Information Sheet on Ramsar Wetlands (RIS) – 2006-2008 version

1. Name and address of the compiler of this form:

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DD MM YY

Designation date | Site Reference Number

2. Date this sheet was completed/updated:

April 25, 2008

3. Country:

USA

4. Name of the Ramsar site:

The precise name of the designated site in one of the three official languages (English, French or Spanish) of the Convention. Alternative names, including in local language(s), should be given in parentheses after the precise name.

Francis Beidler Forest

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only)**:**

a) Designation of a new Ramsar site ☑; or

b) Updated information on an existing Ramsar site ❑

6. For RIS updates only, changes to the site since its designation or earlier update:

7. Map of site:

Refer to Annex III of the *Explanatory Note and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

a) A map of the site, with clearly delineated boundaries, is included as:

i**) a hard copy** (required for inclusion of site in the Ramsar List): ❑;

ii**)an electronic format** (e.g. a JPEG or ArcView image) **X** ;PDF format, attached to this form X

iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** X.

b) Describe briefly the type of boundary delineation applied:

e.g. the boundary is the same as an existing protected area (nature reserve, national park, etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The boundary is the same as a protected area, Francis Beidler Forest, along with one adjacent private holding.

8. Geographical coordinates (latitude/longitude, in degrees and minutes):

Provide the coordinates of the approximate centre of the site and/or the limits of the site. If the site is composed of more than one separate area, provide coordinates for each of these areas.

Approximate Center of the Proposed Area:

Latitude: 33 15’19.10^0 N

Longitude: 80 21’37.39^0 W

9. General location:
Include in which part of the country and which large administrative region(s) the site lies and the location of the nearest large town.

The Francis Beidler Forest is located near Harleyville (pop. 695), South Carolina in Dorchester (pop. 112,858), and Berkeley (pop.151,673) counties. Harleyville is about 1hour NW of Charleston (pop.106,712).

10. Elevation: (in metres: average and/or maximum & minimum)

Minimum elevation: 5.18meters
Maximum elevation: 7.92 meters

11. Area: (in hectares)

6,438 hectares

12. General overview of the site:
Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The Francis Beidler Forest within Four Holes Swamp represents the largest remaining virgin stand of bald cypress and tupelo gum trees in the world. The total area of the Four Holes Swamp watershed is approximately 182,100 ha, of which 7,867 ha is currently protected. Of the 6,483 ha at the Francis Beidler Forest Ramsar Site, 6,127 ha are protected. The conservation goal is to have permanently protected core of about 8100 ha surrounded by a multi-owner bio-reserve. The swamp is a river bottom swamp: some areas are flooded or saturated most of the year, others for only a few months or not at all except in heavy rains. The Beidler Forest is owned and managed by the Audubon Society, the Nature Conservancy and the Pine Tree Conservation Society.

13. Ramsar Criteria:
Tick the box under each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11). All Criteria which apply should be ticked.

1	2	3	4	5	6	7	8	9
X	X	X	X	❑	❑	❑	X	❑.

14. Justification for the application of each Criterion listed in 13 above: Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Criterion 1. Importance to Biogeographical Region's Representative, Rare or Unique Wetlands:
Francis Beidler Forest is the world's largest remaining virgin cypress-tupelo swamp. The Four Holes Swamp's total area is much larger than the area contained within the Francis Beidler Forest. In total, the Four Holes Swamp covers 1821 km^2 in four counties. Some 6,438 ha of the Swamp will be contained in the Francis Beidler Forest Ramsar Site.

Criterion 2. Importance to Endangered, Threatened or Otherwise Sensitive Species.
The Flatwoods Salamander (*Ambystoma cingulatum*), is on the federal and State Endangered/Threatened Species lists and the IUCN Red List of Threatened Species (IUCN, 2007) as vulnerable. Several species of fauna found in the Beidler Forest are on the State endangered and threatened species list (SCDNR, 2007). These include the Eastern Tiger Salamander (*Ambystoma tigrinum*), Big-eared Bat (*Corynorhinus rafinesquii*), Hoary Bat (*Lasiurus cinereus*), Northern Yellow Bat (*Lasiurus intermedius*), Little Brown Myotis (*Myotis lucifugus*), Meadow Vole (*Microtus pennsylvanicus*), Eastern Wood Rat (*Neotoma*

floridana), Scarlet Kingsnake (*Lampropeltis triangulum*), Northern Pine Snake (*Pituophis melanoleucus melanoleucus*), Carolina Black Swamp Snake (*Seminatrix pygaea paludis*), Southern Hognose Snake (*Heterodon simus*), Eastern Coral Snake (*Micrurus fulvius*), Timber Rattlesnake (*Crotalus horridus*), Eastern Diamondback Rattlesnake (*Crotalus adamanteus*), American Alligator (*Alligator mississippiensis*). Threatened or vulnerable flora include, Southern Twayblade (*Listera australis*), Green-fly Orchid (*Epidendrum conopseum*), and Shadow-witch Orchid (*Ponthieva racemosa*).

The Wood Stork (*Mycteria americana*) is an uncommon spring/summer visitor and is on both the United States federal (USFWS, 2007) and South Carolina state (SCDNR, 2007) endangered species lists as an endangered species. It is listed as "critically imperilled state-wide because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation" and "imperilled state-wide because of rarity or factor(s) making it vulnerable."

Ivory-billed Woodpecker (*Campephilus principalis*): This endangered species (IUCN, 2007; USFWS, 2007) was been reported along the Edisto River and specifically within Four Holes Swamp from the 1800's. Reports of observations at Beidler Forest date to the 1930s. Most recently, ivory-billed woodpecker has been reported from near Four Holes Swamp in 2006 (Cornell IBWO Team 2007; SCIBWO 2005). This report is currently being investigated by the South Carolina Ivory-billed Woodpecker Working Group. The USFWS Ivory-billed Woodpecker Recovery Team is developing a recovery plan that will be range wide in scale. The Edisto River corridor is part of the current range. Based on historical data, it is anticipated that 7 pairs of Ivory-Billed Woodpeckers could be supported on 80,000 acres of bottomland habitat. Current modeling efforts are utilizing historical data, current habitat assessment information and energetic needs to identify block sizes representative of the landscape present today.

Criterion 3. Importance in Maintaining Regional Biological Diversity.
More than 300 vertebrates and 300 plants depend on Beidler Forest for survival. Beidler Forest is home to a myriad of South Carolina native reptiles, amphibians, fish and mammals such as: Marbled Salamanders (*Ambystoma opacum*), Two-toed Amphiuma (*Amphiuma means*), Lesser Siren *(Siren intermedia*), Green Tree Frog (*Hyla cinerea*), Southern Cricket Frog (*Acris gryllus*), Green Frog (*Rana clamitans*), Bull Frog (*Rana catesbeiana*), Snapping Turtle (*Chelydra serpentina*), Spotted Turtle (*Clemmys guttata*), Box Turtle (*Terrapene carolina*),Yellow-bellied Turtle (*Chrysemys scripta*), Five-lined Skink (*Eumeces fasciatus*), Broad-headed Skink (*Eumeces laticeps*), Brown Water Snake (*Nerodia taxispilota*), Banded Water Snake (*Nerodia fasciata*), Red-bellied Water Snake (Nerodia erythrogaster), Eastern Hognose Snake (*Heterodon platyrhinos*), Bobcat (*Lynx rufus*), White-tailed Deer (*Odocoileus virgiananus*), Gray Fox (*Urocyon cinereoargenteus*), River Otter (*Lutra canadensis*), Marsh Rabbit (*Sylvilagus palustris*), Flying Squirrel (*Glaucomys volans*), Mink (*Mustela vison*).

Forestland state-wide is becoming increasing fragmented so this habitat's importance increases every year. From primitive Resurrection Fern (*Polypodium polypodioides*), Royal Fern (*Osmunda regalis*) and Netted Chain-Fern (*Woodwardia areolata*) to thickets of High-bush Blueberry (*Vaccinium sp*), Horse Sugar (*Symplocus tinctoria*), and Red Bay (Persea borbonia), to groves of Tupelo Gum (*Nyssa aquatica*), Overcup Oak (*Quercus lyrata*), and towering 1000+ year-old Baldcypress (*Taxodium distichum*) trees, Beidler Forest is home to a wide variety of trees, shrubs, flowering plants and other herbaceous species. The Dwarf Trillium (*Trillium pusillum*) is one of the rarest flowers in South Carolina and can only be found in Four Holes Swamp.

Criterion 4. Importance as Habitat for Critical Stage in the Biological Cycles of Plants and Animals.

The Audubon Society and Bird Conservation International have designated the Francis Beidler Forest as a South Carolina Important Bird Area (IBA). This status is reserved for locations that are critical for habitat for one or more species or that is critical to a large number of bird species. Over 140 species of birds use the Forest and Swamp for habitat.

The Forest and Swamp provide critical habitat for more than 50 species of reptiles, more than 40 species of amphibians and more than 40 fish species. (For example, the Southern Dusky Salamander (*Desmognathus auriculatus*) and Chamberlain's Dwarf Salamander (*Eurycea chamberlaini*) require habitat available in Beidler Forest (Tufford et al. submitted.) The floodplain has a specific hydrology to which local plant communities have adapted. Any serious changes would likely seriously affect the plant communities and their associated fauna. Songbird nesting in the Beidler Forest is some of the densest in the country, as shown by 30 years of Breeding Bird Census data.

Francis Beidler Forest is used by a number of wading birds as a food source. These birds include: the Great Blue Heron (*Ardea herodias*), Little Blue Heron (*Egretta caerulea*), and Green Heron (*Butorides virescens*), Great Egret (*Ardea alba*), Cattle Egret (*Bubulcus ibis*), White Ibis (*Eudocimus albus*), and Wood Stork (*Mycteria americana*). Beidler Forest is used for nesting and foraging by great numbers of Yellow-crowned Night Herons (*Nyctanassa violacea*).

Wood Duck (*Aix sponsa*) and Hooded Merganser (*Lophodytes cucullatus*) live in Beidler Forest through the winter and their nesting season. Both are cavity nesters and use the abundance of natural hollows that can be found in the old-growth trees.

Criterion 8. Importance to fish for food, spawning ground, nursery and/or migration paths for fish stocks, either within the wetland or elsewhere, depend.
The Redbreast Sunfish (*Lepomis auritus*) uses Beidler Forest as breeding ground. Bluegill (*Lepomis spp.*), