitat management goals are broad, qualitative statements derived from the establishing purposes and visions for the refuge and remain unchanged to guide the SHSP. SHSP objectives are directly stepped down, linked, and "SMARTened" CCP objectives. CCP goals and SHSP objectives pertain to ROC identified in Chapter III and can be found on the refuge corresponding habitat management map sheets. The refuge habitat map sheets contain a specific habitat type and include:

- Refuge Specific CCP Habitat Management Goal(s)

- SMART SHSP objectives (with reference to the CCP objectives they are directly stepped down, linked, and SMART)
- ROC the Objectives pertain to; and
- Adaptive Management Monitoring Elements including:
 - Primary Habitat Response Variables; and
 - Associated Assessment Methods.

Chapter V. Habitat Management Strategies

Habitat management strategies are the specific actions, tools, or techniques used to meet specific habitat objectives. Strategies are practices that are applied on the ground and would achieve the SMART criteria of the habitat management objective. Habitat management strategies for each specific habitat type can be found on the refuge corresponding habitat management map sheets. The refuge habitat management map sheets are habitat-specific map sheets containing habitat management strategies.

Adaptive Management & Evaluation

USFWS advocates improving habitat management through adaptive management (<http://www.fws.gov/policy/620fw1.html>). The Service defines adaptive management as “the rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research, monitoring, and evaluation of management actions to support or modify objectives and strategies at all planning levels.” As such, it is imperative that the impacts of habitat management decisions are evaluated regarding resultant habitat conditions and wildlife responses. Management decisions can then be adapted over time as appropriate to achieve refuge management objectives.

Evaluation is a key component of wildlife and habitat conservation because it fosters learning and improvement. The Service is increasingly emphasizing these practices as a means to document our learning and continue to improve and to help us to be more strategic in moving toward our conservation objectives (052 FW 1: Strategic Habitat Conservation). Adaptive management is a decision process that promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. The evaluation section describes what would be monitored to determine progress towards achieving objectives, and how Refuge Managers would determine if an adjustment to objectives or strategies is necessary. It may make sense to adjust or completely change an objective or strategy, depending on how conditions, threats, and opportunities evolve, in light of new lessons learned, or based on the observed outcomes of the strategy. Please also see the Inventory and Monitoring Plan for Santee NWR which describes monitoring protocols referred to in this section in greater detail.

Draft Environmental Assessment

Santee National Wildlife Refuge Draft Spatial Habitat and Species Management Plan 2026

Prepared by Santee National Wildlife Refuge
NEPA Unique Identifier: 2024-0039049-NEPA-001

U.S. Department of Interior
Fish and Wildlife Service
Region 4 (Southeast Region)
Santee National Wildlife Refuge
Clarendon County, South Carolina



Table of Contents

Executive Summary.....	5
Chapter 1: Introduction.....	7
1.1 Background.....	7
1.2 Proposed Action	10
1.3 Purpose and Need for Action.....	11
Chapter 2: Consultation and Coordination.....	11
2.1 Public Involvement	11
2.2 State, Federal, and Local Agency Coordination	12
Chapter 3: Alternatives	13
3.1 Decision Framework	13
3.2 Alternatives	13
Alternative A – Continue Current Management (No Action Alternative).....	13
Features Common to all Alternatives.....	17
Monitoring Applicable to All Alternatives	19
Chapter 4: Affected Environment and Environmental Consequences	19
4.1 General Description of Affected Environment Applicable to All Affected Resources	22
4.2 Natural Resources	23
Habitat and Vegetation: Affected Environment.....	23
Habitat and Vegetation: Environmental Consequences.....	24
Fish and Wildlife Species: Affected Environment.....	25
Fish and Wildlife Species: Environmental Consequences.....	26
Candidate, Threatened and Endangered Species and Critical Habitat: Affected Environment	28
Candidate, Threatened and Endangered Species and Critical Habitat: Environmental Consequences.....	29
Special Status Species: Affected Environment	33
Special Status Species: Environmental Consequences	34

Climate Change/Air Quality-Affected Environment –	35
Climate Change/Air Quality Environmental Consequences –	36
Geology and Soils:-Affected Environment	37
Geology and Soils:-Environmental Consequences	38
Water Resources:-Affected Environment	39
Water Resources -Environmental Consequences	40
4.3 Economic Effects and Effects on the Quality of Life of the American People- Affected Environment.....	41
Economic Effects and Effects on the Quality of Life of the American People: Environmental Consequences.....	42
4.4 Refuge Resources	43
Management and Operations: Affected Environment.....	43
Management and Operations: Environmental Consequences.....	43
Visitor Use and Experience: Affected Environment	44
Visitor Use and Experience: Environmental Consequences	44
4.5 Minimization Measures to Avoid Negative Impacts	45
Monitoring.....	46
4.6 Reasonably Foreseeable Effects: Affected Environment	46
4.7 Summary of Analysis.....	48
Alternative A – Continue Current Management – No Action Alternative	48
Alternative B – Implement the 2026 Santee NWR Spatial Habitat and Species Management Plan – Preferred Alternative	48
Conclusion	50
Chapter 5: List of Preparers and Sources	51
5.1 List of Preparers.....	51
5.2 State /Federal Coordination	51
5.3 Tribal Consultation	51
Chapter 6: Certification and Determination.....	51
References	52
Appendix B: Acronyms and Abbreviations	66

Appendix C: Terms	67
Figures: Location Map of Santee NWR	6

Executive Summary

This draft environmental assessment evaluates the action alternative and a no action alternative. The proposed action would implement the Draft Spatial Habitat and Species Management Plan (SHSP) at the Santee National Wildlife Refuge (NWR) in accordance with the Santee NWR Comprehensive Conservation Plan (CCP) (USFWS 2008).

Management of the refuge was outlined and evaluated in the Santee NWR Comprehensive Conservation Plan (CCP)/Environmental Assessment (EA)/Finding of No Significant Impact (FONSI) (USFWS 2008a, b) located in Clarendon County in the upper coastal plain region of South Carolina. The Service is proposing to update and refine habitat and species management of the 15,095-acre refuge with the proposed Draft SHSP (Section A and MapSheets), including management of grassland and upland cropland, managed wetland, and forest habitat. The Proposed Action would refine and update existing refuge management objectives to serve refuge purposes and goals and adapt management over time. Resources of concern established through the Natural Resource Prioritization Process (USFWS 2022) and articulated in the Draft SHSP for the refuge include the:

- Painted bunting (*Passerina ciris ciris*) and wood thrush (*Hylocichla mustelina*)
- Sandhill crane (*Grus canadensis*)
- Wintering grassland birds-such as Henslow's sparrow (*Centronyx henslowii*), LeConte's sparrow (*Ammospiza leconteii*)
- Wintering dabbling ducks such as green-winged teal (*Anas carolinensis*), wood duck (*Aix sponsa*)
- Wood Stork (*Mycteria americana*)

The Draft SHSP in Section A was fully developed for implementation based on the Proposed Action, including MapSheets i, 1.1 through 1.4. Section A and are incorporated herein by reference.

The no action alternative would continue to management without implementing the SHSP. If adopted, the SHSP will step down the Refuge's existing Comprehensive Conservation Plan (CCP) (USFWS 2008a, b).

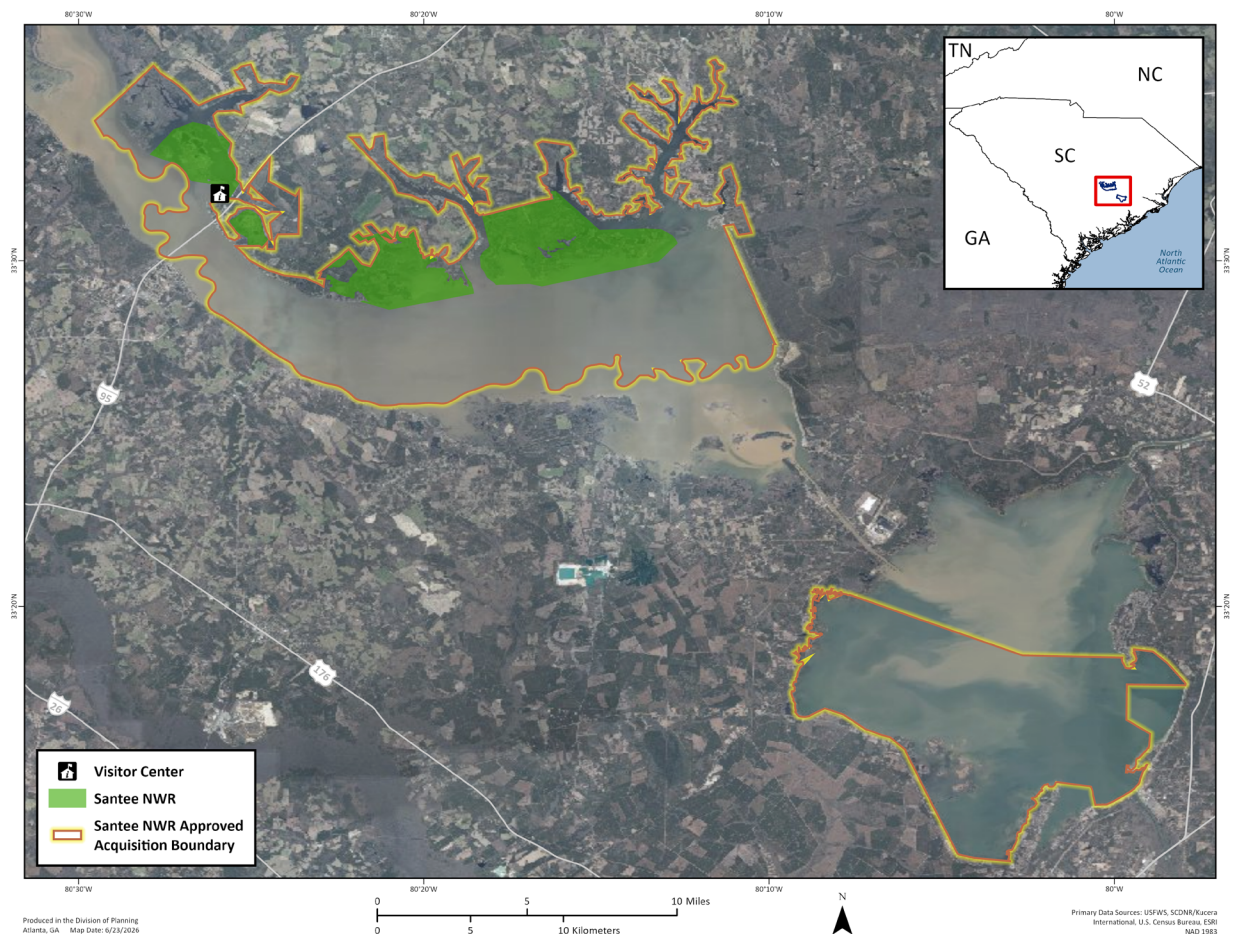
This draft Environmental Assessment (EA) was prepared by the U.S. Fish and Wildlife Service (Service, USFWS) to evaluate the potential environmental impacts associated with the Proposed Action, implementing the 2026 Spatial Habitat and Species Management for Santee NWR (NWR, refuge; Figure 1), and complies with the National Environmental Policy Act (NEPA), Department of the Interior NEPA regulations and policy (43 CFR 46; 516 DM 1), the U.S. Fish

Draft Environmental Assessment: 2026 Spatial Habitat and Species Management Plan for Santee NWR

and Wildlife Service's (Service) NEPA policy (550 FW 3) and other relevant regulations and policies. NEPA requires examination of the effects of proposed actions on the natural and human environment. Appendix A outlines all laws and Executive Orders evaluated through this EA.

The following resources were analyzed in the draft environmental assessment: Habitat and Vegetation; Candidate, Threatened and Endangered Species; Special Status Species; Geology and Soils; Economic Effects and Effects on the Quality of Life of the American People; Management and Operations; and Visitor Use and Experience (see Chapter 4 for more information). The U.S. Fish and Wildlife Service initially considered impacts to several other resources but ultimately dismissed from further analysis because neither the proposed action nor its alternatives would have the potential to result in impacts on these resources.

Figure 1. Location of Santee NWR.



Chapter 1: Introduction

1.1 Background

National Wildlife Refuges are guided by the mission and goals of the National Wildlife Refuge System, the purposes of an individual refuge, federal laws and executive orders, U.S. Fish and Wildlife Service policy, and international treaties. Relevant guidance includes but is not limited to the National Wildlife Refuge Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 United States Code [U.S.C.] 668dd et seq.); the Refuge Recreation Act of 1962; and selected portions of the CFR and the U.S. Fish and Wildlife Service manual.

The mission of the National Wildlife Refuge System, as outlined by the National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd et seq.) is:

“to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.”

Additionally, the NWRSA mandates the Secretary of the Interior in administering the NWRS (16 U.S.C. 668dd(a)(4)) to

- Provide for the conservation of fish, wildlife, and plants, and their habitats within the NWRS;
- Ensure that the biological integrity, diversity, and environmental health of the NWRS are maintained for the benefit of present and future generations of Americans;
- Ensure that the mission of the NWRS described at 16 U.S.C. 668dd(a)(2) and the purposes of each refuge are carried out;
- Ensure effective coordination, interaction, and cooperation with owners of land adjoining refuges and the fish and wildlife agency of the states in which the units of the NWRS are located;
- Assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the NWRS and the purposes of each refuge;
- Recognize compatible wildlife-dependent recreational uses as the priority general public uses of the NWRS through which the American public can develop an appreciation for fish and wildlife;
- Ensure that opportunities are provided within the NWRS for compatible wildlife-

dependent recreational uses; and

- Monitor the status and trends of fish, wildlife, and plants in each refuge.

Santee NWR was established in 1941, recognizing the high migratory bird benefits and recreational opportunities served by the lands and waters of Santee NWR, under the Migratory Bird Conservation Act thus outlining the primary purposes of these lands and waters:

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act)

“...to conserve and protect migratory birds...and other species of wildlife that are listed...as endangered species or threatened species and to restore or develop adequate wildlife habitat.” 16 U.S.C. 715i (Migratory Bird Conservation Act)

“... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...” 16 U.S.C. 460k-1 (Refuge Recreation Act, as amended)

“... the Secretary ... may accept and use ...real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” 16 U.S.C. 460k-2 (16 U.S.C. 460k-460k-4, Refuge Recreation Act, as amended).

Serving NWRS mandates, and refuge purposes, the proposed Draft SHSP would support multiple refuge management goals and objectives articulated in the CCP (USFWS 2008a, b), including those listed.

CCP Supporting Goals (USFWS 2008)

Goal 1. Threatened and Endangered Species

Conserve, protect, and enhance populations of rare, threatened, and endangered species of plants and animals at existing or increased levels on the refuge and conserve, protect, manage, and restore native South Carolina coastal plain habitats occurring on the refuge to contribute to recovery goals.

Goal 2. Migratory Birds

Maintain and actively manage refuge wetlands and uplands primarily to contribute to migratory bird priorities of the refuge and South Carolina coastal plain physiographic area, while providing consistency with state, regional, and national goals.

Goal 4. Wildlife and Habitat Diversity

Protect, manage, and enhance the natural diversity of fish, wildlife, and habitats and the important landscapes of the refuge’s coastal plain habitats to ensure that fish and wildlife populations remain naturally self-sustaining.

Goal 5. Forests

Maintain and manage for high-quality oak-pine mixed woodland and edge habitats on Santee NWR to support Neotropical songbirds, such as the painted bunting, and other resident wildlife within the South Carolina Coastal Plain Physiographic Area.

Goal 6. Exotic, Invasive, and Nuisance Species

Control and eliminate, where feasible, exotic, invasive, and nuisance species on the refuge to maintain and enhance the biological integrity of the refuge's native South Carolina coastal plain habitats.

Threatened and Endangered Species

The refuge provides habitat for two Federally candidate or proposed species (monarch butterfly and tricolored bat). Also as outlined above, another four Federally listed species could potentially occur on or around the refuge (West Indian Manatee, Canby's dropwort, American chaffseed, and Red-cockaded woodpecker). The manatee has never documented.

From 2020 to 2022, Species Status Assessment reports were completed for the monarch butterfly (USFWS 2020b), tricolored bat (USFWS 2021b), and Northern long-eared bat (USFWS 2022b). The recent Programmatic Biological Opinion: Implementation of Forest Habitat Management Practices on National Wildlife Refuges in the Southeast Region for Tree Roosting Bats (PBO) prescribed fire and forestry practices would be utilized to minimize impacts, including reducing fire intensity within forest units and avoiding known bat roosts and retaining or creating snags during mulching/thinning operations, would be utilized to address conflicting management actions (USFWS 2024). Additionally, habitat enhancements through these forestry practices are likely to benefit tree roosting bats long-term.

Further, the refuge supports multiple birds of management concern, including migrating and breeding populations. Many migratory birds are facing threats and declines, including habitat quality and habitat availability. As outlined in the North American Bird Conservation Initiative's State of the Birds 2020 Report, three billion birds have been lost from the United States and Canada, including one in 4 breeding birds; 70 bird species are on the tipping point of being lost; and birds across the United States are showing downward trends in every habitat except wetlands (North American Bird Conservation Initiative 2022). Over time, changing conditions in the landscape are occurring.

Table 2. Listed Species and Designated Critical Habitat on or adjacent to Santee NWR

SPECIES/CRITICAL HABITAT Species Common Name (Scientific Name)	STATUS ¹
Tricolored Bat (<i>Perimyotis subflavus</i>)	PE
West Indian Manatee (<i>Trichechus manatus</i>)	T
Red-cockaded Woodpecker (<i>Picoides borealis</i>)	E
Monarch Butterfly (<i>Danaus plexippus</i>)	C
American Chaffseed (<i>Schwalbea Americana</i>)	E
Canby's Dropwort (<i>Oxypolis canbyi</i>)	E

¹STATUS: E=endangered, T=threatened, PE=proposed endangered, PT=proposed threatened, CH=critical habitat, PCH=proposed critical habitat, C=candidate species

Of the species in Table 1, species known or likely to occur on the refuge is the tricolored bat and monarch butterfly. There are no critical habitats.

In conjunction with Santee Draft SHSP (Section A) and the associated Draft EA (Section B), the Draft SHSP process includes a draft Compatibility Determination, and an intra-Service Section 7 Consultation to fulfill the requirements of the Endangered Species Act (ESA); which are incorporated herein by reference. The ESA provides a program for conserving threatened and endangered plants and animals and their habitats, including critical habitat. An ESA Intra-Service Section 7 Consultation was also completed for the 2008 CCP; it is also incorporated herein by reference (USFWS 2008a, b). The PBO for the implementation of forest habitat management practices for tree roosting bats, prescribed fire and forestry practices also applies to this action in order to minimize impacts include reducing fire intensity within forest units and avoiding known bat roosts and retaining or creating snags during mulching/thinning operations (USFWS 2024). This ESA Programmatic Biological Opinion: Implementation of Forest Habitat Management Practices on National Wildlife Refuges in the Southeast Region for Tree Roosting Bats is incorporated herein by reference (USFWS 2024). Additionally, habitat enhancements through these forestry practices are likely to benefit tree roosting bats long-term.

1.2 Proposed Action

The U.S. Fish and Wildlife Service (Service, USFWS) is proposing a Spatial Habitat and Species Plan (SHSP) for Santee National Wildlife Refuge (NWR) located in Clarendon County, SC.

Management of the refuge was outlined and evaluated in the Santee NWR Comprehensive Conservation Plan (CCP) / Environmental Assessment (EA) / Finding of No Significant Impact (FONSI), which included a Section 7 biological evaluation that had findings of no effect and not likely to adversely affect (USFWS 2008a). Furthering management outlined in the Refuge's CCP (USFWS 2008), the Service is proposing to update and refine habitat and species management of the 15,095-acre refuge with the proposed SHSP, including management of the Santee NWR forests, wetlands, fields, open water, and a rare Carolina Bay (Dingle Pond). Management actions may include prescribed fire, wildfire management, grassland restoration, mowing, herbicide applications, forest thinning, and mulching.

The Proposed Action would refine and update refuge management objectives to serve refuge purposes and goals and adapt management over time. A proposed action is an initial proposal and may evolve during the development of alternatives, the impact analysis, and public involvement. The lead federal agency may determine that there are other, better, or less impactful ways to address the purpose and need, resulting in a different preferred alternative. The proposed action and alternatives may change during the NEPA process as the agency refines its proposal and gathers feedback from the public, federally recognized tribes and tribal entities, and other agencies or organizations. Therefore, the final preferred alternative may differ from the initial proposed action and would be finalized at the conclusion of the public comment period after the incorporation of substantive comments. A decision to implement a proposed action would not be made until the environmental review process is complete.

1.3 Purpose and Need for Action

The purpose of the development of the SHSP is to refine implementation of the CCP for Santee NWR to address changing landscape and natural resource conditions, enhance and adapt refuge habitat and species management, and better serve refuge purposes and management goals.

The need is supported by multiple factors, including addressing management activities, recent updates to information for key resources of concern, changing conditions in the landscape, and limited refuge staff time. Further, the CCP/EA/FONSI for the refuge was finalized in 2008, which was over 17 years ago (USFWS 2008a, b). Changes in conditions, species status, and other factors necessitated review and amendment of the CCP through preparation of the SHSP.

Chapter 2: Consultation and Coordination

2.1 Public Involvement

This Environmental Assessment would be made available for public review and comment concurrent with the publication of the Draft SHSP and Draft Compatibility Determination. The public review period is for 30 days. Members of the public would be notified of availability of these draft documents and how to submit comments via the Refuge or website. Public

comments are accepted through the review process either electronically or via US mail. Any comments, concerns, and suggestions or other feedback requiring a substantive response would be incorporated into the final EA.

2.2 State, Federal, and Local Agency Coordination

To serve shared visions, missions, goals, and objectives, the Service and states continue to work closely together to conserve and manage the fish and wildlife resources of the nation under a variety of laws, regulations, and policies. The Service contacted the state with a letter to request comments on the Draft EA, Draft CD and SHSP on June 26th, 2026.

2.3 Tribal Consultation

The Service and Tribal Nations recognize the need for strong, healthy communication and relationships so that we can work together to improve and enhance conservation of fish and wildlife resources and shared natural and cultural resource goals and objectives. The Service's engagement with and responsibilities to Native American Tribes are guided primarily by doctrines of reserved rights, statutes, treaties, judicial mandates, Executive Orders, Presidential proclamations, and Secretary's Orders. The United States' trust responsibility is a well-established legal obligation that originates from the unique, historical relationship between the United States and Native American Tribes. The trust responsibility consists of the highest moral obligations that the United States must meet to ensure the protection of Tribal and individual Indian lands, assets, resources, and treaty and similarly recognized rights.

The federal government recognizes the valuable contributions of the Indigenous Knowledge (also called Indigenous Traditional Knowledge, Traditional Knowledge, Traditional Ecological Knowledge, and Native Science) that Tribal Nations and Indigenous Peoples have gained and passed down from generation to generation. Indigenous Knowledge combines observations, oral and written knowledge, innovations, practices, and beliefs over long terms and spanning generations, interweaving biological, physical, social, cultural, and spiritual systems. The federal government's consideration and inclusion of Indigenous Knowledge is guided by respect for the sovereignty and self-determination of Tribal Nations, the Nation-to-Nation relationship between the United States and Tribal Nations and the United States' trust responsibility, and the need for the consent of and honest engagement with Tribal Nations and Indigenous Peoples.

For any particular effort, the Tribal Nation(s) or Indigenous People(s) involved clearly drive whether or not to share Indigenous Knowledge and whether or not their Indigenous Knowledge should be applied in federal contexts; the federal government respects these decisions. Indigenous Knowledge offers critical insight into the historic and scientific significance of an area, providing an important foundation for understanding, analysis, and decision making. Consultation and collaboration with Tribal Nations and Indigenous Peoples are critical to ensuring that Indigenous Knowledge is considered and applied in a manner that respects Tribal sovereignty and achieves mutually beneficial outcomes. Indigenous Knowledge can play a key

role in relation to the federal government's planning, analysis, decision making, and compliance under a variety of laws, regulations, and policies, importantly the Endangered Species Act (16 USC §§1531-1544), National Environmental Policy Act (42 USC §§4321 et seq. and 40 CFR Chapter V Subchapter A), Marine Mammal Protection Act (16 USC Chapter 31), Magnuson-Stevens Fishery Conservation and Management Act (16 USC Chapter 38), National Historic Preservation Act (Title 54 USC), and Native American Graves Protection and Repatriation Act (25 USC §§3001-3013).

The Service initially requested consultation and input on changes to the refuge land management program on June 26, 2026 to:

- Absentee Shawnee Tribe
- Catawba Indian Nation
- Shawnee Tribe
- Eastern Shawnee Tribe of Oklahoma

Tribes and tribal members are welcome to provide comment during the public comment period.

Chapter 3: Alternatives

3.1 Decision Framework

Following completion of the EA, the Regional Director in the Southeast Region (Region 4) of the U.S Fish and Wildlife Service would determine if the selected alternative is a major federal action that would significantly affect the quality of the human environment and, require preparation of an environmental impact statement or, alternatively, determine there would be no significant effects to the human environment and complete a Finding of No Significant Impact (FONSI).

3.2 Alternatives

Alternative A – Continue Current Management (No Action Alternative)

Under this alternative, the status quo would be maintained, and refuge management would continue on Santee NWR as outlined in the 2008 CCP and Draft CCP and EA for Santee NWR (USFWS 2008a, b). Refuge management would continue as outlined in the CCP (USFWS 2008a, b). Under Alternative A, passive management of the existing 1,200 acres of forest would continue. Management would continue on 50 acres of cropland and 1,135 acres to provide supplemental wildlife food (USFWS 2008a, b). Active management of the existing 1,200 acres in existing grassland management units would continue for the long-term.

Alternative B Implement the Spatial Habitat and Species Plan (Proposed Action; Preferred Alternative) Under Alternative B, the Service would implement the proposed SHSP, as detailed in the SHSP Supplemental Document in Section A and the listed MapSheets, which are incorporated herein by reference.

MapSheet i: Landscape Level Overview

MapSheet 1.1: Santee NWR Overview

MapSheet 1.2: Santee NWR Forest Habitat

MapSheet 1.3: Santee NWR Grassland and Upland Cropland Habitat

MapSheet 1.4: Santee NWR Managed Wetlands Habitat

While contributing to other national, regional, and state goals to protect and restore habitats and species, refuge management would focus on the achievement of refuge migratory bird purposes, specifically to protect and conserve resources of concern on the refuge, such as the eastern painted bunting, wood thrush, sandhill crane, wintering grassland birds, and wintering dabbling ducks including green-winged teal; and to further the mission of the National Wildlife Refuge System, including to ensure the biological diversity and integrity of Santee NWR, including all federally listed threatened and endangered species.

Alternative B would refine, update, and replace certain objectives or portions of objectives from the refuge's CCP (USFWS 2008a, b). Existing CCP goals would remain unchanged (See Background Section Above).

Alternative B would implement the Draft SHSP, which steps down and provides specifics for several of the identified goals and objectives outlined in the CCP without changing the original intent. The focus under this alternative would be to manage, maintain, restore, and protect the refuge's habitats and wildlife species. Wildlife and plant monitoring and inventory activities would be initiated and maintained to obtain the biological information needed to continue current and implement new priority management programs on the refuge. The Santee NWR Draft SHSP MapSheets depict future habitat management on the refuge: Overview, Grassland and Upland Cropland Habitat, Managed Wetland Habitat, and Forest Habitat. Active management of portions of the existing 1,200 acres of grassland, 50 acres of cropland, 1,135 acres of managed wetlands, and 1,200 acres of forest would occur under Alternative B.

Opportunities for wildlife-dependent recreation activities such as hunting, wildlife observation and photography, and environmental education and interpretation would continue to be provided.

SHSP Objectives

Stepping down from the CCP and serving goals, objectives, and recommendations from the CCP (USFWS 2008), the proposed Santee SHSP articulates future habitat management objectives to provide further refinement, as listed (tables and figures reference MapSheets).

Forest Objective 1 (Stepped down from CCP Goals 1, 2, 5, 6 and Associated Objectives

(USFWS 2008)): On a rotational basis (every 2-4 years), maintain and manage up to 1,200 acres of longleaf, mixed hardwood/pine, and pine stands to support desired stand structure (Table 1), utilizing fire, mechanical, chemical, and biological strategies across the Bluff, Cuddo, Pine Island, and Dingle Pond Units (Figure 1-5). This is part of a larger upland landscape characterized by a mosaic of open forest, scrub-shrub, and grassy patches with the following desired conditions for the painted bunting:

- Pine-oak canopy cover less than 75 percent, and/or canopy tree stocking at a basal area less than 50 feet per acre.
- Mid-story comprised of 20 to 50 percent woody shrubs, less than 20 feet tall and including fleshy fruit-bearing shrubs, such as wax myrtle and yaupon.
- Over time convert loblolly to longleaf pine.

Forest Objective 2 (Stepped down from CCP Goals 1, 2, 5, 6 and Associated Objectives (USFWS 2008)): As appropriate and possible, manage bottomland hardwood, green tree reservoirs, and cypress/tupelo stands in the Bluff, Cuddo, Pine Island, Dingle Pond Units (Figures 1-5) to support desired forest conditions (Table 2).

Grassland Objective (Stepped down from CCP Goals 1, 2, 4, 6 and Associated Objectives

(USFWS 2008)): On an annual basis, maintain and manage up to 1,200 acres (See Figure 1 and Table 1) of grassland-dominated, early successional habitat across the Bluff, Cuddo, and Pine Island Units, as part of a larger upland landscape characterized by a mosaic of open forest, scrub-shrub, and grassland patches with the following desired conditions for breeding and migrant painted buntings, and wintering grassland birds:

- One hundred acre or more grassland patches of greater than 50 percent native warm-season grasses, such as broomsedge (*Andropogon virginicus*), little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), and switch grass (*Panicum virgatum*).
- Interspersed, 2-to-10-acre patches or edge habitat of 3-to-18-feet-tall native woody shrubs including wax myrtle (*Myrica cerifera*), yaupon (*Ilex vomitoria*), American beautyberry (*Callicarpa americana*), Eastern red cedar (*Juniperus virginiana*), Ironwood (*Ostrya virginiana*), American holly (*I. opaca*), Elderberry (*Sambucus nigra*), and Sumac (*Rhus spp.*), with a grassy understory.

- Less than 30 percent encroachment by woody species, such as sweet gum (*Liquidambar styraciflua*) and groundsel tree (*Baccharis halimifolia*).

Upland Agriculture Objective (Stepped down from CCP Goals 1 , 2, 4, 6 and Associated Objectives (USFWS 2008)) Annually, manage up to 50 acres of croplands among Fields A, B, and C in the Bluff Unit (Figure 2, 5, and Table 2) for grain crops such as milo, corn, or millet to create a minimum of 237,500 Waterfowl Energy Days to benefit sandhill cranes and other native wildlife.

Managed Wetland Objective (Stepped down from CCP Goals 1 , 2, 4, 6 and Associated Objectives (USFWS 2008)): Maintain, improve, and/or restore up to 1,135 acres of managed wetlands including moist-soil, permanent, green-tree, and agricultural impoundments (Figures 1-4A-D and Table 1) for the following desired conditions to contribute toward the foraging habitat needs (4,385,097 Waterfowl Energy Days) for 60,895 migrating and wintering (October to March) dabbling ducks, including the green-winged teal, wood duck, Northern shoveler (*Spatula clypeata*), Northern pintail (*Anas acuta*), gadwall (*Mareca strepera*), and American widgeon (*Mareca americana*), and provide high-quality habitat resources for wading birds, such as the wood stork:

- Manage up to 770 wetland acres across the Bluff, Cuddo, Pine Island, and Dingle Pond Units for 70 to 80 percent emergent vegetative cover, such as softstem bulrush (*Schoenoplectus tabernaemontani*), native sedges (*Carex spp.*), duck potato (*Sagittaria latifolia*), spike rush (*Eleocharis palustris*), and native millet (*Panicum decompositum*), 20 percent or less invasive species such as giant salvinia (*Salvinia molesta*), alligatorweed (*Alternanthera philoxeroides*), water hyacinth (*Pontederia crassipes*), and parrot feather (*Myriophyllum aquaticum*), and a range of water depths of 6 to 24 inches from November to March.
- Annually manage up to 15 acres in Bluff (Millet Field) Unit and 65 acres in the Cuddo (Upper Tier and Lower Tier of Timber Island Field) Units for grain crops such as Japanese millet, flooded to water depths of 18 inches or less beginning late summer through the fall to provide 380,000 Waterfowl Energy Days towards the Refuge objective.
- Annually, manage up to 60 acres in the Cuddo Unit (Upper Tier and Lower Tier of Timber Island Field) and 25 acres in the Pine Island Unit (Maidencane, Savannah A, B, and C, and Rail Fields) for grain crops, such as rice, flooded to water depths of 18 inches or less, during cultivation (April -August) and during winter sanctuary (November – February) to provide up to 387,600 Waterfowl Energy Days towards the Refuge objective.
- Annually manage up to 120 acres of green-tree reservoirs in the Cuddo and Pine Island Units to maintain a range of water depths of 6 to 24 inches from November to March for wintering wood ducks and other dabbling ducks.

- Foraging, nesting, and brood-rearing wood ducks.
- Late spring or early summer flooded wetlands and beaver ponds with emergent and scrub-shrub vegetation such as smartweed, fall panicum, wild millet, alder, and willow
- Forested wetland landscapes with a composition of greater than 25 percent hard mast trees per acre, including oak and hickory species, and multiple large cavity trees or snags with diameter at breast height greater than or equal to 12 inches with four small cavities (entrance diameters 3.5 to 10 inches) per acre and one large cavity (entrance diameter greater than 10 inches) per 10 acres.

The recent programmatic biological opinion for the implementation of forest habitat management practices for tree roosting bats, prescribed fire and forestry practices would be utilized to minimize impacts, including reducing fire intensity within forest units and avoiding known bat roosts and retaining or creating snags during mulching/thinning operations, would be utilized to address conflicting management actions (USFWS 2024). Additionally, habitat enhancements through these forestry practices are likely to benefit tree roosting bats long-term.

The scope and timeline to meet habitat and species management objectives are outlined in each MapSheet; however, these activities can be adjusted accordingly to ensure feasibility within existing constraints. Therefore, a reduction in resources may prompt the refuge manager to re-evaluate any habitat or species objectives, including cropland conversion, thus implementation of proposed actions would be contingent upon the availability of resources and Full-Time Equivalents. The scope and timeline of these activities would be adjusted accordingly to ensure feasibility within existing constraints.

Features Common to all Alternatives

Although the alternatives may differ, there are similarities among them as well. These common features are listed below to reduce the length and redundancy of the individual alternative descriptions.

Compatible Uses

The NWRS Administration Act of 1966, as amended by the NWRS Improvement Act of 1997, states that national wildlife refuges must be protected from incompatible or harmful human activities to ensure that Americans can enjoy Refuge System lands and waters. Before activities or uses are allowed on a national wildlife refuge, the uses must be found to be compatible. A compatible use "...will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge." Wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety." Compatibility determinations also include stipulations to ensure compatibility. These include measures to minimize disturbance to sensitive, threatened, and endangered species,

minimize damage to habitat, and reduce the likelihood of introduction of invasive species. For example: "All commercial forest management operations would be subject to stipulations set forth in a Special Use Permit (SUP). Stipulations for each individual project would be dependent upon the goals and objectives of the timber harvest, individual site characteristics, and other resource concerns. Stipulations set forth in the SUP would minimize adverse impacts on resources, maximize desired silvicultural results, and ensure the operation is compatible with the mission of the Refuge System and the goals and objectives of Santee NWR ." The compatibility determinations (CDs) included in the CCP (USFWS 2008a, b) are incorporated herein by reference, as is a draft Commercial Tree Harvesting CD (USFWS 2026).

Candidate, Threatened and Endangered Species

Any timber sales, logging decks, or temporary forestry roads necessary to implement thinning under the SHSMP are part of the Proposed Action and analyzed at a programmatic level. Site-specific prescriptions would undergo Section 7 review with BMPs. If future actions exceed the scope analyzed here or introduce new effects, additional NEPA would be required.

Visitor use and experience

The refuge provides opportunities for hunting, wildlife observation, photography, hiking, and biking, which would continue under either alternative. Hunting on the refuge is allowed within specific dates listed in the refuge's hunt brochure and as regulated by CFR. Refuge management activities under either alternative would continue to support refuge management goals and objectives in the CCP including visitor use and experience.

Other Management

Under either alternative, all management activities that could affect natural resources, including subsurface mineral reservations, soil, water, and air, or that could affect utility lines and easements, would be managed to comply with all laws and regulations.

Cultural Resources

Under both alternatives, the Service is responsible for managing archaeological and historical sites found on refuge lands. Since cultural resource surveys on the refuge have been limited, additional surveys would be conducted prior to any new construction or excavation on refuge lands to fully satisfy provisions of the National Environmental Policy Act of 1969, and all applicable cultural resource laws and policies. Any potentially negative impacts from habitat management would require review by the Service's Regional Archaeologist and consultation with the State Historic Preservation Office, as mandated by Section 106 of the National Historic Preservation Act. The Service's policy is to preserve these cultural resources in the public trust and avoid any adverse effects wherever possible. Determining whether a particular management action has the potential to affect cultural resources is an on-going process that would occur during the detailed planning stages of every project.

The Service has a legal responsibility to consider the effects of its actions on cultural resources. Under all alternatives, the Service would manage these resources in accordance with public law and agency policy. Individual projects could require additional consultation with the Advisory Council on Historic Preservation and the State of South Carolina Historic Preservation Office. Additional consultation, surveys, and clearance would be required where project development is conducted on the refuge or when activities would affect properties that are listed or eligible for listing on the National Register of Historic Places.

Land Acquisition

Service acquisition of tracts adjacent to Service owned lands, would be given priority. Conservation easements and leases can be used to obtain interests necessary to satisfy refuge objectives. The Service can negotiate management agreements with local, state, and federal agencies, and accept conservation easements. The acquisition of private lands is entirely contingent on the landowners and their willingness to participate. Any future land acquisition will be the same under either alternative.

Monitoring Applicable to All Alternatives

Continued annual biological monitoring of both resident and migratory wildlife and their habitats is done on the refuge in conjunction with our partners. In addition, the refuge would stay apprised of the status of threatened and endangered species on the refuge through consultation and local monitoring. The refuge follows recovery plan guidelines for the management of federally threatened and endangered species. The Final ESA would be completed at the same time as the final EA being drafted and the analysis would be consistent with the draft Section 7 consultation. See the section on threatened and endangered species for more details. If needed, the refuge may take additional actions to mitigate any potential impacts to threatened and endangered species.

Chapter 4: Affected Environment and Environmental Consequences

This section is organized by affected resource categories. Each affected resource section discusses the existing environmental baseline in the impact zone (potential area of impact of any of the alternatives) and the effects of the alternatives on each resource. Effects from the proposed action or alternatives are reasonably foreseeable changes to the human environment, whether adverse or beneficial as compared to the environmental baseline for the no action alternative. The impact analysis directly follows the description of the affected environment for a resource and is organized by alternative.

The impact analysis would evaluate various criteria, as defined below, to describe the context and intensity of impacts on affected resources; these are not required terms but they are commonly used in NEPA documents and may be referenced in the subsequent sections.

Table 1 identifies those resources that either don't exist within the project area or would either

not be affected or only negligibly affected by the Proposed Action and those resources that may have greater than negligible impacts. Those resources for which the action is not applicable or for which no or negligible impacts would be anticipated are not further analyzed in this EA.

Table 1. Impacts to Resources Summary Table.

Resource	Not Applicable: Resource does not exist in project area	No / Negligible Impacts: Exists but no or negligible impacts	Greater than Negligible Impacts: Impacts analyzed in this EA
Habitat and Vegetation	☐	☐	☒
Floodplains:	☐	☒	☐
Vegetation of special management concern:	☒	☐	☐
Fish and Wildlife Species	☐	☐	☒
Candidate, Threatened and Endangered Species and Critical Habitat	☐	☐	☒
Special Status Species	☐	☐	☒
Air Quality	☐	☐	☒
Climate Change	☐	☐	☒
Geology and Soils	☐	☐	☒
Land use	☐	☒	☐
Soundscape	☐	☒	☐
Special Land Status Designations	☒	☐	☐
Water Resources	☐	☒	☐
Historic Properties	☐	☒	☐
Archeological Resources	☐	☒	☐
Architectural Resources	☒	☐	☐

Resource	Not Applicable: Resource does not exist in project area	No / Negligible Impacts: Exists but no or negligible impacts	Greater than Negligible Impacts: Impacts analyzed in this EA
Economic Effects and Effects on the Quality of Life of the American People	☐	☐	☒
Public Health and Safety	☐	☒	☐
Aesthetics	☐	☒	☐
Administration	☒	☒	☐
Management and Operations	☐	☐	☒
Land Use and Planning	☐	☒	☐
Visitor Use and Experience	☐	☐	☒

Resources evaluated and dismissed from further analysis:

Floodplains (EO 11988): The land management activities do not affect water flows or other factors relevant to flooding and floodplain landscapes. Therefore, no effects to floodplains are expected because of proposed regulations changes to land management activities on the refuge. Additionally, no modifications would be made that would increase the floodplain elevation or negatively impact its function and value and thus there would be no impacts to E.O. 11988 – Floodplain Management.

Benthic organisms: The proposed action does not involve dredging, substrate disturbance, or any activity that would affect benthic habitats. Therefore, no impacts to benthic organisms are anticipated.

Soundscape: While land management activities may introduce intermittent noise from firearms and human activity, these sounds are localized, seasonal, and short in duration. Wildlife in the area is likely habituated to such disturbances. As a result, impacts to the soundscape are expected to be negligible.

Special land status designation: The refuge does not include special land designations.

Archeological resources: Management actions will not affect the Santee Indian Mound/Fort Watson site because all proposed activities will avoid the cultural resource area. Existing protection including restrictions on ground-disturbing equipment, continued monitoring, and law-enforcement oversight ensure the site remains undisturbed.

Architectural resources: No architectural resources exist on the refuge.

Public health and safety: The proposed action does not introduce new hazards or risks to public health and safety. Activities would be conducted under existing state and federal regulations, with appropriate safety measures in place. Therefore, no significant impacts are anticipated.

Vegetation of special management concern: There is no vegetation of special management concern on the refuge.

Land Use: The proposed action is consistent with the existing land use designation of the refuge as a wildlife conservation and public use area. No changes to land use or zoning are proposed.

Aesthetics, viewsheds and visual resources: The proposed action does involve construction, ad or temporary land clearing, that could alter the visual character of the refuge, however , the change would be negligible. Therefore, no impacts to aesthetics, scenic viewsheds, or visual resources are anticipated, and this resource was excluded from detailed analysis.

4.1 General Description of Affected Environment Applicable to All Affected Resources

Santee National Wildlife Refuge (NWR, refuge) is located in Summerton, South Carolina. Santee National Wildlife Refuge, encompassing approximately 15,000 acres, was established in 1942 and is located in the upper Atlantic Coastal Plain region of South Carolina. The refuge is superimposed on the lands and waters of the 110,600-acre Lake Marion reservoir in Clarendon County.

The South Carolina Public Service Authority, a.k.a. Santee Cooper, created Lake Marion as a hydroelectric project on the Santee River. Santee NWR benefits migratory waterfowl, neo-tropical songbirds and other birds, and terrestrial and aquatic wildlife in this ecosystem. The refuge contains a wide diversity of habitats including mixed hardwoods, mixed pine hardwoods, pine plantations, marsh, croplands, old fields, ponds, impoundments, and open water. For more information regarding and the general characteristics of the Refuge's environment, please see Chapter 2 of the [Santee NWR CCP](#) which are incorporated by reference.

The Southeast Conservation Blueprint: Grassland & Savanna Restoration Indicator (SECAS 2025) from the Southeast Conservation Blueprint, uses a set of natural and cultural resource indicators to produce its main conservation priority categories. SECAS is a regional conservation initiative covering the Southeastern United States and the Caribbean. Established in 2011 by the Southeastern Association of Fish and Wildlife Agencies and the Southeast Natural Resource Leaders Group, SECAS unites state and federal agencies, nonprofits, private landowners and businesses, tribes, partnerships, and universities around a shared conservation vision.

SECAS also tracks regional metrics of ecosystem health, function, and connectivity to report annual progress toward its goal: achieving a 10% or greater improvement in the health, function, and connectivity of Southeastern ecosystems by 2060. According to the Southeast

Conservation Blueprint (2025), 100% of the current Santee NWR boundary is identified as a priority area for regional conservation efforts. This designation reflects the refuge's importance within broader landscape-scale conservation planning. The Blueprint also shows that 100% of the Refuge boundary lies within a designated connectivity corridor and contributes to several large intact habitat cores.

Although Santee NWR already occupies a highly connected portion of the regional landscape, additional land protection and restoration that expand or link intact habitat patches could further reduce fragmentation and support long-term ecological connectivity (Figure 2). Their grassland and savanna restoration indicator represents potential restoration opportunities for grasslands and savannas within their historic ranges. The classes represent areas from highest to very low indicating their restoration potential. Santee NWR contains over 500 acres of land that has highest restoration potential.

4.2 Natural Resources

Habitat and Vegetation: Affected Environment

Tree harvesting and other land management activities can alter habitats by trampling vegetation, compacting soils, and increasing the potential of erosion. Soil compaction makes root penetration more difficult, making it harder for seedlings to become established. In moderate cases of soil compaction, plant cover and biomass is decreased. In highly compacted soils, plant species abundance and diversity is reduced in the long-term as only the most resistant species survive. Walking may impact vegetation succession as disturbance of vegetation not only results in an alteration of vegetation but also a change in light and moisture and topographical changes that can reduce ground and shrub-nesting avian species. Nesting success of ground-nesting birds is also influenced by vegetation cover and disturbance (Blakesly and Reese 1988). The reduction of the vegetation's physical structure and diversity due to over browsing by deer also can negatively impact landbirds. Casey and Hein (1983) have found greatly reduced bird species diversity in areas with long-term, high-density populations of deer. These changes were mainly attributed to habitual landscape alteration with pronounced browse line and sparse cover caused by over browsing.

Repeated visitation to any particular locale at the Refuge could cause damage to vegetation and therefore, wildlife habitat. Substantial, widespread habitat degradation could through time result in negative effects to wildlife by reducing available cover, food, nesting habitat, etc., along heavily used access routes.

People can be vectors for invasive plants when seeds or other propagules are moved from one area to another. Once established, invasives can out-compete native plants, thereby altering habitats and impacting wildlife. The threat of invasive plant establishment would always be an issue requiring annual monitoring, and when necessary, treatment. In the event new

undesirable invasive species are found on the Refuge, staff would work to eradicate the weeds.

Habitat and Vegetation: Environmental Consequences

Alternative A

Some minor effect to vegetation is expected from trampling, but slightly less than Alternative B because of slightly a smaller number of activities. Damage to vegetation including vegetation trampling, littering, minor surface damage on roads/trails from motor vehicles, spread of invasive species can result due to land management activities, but less than Alternative B because of the lower number of activities and acres involved.

Alternative B

Under the Preferred Alternative, some minor effect is expected to vegetation from trampling and spread of invasive species on the new acreage as under Alternative A. The number of users is not expected to be significantly greater than Alternative A. The slight increase in land management activities would be dispersed over a much larger area than in Alternative A and impacts to vegetation are expected to be negligible, and vegetation would respond within the growing season that diminishes the effects of disturbance.

Forest management operations may have negative impacts on both water quantity and quality. Data from experimental forested watersheds in the eastern United States indicate that the leaching of nutrients after timber harvesting, especially clear cutting, tends to increase (Bormann et al. 1968; Bormann et al. 1974), and the increases in stream water temperature are highest where revegetation of cutover areas is delayed (deMaynadier and Hunter 1995; Cullen 2001). These factors may have detrimental effects on stream organisms, including fish, invertebrates, and amphibians (Campbell and Doeg 1989). Maintaining forested buffers near streams and other aquatic resources minimizes impacts on water resources and water quality (Osborne and Kovacic 1993; Castelle et al. 1994; Wilkerson et al. 2006; Bennett 2010). The activities would not entail activities that would drain wetlands, fill wetlands or change the hydrology of the landscape. Road improvements, skid trail planning, harvest operations, and interaction with surface and groundwater hydrology would follow best management practices outlined by the state's forestry agency to minimize water quality impacts. Selective thinning, not clearcutting, would be the primary harvest method.

Commercial tree harvesting for forest management can have several localized and broader impacts on wildlife-related components of forests, including damage to understory vegetation (Scheller and Mladenoff 2002), alterations of microhabitat environments (deMaynadier and Hunter 1995), and changes in the abundance and type of coarse woody debris (deMaynadier and Hunter 1995; Siitonen 2001).

Harvesting may also leave the remaining trees more susceptible to wind throw (Ruel 1995), facilitate the spread of invasive plants (Sakai et al. 2001), and temporarily disturb wildlife (DeMaynadier and Hunter 1995, Campbell et al. 2007; Holmes and Pitt 2007). Impacts would be

minimized through careful planning and implementation. Selective logging methods, equipment with reduced ground disturbing capabilities, and time of year and soil-moisture restrictions would be implemented to minimize disturbance to wildlife and understory vegetation. Pre-harvest multi-resource surveys, strategic layout of skid trails, and clear designation of no-cut zones would also help to protect the wildlife and habitat.

Positive impacts are expected from tree harvesting. In a study conducted in the bottomland hardwood forests at Tensas River National Wildlife Refuge, treated stands resulted in greater community-wide bird diversity in comparison to untreated stands (Twedt and Somershoe 2009).

Fish and Wildlife Species: Affected Environment

The Refuge supports a diverse assemblage of game and nongame wildlife species typical of northern South Carolina, including fish, reptiles, amphibians, invertebrates, and numerous mammalian species. This biodiversity is sustained by the variety of habitat types present across Santee National Wildlife Refuge, which offer abundant food resources and cover.

Approximately 40 mammal species are known or expected to occur within the refuge acquisition area (USFWS 1997). These include wide-ranging species such as black bear (*Ursus americanus*), typically associated with upland forests connected by extensive forested wetland corridors. The area also supports seven species of bats, including two state-listed species of concern, Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) and southeastern myotis (*Myotis austroriparius*), which utilize the refuge for both roosting and foraging. Common forested wetland mammals include white-tailed deer (*Odocoileus virginianus*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), beaver (*Castor canadensis*), mink (*Neogale vison*), river otter (*Lontra canadensis*), marsh rabbit (*Sylvilagus palustris*), and squirrel (*Sciurus* sp.).

The floodplain forests of the South Atlantic Coastal Region provide important breeding habitat for a rich assemblage of bird species, more than half of which are neotropical migratory birds. Approximately 200 bird species have been recorded within the refuge acquisition area. Coastal plain wetlands in South Carolina serve an essential role for migrating and wintering waterfowl by providing staging and wintering areas. Since 1970, South Carolina has wintered substantial proportions of several species within the Atlantic Flyway, including an average of 54 percent of American green-winged teal (*Anas crecca carolinensis*), 50 percent of northern shoveler (*Spatula clypeata*), 35 percent of mallard (*Anas platyrhynchos*), 32 percent of northern pintail (*Anas acuta*) and American wigeon (*Mareca americana*), and 31 percent of gadwall (*Mareca strepera*).

The refuge and surrounding areas support a variety of reptile and amphibian species expected in coastal plain wetland systems. Common aquatic salamanders include the greater siren (*Siren lacertina*), eastern lesser siren (*Siren intermedia*), two-toed amphiuma (*Amphiuma means*),

dwarf waterdog (*Necturus punctatus*), and broken-striped newt (*Notophthalmus perstriatus*). Terrestrial salamanders such as the marbled salamander (*Ambystoma opacum*) and South Carolina slimy salamander (*Plethodon variolatus*) are also present. Frequently encountered frog species include bullfrog (*Lithobates catesbeianus*), southern leopard frog (*Lithobates sphenoccephalus*), and green treefrog (*Hyla cinerea*). The American alligator (*Alligator mississippiensis*) is the largest reptile occurring within the refuge.

Fish and Wildlife Species: Environmental Consequences

Alternative A

Impacts would be similar to those described in Alternative B. Under No Action alternative, land management would continue at current levels and operations, and the disturbance would be similar to past conditions.

Alternative B

The combination of human presence, noise associated with heavy equipment and motorized hand tool operation may disturb wildlife, including birds. Birds exhibit various behavioral and physiological responses to disturbance. Physiological responses include the release of stress hormones (Müllner et al. 2004, Thiel et al. 2008) and increased heart rate (Weimerskirch et al. 2002). Behavioral responses include increased vigilance (Frid and Dill 2002), altered singing behavior (Gutz Wilder et al. 1994), and flushing (Ikuta and Blumstein 2003, Beale and Monaghan 2004, Pease et al. 2005, Livezey et al. 2016). Disturbance can also cause birds to discontinue or avoid foraging (Burger and Gochfield 1998, Thomas et al. 2003, Yasue 2005, Martín et al. 2015) and instead spend more time displaying avoidance behaviors. These physiological and behavioral responses to human activity cause birds to expend energy (Bélanger and Bédard 1990, Weimerskirch et al. 2002) that would otherwise be used for survival, migration, and reproduction.

Amphibians and reptiles may be negatively impacted through various mechanisms. Falling trees could crush amphibians and reptiles, killing them. Ectotherm species are susceptible to short-term changes in microclimates, which should be considered when harvesting to limit adverse impacts (Currylow et al. 2012). For example, tree harvesting can increase sunlight penetration to the forest floor, reducing soil moisture and increasing soil temperatures. Removing trees from the forest can result in fewer large-diameter logs and detritus accumulating on the ground, which could negatively impact plants, soil, amphibians, invertebrates, and other wildlife species that inhabit the forest floor. These microclimate changes can cause cold-blooded animals to overheat and make amphibians vulnerable to desiccation. Further, heavy equipment can introduce or spread invasive species and crush small animals.

Tree harvesting can have long-term localized and broad impacts on wildlife and their habitats, including damage to understory vegetation (Scheller and Mladenoff 2004), alteration of microhabitat environments (deMaynadier and Hunter Jr. 1995), changes in the abundance and type of coarse woody debris (deMaynadier and Hunter 1995, Siitonen 2001), and removal of snags used by wildlife. Depending on their life history characteristics, these impacts can have positive and negative long-term effects on wildlife populations. For example, birds that prefer early successional and shrubby habitats may benefit from tree harvesting, while birds that prefer mature, old-growth forests may decline (Campbell et al. 2007, Holmes and Pitt 2007). Other wildlife, such as amphibians, invertebrates, reptiles, and mammals, may also be affected differently based on their life history traits (Fredericksen et al. 2000).

Using tree harvesting to mimic natural disturbance and improve wildlife habitats relies on creating appropriately timed disturbances similar in size and intensity to historical disturbance regimes (Seymour et al. 2002). Because wildlife species have differing requirements for cover, food, and nesting sites, it is not possible to use tree harvesting to provide high-quality habitat for all species in the same stand. Management actions will be expected to have positive impacts on the habitat, fish and wildlife, including federally listed species populations. The cooperative farming program potential impacts will be minimized by all fertilizer, soil amendment, and pesticide applications following strict requirements, including the approved PUPs' conditions and restrictions, Cooperative Agriculture Agreement and special use permit conditions and restrictions, label and application restrictions, and BMPs.

Some plants and animals may respond more positively to less intense tree harvesting, while others may respond more positively to more intense tree harvesting. Further, disturbance-dependent species may be positively impacted immediately following tree harvesting but may decline long-term (Cahall et al. 2013). To maximize the positive effects of tree harvesting and minimize harm, the Service would aim to mimic the size and intensity of historical disturbance regimes. The Service would also implement rotational tree harvesting to create a complex habitat matrix with various successional stages while maintaining unthinned areas for species negatively impacted by thinning.

Burning or mowing fields to keep them in a perpetual grassland state will exclude upland species that prefer later successional stages (e.g., shrubland and forestland) from using these fields. However, the refuge provides a variety of successional stage habitats, with grasslands being just one component of a complex habitat matrix. While no single date is best for every species, it is generally agreed that reducing prescribed fire and mowing from April to August allows the majority of bird species to nest and fledge at least one brood (Birckhead et al. 2013, Bollinger et al. 1990, Dechant 2007, Perlut et al. 2006, USDA 2009, Warner and Etter 1989). Additionally, mortality can be reduced from mowing or burning by leaving unmanaged strips within or around the edge of a field (Allen et al. 2019, Tyler et al. 1998).

The major effects of prescribed burning on wildlife are mostly indirect yet change in the structure and composition of vegetation impacts availability of food and cover, which directly influences the health, abundance, and diversity of wildlife (USDA 2012). Direct mortality of wildlife from prescribed burning is rare; prescribe burning will continue to be scheduled during periods that are not critical to reproduction and survival of wildlife.

Prescribed fire does not necessarily benefit aquatic organisms, but it should not have adverse effects when implemented properly (USDA 2012). Waterways are often used as firebreaks, and when fire enters into a riparian zone, it should not be detrimental since fire is often not carried very well in these moist and humid environments. Plowed or disked areas, roads, and levees also act as firebreaks. Adequate buffers will continue to be maintained between the firebreak and riparian zone to prevent possible sedimentation, which is much more likely to result from a plowed or disked firebreak than under burning in the riparian zone. Indeed, the positive effects of prescribed burning on vegetation and associated wildlife are just as applicable in a riparian zone as in the uplands.

Within grassland habitats, fields that are mowed or burned annually or bi-annually will continue to provide habitat for short grass preferring species at the expense of species that prefer less disturbed grassland habitats. Grasslands that are mowed or burned less than annually (e.g., once every two or three years) have taller grasses and more residual material (litter) during years when no mowing or burning takes place. Rotating management of a given tract will continue to keep litter available for species that require it. Some bird species prefer to nest in grasslands with little to no litter, while others prefer areas with more litter (Morgan and Burger 2008). The refuge will continue to provide suitable habitat for both short and tall grass preferring species. This spatial and temporal disturbance interspersions is important for providing a variety of grassland cover types across the refuge landscape and ensures that there will be newly managed areas and undisturbed areas within the same habitat mosaic each season (Harper 2007, Herkert et al. 1996). Likewise, using prescribed fire to reach desired forest conditions moves closer to achieving desired habitat conditions for all species on the refuge and increased management will help increase populations of priority resources of concern.

Targeted removal of pests and predators from portions of the refuge will reduce the negative impacts these species have on ecosystem functions. Pest and predator species control has been documented to provide a variety of ecological benefits, including prevention and alleviation of habitat degradation, facilitation of habitat and wildlife restoration, dampening of disease transmission and severity of disease outbreaks among wildlife and between wildlife and humans, maintaining the integrity of infrastructure, and the conservation and enhancement of biological and genetic diversity (Bogges et al. 1990, Organ et al. 1996).

Candidate, Threatened and Endangered Species and Critical Habitat: Affected Environment

The Refuge utilizes the Information for Planning and Consultation (IPaC) tool and the

Environmental Conservation Online System (ECOS) databases to identify threatened and endangered species that may be present within the Refuge and the specific project area for the purpose of completing biological evaluations. It is important to note that these databases are updated regularly, approximately every 90 days. As a result, the list of threatened and endangered species identified as potentially present on or near the Refuge may change between the time of review and the finalization of this document. This is used in conjunction with knowledge of refuge staff and cooperating partners regarding presence of these species or habitats on the refuge.

Six federally threatened and endangered (includes two proposed) species are known to or identified in IPaC as potentially occurring on the refuge. Federally listed threatened and endangered Species that have been documented to potentially occur within the acquisition boundary of the refuge are; the tricolored bat (*Perimyotis subflavus*), proposed endangered, West Indian Manatee (*Trichechus manatus*), threatened, Red-cockaded Woodpecker (*Dryobates borealis*), threatened, monarch butterfly (*Danaus plexippus*) candidate, American Chaffseed (*Schwalbea americana*), endangered, and Canby's Dropwort (*Oxypolis canbyi*), endangered. No critical habitat is designated within the refuge area.

The tricolored bat and monarch butterfly occur on Santee NWR. Manatee have occasionally been documented in the 110,000-acre Lake Marion, but there are no records of them occurring on the refuge. The Red-cockaded Woodpecker has not been observed on the refuge since 1994. There are no historical records that American chaffseed or Canby's dropwort has ever been documented on the refuge.

No significant adverse impacts from the Proposed Action would be expected to any of the above listed threatened, endangered, and other special status species.

Candidate, Threatened and Endangered Species and Critical Habitat: Environmental Consequences

Alternative A

A consultation pursuant to Section 7 of the Endangered Species Act was conducted for the 2008 CCP based on the then current known locations of feeding, nesting, spawning, or physical locations of threatened or endangered species on or adjacent to refuge lands. It was determined that the proposed actions are not likely to adversely affect these species. There have been no known impacts from land management activity on the refuge to these species.

Alternative B

The proposed refuge management implementation was designed to be sustainable and minimize impacts, including to threatened and endangered species and other special status species. It is the policy of the Service to protect and preserve all native species of fish, amphibians, reptiles, birds, mammals, invertebrates, and plants, which are designated threatened or endangered, including their habitats. Management actions would be expected to

have positive impacts on the federally listed species populations.

Habitat management and monitoring activity under the Preferred Alternative is not expected to conflict with recovery or protection of Federally listed and candidate species and there have been no reported/documented issues. A preliminary intra-service consultation pursuant to Section 7 of the Endangered Species Act was formerly conducted as part of this EA and the SHSP Supplemental (Section A) and is incorporated herein by reference (USFWS 2026) resulting in a determination of “May affect but not likely to adversely affect” for red-cockaded woodpecker, and not likely to jeopardize determination for the tricolored bat, and monarch butterfly, and “no effect” for West Indian Manatee, Canby’s dropwort, and American chaffseed as the proposed alternative is likely to cause insignificant, discountable effects to the species. West Indian Manatee (*Trichechus manatus*), threatened, American Chaffseed (*Schwalbea americana*), endangered, and Canby’s Dropwort (*Oxypolis canbyi*) have never been documented on the refuge. A Draft Section 7 consultation has been prepared and would be completed after public review and comment.

The refuge would modify activities if unusual concentrations of threatened and endangered species are known to be present and would be threatened by land management activities.

Tricolored Bat

This nocturnal insectivore, with high potential to occur on the refuge, roosts in trees during summer and hibernates in caves or mines during winter. The primary factors influencing the tricolored bat’s viability include white-nose syndrome, wind related mortality, effects from climate change, habitat loss, and conservation efforts (USFWS 2021). Tricolored bats have decreasing population trends (USFWS 2019, 2022b).

The tricolored bat is one of the smallest bats that is native to North America. The once common species is wide-ranging across the eastern and central United States and portions of southern Canada, Mexico, and Central America. During the winter, tricolored bats are found in caves and mines, although in the southern United States, where caves are sparse, tricolored bats are often found roosting in road-associated culverts. During the spring, summer and fall, tricolored bats are found in forested habitats where they roost in trees, primarily among leaves.

White-nose syndrome is also the predominant threat to this bat. This bat species is quite common and was detected on the refuge during mobile acoustic surveys in 2012 – 2019 (USFWS 2019). Management activities would be designed to minimize adverse impacts on resources (e.g., erosion, rutting, wildlife disturbance, smoke), while maximizing the desired silvicultural results, such as forest health improvements and native understory regeneration to benefit wildlife. Therefore, the Proposed Action is not likely to adversely affect these species.

Roosting bats are not usually roused without major disturbance. While noise from construction vehicles and or activities might flush bats or disturb feeding, they are more likely to remain in place. There could potentially be some adverse effects on individual bats through herbicide use, mulching, or prescribed fire operations. However, the long-term benefits provided by forest

thinning and habitat enhancements would be expected to benefit multiple species. Prescribed fire in or adjacent to forest habitat could have the potential to affect bats. Bats can be sensitive to the timing and intensity to fire. High intensity fire in or adjacent to forest habitat and conducted during summer bat roosting has potential to disturb or harm bats and their roosts (Boyles and Aubrey 2006). Likewise, mulching and woody plant reduction near potential roost trees would be minimized within the active season (April 1 to November 15). Pesticides would be used for the purposes of cropland management, cropland restoration, and woody plant reduction. Although known environmentally harmful pesticides such as organochlorines are no longer used, the use of modern insecticides could potentially impact local food sources for bats (Torquetti et al. 2021). However, little information exists on the effects of indirect application of pesticides, specifically those targeting undesirable plants. Although pesticides would be applied during diurnal periods and not directly to bat roosting habitat, there may be possible unknown indirect effects.

Minimizing prescribed fire operations and forest management operations outside of the non-active winter periods (November-March) within forest units would reduce any potential impacts caused by these management activities. Because Northern long-eared bats roost underneath bark and under crevices in both live trees and snags during the active season (March-November), fire and forestry practices would avoid or minimize activities in these habitats. Prescribed fire and forestry practices that can be implemented to minimize impacts include reducing fire intensity within forest units, avoiding known bat roosts, and retaining or creating snags during mulching/thinning operations.

Under the recent programmatic biological opinion for the implementation of forest habitat management practices for tree roosting bats, prescribed fire and forestry practices that are recommended to minimize impacts include reducing fire intensity within forest units and avoiding known bat roosts and retaining or creating snags during mulching/thinning operations (USFWS 2024). Additionally, habitat enhancements through these forestry practices are likely to benefit tree roosting bats long-term. Any effects are expected to be insignificant.

Tree harvesting has the potential to disturb and displace bats during and after harvesting operations. Specifically, Northern long-eared bat (NLEB) and Tri-colored bat (TCB) are tree roosting bats and would be considered during these proposed operations. Tree harvest such as thinning is likely beneficial to forest-dwelling bats. However, when removing trees from suitable bat habitat, there is the immediate risk of removing trees utilized by bats. The retention of snags and cavity trees as part of the harvest help to reduce adverse effects and long-term negative impacts and this practice should be beneficial to tree roosting bats. This and other best forest management habitat practices would be implemented to minimize adverse impacts to bats (USFWS, 2024). Therefore, tree harvesting is not likely to adversely affect bat species.

While Santee NWR is in the general range of NLEB, this species has not been detected on the refuge. Based on this current scenario, NLEB are not likely to be adversely affected by timber harvesting on the refuge. TCB is common and has been detected on the refuge. The TCB is a

migratory species that may remain active year-round in South Carolina. Minimizing disturbance to summer bat habitat is essential to ensure bats have access to diurnal roosting sites and nocturnal foraging areas. Tree harvesting can alter suitable habitat depending on multiple factors, including the species of bat and habitat requirements across all life stages.

However, requiring harvest activities to occur between November 15 and March 31 would reduce impacts on habitats used by bats during the summer.

Red-cockaded Woodpecker (RCW)

The species historical range included Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, Virginia. Red-cockaded woodpecker historically inhabited the Refuge from the 1970's through the 1980's. A high count of 31 trees were tagged as being active between 1972 and 1977. By 1982, the number of active colonies had declined to four. There were an estimated eight birds in 1987 and 1988 prior to Hurricane Hugo which occurred on September 21, 1989. A few birds (no more than three) were observed in the colony following the hurricane. The hurricane destroyed six of nine active cavity trees. Of the three remaining trees, two had been inactive for the past several years. The last bird was observed in 1994. Management activities would be designed to minimize adverse impacts on resources (e.g., erosion, rutting, wildlife disturbance, smoke), while maximizing the desired silvicultural results, such as forest health improvements and native understory regeneration to benefit wildlife.

RCWs are not documented on the refuge or within its acquisition boundary, likely due to the absence of preferred upland, open-growth pine forests over 70 years old. However, The RCW may recolonize the refuge with improved habitat conditions from actions utilized from SHSP. The refuge lies mainly within the Santee floodplain. Even if present, land management programs/ activities on other refuges with RCWs have not shown documented impacts. Human activity noise can disrupt breeding (April–July), but any potential disturbance from this proposed plan is expected to be discountable or insignificant. Construction noise might flush woodpeckers, but they typically remain in place with intermittent noise. Flushing does not result in mortality or take. The refuge's current land management activities have had no documented disturbances. Any effects are expected to be insignificant.

Monarch Butterfly

Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. In many regions where monarchs are present, monarchs breed year-round. Individual monarchs in temperate climates, such as eastern and western North America, undergo long-distance migration, and live for an extended period of time. In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km and last for over two months. In early spring (February-March), surviving monarchs break diapause and mate at the overwintering sites before dispersing. The same individuals that

undertook the initial southward migration begin flying back through the breeding grounds and their offspring start the cycle of generational migration over again.

Monarch butterflies are commonly seen on the refuge during the summer and fall, within grassland/early successional habitats and in the visitor center butterfly garden. Breeding has been documented on the refuge. Management and restoration efforts in these habitats would benefit pollinators including monarch butterflies. The refuge follows REGIONAL DIRECTOR'S ORDER NO. R4 M-25-05 and applies the associated monarch butterfly and pollinator habitat standards in all applicable land management activities. To ensure that refuge actions actively mitigate potential impacts to monarchs, all habitat restoration and management work as appropriate, would adhere to the following minimum requirements:

Seed mixes would contain at least nine species of native flowering plants, including a minimum of three species blooming in each period: April–June, June–July, and August–October, to provide continuous nectar resources throughout the monarch's lifecycle.

Seed mixes would be free of invasive or aggressive non-native species that could inhibit plant diversity or reduce habitat quality.

