Recreational Hunting

Decision Document Package

for

WACCAMAW NWR

Contents

2. Environmental Assessment
Environmental Assessment

2012 Draft Recreational Hunting Management Plan

on

WACCAMAW NATIONAL WILDLIFE REFUGE
Horry, Georgetown, & Marion Counties, South Carolina

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Chapter 1: Purpose and Need for Action

1.1 Background

Waccamaw National Wildlife Refuge (Refuge) was established in 1997 after the U.S. Fish and Wildlife Service completed and Environmental Impact Statement. Its establishing and acquisition authorities include the Fish and Wildlife Service Coordination Act of 1958 (16 USC 661-667-E), Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b)), and the Fish and Wildlife Act of 1956 (16 U.S.C. 742f (b)(1)). The stated purposes of the Refuge are to:

- Protect and manage diverse habitat components within an important coastal river ecosystem for the benefit of threatened and endangered species, freshwater and anadromous fish, migratory birds, and forest wildlife, including a wide array of plants and animals associated with bottomland hardwood habitats; and
- Provide compatible wildlife-dependent recreational activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation for present and future generations.

This Environmental Assessment (EA) was prepared using guidelines established under the National Environmental Policy Act (NEPA) of 1969. NEPA requires examination of the effects of proposed actions on the natural and human environment. This EA covers the hunting chapter, which is preceding the overall Visitor Services Plan for the Refuge. In the following sections, two alternatives are described for future hunting opportunities on the Refuge, the environmental consequences of each alternative, and the preferred management direction based on the environmental consequences and the ability to achieve the Refuge’s purpose.

In October 2008, a Comprehensive Conservation Plan (CCP) for the Refuge, which involved an EA, was approved. The EA and CCP addressed future management of the Refuge, including visitor services.

1.2 Purpose

The purpose of this EA is to evaluate the opportunities and impacts that can be reasonably expected to occur if the Refuge opens newly acquired or leased tracts to hunting. This document addresses present and future impacts of the Refuge’s hunting program in Horry, Marion, and Georgetown Counties, South Carolina.
1.3 Need for Action

The National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act) provides authority for the U.S. Fish & Wildlife Service (USFWS) to manage the Refuge and its wildlife populations. In addition, this Improvement Act declares that compatible wildlife-dependent public uses are legitimate and appropriate uses of the National Wildlife Refuge System (NWRS) and that they are to receive priority consideration in planning and management. There are six wildlife-dependent public uses: hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation that are specifically named in the Improvement Act. It even goes further in directing managers to increase recreational opportunities including hunting on National Wildlife Refuges (NWR’s) when compatible with the purposes for which the Refuge was established and the mission of the NWRS.

The Refuge completed its first CCP in October of 2008. The CCP is an all-encompassing public process through which the Refuge examines past and present management plans and then determines top management priorities to set the course for future management decisions. Within this document, all existing and proposed public uses are evaluated by using the decision process directed by NEPA including completing an Intra-Service Section 7 Biological Evaluation, Wilderness Review and a Finding of No Significant Impact. In addition to NEPA guidance, the CCP also includes public use reviews which are required by the Improvement Act. The Refuge has completed a Finding of Appropriateness of a Refuge Use and Compatibility Determinations on all public uses including hunting before final approval was given for all of the proposed Refuge uses. During the CCP process, numerous public comments were received in support of the Refuge opening hunting on newly acquired parcels and hunting has been identified as a means for meeting the purposes for which the Refuge was established. Public comments regarding hunting are included in Appendix.

1.4 Decision Framework

The USFWS Regional Director for the Southeast Region (Region 4) will need to make two decisions based on this EA: (1) select an alternative and (2) determine if the selected alternative is a major Federal action significantly affecting the quality of the human environment, thus requiring preparation of an Environmental Impact Statement (EIS).

The following are the two alternatives that were developed. Alternative B is the preferred alternative recommended to the Regional Director. The Draft 2012 Waccamaw NWR Recreational Hunting Management Plan (Draft 2012 Hunt Plan) was developed for implementation based on this recommendation.

1. Alternative A (No Action):
   - Newly acquired or leased Refuge parcels will not be opened to hunting.
2. Alternative B (Proposed Action):
   - Newly acquired or leased Refuge parcels will be open to limited hunting as prescribed in the Draft 2012 Hunt Plan.

1.5 Authority, Legal Compliance, and Compatibility

The NWRS includes federal lands managed primarily to provide habitat for a diversity of fish, wildlife and plant species. NWR’s are established under many different authorities and funding sources for a variety of purposes. The purposes for the Refuge are listed in Section 1.1.

In the past, the ability to open the Refuge to hunting was covered under the National Wildlife Refuge Administration Act, 16 U.S.C 688dd (a) (2). This Act was amended in 1997 with the Improvement Act. These Acts support past hunting activities on the Refuge and future hunting opportunities, as proposed in this document as follows:

   “…. conservation, management, and ... 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...” fl 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

   “..... compatible, wildlife-dependant recreation is a legitimate and appropriate general public use of the System, directly related to the mission of the System and the purposes of many refuges....” Public Law 105-57, 111 STAT. 1254, Sec.5. (B) (National Wildlife Refuge Improvement Act of 1997).

The USFWS developed a strategic plan for implementing the Improvement Act. This plan clarifies the vision for the NWRS and outlines strategies for improving delivery of its mission. The Draft 2012 Hunt Plan is compatible with the priorities and strategies outlined in the Improvement Act.

Additional authority delegated by Congress, federal regulations, executive orders, and several management plans, such as the 2008 CCP, guide the operation of the Refuge. The appendices of the CCP contain a list of the key laws, orders, and regulations that provide a framework for the proposed action.
Chapter 2: Alternatives Including the Proposed Action

This chapter discusses the alternatives considered for hunting on the Refuge. These alternatives are: 1) No Action, which continues with current management of the hunt program and 2) Proposed Action, which implements the Draft 2012 Hunt Plan.

2.1 No Action Alternative: Current Management

Under this alternative, hunting would be limited to the lands currently open to hunting. There would be no change to current public use and wildlife management programs.

The Council on Environmental Quality’s regulations for implementing NEPA requires all EA’s to include the No Action alternative. This action would require that the Refuge post future Refuge parcels as “Closed to Hunting” as well as increase law enforcement patrols of these tracts to enforce closure regulations and provide adequate public information to ensure regulatory compliance.

All or parts of the Refuge may be closed to hunting at any time if necessary for public safety, to provide wildlife sanctuary, or for administrative reasons.

2.2 Proposed Alternative: Draft 2012 Waccamaw NWR Recreational Hunting Management Plan

The proposed action would allow the USFWS to open lands acquired in the future within the approved acquisition boundary to hunting.

All or parts of the Refuge may be closed to hunting at any time if necessary for public safety, to provide wildlife sanctuary, or for administrative reasons.

The proposed action will allow limited public hunting on current and future Refuge lands.

The Refuge hunting season framework will be consistent with all South Carolina Department of Natural Resources (State) statutes within the applicable State Game Zones and further regulated by Refuge regulations according to USFWS policy. Refuge management goals and objectives may require occasional modifications to the hunting program as harvest data, public use pressure, and Refuge programs are developed. Use of quota hunt for special management purposes may be necessary to meet Refuge specific objectives.

Refer to 2012 Draft Hunt Plan for specific regulations.
Chapter 3: Affected Environment

The Refuge was established in December 1997 to provide and protect habitats for a natural diversity of wetland-dependent wildlife associated with the Waccamaw and Great and Little Pee Dee River floodplain basins. Located in portions of Horry, Georgetown, and Marion Counties, the Refuge’s acquisition boundary spans over 55,000 acres and includes large sections of the Waccamaw and Great Pee Dee Rivers, and a small section of the Little Pee Dee River. The Refuge area was first identified in the early 1980s as containing critically important migratory bird habitat that should be preserved. It was included in the USFWS’s Atlantic-Eastern Gulf Coast Migratory Bird Preservation Plan (USFWS 1982) and the Preservation of Black Duck Wintering Habitat Plan (USFWS 1985a). In addition, the Refuge area was identified as one of the top priorities for protection in the USFWS’s Southeast Regional Wetlands Concept Plan (USFWS 1992a), which was prepared as part of the National Wetlands Priority Conservation Plan that was developed at the request of congress in the emergency Wetlands Resources Act of 1986. The Refuge area is also located in heart of the Winyah Bay Focus Area (WBFA), an important conservation priority of the Atlantic Coast Joint Venture of the North American Waterfowl Management Plan. The WBFA encompasses 525,000 acres in the lower drainage of the Black, Great and Little Pee Dee, Sampit, and Waccamaw Rivers and has gained national attention for the conservation partnerships which have afforded permanent protection on more than 131,000 acres within the focus area.

The wetland diversity of the Refuge is what sets it apart from most others found along the east coast. Wetland habitats range from historic, tidal ricefields, to black-water and alluvial floodplain forested wetlands of the Waccamaw and Great Pee Dee Rivers. These tidal freshwater wetlands are some of the most diverse freshwater wetland systems found in North America and they offer many important habitats for migratory birds, fish, and resident wildlife. Avian species such as the swallow-tailed kite, osprey, white ibis, prothonotary warbler, and many species of waterfowl can be observed on a seasonal basis. Additionally, the diversity of these wetland habitats provides important habitats for numerous species of large and small mammals, reptiles, and fish species.

The Refuge has scattered ownership of properties within the approved 54,522-acre acquisition boundary. Currently the Refuge manages over 26,000 acres within the boundary. Three management units are identified according to geographic and habitat types. Each unit is defined by a dominant habitat type and consequently may require unit-specific management goals and objectives. Unit 1 is approximately 34,800 acres and consists of alluvial and black-water floodplain forested wetlands. Unit 2 is 9,144 acres and consists of approximately 6,166 acres of upland longleaf pine forest, located on Sandy Island, and the remaining acreage consisting of primarily of tidal forested and emergent wetlands. Unit 3 is 10,055 acres and is made up of historic tidal ricefields many of which remain intact and are managed today for wintering waterfowl.

The U. S. Fish and Wildlife Service is actively acquiring lands within the acquisition boundary from willing sellers. Funding and authorization for Refuge land acquisition have been primarily provided through the Land and Water Conservation Fund Act of
1965 and more recently Duck Stamp Funding administered by the Migratory Bird Conservation Commission.

3.1 Physical Environment

Wetlands dominate the landscape of the Refuge acquisition boundary. Within the acquisition boundary, nearly 84 percent (46,196 acres) are wetland habitats, broken down as follows: managed wetlands, 629 acres; freshwater marsh, 2,923 acres; and wetland forest, 46,644 acres. The remaining lands (8,226 acres, or 15 percent of the acquisition boundary) are classified as upland forests.

Geographically, the Refuge is situated in a coastal zone within the primary floodplains of the Great Pee Dee and Waccamaw Rivers in Georgetown, Horry, and Marion Counties, South Carolina. The southern portion of the Refuge consists of emergent tidal wetlands. The central and northern portions are mostly hardwood-forested wetlands. Elevations range from near sea level to 76 feet above mean sea level, with the highest point located on Sandy Island in Georgetown County.

Three major rivers, the Waccamaw, Great Pee Dee, and Little Pee Dee, are the major sources of freshwater inflow to the Refuge acquisition boundary. The varied origins of these rivers and their different paths to the coast result in each having its own pattern of seasonal water flow and chemistry that interact with the physical and geological features of the landscape.

Two of the rivers, the Waccamaw and Little Pee Dee, are classified as black-water rivers. They are termed "black-water" because of the tea colored water, the result of tannins leached from vegetation within the extensive bottomland hardwood wetlands adjoining the rivers. Black-water rivers originate in the Coastal Plain, are typically acidic, low in suspended sediments, and support a diversity of native animal species. In contrast, alluvial rivers, like the Great Pee Dee, originate in the Piedmont and carry high sediment loads. Within the acquisition boundary, these rivers and their tributaries combine to form an incredibly diverse wetland landscape that supports many species of plant and animal life.

The Great Pee Dee River Basin originates in North Carolina and covers 2,350 square miles through its course in South Carolina, draining 7.6 percent of the state's land area (Beasley et al. 1988). Within South Carolina, the basin consists of five sub-basins or watersheds bounded by its principal rivers: the Black, Lynches, Great Pee Dee, Little Pee Dee, and Waccamaw. The Lynches River sub-basin traverses both the Piedmont and Atlantic Coastal Plain provinces; the Great Pee Dee River sub-basin is located almost entirely within the Atlantic Coastal Plain, with its northwestern tip extending into the North Carolina Piedmont; and the Waccamaw, Little Pee Dee, and Black River sub-basins lie entirely within the Atlantic Coastal Plain.

The Refuge acquisition boundary encompasses portions of the Great Pee Dee, Little Pee Dee, and Waccamaw River sub-basins. The Little Pee Dee flows into the Great Pee Dee
just inside the northern acquisition boundary; the Lynches River flows into the Great Pee Dee approximately 27 river miles above the northern Refuge acquisition boundary; and the Waccamaw River flows through the Refuge acquisition boundary. Flow data for the rivers within the boundary are not available; however, U.S. Geological Survey (USGS) discharge monitoring stations are located on each of the rivers upstream of the area.

USGS water discharge records are available for the Great Pee Dee River near the town of Pee Dee in Marion County; the Lynches River at Effingham in Florence County; the Little Pee Dee River at Galivants Ferry at the Marion-Horry County Line; and the Waccamaw River near Longs in Horry County (U.S. Geological Survey 1995). Approximate drainage areas, periods of record (POR), 1993 and 1994 annual mean flows, and POR annual mean flows for each of these stations are shown in Table 1 (all flow data are given in cubic feet per second--cfs).

Table 1. Water discharge rates for the Great Pee Dee, Lynches, Little Pee Dee, and Waccamaw Rivers.

<table>
<thead>
<tr>
<th>River</th>
<th>Drainage Area (mi²)*</th>
<th>Period of Record (POR)</th>
<th>1993/1994 Annual Mean Flows (cfs)</th>
<th>POR Annual Mean Flows (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gr. Pee Dee</td>
<td>8,830</td>
<td>1938 – 1994</td>
<td>12,630/10,260</td>
<td>9,957</td>
</tr>
<tr>
<td>Lynches</td>
<td>1,030</td>
<td>1929 – 1994</td>
<td>1,183/888</td>
<td>1,044</td>
</tr>
<tr>
<td>Little Pee Dee</td>
<td>2,790</td>
<td>1942 – 1994</td>
<td>2,904/2,715</td>
<td>3,096</td>
</tr>
<tr>
<td>Waccamaw</td>
<td>1,110</td>
<td>1950 – 1994</td>
<td>1,225/664</td>
<td>1,191</td>
</tr>
</tbody>
</table>

*Includes drainage area located in North Carolina.

The flows of each river fluctuate considerably from month to month and year to year. However, long-term discharge records show consistent seasonal flow patterns for all of them. The lowest average flows typically occur from September through November, with the highest flows occurring from February through April. Overbank flooding is common during the high flow periods. The highest and lowest annual mean and monthly mean discharges of the Great Pee Dee, Lynches, Little Pee Dee, and Waccamaw Rivers (based on the periods of record from the recording stations given above) are shown in Table 2 (all values are given in cubic feet per second--cfs).
Table 2. Highest and lowest annual mean and monthly mean discharges of the Great Pee Dee, Lynches, Little Pee Dee, and Waccamaw Rivers.

<table>
<thead>
<tr>
<th>River</th>
<th>Highest Annual Mean Flow (Year)</th>
<th>Lowest Annual Mean Flow (Year)</th>
<th>Highest Monthly Mean Flow (Month)</th>
<th>Lowest Monthly Mean Flow (Month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gr. Pee Dee</td>
<td>16,470 (1960)</td>
<td>5,392 (1981)</td>
<td>17,800 (March)</td>
<td>6,576 (Sept.)</td>
</tr>
<tr>
<td>Lynches</td>
<td>1,823 (1960)</td>
<td>451 (1934)</td>
<td>1,952 (March)</td>
<td>*597 (June)</td>
</tr>
<tr>
<td>Little Pee Dee</td>
<td>5,947 (1965)</td>
<td>1,371 (1951)</td>
<td>5,856 (March)</td>
<td>1,780 (Nov.)</td>
</tr>
<tr>
<td>Waccamaw</td>
<td>2,418 (1960)</td>
<td>439 (1952)</td>
<td>2,556 (March)</td>
<td>525 (Nov.)</td>
</tr>
</tbody>
</table>

*Not significantly different than the September, October, and November flows of 684 cfs, 685 cfs, and 689 cfs, respectively.

The water regimes throughout the Refuge acquisition boundary depend on a complex of closely integrated and dynamic variables. These variables include daily tidal fluctuations, as well as periodic flooding related to the seasonal high volume flows of the Great and Little Pee Dee and Waccamaw Rivers. Depending on the site, the mean high tides can fluctuate as much as two feet. The effects of seasonal flooding may be more or less dramatic. On the lower end of the Refuge acquisition boundary, a deltaic fan accommodates high volume flows; whereas the upper reaches of the floodplain are less extensive and experience prolonged flooding during high flows. These distinguishing features have separate ecologically significant functions that contribute to the diversity of wetland habitats on the Refuge. Other notable factors that influence the area's hydrology include varying states of dike disrepair, bed elevations, and channelization; varying stages of successional encroachment by aquatic plants; the presence or lack thereof of spoil disposal sites; past and present forestry and agricultural practices; alterations in runoff caused by man-made developments; and natural phenomena such as hurricanes, tropical storms, and heavy rains.

Climate within the Refuge acquisition boundary is influenced by the coastal waters of the Atlantic Ocean. In Georgetown, SC, the average winter temperature is 47 degrees Fahrenheit, with an average daily minimum of 38 degrees. In summer, the average temperature is 81 and the average daily maximum is 90 (National Climatic Center, Asheville, N.C., personal communication).

The total average annual precipitation is 53 inches. Of this, 60 percent usually falls in April through September, which includes the growing season for most crops. Thunderstorms occur on about 50 days each year, and most occur in summer.
Snowfall is rare. In 90 percent of the winters, there is no measurable snowfall. In 10 percent, the snowfall, usually of short duration, is little more than a trace. The heaviest 1-day snowfall on record in the area was more than 11 inches.

The average relative humidity in mid-afternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 70 percent of the time in summer and 60 percent in winter. The prevailing wind is from the south-southwest. Average wind speed is highest, 10 miles per hour, in spring. The Refuge is subject to the effects of tropical storms and hurricanes from June through September.

3.2 Vegetation

The Refuge acquisition boundary is divided into three management units. Each unit is defined by a dominant habitat type and consequently may require unit-specific management goals and objectives. Unit 1 is approximately 34,800 acres and is made up entirely of alluvial and black water flood plain forested wetlands. Unit 2 is 9,144 acres and is made up of approximately 6,166 acres of upland longleaf pine forest, located on Sandy Island, and the remaining acreage being made up primarily of tidal forested and emergent wetlands. Unit 3 is 10,055 acres and is made up of historic tidal rice fields many of which remain intact and are managed today for wintering waterfowl.

3.2.1 Open Water: This category includes all unvegetated freshwater bodies. Among these are bays, lakes, ponds, and rivers. Approximately 2,430 acres of open water occur in the Refuge acquisition boundary. Most of the open water is regulated by the State of South Carolina.

3.2.2 Freshwater Marsh: This category includes freshwater wetlands dominated by emergent vegetation. The majority of this habitat type is tidally influenced. Freshwater marshes remain flooded or saturated except during extremely dry weather cycles. Most of the freshwater marshes are criss-crossed with abandoned dikes and canals that were constructed for rice cultivation during the 18th and 19th Centuries. Plant diversity is greater here than within any other wetland habitat type in the Refuge area. Among the most common species are giant cutgrass, pickerelweed, sawgrass, jewelweed, water parsnip, yellow pond-lily, water hemlock, arrowhead, rose mallow, soft-stem bulrush, cattail, loosestrife, white water lily, and alligator weed. Woody vegetation, such as tag alder, bald-cypress, buttonbush, tupelo, and black gum may be interspersed on the old rice field levees. Approximately 2,923 acres of this habitat occur within the Refuge acquisition area.

3.2.3 Managed Wetlands: This category includes former rice field areas impounded by dikes or levees, where the hydrology is usually manipulated for the purpose of promoting plant species that are beneficial to waterfowl. The hydrological regimes are controlled by the impoundment managers. Most impoundments are managed for emergent vegetation including smartweed, fall panicum, wild millet(s), and Asiatic dayflower. Cultivated grains may be also planted during drawdown periods. Approximately 629 acres of managed wetlands occur within the southernmost portions of the Refuge acquisition
3.2.4 Deciduous Forested Wetlands- Temporarily and Seasonally Flooded Tidal: These areas remain flooded or saturated throughout most years except during extreme drought periods. Water depth may periodically fluctuate as a result of tidal influences. Plant community composition is relatively homogeneous. Dominant species include swamp tupelo, bald-cypress, green ash, water tupelo, and red maple. Approximately 25,077 acres of this habitat type occur in the Refuge acquisition boundary.

3.2.5 Deciduous Forested and Shrub Wetlands – Regularly Flooded Tidal: These areas remain flooded or saturated throughout most years. Water depths fluctuate daily with tides. Tree species composition is very similar to the immediately preceding habitat type. Shrub-dominated habitats within this habitat type include species such as swamp privet, buttonbush, and tag alder. The Refuge acquisition boundary contains approximately 5,780 acres of this habitat type.

3.2.6 Deciduous Forested and Shrub Wetlands – Temporarily Flooded or Saturated: These areas normally remain flooded or saturated throughout the winter and for brief periods during the spring. Diurnal tides have little or no influence on the hydrology of this wetland type. This habitat usually occurs at the higher elevations within the flood plain. Typical plant species include swamp chestnut oak, water oak, cherrybark oak, loblolly pine, several species of hickories, white oak, tulip poplar, ironwood, sycamore, and sweetgum. Only about 461 acres of this habitat type is present within the Refuge acquisition boundary.

3.2.7 Deciduous Forested and Shrub Wetlands – Seasonally and Semipermanently Flooded: These areas are flooded for very long periods during the growing season to almost continuously throughout the year. Diurnal tides have little or no influence on the hydrology of this wetland type. Typical species in the drier zones of this habitat range include diamond-leaf oak, green ash, American elm, and sweetgum. In wetter zones, overcup oak, water hickory, water tupelo, swamp tupelo, and bald-cypress predominate. Approximately 2,719 acres of this habitat type occur within the Refuge acquisition boundary.

3.2.8 Evergreen Forested and Shrub Wetlands: Most of these areas are rarely flooded but may be periodically saturated to the surface. This type usually occurs at the very highest elevations within the flood plain and on poorly drained flats and in depressions outside of the floodplain. Within the flood plain, these areas are at the driest end of the wetland spectrum and are vegetated by species such as loblolly pine, spruce pine, live oak, and American holly. Outside of the floodplain these areas are commonly called bay swamps, pine savannahs, or wet pine flatwoods and are vegetated by pond pine, loblolly bay, sweet bay, red bay, titi, fetter-bush, wax myrtle, zenobia, and sweet gallberry. The Refuge acquisition boundary contains approximately 1,167 acres of this habitat type.

3.2.9 Upland Forests: This category includes any area that does not meet the definition of wetland or deep-water habitat as classified by Cowardin et al. (1979). Approximately
6,166 acres of upland forest occur within the Refuge acquisition boundary. The majority of these uplands occur on Sandy Island. The natural plant communities of Sandy Island were described by Aulbach-Smith (1993). The upland plant communities on Sandy Island are highly diverse and include a maritime sandhill community, longleaf pine savannahs, and flatwoods with intermittent inclusions of small evergreen and deciduous depressions, pocosins, freshwater depression meadows, broad-leaved deciduous swamps, and pond pine woodlands. The maritime sandhill community on Sandy Island appears to be the only known site of this type in the state (WBFA Task Force Draft Plan 1994). The predominant vegetative community on Sandy Island is the longleaf pine/turkey oak type typically found within the Lakeland Fine Sand Ridges and covers approximately 3,000 acres. This is a natural pine stand that is developing into a mature forest community. Many of the longleaf pines are well in excess of 100 years old (WBFA Task Force Draft Plan 1994). Longleaf pine forests and savannahs, such as those on Sandy Island, were recently identified as a nationally critically endangered ecosystem (Noss et al. 1995). Of the 74 million acres that once existed, less than four million acres exist now in scattered remnants, and not many of these contain the entire components of the ecosystem (Frost 1993). Most of the other upland acreage within the Refuge acquisition boundary is pine forestlands under silvicultural management within Unit 1.

3.3 Wildlife Resources

3.3.1 Mammals: Temporarily flooded bottomland forests provide ideal habitat for many species of mammals. Food and cover are abundant and diverse, and a variety of mammalian species are present. About 40 species of mammals potentially inhabit the Refuge acquisition boundary. They include the largest omnivore native to South Carolina, the black bear, which is primarily associated with upland forests joined by extensive forested wetland corridors. On the smallest end of the mammalian size scale is the least shrew, which inhabits the marshes and open grass-covered areas. Seven species of bats may also be found throughout the watershed. Additionally, the acquisition area likely contains roosting and foraging habitat for at least two rare bats: the Rafinesque’s big-eared bat and the southern myotis. Both species hold state-listed rankings of concern throughout their ranges, and are known to use mature forested wetlands (Mary K. Clark, personal communication). Other mammals associated with this watershed include forest wetland inhabitants such as deer, bobcat, raccoon, beaver, mink, river otter, marsh rabbit, and squirrel. Because of the diversity of habitat types throughout the watershed, the mammalian species composition varies from site to site.

Mammals likely found on the Refuge

<table>
<thead>
<tr>
<th>Big brown bat</th>
<th>Longtail weasel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red bat</td>
<td>Beaver</td>
</tr>
<tr>
<td>Seminole bat</td>
<td>Gray fox</td>
</tr>
<tr>
<td>Hoary bat</td>
<td>Southern flying squirrel</td>
</tr>
<tr>
<td>Evening bat</td>
<td>Eastern gray squirrel</td>
</tr>
<tr>
<td>Silver-haired bat</td>
<td>Eastern fox squirrel</td>
</tr>
</tbody>
</table>
Eastern pipistrel  Golden mouse
Rafinesque’s big-eared bat Eastern woodrat
Southeastern myotis Rice rat
Whitetail deer Hispid cotton rat
Bobcat Meadow vole
Raccoon Pine vole
Opossum Norway rat
Eastern cottontail Black rat
Marsh rabbit Shorttail shrew
River otter Eastern mole
Mink Black bear
Feral Hogs

### 3.3.2 Waterfowl:
Coastal South Carolina has long been noted for its abundance of diverse and quality overwintering habitats and their significance to migratory waterfowl. The Winyah Bay drainage area, which includes the entire Refuge acquisition boundary, stands out as one of the most extensive, intact wetland complexes in the southeastern United States. The wetland habitats in the Refuge acquisition boundary range from forested, riverine floodplains to an extensive freshwater deltaic fan. The deltaic fan, in turn, contains a diversity of habitats such as managed wetlands, abandoned and unmanaged tidal ricefields, creeks, and flats. Acre for acre, the managed wetlands of the WBFA winter more ducks than any comparable habitat in South Carolina (WBFA Draft Plan 1994.) In addition to overwintering habitats, the Great Pee Dee and Waccamaw Rivers serve as flight corridors for waterfowl migrating along the coastal wetland wintering grounds. The forested wetlands where mature trees are present also provide important nesting habitat for wood ducks and hooded mergansers.

### 3.3.3 Neotropical Migratory Birds:
The Refuge acquisition boundary presently contains extensive, contiguous flood plain forested wetlands interspersed with a diversity of habitat components such as isolated hummocks, remnant dikes, and a natural ridge and swale topography. This mosaic of habitats along with a specialized flora composition associated with each component, have a direct bearing on specific breeding nongame birds, particularly neotropical migrants, and their presence and use of existing habitats. Point count surveys conducted within the Refuge acquisition boundary have further demonstrated the importance of this wetland habitat diversity to several high priority species such as Swainson’s warblers and swallow-tailed kites. Additionally, contiguous forested wetland ecosystems such as those represented within the Great Pee Dee and Waccamaw River watersheds undoubtedly serve as important habitat for other temperate migrant and resident species.

#### Neotropical migratory birds likely found on the Refuge

<p>| Common loon | Pied-billed grebe |
| Brown pelican | Double-crested cormorant |
| Anhinga | American bittern |
| Least bittern | Great blue heron |</p>
<table>
<thead>
<tr>
<th>Great egret</th>
<th>Snowy egret</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little blue heron</td>
<td>Tricolored heron</td>
</tr>
<tr>
<td>Cattle egret</td>
<td>Green heron</td>
</tr>
<tr>
<td>Black-crowned night heron</td>
<td>Yellow-crowned night heron</td>
</tr>
<tr>
<td>White ibis</td>
<td>Glossy ibis</td>
</tr>
<tr>
<td>Wood stork</td>
<td>Fulvous whistling-duck</td>
</tr>
<tr>
<td>Tundra swan</td>
<td>Snow goose</td>
</tr>
<tr>
<td>Canada goose</td>
<td>Wood duck</td>
</tr>
<tr>
<td>Green-winged teal</td>
<td>American black duck</td>
</tr>
<tr>
<td>Mottled duck</td>
<td>Mallard</td>
</tr>
<tr>
<td>Northern pintail</td>
<td>Blue-winged teal</td>
</tr>
<tr>
<td>Northern shoveler</td>
<td>Gadwall</td>
</tr>
<tr>
<td>American wigeon</td>
<td>Canvasback</td>
</tr>
<tr>
<td>Redhead</td>
<td>Ring-necked duck</td>
</tr>
<tr>
<td>Greater scaup</td>
<td>Lesser scaup</td>
</tr>
<tr>
<td>Common goldeneye</td>
<td>Bufflehead</td>
</tr>
<tr>
<td>Hooded merganser</td>
<td>Common merganser</td>
</tr>
<tr>
<td>Red breasted merganser</td>
<td>Ruddy duck</td>
</tr>
<tr>
<td>Black Vulture</td>
<td>Turkey vulture</td>
</tr>
<tr>
<td>Osprey</td>
<td>American Swallow-tailed kite</td>
</tr>
<tr>
<td>Mississippi kite</td>
<td>Bald eagle</td>
</tr>
<tr>
<td>Northern harrier</td>
<td>Sharp-shinned hawk</td>
</tr>
<tr>
<td>Cooper’s hawk</td>
<td>Red-shouldered hawk</td>
</tr>
<tr>
<td>Broad-winged hawk</td>
<td>Red-tailed hawk</td>
</tr>
<tr>
<td>American kestrel</td>
<td>Merlin</td>
</tr>
<tr>
<td>Peregrine falcon</td>
<td>Wild turkey</td>
</tr>
<tr>
<td>Northern bobwhite</td>
<td>Black rail</td>
</tr>
<tr>
<td>Clapper rail</td>
<td>King rail</td>
</tr>
<tr>
<td>Virginia rail</td>
<td>Sora</td>
</tr>
<tr>
<td>Purple gallinule</td>
<td>Common moorhen</td>
</tr>
<tr>
<td>American coot</td>
<td>Killdeer</td>
</tr>
<tr>
<td>Greater yellowlegs</td>
<td>Lesser yellowlegs</td>
</tr>
<tr>
<td>Spotted sandpiper</td>
<td>Common snipe</td>
</tr>
<tr>
<td>American woodcock</td>
<td>Laughing gull</td>
</tr>
<tr>
<td>Ring-billed gull</td>
<td>Herring gull</td>
</tr>
<tr>
<td>Caspian tern</td>
<td>Royal tern</td>
</tr>
<tr>
<td>Sandwich tern</td>
<td>Forster’s tern</td>
</tr>
<tr>
<td>Least tern</td>
<td>Rock dove</td>
</tr>
<tr>
<td>Mourning dove</td>
<td>Common ground-dove</td>
</tr>
<tr>
<td>Yellow-billed cuckoo</td>
<td>Common barn owl</td>
</tr>
<tr>
<td>Eastern screech owl</td>
<td>Great horned owl</td>
</tr>
<tr>
<td>Barred owl</td>
<td>Common nighthawk</td>
</tr>
<tr>
<td>Chuck-will’s-widow</td>
<td>Whip-poor-will</td>
</tr>
<tr>
<td>Chimney swift</td>
<td>Ruby-throated hummingbird</td>
</tr>
<tr>
<td>Belted kingfisher</td>
<td>Red-headed woodpecker</td>
</tr>
<tr>
<td>Red-bellied woodpecker</td>
<td>Yellow-bellied sapsucker</td>
</tr>
<tr>
<td>Downy woodpecker</td>
<td>Hairy woodpecker</td>
</tr>
<tr>
<td>Red-cockaded woodpecker</td>
<td>Northern flicker</td>
</tr>
<tr>
<td>Pileated woodpecker</td>
<td>Eastern wood-pewee</td>
</tr>
<tr>
<td>Acadian flycatcher</td>
<td>Eastern phoebe</td>
</tr>
<tr>
<td>Great crested flycatcher</td>
<td>Eastern kingbird</td>
</tr>
</tbody>
</table>
Purple martin  
N. rough-winged swallow  
Blue jay  
Fish crow  
Tufted titmouse  
Brown-headed nuthatch  
Sedge wren  
Marsh wren  
Ruby-crowned kinglet  
Eastern bluebird  
Swainson’s thrush  
Wood thrush  
Gray catbird  
Brown thrasher  
Cedar waxwing  
European starling  
Solitary vireo  
Northern parula  
Black-throated green warbler  
Black-throated gray warbler  
Pine warbler  
Palm warbler  
American redstart  
Swainson’s warbler  
Northern waterthrush  
Common yellowthroat  
Yellow-breasted chat  
Scarlet tanager  
Blue grosbeak  
Painted bunting  
Chipping sparrow  
Henslow’s sparrow  
Savannah sparrow  
Seaside sparrow  
Swamp sparrow  
Bobolink  
Eastern meadowlark  
Boat-tailed grackle  
Brown-headed cowbird  
Purple finch  
House sparrow

Tree swallow  
Barn swallow  
American crow  
Carolina chickadee  
White-breasted nuthatch  
Carolina wren  
House wren  
Golden-crowned kinglet  
Blue-gray gnatcatcher  
Veery  
Hermit thrush  
American robin  
Northern mockingbird  
Water pipit  
Loggerhead shrike  
White-eyed vireo  
Red-eyed vireo  
Black-throated blue warbler  
Yellow-rumped warbler  
Yellow-throated warbler  
Prairie warbler  
Black and white warbler  
Prothonotary warbler  
Ovenbird  
Kentucky warbler  
Hooded warbler  
Summer tanager  
Northern cardinal  
Indigo bunting  
Rufous-sided towhee  
Field sparrow  
Vesper sparrow  
Sharp-tailed sparrow  
Song sparrow  
White-throated sparrow  
Red-winged blackbird  
Rusty blackbird  
Common grackle  
Orchard oriole  
American goldfinch

### 3.4 Threatened and Endangered Species

Seven federally listed endangered or threatened species are known to occur or potentially occur within the Refuge acquisition boundary. These include three species of birds, one species of fish, and three species of plants. They are as follows:
3.4.1 **Red-cockaded woodpecker (Picoides borealis)** – **Endangered.** Red-cockaded woodpeckers are known to nest in the Refuge acquisition boundary, with the principal population residing in the mature pine forest of Sandy Island. Specific data on this population is being maintained by The Nature Conservancy and SCDNR who manage the state-owned portion on Sandy Island. With the addition of lease lands on Sandy Island that are owned by Brookgreen Gardens, the Refuge will begin active monitoring the RCW population on these leased lands.

3.4.2 **Wood stork (Mycteria americana)** – **Endangered.** Nesting has been observed within the Refuge acquisition boundary however the two known rookeries are located on private land. The contiguous mature blocks of wetland habitats on Refuge lands provide suitable habitat for wood storks to nest, forage, and roost. Wood storks have been observed foraging and loafing on the Refuge but nesting has not been documented.

3.4.3 **Shortnose sturgeon (Acipenser brevirostrum)** – **Endangered.** The shortnose sturgeon is found in the rivers and creeks throughout the Refuge acquisition boundary.

3.4.5 **Kirtland’s Warbler (Dendroica kirtlandii)** – **Endangered.** Although not known to occur in the Refuge acquisition boundary, potential habitat is present.

3.4.6 **Pondberry (Lindera melissifolia)** – **Endangered.** Although not known to occur in the Refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

3.4.7 **Canby’s dropwort (Oxypolis canbyi)** – **Endangered.** Although not known to occur in the Refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

3.4.8 **American chaffseed (Schwalbea americana)** – **Endangered.** Although not known to occur in the Refuge acquisition boundary, potential habitat is present on Sandy Island and in other pineland areas.

3.4.9 **Species of Concern:** Nine species of plants and animals, considered by the USFWS to be Species of Concern, are known to occur or potentially occur within the Refuge acquisition boundary. Species of concern are those species for which available data suggest that a proposal to list the species may be appropriate, but conclusive data on vulnerability and threat are not currently available to support listing action. These species include the Bachman’s sparrow (*Aimophila aestivalis*); Rafinesque’s big-eared bat (*Plecotus rafinesquii*); Southeastern myotis bat (*Myotis austroriparius*); Carolina pygmy sunfish (*Elassoma boehlkei*); Eulophia (*pteroglossapis ecristata*); Sarvis holly (*Ilex amelanchier*); Pondspice (*Listea aestivalis*); Carolina birds-in-a-nest (*Macbridea caroliniana*); Carolina grass-of-pannassus (*Parnassia caroliniana*); and Well’s pixie moss (*Pyxidanthera barbulata var. brevifolia*).
3.5 Invasive Wildlife Species

One of the most important invasive animal species is the feral hog. Feral hogs are currently distributed throughout the Refuge acquisition boundary. These animals were introduced to the eastern United States from Eurasia by early European settlers as a source of food. The feral swine population that exists today is a combination of domestic, escaped, or neglected domestic swine, Eurasian wild boar, or feral pigs, that have been captured for the purpose of starting wild, free-living populations. The rooting and wallowing activities of feral hogs cause serious erosion to river banks and areas along streams. Feral hogs carry diseases, such as swine brucellosis (APHIS 2005). They also compete for food with native wildlife, particularly acorns, which are an important food for both wild turkey and deer. Furthermore, feral hogs create wallows in wet sites, impinging on the integrity of the plant and soil community (Georgia Wildlife Web 2000).

3.6 Cultural Resources

The body of federal historic preservation laws has grown dramatically since the enactment of the Antiquities Act of 1906. Several themes recur in these laws, their promulgating regulations, and more recent Executive Orders. They include: 1) each agency is to systematically inventory the historic properties on their holdings and to scientifically assess each property’s eligibility for the National Register of Historic Places; 2) federal agencies are to consider the impacts to cultural resources during the agencies’ management activities and seek to avoid or mitigate adverse impacts; 3) the protection of cultural resources from looting and vandalism are to be accomplished through a mix of informed management, law enforcement efforts, and public education; and; 4) the increasing role of consultation with groups, such as Native American tribes, in addressing how a project or management activity may impact specific archaeological sites and landscapes deemed important to those groups. The USFWS, like other federal agencies, are legally mandated to inventory, assess, and protect cultural resources located on those lands that the agency owns, manages, or controls. The USFWS’s cultural resource policy is delineated in 614 FW 1-5 and 126 FW 1-3. In the USFWS’s Southeast Region, the cultural resource review and compliance process is initiated by contacting the Regional Historic Preservation Officer/Regional Archaeologist (RHPO/RA). The RHPO/RA will determine whether the proposed undertaking has the potential to impact cultural resources, identify the “area of potential effect,” determine the appropriate level of scientific investigation necessary to ensure legal compliance, and initiates consultation with the pertinent State Historic Preservation Office (SHPO) and federally recognized Tribes.

There is currently one recorded historic property located on Waccamaw National Wildlife Refuge located on the Yauhannah Bluff Tract. The Yauhannah Bluff site was first identified by Richard Polhemus in 1972. A portion of this site was examined by Bill Weeks and Jim Michie of Coastal Carolina University in the early to mid 1990s through the excavation of shovel tests and test units. In 2002, New South Associates shovel tested the entire tract at a 65-foot interval using the permanent datum established by Jim Michie. In 2006, the USFWS contracted New South Associates to perform a data
recovery survey on the area closest to the Great Pee Dee River in order to mitigate any impacts to archeological resources that might be impacted during the construction of an environmental education center (Archeological Investigations at the Yourhaney Plantation (38GE18) Yauhannah Bluff, Waccamaw National Wildlife Refuge, Georgetown County, South Carolina. New South Associates Technical Report 1314, New South Associates, Columbia SC, May 1, 2006).

3.7 Wildlife-Dependent Recreation

Hunting around the Refuge is culturally important to the local community. If Alternative B is implemented, newly acquired or leased Refuge tracts would reduce commuting distances for hunters. Additionally, under this alternative, a careful balance of hunting seasons have been fully examined to ensure that hunting and other wildlife dependent recreation do not overlap. This alternative would also allow the public to enjoy quality hunting opportunities at little cost.

The Refuge hunt program has also increased the public awareness of the Refuge and the NWRS more so than almost every other program. Through this public support, which has evolved principally through hunters and fisherman, the Refuge has received significant private donations from local sporting goods outlets, which have now been matched with grants and dedicated to building facilities for non-consumptive public uses. These facilities include boardwalks, docks, weather shelters, environmental education outposts, overlooks, and nature trails. Hunters also play a significant role in helping with law enforcement activities. Because Refuge staff resources are very limited, hunters provide vital tips that often lead to the conviction of poachers, illegal wildlife and plant possession, trespassing, wildlife disease, and public hazards.

3.8 Socioeconomic Environment

Waccamaw NWR includes portions of Georgetown, Horry, and Marion counties between the cities of Georgetown and Conway, about 16 miles north of Winyah Bay. Three primary urban centers are associated with the study area: the cities of Georgetown, Conway, and Myrtle Beach. The major area of growth is the Grand Strand, a 60-mile stretch of coastline between the Atlantic Ocean and the Waccamaw River in Georgetown and Horry counties. The Grand Strand is one of the nation’s top vacation destinations, stretching from Pawley’s Island north to the town of Little River near the South Carolina-North Carolina State line. The area has both a large resident population and a large tourist population, both of which are rapidly growing.
Georgetown County is about half as densely populated as the state (69 people per-square-mile vs. 133 people per-square-mile) but growing faster. In 2004, the county’s estimated population was 59,790, about 1 percent of South Carolina’s population of 4,198,068 (USCB 2006). The county population grew by 7.2 percent from 2000 to 2004, compared to South Carolina’s 4.6 percent growth in the same four years. From 1990 to 2000, Georgetown County grew 20.5 percent compared to South Carolina’s 15.1 percent in the same decade.

Horry County is more densely populated as the state (173 people per-square-mile vs. 133 people per-square-mile) and also growing faster. In 2004, the county’s estimated population was 217,608, about 5 percent of South Carolina’s population of 4,198,068 (USCB 2006). The county population grew by 10.7 percent from 2000 to 2004, compared to South Carolina’s 4.6 percent growth in the same four years. From 1990 to 2000, Horry County grew 36.5 percent compared to South Carolina’s 15.1 percent in the same decade.

Marion County is also about half as densely populated as the state (72 people per-square-mile vs. 133 people per-square-mile) but growing more slowly. In 2004, the county’s estimated population was 35,086, about 0.8 percent of South Carolina’s population of 4,198,068 (USCB 2006). The county population declined by 1.1 percent from 2000 to 2004, compared to South Carolina’s 4.6 percent growth in the same four years. From 1990 to 2000, Marion County grew 4.6 percent, compared to South Carolina’s 15.1 percent growth in the same decade.

In 2004, of the data available, accommodation and food services were the largest of twenty major economic and employment sectors in Georgetown and Horry counties, followed by retail trade (STATS Indiana 2006). Horry County is promoting rapid growth and development, while Georgetown County is striving to provide an environment more conducive to a slower pace of development. Manufacturing was the largest sector in Marion County. Employment by major industrial sectors is shown in Table 1.
South Carolina’s statistics are slightly below the national averages for persons below the poverty line, median household and per capita income, and educational attainment levels (USCB 2006). Georgetown and Horry counties conform to this profile, but Marion County fares a little worse (Table 2). In terms of race and ethnicity, whites and blacks dominate both the county and the state populations.

Table 1. Employment of civilian population 16 years and older by industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Georgetown County</th>
<th>Horry County</th>
<th>Marion County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry, Hunting</td>
<td>2.2%</td>
<td>0.3%</td>
<td>N/A</td>
</tr>
<tr>
<td>Mining</td>
<td>0.2%</td>
<td>0.1%</td>
<td>N/A</td>
</tr>
<tr>
<td>Construction</td>
<td>7.4%</td>
<td>8.5%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>9.4%</td>
<td>4.1%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>1.8%</td>
<td>1.9%</td>
<td>N/A</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>13.7%</td>
<td>17.1%</td>
<td>13.0%</td>
</tr>
<tr>
<td>Transportation and Warehousing</td>
<td>1.5%</td>
<td>1.5%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.4%</td>
<td>0.3%</td>
<td>N/A</td>
</tr>
<tr>
<td>Information</td>
<td>0.8%</td>
<td>1.5%</td>
<td>N/A</td>
</tr>
<tr>
<td>Finance and Insurance</td>
<td>2.2%</td>
<td>3.8%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>2.8%</td>
<td>4.0%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Professional and Technical Services</td>
<td>N/A</td>
<td>2.6%</td>
<td>N/A</td>
</tr>
<tr>
<td>Management of Companies</td>
<td>N/A</td>
<td>0.4%</td>
<td>N/A</td>
</tr>
<tr>
<td>Waste Services</td>
<td>4.6%</td>
<td>4.8%</td>
<td>N/A</td>
</tr>
<tr>
<td>Educational Services</td>
<td>0.3%</td>
<td>0.3%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Health Care and Social Assistance</td>
<td>8.7%</td>
<td>7.5%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Arts, Entertainment, Recreation</td>
<td>3.5%</td>
<td>5.0%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Accommodation and Food Services</td>
<td>15.3%</td>
<td>23.6%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Other Services</td>
<td>2.3%</td>
<td>2.5%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Public Administration</td>
<td>5.5%</td>
<td>3.5%</td>
<td>7.3%</td>
</tr>
</tbody>
</table>

Source: STATS Indiana 2006 (Note: N/A = data not available)
Table 2. Comparison of demographic statistics for Georgetown, Horry, and Marion Counties, South Carolina, and the USA

<table>
<thead>
<tr>
<th>Location</th>
<th>Median Household Income</th>
<th>Per Capita Income</th>
<th>% Below Poverty</th>
<th>% High School Graduates</th>
<th>% Bachelor Degree</th>
<th>% White</th>
<th>% Black</th>
<th>% Hispanic</th>
<th>% Asian</th>
<th>% Native American</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgetown County</td>
<td>$35,312</td>
<td>$19,805</td>
<td>17.1</td>
<td>75.2</td>
<td>20.0</td>
<td>59.7</td>
<td>38.6</td>
<td>1.6</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Horry County</td>
<td>$36,470</td>
<td>$19,949</td>
<td>12.0</td>
<td>81.1</td>
<td>18.7</td>
<td>81.0</td>
<td>15.5</td>
<td>2.6</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Marion County</td>
<td>$26,526</td>
<td>$13,878</td>
<td>23.2</td>
<td>68.0</td>
<td>10.2</td>
<td>41.7</td>
<td>56.3</td>
<td>1.8</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>South Carolina</td>
<td>$37,082</td>
<td>$18,795</td>
<td>14.1</td>
<td>76.3</td>
<td>20.4</td>
<td>67.2</td>
<td>29.5</td>
<td>2.4</td>
<td>0.9</td>
<td>0.3</td>
</tr>
<tr>
<td>USA</td>
<td>$41,994</td>
<td>$21,587</td>
<td>12.4</td>
<td>80.4</td>
<td>24.4</td>
<td>75.1</td>
<td>12.3</td>
<td>12.5</td>
<td>3.6</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Source: USCB, 2006

Chapter 4: Environmental Consequences

This chapter describes the foreseeable environmental consequences of implementing each of the management alternatives in Chapter 2. When detailed information is available, a scientific and analytic comparison between alternatives and their anticipated consequences is presented, which is described as “impacts” or “effects.” When detailed information is not available, those comparisons are based on the professional judgment and experience of Refuge staff and USFWS and State biologists.

4.1 Effects Common to all Alternatives

4.1.1 Refuge Physical Environment

Impacts of each of the alternatives on the Refuge’s physical environment would be similar and have minimal to negligible additive effects on the physical environment. The Refuge is limited to foot access for all approved public uses which minimizes habitat degradation and disturbance to surface soils and topography.

Impacts of each of the alternatives on the natural hydrology would also be similar in that they would be expected to have negligible effects on the natural hydrology. The Refuge expects impacts of each of the alternatives to air and water quality to be similar in having minimal effects primarily related to Refuge visitors’ automobile and boat emissions on roads, creeks and rivers used to access Refuge lands. The cumulative effect of these Refuge-related activities on overall air and water quality in the region would also be similar between alternatives and the additive effects would be negligible due to premise that these public use constituents would be making longer trips to have the same
experiences if the Refuge did not allow the public uses outlined in each alternative. Existing State water quality criteria and use classifications are acceptable however, a recognition from environmental groups of shortfalls in current legislation has increased awareness of legislators in hopes that these laws will be improved to achieve improved on-Refuge environmental conditions. Thus, implementation of the proposed action would not impact adjacent landowners or users beyond the constraints already implemented under existing State standards and laws.

Impacts associated with each alternative on solitude and the quality of the outdoor experience are expected to be similar and minimal given the complexity and remoteness of access for hunters which will preclude many visitors from accessing areas open to hunting. Although some public use areas such as trails might be temporarily closed during Refuge hunts, these impacts are mitigated by having two significant public use areas which are closed year-round to hunting to help prevent conflicts during Refuge hunts.

4.1.2 Environmental Justice

Executive Order 12898 “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” was signed by President Bill Clinton on February 11, 1994, to focus federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment. There are several rural communities adjacent to the Refuge that meet some part or all of the criteria identified and protected by Executive Order 12898.

With respect to impacts that may adversely effect minority or low-income populations in the affected area, this EA has not identified any adverse environmental or human health effects specific to any of the alternatives.

4.1.3 Public Health and Safety

The Refuge is a suburban Refuge with many miles of urban/wildland interface along its boundary. As wildlife habitats and migratory corridors diminish, human/wildlife encounters are becoming more common and problematic. State law enforcement officers are spending a disproportionate amount of their annual tour of duty addressing nuisance animal complaints (SCDNR personal communications). High population densities of deer and feral hogs can lead to increased automobile collisions, property damage, and nuisance complaints. In 2010, 24 deer-vehicle collisions in Georgetown County, 85 in Horry County, and 19 in Marion County were reported to the South Carolina Department of Public Safety. These collisions numbers are a significant increase to those reported in
2006 (SCDNR, 2010). In the more rural portions of the Refuge, increased crop damage and degradation to dikes, roads, and levees can result. High deer numbers are also implicated in the rapid increase in the incidence of Lyme’s disease in humans.

As a result of the growing number of human/wildlife incidents many homeowner associations and insurance companies are requesting local and state agencies to control populations through depredation permits to reduce populations down to a manageable level. Under Alternative A, the “No Action” alternative, hunting would be prohibited on future acquired and leased Refuge tracts and would not help reduce the risk of the above mentioned concerns. Under Alternative B, hunting on newly acquired or leased Refuge tracts would reduce the risk of public health and safety issues.

4.1.4 Cultural Resources

Under each alternative, impacts to cultural resources on the Refuge are similar in that none of the public uses allowed under each alternative would increase opportunities for impacts to cultural resources. All known areas containing cultural resources are generally closed to public access and/or every effort is taken by the Refuge to protect these sites. Hunting, regardless of method or species targeted, is a public use activity that does not pose any additive threat to historic properties on and/or near the Refuge. Additionally, the removal of feral hogs through hunting would be a significant measure against the destruction of significant archeological resources that can be uncovered or displaced by feral hog rooting and wallowing.

4.1.5 Facilities

The Service defines facilities as: “Real property that serves a particular function(s) such as buildings, roads, utilities, water control structures, raceways, etc”. Annual maintenance or improvement(s) of existing facilities (i.e. parking areas, roads, trails, boat ramps and buildings) for each alternative is similar in that it may cause minimal short term impacts to localized soils and waters, and, may cause some wildlife disturbances and damage to vegetation when being performed by Refuge staff. Facility maintenance and improvement activities are periodically conducted to accommodate daily Refuge management operations and general public uses such as wildlife observation and photography. When these activities are necessary, they will be conducted at times (seasonal and/or daily) to cause the least amount of disturbance to wildlife. Siltation barriers will be used to minimize soil erosion, and all disturbed sites will be restored to as natural a condition as possible.

The Refuge has no new facilities planned for new Refuge parcels to administer the hunting program. Cox Ferry Lake Recreation Area facilities completed in 2010 are closed to hunting. ATVs and other land conveyance vehicles are not allowed on Refuge roads or trails. Under all of the alternatives, adverse effects to existing facilities would be the same. Almost all of the existing Refuge maintained parking areas, roads and trails are located on two Refuge tracts which will be closed year-round to hunting. The only facilities that will be utilized during Refuge hunts by hunters are existing parking areas
and boat ramps that are public facilities, which are open year-round and maintained by the county or state. Due to the high number of boat landings adjacent to the Refuge, there should be minor impacts of these facilities during Refuge hunts.

4.2 Summary of Effects

4.2.1 Impacts to Habitat

Alternative A (No Action) – Current Management

Under this alternative, hunting would not be opened to the public on any future acquired or leased tracts of the Refuge. Negative impacts to wildlife habitat would be expected on these tracts based on studies showing negative impacts to wildlife habitat and population interrelationships caused by an overabundance of deer. For example, allowing the Refuge deer herd population on future properties to increase without hunting those properties as a method to manage deer populations could result in significant negative impacts on other plant and animal species. When habitat carrying capacity is exceeded, competition for limited food resources results in overbrowsing by deer. Severe overbrowsing alters plant species composition, distribution, and abundance, and reduces understory structural diversity. These changes may have a deleterious impact on local animal communities which depend on healthy vegetative systems for food and cover (Ellingwood and Caturano 1988).

A separate category of negative impacts that must be considered is the economic impacts related to forest and farm land habitats on adjoining landowners. Approximately one-half of the Refuge acquisition boundary adjoins urban to suburban residential areas. By not allowing any hunting on the newly acquired tracts, these impacts would not only occur on the new tracts but they would also increase on adjoining lands.


Under this alternative, hunting on future acquired or leased Refuge tracts would be opened to the public on a limited basis. Impacts to Refuge habitats would be reduced, due in part, to the management of the deer and feral hog population. No additive impacts from the use of ATVs or other off-road vehicles because of the standing Refuge policy that prohibits the use of land vehicles including ATVs for Refuge hunts.

Ecological benefits derived from regulated hunting include protection of wildlife habitats from overbrowsing (Behrend et al. 1976), protection of species diversity of flora and fauna that may be negatively impacted by deer and hog overpopulation, and the maintenance of healthy, viable deer populations (McCullough 1979). Hunting pressure on private lands within and adjacent to the Refuge acquisition boundary has historically been a significant factor in influencing seasonal wildlife immigration to Refuge lands. By providing limited hunting on the Refuge, these seasonal population swings can provide
opportunities to positively impact the overall population, thus influencing herd health and wildlife habitats both on the Refuge and on adjoining private lands.

Additionally, all Refuge administered lands within each respective hunt unit will be managed uniformly and open to hunting during the restricted hunting seasons. Public information management related to the Draft 2012 Hunt Plan will be consistent and uniform and easier to manage by the Refuge.

4.2.2 Impacts to Hunted Wildlife

Alternative A (No Action) – Current Management

Under this alternative, hunting would not be opened to the public on newly acquired or leased Refuge tracts. Mortality of individually hunted animals as a result of a sanctioned Refuge hunt would not occur under this alternative; however, poaching is an on-going challenge on closed hunting areas, so some mortality could still occur. Disturbance by Refuge hunters to wildlife would not occur; however, other public uses that cause disturbance, such as hiking, wildlife observation and photography, & environmental education and interpretation would still occur. Because most of the Refuge is bisected by a multitude of navigable, public waterways which the Refuge has no management authority over, disturbance by public waterfowl hunting, boating, & fishing on the creeks and rivers will exist with or without allowing hunting.

In the absence of regulated hunting, wildlife populations on newly acquired Refuge lands could become unbalanced favoring more adaptive and opportunistic species such as feral hogs, white-tailed deer, raccoons and squirrels. Due to the decline or lack of natural predators, these populations would expand beyond the biological carrying capacity of the land causing environmental and health threats. For example feral hog populations can increase by 300% in one year without any measure of predatory control. Sexual maturity in wild hogs is generally reached before the end of the first year of life (Sweeney 1970, Barrett 1978) and in the Southeast, hogs are sexually active and will breed throughout the year. Feral hogs can harbor several infectious diseases, some of which can be fatal to native wildlife. Additionally, feral hogs compete directly for food with deer, bears, turkeys, squirrels and many other birds and mammals.

Deer herd densities can double in one year (McCullough 1979) and depending on habitat quality can increase to levels exceeding the carrying capacity as quickly as two to three years. Deer herds at upper density limits consist of deer in relatively poor health (Dasmann 1981). High density herds are prone to cyclic population fluctuations and catastrophic losses (McCullough 1979). Dickinson (1983) reported white-tail deer harvested from New York’s Bear Mountain-Harriman State Park, following a 71 year history of no hunting, were the poorest physical specimens ever recorded in New York and possibly in the northeast. The likelihood of starvation and diseases, such as bluetongue and EHD in deer and distemper and rabies in raccoon and opossum, would increase, as would vehicle-deer collisions.

Under this alternative, hunting would be opened to the public on current and future acquired or leased Refuge tracts on a limited basis, in accordance with the Draft 2012 Hunt Plan.

Regulated hunting has been proven to be an effective deer population management tool (Hesselton et al. 1965). In addition, it has been shown to be the most efficient and least expensive technique for removing deer (Palmer et. al 1980). For feral hogs, regulated hunting may not reduce hog populations to desired levels; however, it will contribute to the on-going efforts of the Refuge to control this invasive species. Reduction of the hog population would also decrease risk of transmitting fatal diseases by hogs to other wildlife species. Fewer hogs would decrease competition for food with native wildlife, such as deer, bear, turkey, and squirrel. Special hunting seasons for hogs may be implemented to further reduce populations beyond those taken during the prescribed deer seasons. Hunting seasons for all species may be adjusted annually to take into consideration changes indicated in herd quality by other biological monitoring (APC’s, body weights, age ratios, antler size, and reproductive rates). Additionally, the hunting season structure will be based on hunter success, and sex-age-kill ratios. The likelihood of starvation and diseases, such as bluetongue and EHD in deer would be decreased as would deer-vehicle collisions.

Public waterfowl hunting provides an economical means for statistical data collection. Random checks of hunters can provide kill ratios, population composition, and bird habitat data as well as the possibility of organ collection (gizzards, etc.) for various studies. However, wildlife disturbance associated with waterfowl hunting does impact diurnal and nocturnal use of an area by waterfowl (Cronan 1957, McNeil et al. 1992, Paulus, 1984). Disturbance associated with a Refuge hunt may have an additive effect on reducing waterfowl use within the hunt area; however it will be minimal in areas where unrestricted public hunting already occurs in nearby public waters.

There are, however, management tools that can be used to minimize and/or mitigate disturbance and the interruption of use of Refuge habitats by wintering waterfowl. Afternoon closure of hunting reduces disturbance (Gordon et al. 1989) as well as reduces the total take of waterfowl (Kirby et al.1983). Unhunted, managed wetlands provide areas that are utilized as resting and feeding areas when adjacent areas are hunted (Gordon et al. 1989, Paulus 1984). Privately owned managed wetlands as well as natural bays, ponds, oxbows, and tidal marshes within or adjacent to the Refuge acquisition boundary that are permanently set aside for waterfowl sanctuary are few and far between. Areas that have been set aside as wildlife sanctuaries are heavily used by waterfowl during the day as resting/loafing areas. Many of these areas are now being impacted by land use changes as commercial development continues to grow throughout the region. As Refuge tracts are acquired, consideration will be given to closing isolated water areas to provide additional waterfowl rest sites on the Refuge. For instance, waterfowl hunting is currently allowed only on Refuge parcels in Unit 1 that are bounded by the Great Pee Dee River.
There are several Refuge parcels in Unit 2 closed year-round to all public use activities, which provide sanctuary for many species of wildlife including waterfowl. Mitigation measures such as this will continue to be incorporated into the Refuge hunt program as well as other restrictions such as noon closure to waterfowl hunting, and opening no more than 60% of the Refuge to waterfowl hunting.

For upland/small game species, negative impacts of this alternative will be minimal. Woodcock hunting would be added as an additional hunting opportunity on Refuge lands and monitored accordingly during hunting season to maintain healthy population levels.

Studies show that there are only small differences in density and/or mortality rates in squirrels and rabbits on hunted verses non-hunted populations (Mosby 1969, Rose 1977). As a result, limited hunting mortality does not affect the overall status of these species however it would help to lower the risk of diseases such as rabies and distemper that can plague many small game species. Additionally, hunting of these species will cause only minimal disturbance to other wildlife populations. Everett (1982), monitored movements of wild turkeys before, during and after squirrel, deer and turkey hunts and found no permanent movement out of established ranges which could be attributed to hunting.

Furthermore, if Refuge turkey hunts are implemented in the future, disturbance to target and non target species should be minimal due to the nature of turkey hunting itself. Throughout the Refuge acquisition boundary, many adjoining landowners manage intensively for wild turkey and consequently, turkey populations on Refuge owned tracts often fluctuate as the turkey flocks move back and forth between federally owned and private property. Additionally, because of the difficulty of physical accessing many tracts and due to seasonal habitat availability related to river levels, turkey hunting may be physically restrictive; and therefore, should have minimal direct and/or indirect impacts on the resident wild turkey population.

### 4.2.3 Impacts to Non-hunted Wildlife

**Alternative A (No Action) – Current Management**

Hunting has proven to be an effective management tool to manage for both hunted and non-hunted wildlife. Under this alternative, hunting would not be opened to the public on future Refuge tracts on the Refuge. Increased disturbance to non-hunted wildlife would not occur as a result of hunting on the Refuge however, all the Refuge is open to the public outside of hunting season which might cause equal disturbance to wildlife.

Research conducted by USFWS on alligator snapping turtles has demonstrated significant depredation of turtle nest eggs from raccoons. The likelihood of inter-specific disease outbreaks from raccoons and opossum, such as distemper and rabies, would affect all mammalian species including rare bats that inhabit the Refuge. Based on Refuge monitoring prior to the establishment of a hunt program, feral hog populations would increase dramatically under this alternative.
Prior to a Refuge hunting program, illegal introduction of feral hogs became a law enforcement challenge as poachers would release female hogs on non-hunted Refuge lands so that they would be protected until they needed them to for illegal sale and release on private game farms. By not hunting feral hogs, the feral hog populations will rapidly increase and habitat destruction and impacts to other wildlife will reach epidemic proportions on the Refuge.

Under State regulations, hunting Black bear and American alligators is permitted. However, the USFWS will continue to prohibit any take of alligators and bear on Refuge lands. Federal law enforcement officers will strictly enforce regulations to prohibit the take of any alligators or black bear on Refuge lands year-round.


Under this alternative, hunting would be opened to the public on current and future acquired and leased Refuge tracts on a limited basis. Populations of raccoon would be decreased through hunting. With hunted (managed) raccoon populations, depredation rates of songbirds, turkeys, turtles, and their nests would decrease. Feral hog populations would be reduced, thereby decreasing predation of prey, such as ground nesting birds, and small mammals. The Refuge would continue to prohibit alligator and bear hunting on the Refuge so there would be no impact to these species.

Under this alternative, disturbance to non-hunted wildlife will have little to no effect. Refuge access for hunting is primarily restricted to alluvial ridges and hammocks fronting the river. Boat access is required for these areas and this alone precludes many hunters from participating in Refuge hunts. The broad spans of forested floodplain wetlands along the Great Pee Dee and Waccamaw Rivers, allows most wildlife species, including those species permitted to be hunted, to seek cover quickly within the often impenetrable interior swamps. Disturbance to the daily wintering activities, such as feeding and resting, of birds might occur, but would be transitory as hunters traverse habitats along the rivers edge.

Other wildlife disturbances will be minimized under this alternative and implementation of Refuge specific regulations will be structured to reduce these impacts. Closure to the use of ATV’s, restrictions on use of dogs, weapons, and access are some hunting regulations used to limit non-hunted wildlife disturbances.

**4.2.4 Impacts to Endangered and Threatened Species**

An Intra-Service Section 7 Evaluation Consultation was completed for the 2007 Hunt Plan, in 2008 for the CCP, and the 2009 Hunt Plan. Additionally, one was completed in December 2011 for the Draft 2012 Hunt Plan.

Seven federally listed endangered or threatened species are known to occur or potentially occur within the proposed boundary of the Refuge. These include three species of birds,
one species of fish, and three species of plants (listed in Section 3.4). If wood stork or RCW nesting activity occurs on, or nearby Refuge lands, closed areas will be established to buffer the nesting area from any human disturbance and/or activity associated with any permitted public use. This requirement would be the same with or without hunting. For instance, RCW nesting has been documented to be on the Refuge’s leased upland portion of Sandy Island. Because this area will be closed altogether to hunting, it has been determined that the proposed action of opening hunting to newly acquired or leased Refuge tracts is not likely to adversely affect these species. Because of seasonal use parameters listed above and the legal authority available to Refuges to close areas to public access when necessary, no one alternative would be any more likely to adversely affect threatened and endangered species than another.

4.2.5 Impacts to Wildlife-Dependant Recreation

Compatible wildlife-dependant recreation will change under either alternative. The Refuge was established specifically to provide opportunities for hunting, fishing, wildlife observation and photography, and environmental education and interpretation. As Refuge parcels are acquired, these areas will be opened to public use activities.

As public use levels expand across time, unanticipated conflicts between user groups may occur. These conflicts can be mitigated by providing competing interests groups with alternative access opportunities as well as special interest outreach forums. For example, the Refuge has developed an environmental education center along with a recreation area with multi conveyance access (ie. boat, car, bike or foot). Both facilities will be closed to hunting and as they are developed and will provide Refuge visitors with spectacular recreational opportunities on a year-round basis.

4.2.6 Impacts to Facilities (roads, trails, parking lots, levees)

Annual maintenance or improvement(s) of existing facilities (i.e. parking areas, roads, trails, boat ramps and buildings) for each alternative is similar in that it may cause minimal short term impacts to localized soils and waters, and, may cause some wildlife disturbances and damage to vegetation when being performed by Refuge staff. Facility maintenance and improvement activities are periodically conducted to accommodate daily Refuge management operations and general public uses such as wildlife observation and photography. When these activities are necessary, they will be conducted at times (seasonal and/or daily) to cause the least amount of disturbance to wildlife. Siltation barriers will be used to minimize soil erosion, and all disturbed sites will be restored to as natural a condition as possible.

The Refuge has no new facilities planned for new Refuge parcels to administer the hunting program. Cox Ferry Lake Recreation Area facilities completed in 2010 are closed to hunting. ATVs and other land conveyance vehicles are not allowed on Refuge roads or trails. Under all of the alternatives, adverse effects to existing facilities would be the same. Almost all of the existing Refuge maintained parking areas, roads and trails are located on two Refuge tracts which will be closed year-round to hunting. The only
facilities that will be utilized during Refuge hunts by hunters are existing parking areas and boat ramps that are public facilities, which are open year-round and maintained by the county or state. Due to the high number of boat landings adjacent to the Refuge, there should be minor impacts of these facilities during Refuge hunts.

4.3 Cumulative Impacts Analysis

4.3.1 Anticipated Direct and Indirect Impacts of Proposed Action on Wildlife Species.

4.3.1.1 Migratory Birds


The USFWS, working with partners, annually prescribe frameworks, or outer limits, for dates and times when hunting may occur and the number of birds that may be taken and possessed. These frameworks are necessary to allow State selections of season and limits for recreation and sustenance; aid Federal, State, and tribal governments in the management of migratory game birds; and permit harvests at levels compatible with population status and habitat conditions. Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the USFWS annually promulgates regulations (50 CFR Part 20) establishing the frameworks from which States may select season dates, bag limits, shooting hours, and other options for each of the migratory bird hunting seasons. The frameworks are essentially permissive in that hunting of migratory birds would not be permitted without them. Thus, in effect, Federal annual regulations both allow and limit the hunting of migratory birds.

Migratory game birds are those bird species so designated in conventions between the United States and several foreign nations for the protection and management of these
birds. Under the Migratory Bird Treaty Act (16 U.S.C. 703-712), the Secretary of the Interior is authorized to determine when "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any ... bird, or any part, nest, or egg" of migratory game birds can take place, and to adopt regulations for this purpose. These regulations are written after giving due regard to "the zones of temperature and to the distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds, and are updated annually (16 U.S.C. 704(a)). This responsibility has been delegated to the USFWS as the lead federal agency for managing and conserving migratory birds in the United States. Acknowledging regional differences in hunting conditions, the USFWS has administratively divided the nation into four Flyways for the primary purpose of managing migratory game birds. Each Flyway (Atlantic, Mississippi, Central, and Pacific) has a Flyway Council, a formal organization generally composed of one member from each state and Province in that Flyway. The Refuge is within the Atlantic Flyway.

The process for adopting migratory game bird hunting regulations, located in 50 CFR part 20, is constrained by three primary factors. Legal and administrative considerations dictate how long the rule making process will last. Most importantly, however, the biological cycle of migratory game birds controls the timing of data-gathering activities and thus the dates on which these results are available for consideration and deliberation. Because the USFWS is required to take abundance of migratory birds and other factors into consideration, it undertakes a number of surveys throughout the year in conjunction with the Canadian Wildlife Service, state and Provincial wildlife-management agencies, and others. To determine the appropriate frameworks for each species, the USFWS considers factors such as population size and trend, geographical distribution, annual breeding effort, the condition of breeding and wintering habitat, the number of hunters, and the anticipated harvest. After frameworks are established for season lengths, bag limits, and areas for migratory game bird hunting, migratory game bird management becomes a cooperative effort of state and Federal Governments. After USFWS establishment of final frameworks for hunting seasons, the states may select season dates, bag limits, and other regulatory options for the hunting seasons. States may always be more conservative in their selections than the Federal frameworks but never more liberal. Season dates and bag limits for NWR’s open to hunting are never longer or larger than the State regulations. In fact, based upon the findings of an environmental assessment developed when a NWR opens a new hunting activity, season dates and bag limits may be more restrictive than the State allows.

Annual harvest estimates are that a maximum additional 25 wood ducks are harvested each year on the Refuge. This harvest impact represents a mere 0.001% of South Carolina’s four-year average harvest of 80,440 wood ducks (USFWS, 2006). Waterfowl hunting will only be allowed until noon one day per week throughout the season, which is more restrictive than regulations set forth by the State.

Additionally, the Refuge entered into a long-term lease agreement in fiscal year 2006 with the State which allowed the 7,661 acre Bucksport WMA to be combined with other fee title Refuge lands. By adding this significant block of land, the Refuge in now able to
better manage important riverine habitats as well as provide a more consistent set of regulations for the visiting public. Equally as important as uniform management throughout the Refuge acquisition boundary, by adding the Bucksport WMA to the Refuge, it was able to create a contiguous 12,323 acre waterfowl sanctuary along the Waccamaw River. This area has now become an important resource for protecting wood duck populations in an area of the Refuge where State or private sanctuaries do not exist.

In a study done by U.S. Geological Patuxent Wildlife Research Center in 2005 (McAuley et al. 2005), results showed no significant differences in woodcock survival between hunted and non-hunted areas. Furthermore, the authors concluded that hunting was not having a considerable impact on woodcock numbers in the Northeast (McAuley et al. 2005).

Snipe hunting is proposed for only the tidal wetland marshes in Unit 3 and on a much more restricted basis (two days a week for one month of the season or approximately eight days) than allowed by South Carolina state regulations. In addition to restricted hunting days, non toxic shot is required to be used by hunters. This Refuge restriction further restricts hunters, possibly even more than days open, due to the lack of availability of smaller shot sizes in non toxic shot. Other factors such as weather, daily tidal cycles, and private lands, which are rarely hunted for snipe, will have additive impacts on hunter success.

Based on the USFWS Harvest Report (USFWS, 2011), snipe harvest estimates for South Carolina for 2009 and 2010 were 1,900 and 7,400 respectively. Seasonal harvest per hunter was 1.6 in 2009 and 5.2 in 2010. Total harvest of snipe for the Atlantic Flyway was 43,600 in 2009 and 54,000 in 2010. Although flyway harvest did not vary significantly between 2009 and 2010, seasonal harvest variations for South Carolina demonstrate how weather may be a significant factor in hunter success throughout the state.

4.3.1.2 Resident Big Game

4.3.1.2.1 Deer

Home range size in mammals often decreases as population density increases (Sanderson 1966). Bridges (1968) and Smith (1970) both observed a threefold increase in home-range size following a die-off in a Florida deer population. Adult bucks generally have larger home ranges than does and these ranges can vary in size due to many environmental factors. In Florida, minimum home ranges averaged 622.8 hectares (1,539 acres) for two mature bucks, and 153.0 hectares (606 acres) for two does, and 153.0 hectares (378 acres) for a buck fawn (Smith 1970). Deer hunting does not have regional population impacts due to restricted home ranges of white tailed deer. Therefore, only local impacts are likely to occur from deer hunting on the Refuge.

Deer herd health checks are conducted every 5 years on most NWR’s by the Southeast Cooperative Wildlife Disease Study at the University of Georgia. In 2005, the health
check report stated that “Although continuation of current herd density may result in declines in herd health or higher rates of disease-induced mortality, the data suggests that some level of covert mortality may be present. These losses will predominantly affect younger animals, 4-12 month of age, mainly during winter and early spring, and will be associated with parasitism by stomach worms (Haemonchus contortus) and lungworms (Dictyocaulus viviparous). Any significant increase in density likely would result in declines in population health from this density-dependent parasitism/malnutrition syndrome.”

Harvest and survey data confirm that decades of deer hunting on surrounding private lands (using bait and a longer season) have not had a local cumulative adverse effect on the deer population. The State estimates that 222,649 deer were harvested in South Carolina in 2010 (SCDNR, 2010). Harvest records by each county indicate that Georgetown County harvested 4,741 deer in 2010. This total harvest also computes to 84.3 acres/deer or 7.6 deer/square mile. For Horry County, 4,613 deer were harvested in 2010 which also computes to 115.6 acres/deer or 5.5 deer/square mile (SCDNR, 2010). Harvest rates on Refuge lands have been significantly lower than private lands adjoining the Refuge due to the allowance of baiting, longer seasons and no restrictions of method of take on private lands.

4.3.1.2.2 Feral Hogs

Feral hogs are an extremely invasive introduced non-native species and are not considered a game species by the State. No bag limits are established for feral hogs. Hunting of feral hogs provides the Refuge with another management tool in reducing this detrimental species, and at the same time, is widely enjoyed by local hunters. Cumulative effects to an exotic, invasive species should not be of concern because the Refuge would like to extirpate this species on Refuge lands. Hunting of hogs is not considered detrimental to the biological integrity of the Refuge, is not likely to create conflict with other public uses, and is within the wildlife-dependant public uses to be given priority consideration. Since hogs are exotic, they are a priority species for Refuge management only in terms of their negative impacts on Refuge biota and need for eradication. Georgetown County, South Carolina ranked 6th in the state for overall hog harvest in 2009 and 9th in 2010 (SCDNR, 2010). They are a popular hunted species, and the public interest would best be served by allowing this activity on the Refuge. However, even with hunting, feral hogs are likely to always be present because they are prolific breeders.

4.3.1.2.3 Wild Turkey

Turkeys are non-migratory and therefore hunting only impacts the local population. Because Refuge turkey would be restricted to Refuge tracts along the Great Pee Dee River, frequent flooding along with many other environmental circumstances often further impedes hunter success. Based on harvest data from six South Carolina Department of Natural Resources youth turkey hunts, the overall harvest rates were less than 40% unless accompanied by a professional guide (personal communications with
SCDNR Biologist). These data indicate that the local turkey population has withstood hunting on surrounding private lands for several years without negative cumulative effects on turkeys. Therefore, the Refuge should not cumulatively adversely impact the population.

4.3.1.3 Small Game (Squirrel, Raccoon, Opossum)

Squirrels, raccoon, and opossum cannot be affected regionally by Refuge hunting because of their limited home ranges. Only local effects will be discussed. Opossum and raccoon are hunted primarily at night. Raccoon are more sought after than opossum by the public. Hunting helps regulate opossum and raccoon populations; however, unless the popularity of this type of hunting increases, raccoons and opossums numbers will always be higher than desired. When these species become extremely overabundant, diseases such as distemper and rabies reduce the populations. However, waiting for disease outbreak to regulate their numbers can be a human health hazard. Cumulative adverse impacts to raccoon and opossum are unlikely considering they reproduce quickly, are difficult to hunt due to their nocturnal habits, and are not as popular for hunting as other game species.

Studies have been conducted within and outside of South Carolina to determine the effects of hunting on the population dynamics of small game. Results from studies have consistently shown that small game, such as squirrels, are not affected by hunting, but rather are limited by food resources. Refuge staff consulted with State biologists in association with this assessment on the cumulative impacts of hunting squirrel, raccoons and opossum. Although overall State harvest data was unavailable for South Carolina for these species, the Refuge hunt program is not expected to have any significant impact even on local populations of these species due to limited Refuge access and frequent flood events. Under the proposed action, the Refuge estimates a maximum additional 50 squirrels would be harvested. Gray squirrels are prolific breeders and their populations have never been threatened by hunting in South Carolina even prior to the passing of hunting regulations as we know them today.

4.3.1.4 Non-hunted Wildlife

Non-hunted wildlife would include non-hunted migratory birds such as songbirds, wading birds, raptors, and woodpeckers; small mammals such as voles, moles, mice, shrews, rabbits, and bats; reptiles and amphibians such as snakes, skinks, turtles, lizards, salamanders, frogs and toads; and invertebrates such as butterflies, moths, other insects and spiders. Except for migratory birds and some species of migratory bats, butterflies and moths, these species have very limited home ranges and hunting could not affect their populations regionally; thus, only local effects will be discussed.

Disturbance to non-hunted migratory birds could have regional, local, and flyway effects. Regional and flyway effects would not be applicable to species that do not migrate such as most woodpeckers, and some songbirds including cardinals, titmice, wrens, chickadees, etc. The cumulative effects of disturbance to non-hunted migratory birds
under the proposed action are expected to be negligible for the following reasons: Hunting season would not coincide with the nesting season; and disturbance to the daily wintering activities, such as feeding and resting, of birds might also be caused by non-hunters.

The cumulative effects of disturbance to other wildlife under the proposed action are also expected to be negligible, however, disturbance would be unlikely. Small mammals, including bats, are inactive during winter when hunting season occurs. These species are also nocturnal. Both of these qualities make hunter interactions with small mammals very rare. Hibernation or torpor by cold-blood reptiles and amphibians also limits their activity during the hunting season when temperatures are low. Hunters would rarely encounter reptiles and amphibians during most of the hunting season. Encounters with reptiles and amphibians in the early fall are few and should not have cumulative negative effects on reptile and amphibian populations. Invertebrates are also not active during cold weather and would have few interactions with hunters during the hunting season. The Refuge has estimated current hunter density on peak days to be no more than 1 hunter per 1000 acres. During the vast majority of the hunting season, hunter density is much lower (1 hunter/3,000 acres). Refuge regulations further mitigate possible disturbance by hunters to non-hunted wildlife. Vehicles and ATVs are prohibited on Refuge roads and the harassment or taking of any wildlife other than the game species legal for the season is not permitted.

Although ingestion of lead-shot by non-hunted wildlife could be a cumulative impact, it is not relevant to the Refuge because the use of lead shot would not be permitted for any type of hunting.

Some species of bats, butterflies and moths are migratory. Cumulative effects to these species at the “flyway” level should be negligible. These species are in torpor or have completely passed through South Carolina by peak hunting season in Nov-Jan. Some hunting occurs during September and October when these species are migrating; however, hunter interaction would be commensurate with that of non-consumptive users.

4.3.1.5 Federally Threatened or Endangered Species

An Intra-Service Section 7 Evaluation Consultation was completed for the 2007 Hunt Plan, in 2008 for the CCP, and the 2009 Hunt Plan. Additionally, one was completed in December 2011 for the Draft 2012 Hunt Plan.

Seven federally listed endangered or threatened species are known to occur or potentially occur within the proposed boundary of the Refuge. These include three species of birds, one species of fish, and three species of plants (listed in Section 3.4). If wood stork or RCW nesting activity occurs on, or nearby Refuge lands, closed areas will be established to buffer the nesting area from any human disturbance and/or activity associated with any permitted public use. This requirement would be the same with or without hunting. For instance, RCW nesting has been documented to be on the Refuge’s leased upland portion of Sandy Island. Because of the legal authority available to Refuges to close areas to
public access when necessary, no one alternative would be any more likely to adversely affect threatened and endangered species than another.

4.3.2 Anticipated Direct and Indirect Impacts of Proposed Action on Refuge Programs, Facilities, and Cultural Resources.

4.3.2.1 Wildlife-Dependant Recreation

As public-use levels expand over time, unanticipated conflicts between competing user groups may occur. The Refuge’s visitor use programs would be adjusted as needed to eliminate or minimize each problem and provide quality wildlife-dependent recreational opportunities. Experience has proven that time and space zoning (e.g., establishment of separate use areas, use periods, and restrictions on the number of users) is an effective tool in eliminating conflicts between user groups. The Refuge has focused more resources on establishing public-use areas that are closed year-round to hunting than it has on hunting programs.

The level of recreational use and ground-based disturbance from visitors would be largely concentrated on trails and the Refuge’s office and maintenance areas. This use should remain the same or increase as interests grow at the same rate with or without hunting. Access to more areas will remain a Refuge priority, however, the lay of the land will preclude most areas from increased visitor access.

The opportunities for hunting would be increased under the proposed action. High deer, feral hog, and raccoon numbers are recognized as a problem causing crop damage, reducing some forest understory species, and reducing reforestation seedling survival. Hunting would be used to keep these populations as well as other resident wildlife populations in balance with the habitat’s carrying capacity, resulting in long-term positive impacts on wildlife habitat.

The Refuge prohibits all land conveyance vehicle access for any public use on the Refuge to minimize wildlife disturbance and habitat degradation. Some areas, such as waterfowl sanctuaries, would be closed seasonally to hunting to minimize disturbance to wintering waterfowl.

4.3.2.2 Refuge Facilities

The Service defines facilities as: “Real property that serves a particular function(s) such as buildings, roads, utilities, water control structures, raceways, etc.” Under the proposed action those facilities most utilized by hunters are: parking lots and boat launching ramps. Because hunters are permitted to access the Refuge by foot only, no additional maintenance or improvements of existing facilities will be required.
4.3.2.3 Cultural Resources

Hunting, regardless of method or species targeted, is a consumptive activity that does not pose any threat to historic properties on and/or near the Refuge. In fact, hunting meets only one of the two criteria used to identify an “undertaking” that triggers a federal agency’s need to comply with Section 106 of the National Historic Preservation Act. These criteria, which are delineated in 36 CFR Part 800, state:

1- an undertaking is any project, activity, or program that can alter the character or use of an archaeological or historic site located within the “area of potential effect;” and
2- the project, activity, or program must also be either funded, sponsored, performed, licenses, or have received assistance from the agency.

Consultation with the pertinent State Historic Preservation Office and federally recognized Tribes are, therefore, not required.

4.3.3 Anticipated Impacts of Proposed Action on Refuge Environment and Community.

The Refuge expects no sizeable adverse impacts of the proposed action on the Refuge environment which consists of soils, vegetation, air quality, water quality, and solitude. Hunting would benefit vegetation as it is used to keep many resident wildlife populations in balance with the habitat’s carrying capacity. The Refuge would also control access to minimize habitat degradation.

The Refuge expects impacts to air and water quality to be minimal and only due to boat emissions traveling to and from Refuge lands. The effect of these Refuge-related activities, as well as other management activities, on overall air and water quality in the region are anticipated to be relatively negligible, compared to the contributions of industrial centers, power plants, and non-Refuge vehicle traffic. Existing State water quality criteria and use classifications are minimal but are improving to achieve desired on-Refuge conditions; thus, implementation of the proposed action would not impact adjacent landowners or users beyond the constraints already implemented under existing State standards and laws.

Impacts associated with solitude are expected to be minimal given time and space zone management techniques, such as seasonal access and area closures, used to avoid conflicts among user groups.

The Refuge would work closely with State, Federal, and private partners to minimize impacts to adjacent lands and its associated natural resources; however, no indirect or direct impacts are anticipated. The addition of land for Refuge hunts would result in a net gain of public hunting opportunities positively impacting the general public, nearby residents, and Refuge visitors. The Refuge expects increased visitation and tourism to bring additional revenues to local communities but not a significant increase in overall
revenue in any area. Through these direct and indirect economic impacts, community support has increased significantly for Refuge land acquisition and public use opportunity funding.

Additionally, traditional uses such as hunting have been a way of life for rural communities around the Refuge, often occurring on lands that are now part of the Refuge. In recent years land use changes around the Refuge have eliminated many areas that have been traditionally leased by hunters. Commercial timber lands have been sold to residential developers and the interest in public lands in upper coastal South Carolina has increased significantly since the establishment of the Refuge. By opening newly acquired or leased Refuge Tracts to limited hunting, new opportunities would be gained for continuing a traditional use and consequently it would have a positive economic impact on these rural communities.

4.3.4 Other Past, Present, Proposed, and Reasonably Foreseeable Hunts and Anticipated Impacts

Cumulative effects on the environment result from incremental effects of a proposed action when these are added to other past, present, and reasonably foreseeable future actions. While cumulative effects may result from individually minor actions, they may, viewed as a whole, become substantial over time. The proposed action has been fully evaluated and by design is sustainable through time given relatively stable conditions.

4.3.5 Anticipated Impacts if Individual Hunts are allowed to Accumulate

All NWR’s conduct hunting programs within the framework of state and Federal regulations. The Refuge is more restrictive than most State Wildlife Management Areas (WMA). By maintaining hunting regulations that are as, or more, restrictive than the State regulation on private lands and/or State WMAs, individual NWR’s ensure that a better diversity of management options exist upon which statewide and regional management implications can be better assessed. The proposed 2012 Draft Hunt Plan has been reviewed and is supported by the State. Additionally, South Carolina NWR’s coordinate with State annually to maintain regulations and programs that are consistent with the State management program.
Chapter 5: List of Preparers

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Chapter 6: Consultation and Coordination with Others

The South Carolina Department of Natural Resources concurs and fully supports the regulated consumptive public use of the natural resources associated with the Refuge (Refer to Letters of Concurrence). Furthermore, the long-term lease agreement between the State and the USFWS for the incorporation of the Bucksport WMA into the NWRS as part of the Refuge requires that there be no net loss of hunting opportunities. The USFWS also provided an in depth review by its regional office personnel and staff biologists. Numerous contacts were made throughout the area of the Refuge soliciting comments, views, and ideas into the development of the accompanying Draft 2012 Hunt Plan.
Appendix A: Literature References


Cape Romain National Wildlife Refuge annual narrative. 2002 (unpubl.). Awendaw, South Carolina.


**Personal Communications**

Mary K. Clark, North Carolina State Museum of Natural Sciences, Raleigh, North Carolina.

Tom Murphy, 2003. South Carolina Department of Natural Resources, Charleston, South Carolina.
Appendix B: Response to Public Comments