When milkweed is included, only regionally appropriate native milkweed species would be used, and tropical milkweed and other non-native species would be strictly avoided to prevent ecological or physiological risks to monarchs.

Beyond these foundational standards, the refuge would, where appropriate, implement additional best management practices to avoid, minimize, and mitigate any potential adverse effects to monarchs and other pollinators. These measures include strategic timing of management actions, protection of existing high-quality nectar and host plant patches, and adaptive management adjustments informed by ongoing monitoring. Where appropriate, land management activities should incorporate the following monarch-supportive practices:

- **Increase native floral diversity** by maximizing the variety of flowering plants across all seasonal bloom periods.
- **Time mowing strategically** to support and extend the availability of nectar resources.
- **Use regionally tailored guidance** and source seed locally when possible, considering future climate conditions.
- **Control invasive and noxious plants** through targeted removal methods such as selective herbicide use or prescribed fire.
- **Apply ecological forestry principles** by creating variable-sized canopy openings that promote herbaceous understory growth, and using prescribed fire in pine or oak systems to sustain conditions important for monarchs and other pollinators.
- **Enhance transition zones** by maintaining infrequently mowed buffer areas along forest–

road edges and establishing native plant communities.

- **Limit insecticide exposure** through Integrated Pest Management and adherence to approved Pesticide Use Permits.

Special Status Species: Affected Environment

Bald eagles, although delisted under the Endangered Species Act, remain protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (16 U.S.C. 668a–d). The Eagle Act prohibits the “take” of eagles, including disturbance that interferes with essential breeding, feeding, or sheltering behaviors. Bald eagles are regularly present on the refuge, and four known nests have been documented. Refuge habitats provide suitable foraging and nesting opportunities, and existing management practices already incorporate avoidance and minimization measures to prevent disturbance during sensitive periods.

Golden eagles have not been documented nesting within the refuge boundary, but both species are included under the same federal protections and are therefore addressed together as Special Status Species.

Wood Stork

Wood storks are present on the refuge primarily during late summer through early fall (August–October), coinciding with low water levels and prey concentration in managed wetlands. Although nesting has not been documented on the refuge, more than 20 wood stork rookeries occur statewide, and the refuge lies within the regional foraging range used by birds during the nesting season. Wood storks rely on managed wetlands and flooded forested wetlands for efficient foraging, particularly during chick-rearing, when hydrology strongly influences prey availability. Current water-level management on the refuge provides seasonal habitat conditions that benefit wood storks by creating concentrated foraging zones. While wood storks also use refuge wetlands for loafing, all documented use to date has been non-breeding in nature.

Special Status Species: Environmental Consequences

Alternative A

Under Alternative A, current land management activities would remain unchanged. Under Alternative A, no changes would be made to existing land management practices. Current protections under the MBTA and the Eagle Act would continue to be implemented for bald and golden eagles. Because management activities, staffing levels, and operational timing would remain unchanged, no new direct, indirect, or cumulative impacts to any Special Status Species are anticipated.

For bald eagles, continued implementation of existing spatial buffers, activity timing restrictions, and monitoring would ensure that nesting pairs are not disturbed. For wood storks, ongoing water-level management would maintain current foraging opportunities. No additional disturbance or habitat alteration would occur, and thus overall effects on Special Status Species under Alternative A would remain neutral. No additional impacts to any special status species are anticipated under this alternative.

Alternative B

Alternative B would implement additional habitat improvement strategies identified in the Spatial Habitat and Species Management Plan. These actions may include enhanced vegetation management, wetland hydrology refinements, and targeted habitat restoration. While these measures are intended to improve ecological conditions, implementation requires consideration of Special Status Species.

Bald and Golden Eagles

If management actions occur near known bald eagle nests or potential nesting structures, the refuge would apply established protection parameters, including implementation of seasonal and spatial buffers, activity restrictions during the breeding season, and avoidance of high-disturbance actions within recommended distances. These measures ensure compliance with the Eagle Act and prevent disturbance that could constitute “take.” Habitat improvements may yield long-term benefits by supporting prey availability and maintaining suitable nesting and roosting conditions.

Wood Stork

Because wood storks regularly forage on the refuge, habitat enhancement activities in managed wetlands must consider seasonal hydrology and disturbance. Potential short-term disturbances (e.g., noise from equipment, vehicular presence, temporary vegetation trampling) may occur during implementation. However, these effects would be localized, brief, and mitigated through timing and spatial avoidance strategies. If habitat work occurs near potential rookery locations, the Service would apply protective buffers consistent with regional guidance, even though nesting has not been documented on-refuge.

Long term, improved wetland management, habitat structure, and hydrologic control under Alternative B are expected to enhance foraging efficiency for wood storks during their late-summer use of the refuge. Given mitigation measures and the absence of documented nesting, no adverse impacts are expected, and beneficial effects are likely.

Climate Change/Air Quality-Affected Environment –

Air quality within and around Santee National Wildlife Refuge is generally good, with no major stationary emission sources on-refuge and limited industrial activity in the surrounding rural landscape. The refuge is located within an area that meets National Ambient Air Quality Standards (NAAQS). Under existing operations, the primary contributors to localized, temporary air emissions include prescribed fires, routine vehicle use, and operation of small equipment for habitat management.

Prescribed burns conducted under the Fire Management Plan occur on a limited number of acres annually, generating short-duration smoke that disperses rapidly under selected burn-window conditions. Smoke management techniques including appropriate fuel moisture, wind direction, transport winds, and dispersion indices are used to minimize smoke impacts on nearby communities, roadways, and sensitive receptors.

With respect to climate change, the refuge experiences the same regional trends observed across the southeastern coastal plain, including more variable precipitation, increased frequency of intense rainfall, longer growing seasons, and periodic drought. These changes influence hydrology, vegetation growth, and habitat conditions within wetland, forest, and grassland systems. No measurable greenhouse gas (GHG) emissions originate from industrial activity on the refuge; emissions arise only from small-scale management operations.

Climate Change/Air Quality Environmental Consequences

Alternative A

Under the No Action Alternative, current management patterns would continue, and air emissions would remain low and temporary. Prescribed fire would still occur at current intervals, producing short-term smoke that is localized and managed under established burn protocols. Equipment use (e.g., tractors, ATVs, pumps, trucks) would continue at presently low levels, resulting in minor combustion emissions with no long-term air-quality implications.

Greenhouse gas emissions under this alternative would remain minimal and consistent with ongoing refuge operations. Climate change would continue to influence the refuge environment, but the refuge would have limited capacity to adapt forest and grassland structures under present management levels, potentially reducing the system's long-term resilience to climatic shifts. Overall, no significant air-quality or climate-related impacts occur under Alternative A.

Environmental Consequences – Alternative B

Implementation of the SHSMP would result in slightly increased prescribed fire acreage, periodic forest-management operations, and expanded use of equipment needed to carry out thinning, mowing, water-management adjustments, and invasive species control. These

activities would generate minor, short-term increases in combustion emissions including particulates, carbon monoxide, nitrogen oxides, and carbon dioxide.

However, all activities would continue to occur at the refuge scale, under established burn plans, and with Best Management Practices (BMPs) designed to minimize smoke, reduce drift, and ensure favorable dispersion conditions. Smoke impacts would remain temporary, localized, and similar to emissions produced under Alternative A, though occurring on a slightly larger annual footprint. These emissions would remain small relative to regional transportation and industrial sources and would not cause or contribute to a violation of air quality standards.

The proposed land management activities including prescribed fire, mechanical vegetation treatments, limited herbicide use, and operation of refuge equipment would generate minor, short-term greenhouse gas (GHG) emissions. These emissions primarily come from combustion of diesel and gasoline during equipment use and from prescribed burning conducted under approved burn plans. Prescribed burns are expected to occur on limited acreages in any given year and are implemented under conditions that minimize smoke production, including moisture, wind, and dispersion parameters.

Although GHG emissions would occur at small, episodic scales, the Proposed Action would not meaningfully contribute to regional or national greenhouse gas inventories. Refuge activities occur at a landscape scale small relative to statewide wildfire emissions, transportation, energy production, or industrial sectors. In addition, several components of the Proposed Action would support long-term climate resilience:

- Forest thinning and longleaf pine restoration increase stand health, reduce fuel loading, and improve resilience to drought, pests, and severe wildfire.
- Managed wetland improvements can enhance water retention and stabilize seasonal habitat conditions under variable precipitation regimes
- Native grassland restoration contributes to improved soil structure and potential increases in below-ground carbon storage over time.

Geology and Soils:-Affected Environment

Santee National Wildlife Refuge is situated within the South Carolina Coastal Plain, an area underlain by the Santee Limestone formation. While this limestone is exposed at the surface primarily along the Santee River valley and its surrounding counties, its influence is evident in the region's distinctive karst topography. Notable features such as sinkholes, caves, disappearing streams, and solution valleys are present in nearby Santee State Park, reflecting the landscape's development through groundwater activity over geologic time. The limestone itself is composed of limey sands, lime muds, and shell-hash layers, with fossil-rich oyster beds marking the remnants of a shallow continental shelf that existed some 40 million years ago.

These geological characteristics contribute to the unique physical landscape and hydrologic dynamics of the refuge and surrounding areas (USFWS 2008a,b).

The soils within the refuge acquisition area are predominantly poorly drained and acidic, often featuring a perched water table due to a subsurface clayey hardpan. Surface soils are generally sandy to loamy, while subsoils range from silty to clayey textures. The primary soil types include Levy (silty clay loam, very poorly drained), Hobonny (muck, very poorly drained), Lakeland (sand, excessively drained), Rutlege (loamy sand, very poorly drained), Chastain (loam, poorly drained), and Johnston (mucky loam, very poorly drained). These soils support a diversity of wetland and upland habitats, providing essential substrate for the refuge's varied plant communities and wildlife habitat.

Geology and Soils:-Environmental Consequences

Alternative A

Under Alternative A, the refuge would continue implementing all current land management practices identified in the existing Comprehensive Conservation Plan (CCP). Because no new ground-disturbing actions, facility construction, vegetation treatments, or operational changes are proposed, no additional impacts to geology or soils are anticipated beyond those already occurring under existing management.

The refuge's geologic setting including underlying substrates, landforms, and geomorphic processes would remain unchanged. Current management practices do not alter bedrock, geomorphic stability, or landscape-level soil formation processes; therefore, geologic resources would be maintained in their present condition.

Similarly, soil resources would not be modified under the No Action Alternative. Rates of erosion, compaction, sediment transport, and soil disturbance would continue at levels associated with ongoing activities such as routine refuge operations and established visitor use. Because no new activities are proposed that would increase soil exposure, alter drainage, or introduce heavy equipment beyond current patterns, no measurable direct, indirect, or cumulative effects on soils are expected. Existing conditions and ongoing management activities would continue without change, and the physical landscape would remain stable under the current management framework.

Alternative B

Soil disturbance due to restoration and habitat management activities would be expected to be minor and of short duration. To further reduce potential impacts, the refuge would use BMPs to minimize the erosion of soils, as well as seasonal restrictions. The increased use and ongoing maintenance of roads, creation of logging decks, and the operation of heavy equipment may impact soil, causing rutting and erosion (Helfrich et al. 1998; Wiest 1998; Cullen 2001). To minimize potential impacts and erosion, timber harvesting operations would follow the best

management practices as recommended by the South Carolina Forestry Commission. Timber harvesting would occur during dry periods or colder months to reduce soil erosion, compaction, and rutting. Active forest management would occur when site-specific soil conditions are appropriate.

Tree harvesting can have long-term impacts on soil chemistry, with impact intensity based on the harvest method. Whole tree harvesting, or the practice of cutting the entire above-ground portion of a tree and removing it from the forest, typically has the most severe effects and has been documented to increase soil acidity, decrease soil saturation, and alter nutrient concentrations (Vanguelova et al. 2010, Brandtberg and Olsson 2012). Soil disturbance following timber harvest may increase the export of particulate matter and soil nutrients. To reduce the possibility of negatively impacting soil, the Service would conduct timber harvesting during the fall and winter when conditions are driest and when cold temperatures reduce soil compaction and erosion. The Service would apply extra caution when performing management in areas with hydric, steep, shallow, or easily erodible soils.

Heavy equipment could be required for tree harvesting, depending on the magnitude of the harvesting operation. Heavy equipment can damage uncut trees, creating entry points for invasion by insects or disease (Nichols et al. 1994). The construction and maintenance of roads and landings and heavy equipment operation may impact soil, causing rutting and erosion (Helfrich et al. 1998, Wiest 1998). The consequences of compacted soil include increased soil temperatures, reduced moisture (Marion et al. 2016), reduced soil biota (Liddle 1997), and resistance to seed germination and penetration by plant roots (Alessa and Earnhart 2000). Best management practices would be used to protect refuge resources from being damaged by heavy equipment.

The interaction of many factors determines the impact of fire on soil, but most evidence indicates that low-intensity prescribed fires have few, if any, adverse effects. Prescribed fires affect soil by both heat transfer and changes in soil physical properties. The most important soil physical characteristic affected by fire is soil structure because organic matter can be lost at relatively low temperatures. Loss of soil structure can increase bulk density and reduce porosity, thereby reducing soil productivity and making the soil more vulnerable to post-fire runoff and erosion. Prescribed burning in the South normally causes little or no detectable change in amount of organic matter in surface soils. In fact, slight increases have been reported on some burned areas. Some minor extent of soil surface contamination could occur from fuel or other engine fluids, or pesticide spillage, but operators would continue to be cautious about preventing spillage.

Water Resources:-Affected Environment

The hydrology of Santee National Wildlife Refuge is dominated by the presence of Lake Marion, a 110,600-acre reservoir created between 1939 and 1942 as part of a hydroelectric project. This reservoir, together with Lake Moultrie, forms the Santee-Cooper Lake System, one of the

largest drainage basins on the East Coast. The Santee River, originating at the confluence of the Congaree and Wateree Rivers, supplies most of the inflow, supplemented by seasonal precipitation averaging 43 inches annually. The creation of Lake Marion inundated extensive floodplain and bottomland forests, fundamentally altering the region's natural hydrology and converting vast tracts of forested wetlands into open water and managed impoundments.

Water levels in Lake Marion are managed primarily for hydroelectric power generation and recreation, resulting in seasonal fluctuations that often conflict with optimal water management for wildlife habitat within the refuge. High summer lake levels impede gravity drainage from managed impoundments, necessitating the use of pumps to maintain desired water levels for moist-soil vegetation and greentree reservoirs. Conversely, low lake levels in fall and winter can limit the ability to flood impoundments when needed for waterfowl habitat. The permeability of soils and dikes, particularly in the Bluff Unit, further complicates water retention and management. Additionally, the porous limestone aquifer underlying the region is highly susceptible to contamination, making groundwater protection a critical concern for both the refuge and the surrounding community. The maintenance of water quality and the integrity of wetland systems are essential for sustaining the refuge's ecological functions and supporting its diverse assemblage of aquatic and terrestrial species

Water Resources -Environmental Consequences

Alternative A

Under Alternative A, the refuge would continue implementing the existing land management techniques and operational practices identified in the current Comprehensive Conservation Plan (CCP). Because no new actions, projects, or management changes are proposed, no additional impacts on water resources are anticipated beyond those previously analyzed and already occurring under current management. Hydrologic conditions including surface water flow patterns, groundwater interactions, wetland hydrology, and floodplain function would remain consistent with existing baselines. Current management activities have been in place long enough to establish a predictable pattern of water movement, sedimentation, and hydrologic response across the refuge. Continuing these same practices would therefore not introduce new disturbances, alter drainage features, or modify existing water retention or flow regimes.

Alternative B

Research has shown that tree harvesting can affect water quality. For example, several studies have suggested that total mercury and methylmercury leach into the water from tree harvesting areas (Munthe and Hultberg 2004, Porvari et al., 2003, Sørensen et al. 2009). All forest management measures, including harvesting, can increase sediment and nutrient export into the watershed (Ahtiainen and Huttunen 1999, Laurén et al. 2005, Miettinen et al. 2012). Although tree harvesting can cause increases in nutrient concentrations in the watershed,

implementing best management practices can minimize these increases (Wynn et al. 2000).

Road construction, skid trail planning, harvest operation, and stream crossings would, at a minimum, follow the best management practices from the State's forestry agency to minimize hydrological alterations and siltation impacts on water quality. Harvesting would use existing forest roads whenever possible; construction of new roads would occur only when necessary. The decommission of forestry roads would be standard practice after all forest management is completed. The use of vegetative buffers along field edges would continue to provide cover for wildlife and reduces erosion and sedimentation in streams, and along with cautious pesticide/fertilizer application, reduces nutrient and chemical runoff.

4.3 Economic Effects and Effects on the Quality of Life of the American People- Affected Environment

The refuge contributes meaningfully to the economic vitality and quality of life of surrounding communities. As documented in the Comprehensive Conservation Plan (CCP) and supported by recent Conservation Design (CD) analyses, National Wildlife Refuges function as important economic engines in rural areas by attracting visitors, sustaining local recreational spending, and reinforcing the cultural and natural-resource identity of the region.

Santee National Wildlife Refuge provides diverse opportunities for wildlife-dependent recreation including wildlife observation, photography, hunting, fishing, environmental education, and interpretation which together contribute to a steady stream of regional visitation. These activities support local businesses such as lodging, food services, gas stations, outdoor outfitters, and guide services. The refuge also enhances the overall quality of life for residents by protecting scenic open space, preserving ecosystem services, and offering accessible public lands for outdoor recreation, which is an increasingly important driver of community well-being.

The refuge's ecological health, maintained through the CCP and refined in the SHSMP, supports the region's recreational appeal by protecting wetland, forest, and open-water habitats that attract birdwatchers, anglers, photographers, and hunters. As a result, the refuge plays an essential role in sustaining both the economic base and cultural traditions of the surrounding rural communities.

Outdoor recreation including the Service's "Big Six" wildlife-dependent activities of hunting, fishing, wildlife observation, photography, environmental education, and interpretation forms a major economic pillar in South Carolina. These activities generate substantial spending on travel, equipment, lodging, fuel, and recreational supplies, directly supporting rural economies and indirectly reinforcing conservation funding at the state and national level.

National Wildlife Refuges, including Santee NWR, draw visitors from across the Southeast and abroad due to the area's high biodiversity, iconic birdwatching opportunities, and abundant

public-land access. Rural recreation counties dependent on outdoor recreation consistently demonstrate higher-than-average economic growth rates, and public lands such as Santee NWR help anchor this growth. The refuge also improves regional quality of life by providing clean water, aesthetic landscapes, climate resilience, and accessible recreation on public lands, elements increasingly recognized as essential to social well-being and local workforce retention

Economic Effects and Effects on the Quality of Life of the American People: Environmental Consequences

Alternative A

Under Alternative A, current land management and visitor-use levels described in the CCP would continue without modification. Because no changes would occur in available public uses, habitat quality, or access opportunities, economic contributions associated with refuge visitation would remain similar to existing levels. Local spending on food, fuel, lodging, and recreation equipment would continue at present rates, with no anticipated increase or decrease tied to refuge operations.

Quality-of-life benefits associated with open-space preservation, outdoor recreation access, and cultural heritage activities would also remain unchanged. Therefore, Alternative A would result in no additional economic impacts and no change to the quality of life of the American people beyond those currently provided.

Alternative B

Under Alternative B, implementation of habitat improvement actions and strategic forest and wetland management outlined in the SHSMP is expected to enhance wildlife-dependent recreation opportunities, particularly wildlife observation, photography, and potentially expanded hunting access. Incremental increases in visitation are anticipated as habitat conditions improve, bird and wildlife viewing opportunities expand, and communication and outreach efforts increase public awareness of refuge offerings.

These increases, though modest, are expected to enhance local economic activity through additional spending in nearby rural communities including small businesses, lodging providers, gas stations, and sporting-goods retailers. Even minor increases in visitation can generate meaningful cumulative economic benefits over time, particularly in rural areas where outdoor recreation serves as a cornerstone of community identity and economic stability.

In addition, the Proposed Action supports improved quality of life by maintaining healthy ecosystems, improving scenic and wildlife-viewing conditions, offering expanded educational and recreational opportunities, and reinforcing traditional outdoor uses valued by local residents. Although Alternative B is not expected to produce large or sudden economic impacts,

it is fully consistent with Service-wide objectives to expand nature-based recreation, support rural economies, and strengthen the long-term social value of public lands.

4.4 Refuge Resources

Management and Operations: Affected Environment

The Refuge Manager, Wildlife Biologist and Equipment Operator all assist with various aspects of the administration of the Land Management programs. Funds are available to meet the conditions set forth in the Refuge Recreation Act from operating funds. It is anticipated that funding and staffing would continue to be sufficient to maintain the program in the future. If staffing levels are reduced further, the administration of the existing program would be re-evaluated and changes implemented.

Refuge officers primarily carry out the enforcement of refuge regulations. Occasionally officers from nearby Refuges are called to assist. USFWS officers provide for visitor safety and compliance and Service officers work closely with State enforcement officers to ensure compliance with Refuge and State regulations and to address any conflicts with adjoining landowners.

Management and Operations: Environmental Consequences

Alternative A

No additional increase in costs for administration, law enforcement, biological monitoring, or annual maintenance is anticipated for Alternative A.

Alternative B

The refuge manager, in consultation with the regional forester and relevant staff, would develop silvicultural prescriptions and oversee all forest-related activities on the refuge. The costs associated with commercial forest management would vary depending on the scope, goals, and objectives of the operation. With existing staff capacity, periodic and small-scale timber harvests can be administered properly and safely, and in a manner that does not materially interfere with or detract from achieving the refuge's purposes or the mission of the National Wildlife Refuge System. Most forest management activities would be conducted using contract labor or through timber sales to forest products companies that employ or subcontract professional logging crews, reducing the need for specialized equipment or refuge-owned infrastructure.

An initial investment of approximately \$14,000 would be required to complete the forest management plan and to develop signage and informational brochures prior to implementing on-the-ground forest management actions. Following plan development, the average annual cost to support forest management activities at Santee NWR is estimated at \$6,500. These recurring costs include posting required signage and administering and overseeing contractual

work. Revenue generated through permit fees or timber sale receipts would not offset management expenses, as such funds are deposited into general accounts rather than being returned to the refuge for local use.

Visitor Use and Experience: Affected Environment

The Refuge is open to all six-priority wildlife dependent public uses; hunting, fishing, wildlife observation, photography, environmental education and interpretation. With the 605 units of the National Wildlife Refuge System (NWRS), the U.S. Fish and Wildlife Service (USFWS) manages public lands in all 50 states and 5 U.S. territories and within an hour's drive of 100 major cities. This varied and abundant network of public lands and waters generates many individual and societal benefits. These include, but are not limited to, fish and wildlife conservation, open space, science and education, water quality improvement and flood resilience. The thriving fish and wildlife populations of the Refuge System also attract millions of recreational users. Some visitors take part in heritage sports such as hunting and fishing (consumptive). Others enjoy hiking, paddling, wildlife viewing or nature photography (non-consumptive). This report focuses on economic contributions associated with recreational visitation. As a result, these are conservative estimates and do not represent the refuge's total social and environmental contributions.

This report examines the local economic contributions of recreational visits to 162 national wildlife refuges in 47 states and 1 territory for the fiscal year (FY) 2017 (October 1, 2016 - September 30, 2017). Furthermore, this report utilizes the individual refuge results to estimate the local economic contributions of the entire Refuge System. Findings of this study include: For FY 2017, the National Wildlife Refuge System estimated 53.6 million visitors to national wildlife refuges. Trip-related spending by recreational visits generated \$3.2 billion of economic output in local economies. As this spending flowed through the economy, it supported over 41,000 jobs and generated about \$1.1 billion in employment income. About 86 percent of total recreation-related expenditures are generated by non-consumptive activities on refuges. Fishing accounted for 10 percent and hunting 4 percent of expenditures. On average, local visitors accounted for 17 percent of expenditures while visitors traveling more than 50 miles accounted for 83 percent of expenditures. Refuge recreational spending generated about \$229 million in tax revenue at the local, county, and state.

Visitor Use and Experience: Environmental Consequences

Alternative A

Under this alternative, current Refuge visitor use opportunities would continue across the Refuge. Status quo. The Refuge would continue historical land management activities and to serve as habitat for fish and wildlife, as well as provide outdoor recreational opportunities for all six-priority wildlife dependent public uses; hunting, fishing, wildlife observation,

photography, environmental education and interpretation.

Alternative B

All other public uses on the Refuge would not change and would continue to be managed as described in current plans. Overall, land management impacts to visitor services or other recreation opportunities are considered short-term, minor, and local since other parts of the Refuge are available for use. Impacts between land management activities and visitors are anticipated to be similar to the impacts between other user groups (eg. hikers and photographers) and would be negligible. The Refuge could employ time and space zoning measures to separate and reduce the likelihood of conflict. The noise associated with tree harvesting could disturb visitors and impact their safety. To ensure visitor safety, areas of the refuge where tree harvesting occurs may be temporarily closed. Signage would be utilized to inform visitors of land management activities as appropriate and necessary.

4.5 Minimization Measures to Avoid Negative Impacts

Continuing to employ appropriate BMPs, the Proposed Action Alternative would refine and update current refuge management activities to respond to changing conditions in the landscape, enhance refuge habitat and species management activities, and serve refuge purposes and goals.

The Service, and other partners would continue to coordinate to minimize impacts to the refuge, including minimizing access to pertinent management and monitoring activities at times when impacts would be minimized and restricting public access.

Before conducting forest management projects such as thinning operations or applying prescribed fire, a site-specific prescription would be developed in accordance with the PBO for Bats (USFWS 2024). The management prescription would minimally identify the refuge's resources of concern and any management constraints (e.g., cultural resources, ESA), describe the forest's current condition, outline the forest's desired future condition, and identify the processes and treatment(s) required to shift toward desired conditions. Additionally, a Section 106 (cultural resources review) and Section 7 (ESA intra-service consultation and use of USFWS 2024) would be completed before the prescription would be approved for implementation. Finally, as applicable (e.g., for a Service contractor conducting forest thinning for the refuge), a Service Special Use Permit would outline necessary stipulations required for the activity to remain compatible and meet refuge objectives. The Refuge Manager would ensure project implementation that specifically supports refuge plans and compliance documents (e.g., CCP, SHSP, Fire Management Plan, Cooperative Agriculture Agreement, Forest Management Prescription, and Compatibility Determination), meets applicable laws and policies, and includes appropriate conservation measures and BMPs.

Should previously unrecorded cultural resources or human remains be discovered on refuge land, activities would be halted and the Regional Archaeologist and Refuge Manager contacted at once.

Monitoring

The Service would continue to work with partners, to monitor resources of management concern. The Proposed Action would apply adaptive management, specific survey, inventory, and monitoring protocols as necessary. The habitat management strategies would be systematically evaluated to determine management effects on wildlife populations. This information would be used to refine approaches and determine how effectively the objectives are being accomplished. If monitoring and evaluation indicate undesirable effects for target, non-target species, and/or communities, then adaptations to the management strategies would be made.

4.6 Reasonably Foreseeable Effects: Affected Environment

The terminology “reasonably foreseeable effects” is used throughout this EA and refers to effects that are sufficiently likely to occur and that encompass both the direct and indirect effects of the action as well as effects of the action when combined with other potential past, present, and future effects." For an EA, the reasonably foreseeable effects analysis is done only to a sufficient level to allow the decision-maker to make a determination of significance for the proposed action, as stated in the Service Manual (550 FW 1).

Under both the No Action and Action Alternatives, the refuge would continue to experience reasonably foreseeable external pressures such as regional development, landscape fragmentation, altered hydrology, and climate-driven changes. The way each alternative positions the refuge’s forests and wildlife to cope with those pressures differs substantially.

Under the No Action Alternative, forest stands would continue aging without density reduction or structural restoration. Over time, overstories would close further, understory conditions would degrade, and mixed pine-hardwood habitats would drift farther from desired ecological conditions needed to support refuge priority species. Without periodic thinning or regeneration harvests, the refuge’s ability to mimic natural disturbance regimes would decline, resulting in reduced wildlife habitat quality and lower ecological resistance to storm events, drought, and pest/disease outbreaks; pressures that are reasonably foreseeable and likely to intensify.

Heavy canopy closure could also decrease understory light availability, slowing natural regeneration and reducing long-term resilience of key habitat types, particularly longleaf pine and mixed hardwood-pine systems. Changes to microhabitats, reductions in coarse woody debris quality, and slower recruitment of high-value habitat structures would diminish the refuge’s ability to support amphibians, invertebrates, and species reliant on a mosaic of successional stages.

The No Action Alternative would also provide less protection to aquatic resources. Without targeted thinning and BMP-directed operational restrictions, unmanaged aging stands may become increasingly susceptible to windthrow and storm damage, leading to pulses of sediment, woody debris, and nutrient loading into streams during extreme events, which are expected to occur more frequently under climate-driven conditions. The refuge's ability to buffer watershed impacts from surrounding land-use growth would therefore be reduced. In contrast, the No Action Alternative allows known and likely pressures such as climate change, adjacent development, and hydrological alteration to degrade forest health, wildlife habitat quality, and overall adaptive capacity over time.

Under the Action Alternative, continued commercial forest management using selective thinning, shelterwood, and seed tree harvests would actively shift forest structure toward desired future conditions described in the SHMP, including conversion of loblolly pine to longleaf pine and improved mixed hardwood-pine structure.

Managed disturbance would maintain canopy openings, promote understory regeneration, and mimic natural processes such as fire, allowing habitats to retain greater structural diversity and ecological function even as climate conditions shift.

These conditions increase resilience to storm damage, drought, disease outbreaks, and invasive species spread by reducing stand density, improving light penetration, and maintaining spatial heterogeneity. The Action Alternative also reduces the likelihood that aging, overstocked stands become more vulnerable to windthrow, pest outbreaks, or catastrophic habitat loss during extreme weather events, which are reasonably foreseeable under changing climate conditions.

Wildlife dependent on early-successional or structurally diverse forest such as Neotropical songbirds, painted bunting, and species that benefit from increased understory productivity would retain or improve habitat suitability under this alternative. Managed thinning also improves conditions for bat species by retaining snags and cavity trees while reducing clutter and increasing foraging space, improving their ability to persist despite projected environmental shifts.

Aquatic systems, which are susceptible to nutrient pulses, sedimentation, and thermal changes, remain better protected under a BMP-guided harvest regime that maintains forested buffers, limits soil disturbance, and reduces hydrological impacts in a future where nutrient loading and altered streamflow may increase due to regional development patterns.

Overall, the Action Alternative positions the refuge to better maintain species and habitat resilience under reasonably foreseeable environmental change by proactively shaping forest

structure, maintaining disturbance-dependent habitat conditions, and reducing vulnerabilities associated with unmanaged stand maturation.

The activities proposed are standard refuge management practices supported by BMPs and the Programmatic Biological Opinion (PBO) for bats. Effects are well-understood and not characterized by substantial scientific controversy or uncertainty. The Proposed Action incorporates avoidance and minimization measures identified through Section 7 consultation and the PBO and effects on listed species are expected to remain minimal and within previously evaluated thresholds. Cumulative effects when considered with past, present, and reasonably foreseeable future actions, are expected to remain minor, localized, and not cumulatively significant.

4.7 Summary of Analysis

Alternative A – Continue Current Management – No Action Alternative

As described above, land management on the Refuge would be maintained at current levels with no significant changes. Under Alternative A, impacts to threatened and endangered species and other special status species would be expected to continue to be negligible to minor beneficial. Impacts to habitat and vegetation under Alternative A would be expected to be minor adverse to minor beneficial. Minor beneficial impacts would be expected for hydrology. No impacts would be anticipated for geology. Negligible to minor effects would be expected to soils and soil formation processes with continued farming activities. Negligible to minor adverse impacts would be anticipated for water quality, and negligible impacts would be anticipated for air quality. No impacts would be anticipated for land use on and around the refuge. Refuge management activities would remain substantially similar to past management. There is not likely to be an adverse effect on endangered or threatened species.

Alternative B – Implement the 2026 Santee NWR Spatial Habitat and Species Management Plan – Preferred Alternative

Alternative B implements the Spatial Habitat and Species Plan (Proposed Action) which steps down and provides specifics to several of the identified goals and objectives outlined in the CCP without changing the original intent. The focus under this alternative would be to manage, maintain, restore, and protect the refuge's habitats and wildlife species.

While minor adverse temporary impacts could be expected during habitat management and restoration activities under the Proposed Action, overall, minor beneficial impacts to wildlife and aquatic species, threatened and endangered species, and other specie status species would be expected. Under the Proposed Action, more active restoration, habitat management, and monitoring would occur. Minor beneficial impacts would be expected for habitat and vegetation under Alternative B. The SHSMP adds slightly increased prescribed fire acreage and

periodic equipment use, resulting in minor, short-term greenhouse gas and smoke emissions. These activities remain small relative to regional emissions sources. Long-term, habitat improvements (forest health, wetland resilience, grassland restoration) enhance ecosystem resilience to climate variability. No significant climate or air-quality impacts would occur.

Comparison of Alternatives

Table 2 summarizes the level of impact for each alternative under each affected resource analyzed. The level of impacts described in the table includes a summary of the intensity of the impact. Intensity describes the severity of the impact and includes both positive and negative effects as well as the net effect. When assessing significance, both context and intensity must be considered to determine whether potential impacts are “significant” under NEPA and the level of review. Context describes the geographic, biophysical, and social setting where effects would occur and can be found in the appropriate affected resource section.

Table 2. Comparison of Alternatives of Actions

Affected Resource	Alternative A: No Action	Alternative B: 2026 Spatial Habitat and Species Management Plan (Preferred Alternative)
Habitat and Vegetation	Negative short-term localized impacts	Negative short-term localized impacts similar to Alternative A but negligible increase, albeit spread over a larger geographical area. Minor beneficial long term impacts.
Fish and Wildlife Species	Negligible short-term and localized impacts	Negligible short-term and localized impacts. Minor beneficial long term impacts.
Candidate, Threatened and Endangered Species and Critical Habitat:	Overall impacts are considered less than significant	Overall impacts are considered less than significant Minor beneficial long term impacts.
Special Species Status	Negligible overall potential impacts	Negligible overall potential impacts

		Minor beneficial long term impacts.
Climate Change/Air Quality	Negative short-term localized impacts	Negligible overall potential impacts Minor beneficial long term impacts.
Geology and Soils	Negative short-term localized impacts	Negligible overall potential impacts Minor beneficial long term impacts.
Water Resources	Negative short-term localized impacts	Negligible overall potential impacts Minor beneficial long term impacts.
Economic Effects and Effects on the Quality of Life of the American People	Positive impacts	Positive impacts
Management and Operations	Negligible overall potential impacts	Compared to alternative A, there is a slight increase in potential expenditures
Visitor Use and Experience	Negligible overall potential impacts	Compared to alternative A, there is a slight increase in visitor use, albeit spread over a larger geographical area. Minor beneficial long term impacts.

Conclusion

Based on the above analyses, the Service expects that none of the alternatives considered above would have any significant adverse or beneficial impacts on the human environment. No significant adverse or beneficial long-term or foreseeable impacts would be anticipated under either of the alternatives. As outlined and analyzed above, Alternative B (Proposed Action) best meets the stated purpose and need.

Chapter 5: List of Preparers and Sources

5.1 List of Preparers

Daniel P Asyn, Refuge Biologist, Santee NWR, National Wildlife Refuge System, Southeast Region, USFWS

Brett Craig, Wildlife Refuge Manager, Santee NWR, National Wildlife Refuge System, Southeast Region, USFWS

Emery Hoyle, Refuge Supervisor, Area III, National Wildlife Refuge System, Southeast Region, USFWS

Maena Angelotti, Natural Resource Planner, National Wildlife Refuge System, Southeast Region, USFWS

Katy McCurdy, Geographer/GIS Specialist, National Wildlife Refuge System, Southeast Region, USFWS

Megan E Lapinsky, GIS Support Member, National Wildlife Refuge System, Southeast Region, American Conservation Experience/USFWS

5.2 State /Federal Coordination

- South Carolina Department of Administration State Clearinghouse

5.3 Tribal Consultation

- Absentee Shawnee Tribe
- Catawba Indian Nation
- Shawnee Tribe
- Eastern Shawnee Tribe of Oklahoma

Chapter 6: Certification and Determination

The Services prepared this Draft EA pursuant to the NEPA (42 U.S.C. 4321 et seq.), the DOI NEPA Implementing Regulations (43 CFR 46), the DOI Handbook of NEPA Implementing Procedures (516 DM 1) and other applicable Federal and state laws and regulations.

References

- Allen, M., J. Burger, and J. Lockwood. 2019. Evaluation of unharvested refugia for grassland bird conservation within active hayfields. *Avian Conservation and Ecology* 14:15.
- Alessa, L. and C. G. Earnhart. 2000. Effects of soil compaction on root and root hair morphology: Implications for campsite rehabilitation. In Cole, D. N., S. F. McCool, W. T. Borrie, J. O Loughlin (comps.). 2000. *Wilderness science in a time of change conference-Volume 5: Wilderness ecosystems, threats, and management*; 1999 May 23 27; Missoula, MT. Proceedings RMRS-P-15-VOL-5.
- Ahtiainen, M. and P. Huttunen. 1999. Long-term effects of forestry managements on water quality and loading in brooks. *Boreal Environment Research* 4:101–114.
- Anderson, L. G., S. Roccliffe, N. R. Haddaway, and A. M. Dunn. 2015. The role of tourism and recreation in the spread of non-native species: A systematic review and meta-analysis. *PloS ONE* 10:p.e0140833.
- Beale, C. M. and P. Monaghan. 2004. Behavioural responses to human disturbance: A matter of choice? *Animal Behavior* 68:1065–1069. doi:10.1016/j.anbehav.2004.07.002
- Bélanger, L. and J. Bédard. 1990. Energetic cost of man-induced disturbance to staging snow geese. *Journal of Wildlife Management* 54:36–41.
- Bennett, K. P. (Ed.). 2010. *Good forestry in the Granite State: Recommended voluntary forest management practices for New Hampshire*, 2nd ed. University of New Hampshire, Cooperative Extension. Durham, NH.
- Birckhead, J. L., C. A. Harper, P. D. Keyser, D. McIntosh, E. D. Holcomb, G. E. Bates, and J. C. Waller. 2014. Structure of avian habitat following hay and biofuels production in native warm-season grass stands in the mid-south. *Journal of the Southeastern Association of Fish and Wildlife Agencies* 1:115–121.
- Boggess, E. K., G. R. Batcheller, R. G. Linscombe, J. W. Greer, M. Novak, S. B. Linhart, D. W. Erickson, A. W. Todd, D. C. Juve, and D. A. Wade. 1990. Traps, trapping, and forbearer management. The Wildlife Society, Bethesda, MD. *Wildlife Society Technical Review* 90–1.
- Bollinger, E. K., P. B. Bollinger, and T. A. Gavin. 1990. Effects of hay-cropping on eastern population of the bobolink. *Wildlife Society Bulletin* 18:142–150.
- Bormann, F. H., G. E. Likens, D. W. Fisher, and R. S. Pierce. 1968. Nutrient loss accelerated by clear-cutting of a forest ecosystem. *Science*, 159:882–884.

- Bormann, F.H., G. E. Likens, T. G. Siccama, R. S. Pierce, and J. S. Eaton. 1974. The export of nutrients and recovery of stable conditions following deforestation at Hubbard Brook. *Ecological Monographs*, 44:255–277.
- Boyles, J. G. and D. P. Aubrey. 2006. Managing forests with prescribed fire: implications for a cavity-dwelling bat species. *Forest Ecology and Management* 222:108–115.
- Brandtberg, P.O. and B. A. Olsson. 2012. Changes in the effects of whole tree harvesting on soil chemistry during 10 years of strand development. *Forest Ecology and Management* 277:150–162.
- Burger, J. and M. Gochfeld. 1998. Effects of ecotourists on bird behavior at Loxahatchee National Wildlife Refuge, FL. *Environmental Conservation* 25:13–21.
- Cahall, R., J. Hayes, and M. Betts. 2013. Will they come? Long-term response by forest birds to experimental thinning supports the “field of dreams” hypothesis. *Forest Ecology and Management* 304: 137–149.
- Campbell, S. P., J. W. Witham, and M. L. Hunter. 2007. Long-term effects of group-selection timber harvesting on abundance of forest birds. *Conservation Biology* 21:1218–1229.
- Campbell, I, and T. Doeg. 1989. Impact of timber harvesting and production on streams: A review. *Marine and Freshwater Research*, 40:519–539.
- Castelle, A. J., A. W. Johnson, and C. Conolly. 1994. Wetland and stream buffer size requirements a review. *Journal of Environmental Quality*, 23:878–882.
- Cullen, J. B. (Ed.). 2001. Best management practices for erosion control on timber harvesting operations in New Hampshire. University of New Hampshire Cooperative Extension.
- Currylow, A. F., B. J. MacGowan, and R. N. Williams. 2012. Short-term forest management effects on a long-lived ectotherm. *PLoS ONE* 7:e40473.
<https://doi.org/10.1371/journal.pone.0040473>.
- Davies, K. W. and R. L. Sheley. 2007. A conceptual framework for preventing the spatial dispersal of invasive plants. *Weed Science* 55:178–184.
- Dechant, J. A., M. L. Sondreal, D. H. Johnson, L. D. Igl, C. M. Goldade, M. P. Nenneman, A. L. Zimmerman, and B. R. Euliss. 2002. Effects of management practices on grassland birds: Loggerhead shrike. USGS Northern Prairie Wildlife Research Center, Jamestown, ND. 19 pp.
<https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1140&context=usgspwrc>

- deMaynadier, P.G. and M. L. Hunter Jr. 1995. The relationship between forest management and amphibian ecology: A review of the North American literature. *Environmental Review* 3:230–261.
- Eiswerth, M. E., T. D. Darden, W. S. Johnson, J. Agapoff, and T. R. Harris. 2005. Input–output modeling, outdoor recreation, and the economic impacts of weeds. *Weed Science* 53:130–137.
- Fedrowitz, K., J. Koricheva, S. C. Baker, D. B. Lindenmayer, B. Palik, R. Rosenvald, W. Beese, J. F. Franklin, J. Kouki, E. Macdonald, C. Messier, A. Sverdrup-Thygeson, and L. Gustafsson. 2014. Can retention forestry help conserve biodiversity? A meta-analysis. *Journal of Applied Ecology* 51:1669–1679.
- Fredericksen, T. S., B. D. Ross, W. Hoffman, E. Ross, M. L. Morrison, J. Beyea, M. B. Lester, and B. N. Johnson. 2000. The impact of logging on wildlife: A study in northeastern Pennsylvania. *Journal of Forestry* 98:4–10.
- Frid, A. and L. M. Dill. 2002. Human-caused disturbance stimuli as a form of predation risk. *Conservation Ecology* 6.
- Gutzwiller, K. J., R. T. Wiedenmann, K. L. Clements, and S. H. Anderson. 1994. Effects of human intrusion on song occurrence and singing consistency in subalpine birds. *The Auk* 111:28–37.
- Harper, C. A. 2007. Strategies for managing early succession habitat for wildlife. *Weed Technology* 21:932–937.
- Helfrich, L. A., D. L. Weigmann, and R. J. Neves. 1998. Landowner’s guide to managing streams in the Eastern United States. Virginia Cooperative Extension, Blacksburg, VA.
- Heller M. 2026. FWS NWRS Management Units 2026. National Wildlife Refuge System. NWRS System-wide.
- Herkert, J. R., D. W. Sample, and R. E. Warner. 1996. Management of midwestern grassland landscapes for the conservation of migratory birds. U.S. Department of Agriculture Forest Service. 116 pp.
https://www.researchgate.net/publication/237399479_Management_of_Midwestern_Grassland_Landscapes_for_the_Conservation_of_Migratory_Birds
- Holmes, S. B. and D. G. Pitt. 2007. Response of bird communities to selection harvesting in a northern tolerant hardwood forest. *Forest Ecology and Management* 238:280–292.
- Hunter, C. 2020. Southeastern Broad Ecological System Habitat Classification database.

<<https://ecos.fws.gov/ServCat/Reference/Profile/132348>>.

Hunter, W. C. 2006. Painted Bunting (Eastern subspecies): Description. South Carolina Department of Natural Resources
<<https://www.dnr.sc.gov/cwcs/pdf/PaintedBunting.pdf>>.

Ikuta, L. A. and D. T. Blumstein. 2003. Do fences protect birds from human disturbance? *Biological Conservation* 112:447–452. doi:10.1016/S0006-3207(02)00324-5

Kucera International and South Carolina Department of Natural Resources. (2023). South Carolina Aerial Imagery 2023: True Color RGB [Data set]. Esri ArcGIS Online.
https://tiles.arcgis.com/tiles/RvqSyw3dIl7dTKo5/arcgis/rest/services/SC_2023_RGB/MapServer

Laurén, A., L. Finér, H. Koivusalo, T. Kokkonen, T. Karvonen, S. Kellomäki, H. Mannerkoski, and M. Ahtiainen. 2005. Water and nitrogen processes along a typical water flowpath and streamwater exports from a forested catchment and changes after clear-cutting: A modelling study. *Hydrology and Earth System Sciences* 9:657–674.

Liddle, M. 1997. *Recreation ecology: The ecological impact of outdoor recreation and ecotourism*. Chapman & Hall Ltd.

Livezey, K. B., E. Fernández-Juricic, and D. T. Blumstein. 2016. Database and metadata of bird flight initiation distances worldwide to assist in estimating human disturbance effects and delineating buffer areas. *Journal of Wildlife Management* 7. doi:10.3996/082015-JFWM-078

Marion, J. L., Y. Leung, H. Eagleston, and K. Burroughs. 2016. A review and synthesis of recreation ecology research findings on visitor impacts to wilderness and protected natural areas. *Journal of Forestry* 114:352–362.

Marion, J. L., Y. F. Leung, and S. K. Nepal. 2006. Monitoring trail conditions: New methodological considerations. *The George Wright Forum* 23:36–49.

Martín, B., S. Delgado, A. de la Cruz, S. Tirado, and M. Ferrer. 2015. Effects of human presence on the long-term trends of migrant and resident shorebirds: Evidence of local population declines. *Animal Conservation* 18:73–81.

Miettinen, J., M. Ollikainen, L. Finér, H. Koivusalo, A. Laurén, and L. Valsta. 2012. Diffuse load abatement with biodiversity co-benefits: The optimal rotation age and buffer zone size. *Forest Science* 58:342–352.

Morgan, M. and M. Burger. 2008. A plan for conserving grassland birds in New York: Final report to the New York State Department of Environmental Conservation. Contract

- Number C005137. 144 pp.
https://www.researchgate.net/publication/228618535_A_plan_for_conserving_grassland_birds_in_New_York_Final_report_to_the_New_York_State_Department_of_Environmental_Conservation_under_contract_C005137
- Müllner, A., K. E. Linsenmair, and M. Wikelski. 2004. Exposure to ecotourism reduces survival and affects stress responses in hoatzin chicks (*Opisthocomus hoazin*). *Biological Conservation* 118:549–558.
- Munthe, J. and H. Hultberg. 2004. Mercury and methylmercury in runoff from a forested catchment—concentrations, fluxes, and their response to manipulations. In *Biogeochemical Investigations of Terrestrial, Freshwater, and Wetland Ecosystems across the Globe* (pp. 607–618). Springer, Dordrecht.
- Nichols, M. T., R. Lemin Jr., and W. D. Ostrofsky. 1994. The impact of two harvesting systems on residual stems in a partially cut stand of northern hardwoods. *Canadian Journal of Forest Research* 24:350–357.
- Organ, J. F., T. Decker, J. Distefano, K. Elowe. and P. Rego. 1996. Trapping and furbearer management: Perspectives from the Northeast. Northeast Furbearer Resources Technical Committee. Massachusetts Division of Fish and Wildlife, Division of Federal Aid, Hadley, Massachusetts.
- Osborne, L. L and D. A. Kovacic. 1993. Riparian vegetated buffer strips in water- quality restoration and stream management. *Freshwater Biology*, 29:243–258.
- Pauli, B. P., P. A. Zollner, G. S. Haulton, G. Shao, and G. Shao. 2015. The simulated effects of timber harvest on suitable habitat for Indiana and northern long-eared bats. *Ecosphere* 6:1–24. <http://dx.doi.org/10.1890/ES14-00336.1>
- Pease, M. L., R. K. Rose, and M. J. Butler. 2005. Effects of human disturbance on the behavior of wintering ducks. *Wildlife Society Bulletin* 33:103–112.
- Perlut, N. G., A. M. Strong, T. M. Donovan, and N. J. Buckley. 2006. Grassland songbirds in a dynamic management landscape: Behavioral responses and management strategies. *Ecological Applications* 16:2235–2247.
- Petrasova, A., Sanchez, G.M., Lawrimore, M.A., Vogler, J.B., Collins, E.L., Petras, V., Harper, T., Butzler, E., and Meentemeyer, R.K., 2023, FUTURES v2: Status Quo Projections of Future Patterns of Urbanization Across the Conterminous United States from 2020 to 2100: U.S. Geological Survey data release, <https://doi.org/10.5066/P94N3ICH>

- Porvari, P., M. Verta, J. Munthe, and M. Haapanen. 2003. Forestry practices increase mercury and methyl mercury output from boreal forest catchments. *Environmental Science and Technology* 37:2389–2393.
- Ruel, J. 1995. Understanding windthrow: Silvicultural implications. *The Forestry Chronicle* 71:434–445.
- Sakai, A. K., F. W. Allendorf, J. S. Holt, D. M. Lodge, J. Molofsky, K. A. With, S. Baughman, R. J. Cabin, J. E. Cohen, N. C. Ellstrand, D. E. McCauley, P. O’Neil, I. M. Parker, J. N. Thompson, and S. G. Weller. 2001. The population biology of invasive species. *Annual Review of Ecology and Systematics* 32:305–332.
- Scheller, R. and D. Mladenoff. 2004. A forest growth and biomass module for a landscape simulation model, LANDIS: Design, validation, and application. *Ecological Modelling* 180:211–229. 10.1016/j.ecolmodel.2004.01.022
- Scheller, R. M., and D. J. Mladenoff. 2002. Understory species patterns and diversity in old-growth and managed northern hardwood forests. *Ecological Applications*, 12:1329–1343.
- Seymour, R. S., A. S. White, and P. G. deMaynadier. 2002. Natural disturbance regimes in northeastern North America—evaluating silvicultural systems using natural scales and frequencies. *Forest Ecology and Management* 155:357–367.
- Siitonen, J. 2001. Forest management, coarse woody debris and saproxylic organisms: Fennoscandian boreal forests as an example. *Ecological Bulletins* 49:11–41.
- Soil Science Division Staff. 2017. Examination and description of soil profiles. In C. Ditzler, K. Scheffe, and H.C. Monger (eds.) *Soil survey manual*, USDA Handbook 18, Government Printing Office, Washington, D.C., p. 214.
- Soil Survey Geographic Database (SSURGO), Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at https://landscape11.arcgis.com/arcgis/rest/services/USA_Soils_Map_Units/featureserv er. Accessed June 2026.
- Sorensen, R., M. Meili, L. Lambertsson, C. von Brömssen, and K. Bishop. 2009. The effects of forest harvest operations on mercury and methylmercury in two boreal streams: Relatively small changes in the first two years prior to site preparation. *Ambio* 38:364–372.
- South Carolina Forestry Commission. 2021. *Best Management Practices for Forestry*. Columbia, SC. 65pp.

- South Carolina Department of Natural Resources (SCDNR). 2015. South Carolina's State Wildlife Action Plan. South Carolina Department of Natural Resources, Columbia, South Carolina.
- South Carolina Department of Natural Resources (SCDNR). 2025. South Carolina's State Wildlife Action Plan. South Carolina Department of Natural Resources, Columbia, South Carolina.
- Southeast Conservation Adaptation Strategy (SECAS). (2025). Southeast Conservation Blueprint 2025. Southeast Conservation Adaptation Strategy. <https://secas-fws.hub.arcgis.com/pages/blueprint>
- Thiel, D., S. Jenni-Eiermann, V. Braunisch, R. Palme, and L. Jenni. 2008. Ski tourism affects habitat use and evokes a physiological stress response in capercaillie Tetrao urogallus: A new methodological approach. *Journal of Applied Ecology* 45:845–853.
- Thomas, K., R. G. Kvitek, and C. Bretz. 2003. Effects of human activity on the foraging behavior of sanderlings *Calidris alba*. *Biological Conservation* 109:67–71.
- Torquetti, C. G., A. T. B. Guimarães, and B. Soto-Blanco. 2021. Exposure to pesticides in bats. *Science of the Total Environment* 755:142509.
- Twedt, D. J., and S. G. Somershoe. 2009. Bird response to prescribed silvicultural treatments in bottomland hardwood forests. *The Journal of Wildlife Management*, 73:1140–1150.
- Tyler, G. A., R. E. Green, and C. Casey. 1998. Survival and behaviour of Corncrake *Crex crex* chicks during the mowing of agricultural grassland. *Bird Study* 45:35–50.
- U.S. Census Bureau, South Carolina roads from counties Clarendon, Berkeley, and Orangeburg, TIGER/Line Shapefiles: Roads, 2025, 2025 TIGER/Line® Shapefiles, accessed on April 29, 2026.
- U.S. Department of Agriculture. 2009. Summary report: 2007 National Resources Inventory. Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. 123 pages. http://www.nrcs.usda.gov/technical/NRI/2007/2007_NRI_Summary.pdf
- U.S. Environmental Protection Agency. (2013). Level III Ecoregions of the Conterminous United States. [Vector data set]. U.S. EPA Office of Research and Development - National Health and Environmental Effects Research Laboratory. <https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states>
- U.S. Environmental Protection Agency. (2013). Level IV Ecoregions of the Conterminous United States. [Vector data set]. U.S. EPA Office of Research and Development - National Health and Environmental Effects Research Laboratory. <https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states>

- U.S. Fish and Wildlife Service. 2000. Part 603 FW 2: National Wildlife Refuge System Uses-- Compatibility. Fish and Wildlife Service Manual. Division of Conservation Planning and Policy. <https://www.fws.gov/policy/603fw2.html>
- U.S. Fish and Wildlife Service. 2006. Part 601 FW 3. National Wildlife Refuge System—Biological Integrity, Diversity, and Environmental Health. Division of Natural Resources. <https://www.fws.gov/policy/601fw3.html>
- U.S. Fish and Wildlife Service (USFWS). 2008a. Santee National Wildlife Refuge draft comprehensive conservation plan and environmental assessment. U.S. Department of the Interior, Fish and Wildlife Service, Southeast Region, Atlanta, GA. 261 pp. <https://ecos.fws.gov/ServCat/Reference/Profile/148891>
- U.S. Fish and Wildlife Service (USFWS). 2008b. Santee National Wildlife Refuge comprehensive conservation plan. U.S. Department of the Interior, Fish and Wildlife Service, Fish and Wildlife Service, Southeast Region, Atlanta, GA. 224 pp. <https://ecos.fws.gov/ServCat/Reference/Profile/1504>
- U.S. Fish and Wildlife Service (USFWS). 2014. Endangered and threatened wildlife and plants; reclassification of the U.S. breeding population of the wood stork from endangered to threatened. Federal Register 79:37078–37103.
- U.S. Fish and Wildlife Service. 2019. Indiana bat (*Myotis sodalis*) 5-year review: Summary and evaluation. Indiana Ecological Services Field Office, Great Lakes Region (Midwest Region), U.S. Fish and Wildlife Service, U.S. Department of the Interior, Bloomington, IN. https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3382.pdf
- U.S. Fish and Wildlife Service. 2020. U.S. Fish and Wildlife Service National Ecosystem Regions. U.S. Fish and Wildlife Service.
- U.S. Fish and Wildlife Service. 2021. Species status assessment (SSA) report for the tricolored bat (*Perimyotis subflavus*), version 1.1. U.S. Fish and Wildlife Service, Northeast Region, Hadley, MA. 158 pp. <https://ecos.fws.gov/ServCat/DownloadFile/221212>
- U.S. Fish and Wildlife Service (USFWS). 2022. Natural Resource Prioritization Phase I Decision Report: Santee National Wildlife Service. U.S. Department of the Interior, U.S. Fish and Wildlife Service, Southeast Region, Atlanta, Georgia, USA
- U.S. Fish and Wildlife Service. 2022b. Species status assessment report for the northern long-eared bat (*Myotis septentrionalis*), version 1.2. Great Lakes Region (Midwest Region), U.S. Fish and Wildlife Service, U.S. Department of the Interior. Bloomington, MN. <https://ecos.fws.gov/ServCat/DownloadFile/225001>

- U. S. Fish and Wildlife Service. 2024a. Programmatic Biological Opinion: Implementation of Forest Habitat Management Practices on National Wildlife Refuges in the Southeast Region for Tree Roosting Bats. Southeast Region. Atlanta, GA.
- U.S. Fish and Wildlife Service. 2025. Santee National Wildlife Refuge Inventory and Monitoring Plan. Southeast Region. Atlanta, GA.
- U.S. Fish and Wildlife Service. 2025. REGIONAL DIRECTOR'S ORDER NO. R4 M-25-05 . Guidance for Monarch Butterfly and Pollinator Habitat Standards. Southeast Region. Atlanta, GA.
- U.S. Fish and Wildlife Service. 2026. U.S. Fish and Wildlife Service Buildings Points. U.S. Fish and Wildlife Service.
- USFWS, NWRS, Division of Realty. 2026. FWS National Realty Approved Acquisition Boundaries. Chief Cartographer.
- USFWS, NWRS, Division of Realty. 2026. FWS National Realty Centroids. Chief Cartographer.
- U.S. Geological Survey (USGS), 2024, Annual NLCD Collection 1 Science Products (ver. 1.1, June 2025): U.S. Geological Survey data release, <https://doi.org/10.5066/P94UXNTS>.
- U.S. Geological Survey National Hydrography Dataset, 2023, NHD_H_South Carolina_State_GDB, accessed May 15, 2026, at <https://prd-tnm.s3.amazonaws.com/index.html?prefix=StagedProducts/Hydrography/NHD/State/GDB/>
- Vanguelova, E., R. Pitman, J. Luiro, and H.S. Helmisaari. 2010. Long term effects of whole tree harvesting on soil carbon and nutrient sustainability in the UK. *Biogeochemistry* 101:43–59.
- Warner, R. E. and S. L. Etter. 1989. Hay cutting and the survival of pheasants: A long-term perspective. *The Journal of Wildlife Management* 53:455–461.
- Weimerskirch, H., S. A. Shaffer, G. Mabile, J. Martin, O. Boutard, J. L. Rouanet. 2002. Heart rate and energy expenditure of incubating wandering albatrosses: Basal levels, natural variation, and the effects of human disturbance. *Journal of Experimental Biology* 205:475–483.
- Wiest, R. L. 1998. A landowner's guide to building forest access roads. U.S. Department of Agriculture, Forest Service, Northeastern Area State and Private Forestry, Radnor, PA. <https://www.landcan.org/pdfs/accessroads.pdf>

Wilkerson, E., J. M. Hgan, D. Siege, and A. A. Whitman. 2006. The effectiveness of different buffer widths for protecting headwater stream temperature in Maine. *Forest Science*, 52:221–231.

Wynn, T. M., S. Mostaghimi, J. W. Frazee, P. W. McClellan, R. M. Shaffer, and W. M. Aust. 2000. Effects of forest harvesting best management practices on surface water quality in the Virginia coastal plain. *Transactions of the ASAE* 43:927–936.

Yasue, M. 2005. The effects of human presence, flock size and prey density on shorebird foraging rates. *Journal of Ethology* 23:199–204.
<<https://ecos.fws.gov/ServCat/Reference/Profile/142225>>.

Appendix A: Applicable Statutes and Executive Orders

This appendix provides a summary of other applicable laws, regulations, statutes, policies, executive orders and/or other rules apply to the proposed action or project and any additional steps taken by the service to comply with these laws.

The following laws, regulations, statutes, policies, executive orders and/or other rules apply to the proposed action or project. A description of how compliance is being met for each applicable law or regulation is under the appropriate affected resources section.

Fish and Wildlife

- Bald and Golden Eagle Protection Act, as amended, 16 U.S.C. 668-668c, 50 CFR 22 is applicable to this project and compliance is addressed in the section on special status species.
- Endangered Species Act of 1973, as amended, 16 U.S.C. 1531-1544; 36 CFR Part 13; 50 CFR Parts 10, 17, 23, 81, 217, 222, 225, 402, and 450 is applicable to this project and compliance is addressed in the candidate, threatened and endangered species section the Refuge has documented an internal informal consultation stating the expected impacts from the proposed project to these species.
- Fish and Wildlife Coordination Act, as amended in 1964, 15 U.S.C. § 661 et seq. Requires that all federal agencies consult with NMFS, U.S. Fish and Wildlife Service, and state wildlife agencies when proposed actions might result in modification of a natural stream or body of water. Federal agencies must consider effects that these projects would have on fish and wildlife development and provide for improvement of these resources. The Fish and Wildlife Coordination Act allows these agencies to provide comments to the lead federal action agency (the Refuge) during their review of the proposed project. The Refuge has consulted and coordinated with all relevant fish and wildlife agencies to reduce adverse impacts to migratory, estuarine, and marine fisheries and their habitats. Correspondence is noted in Chapter 5, State and Federal Coordination, and any comments received and any responses made to comments, would be summarized in Appendix.
- Migratory Bird Treaty Act, as amended, 16 U.S.C. 703-712; 50 CFR Parts 10, 12, 20, and 21 and Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds, 66 Fed. Reg. 3853 (2001), Migratory Bird Conservation Act (1929), Migratory Bird Hunting and Conservation Stamp Act (1934) is applicable and is addressed in the sections on special status species and fish and wildlife species. The preferred alternative is consistent because the EA evaluates the effects of agency actions, including proposed action, on migratory birds.

Cultural and Historic Preservation

- Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, is

applicable. An invitation for the option to consult letter and provide comments on the proposed changes to the program was sent to 4 tribal government leaders who have made known that they have an interest related to cultural, and historic locations in Santee NWR. Additional details on tribal government coordination can be found in that section of the assessment.

- Archaeological Resources Protection Act of 1979, 16 U.S.C. 470aa – 470mm; 18 CFR Part 1312; 32 CFR Part 229; 36 CFR Part 296; 43 CFR Part 7, could apply if infrastructure projects supporting the use occur. Compliance with the law would be completed if and when a more detailed project location is available for a supporting use. Projects of this nature are not expected to impact the preservation of historical and archaeological data (including relics and specimens), which might otherwise be irreparably lost or destroyed.

Regulatory and Planning Framework

- National Environmental Policy Act (NEPA) as amended 42 U.S.C. § 4321 et seq. This EA was prepared pursuant to Department of Interior (DOI) regulations implementing NEPA, which requires federal agencies to assess, consider, and disclose to the public the impacts that their actions may have on the environment before taking major federal actions.
- National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, is applicable. This assessment and associated step-down plan allow for implementation of the CCP for the refuge. This assessment and plan allow for the refuge to manage wildlife, their habitat and ensure the biological integrity, diversity, and environmental health of refuge is maintained. The activity of implementing a new land management plan has a draft compatibility determination.
- Refuge Recreation Act of 1962, as amended, Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System, and Executive Order 13563 – Improving Regulation and Regulatory Review (2011) are applicable and evaluated through the compatibility determination associated with this full compliance package. It has preliminarily been determined to be compatible uses and not interfere with the primary purpose for which the refuge was established. Compatibility Determinations are available in Appendix.

Environmental Protection and Conservation

- Federal Noxious Weed Act of 1990 Executive Order 13112 – Invasive Species, 64 Fed. Reg. 6183 (1999), Executive Order 13751 (2016) — Safeguarding the Nation from the Impacts of Invasive Species and Executive Order 11987, Exotic Organisms, are applicable as there implementation of activities to treat invasive species and they could be transportation of invasive species from site to site by users. Staff treat for any invasive plant species through the habitat management program and promote educational campaigns to make recreational users aware of the potential to spread invasives species and is discussed in

Habitat and Vegetation: Affected Environment and Environmental Consequences section.

- Lacey Act, as amended, 16 U.S.C. 3371 et seq.; 15 CFR Parts 10, 11, 12, 14, 300, and 904 is applicable as we must comply with state and federal regulations that mitigate the importation, exportation, transportation, sale or purchase of fish, wildlife or plants to participate in the activity on the refuge. Laws and regulations are enforced by refuge law enforcement and state conservation officers.

The following statutes do not apply to this proposed project area because the nexus for protection does not occur within the project area, or the affected resource associated with the statute has been determined to not be affected or only negligibly affected by the proposed action. Any resources that would not be more than negligibly impacted by the action have been dismissed from further analysis. The following statutes are not applicable:

Cultural and Historic Preservation

- American Indian Religious Freedom Act (1978) , as amended, 42 U.S.C. 1996 – 1996a; 43 CFR Part 7
- Antiquities Act of 1906, 16 U.S.C. 431-433; 43 CFR Part
- Archaeological and Historic Preservation Act (1974)
- Executive Order 11593 – Protection and Enhancement of the Cultural Environment, 36 Fed. Reg. 8921 (1971)
- Executive Order 13007 – Indian Sacred Sites, 61 Fed. Reg. 26771 (1996)
- National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470-470x-6; 36 CFR Parts 60, 63, 78, 79, 800, 801, and 810
- Native American Graves Protection and Repatriation Act, 1990, 25 U.S.C. 3001-3013; 43 CFR Part 10
- Paleontological Resources Protection Act (2009), 16 U.S.C. 470aaa – 470aaa-11

Environmental Protection and Conservation

- Clean Air Act, 1970, as amended, 42 U.S.C. 7401-7671q; 40 CFR Parts 23, 50, 51, 52, 58, 60, 61, 82, and 93; 48 CFR Part 23
- Federal Water Pollution Control Act of 1972 (commonly referred to as Clean Water Act), 33 U.S.C. 1251 et seq.; 33 CFR Parts 320-330; 40 CFR Parts 110, 112, 116, 117, 230-232, 323, and 328Clean Water Act (1972)
- Coastal Barrier Resources Act (1982)
- Coastal Zone Management Act of 1972, 16 U.S.C. as amended1451 et seq.; 15 CFR Parts 923, 930, 933"

- Emergency Wetlands Resources Act (1986)
- Farmland Protection Policy Act (1981)
- Federal Cave Resources Protection Act (1988)
- Noise Control Act of 1972 42 U.S.C. § 4901 et seq
- Resource Conservation and Recovery Act (1976)
- Safe Drinking Water Act of 1974, 42 U.S.C. 300f et seq.; 40 CFR Parts 141-148
- Water Resources Planning Act (1965)
- Executive Order 11988 – Floodplain Management, 42 Fed. Reg. 26951 (1977)
- Wetlands (Executive Order 11990)

Fish and Wildlife Conservation

- Fish and Wildlife Act of 1956, 16 U.S.C. 742 a-m
- Magnuson-Stevens Fishery Conservation and Management Act (1976)
- Marine Mammal Protection Act (1972)

Public Access and Land Use

- Wild and Scenic Rivers Act, 1968, 16 U.S.C. 1271 et seq.
- Wilderness Act, 16 U.S.C. 1131 et seq.
- Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.; 33 CFR Parts 114, 115, 116, 321, 322, and 333 is not applicable as infrastructure is not being built or modified on rivers or navigable waterways.
- Americans with Disabilities Act (ADA) of 1990

Appendix B: Acronyms and Abbreviations

- **Administration Act** – National Wildlife Refuge System Administration Act of 1966
- **CCP** – Comprehensive Conservation Plan
- **Improvement Act** – National Wildlife Refuge System Improvement Act of 1977
- **CD** – Compatibility Determination
- **CFR** – Code of Federal Regulations
- **EA** – Environmental Assessment
- **ESA** – Endangered Species Act
- **FONSI** – Finding of No Significant Impacts
- **LDWF** – Louisiana Department of Wildlife and Fisheries
- **NEPA** – National Environmental Policy Act
- **NWR / Refuge** – National Wildlife Refuge
- **NWRS** – National Wildlife Refuge System
- **NWRSAA** – National Wildlife Refuge System Administration Act
- **U.S.C.** – United States Code
- **USFWS / Service** – U.S. Fish and Wildlife Service

Appendix C: Terms

Adverse Effects – Negative or detrimental impacts to a resource.

Beneficial Effects – Positive impacts to a resource.

Direct Effects – Effects caused by the action that occur at the same time and place (40 C.F.R. §1508.1[i][1]).

Indirect Effects – Effects caused by the action that occur later in time or are farther removed in distance but are still reasonably foreseeable (40 C.F.R. §1508.1[i][2]).

Irreversible Effects – Impacts that cannot be undone or altered.

Irretrievable Effects – Impacts that result in the permanent loss of resources, which cannot be regained, recovered, or repaired.

Major Effects – Impacts that are obvious and result in substantial local or broader-scale consequences to the resource.

Moderate Effects – Impacts that are readily detectable and may have temporary effects on populations or resources at a broader scale, but do not cause substantive declines or increases.

Minor Effects – Impacts that are detectable but small, with limited consequences that do not affect populations or resources on a large scale.

Negligible Effects – Impacts that are so minimal they are not detectable or observable.

No Effect – The resource is not affected by the proposed action.

Reasonably Foreseeable Effects – Effects that are sufficiently likely to occur and include both direct and indirect impacts, as well as cumulative effects from past, present, and future actions.

Short-Term Effects – Impacts occurring over a relatively brief period.

Long-Term Effects – Impacts occurring over an extended period.

Unavoidable Effects – Impacts that cannot be prevented or avoided; considered inevitable.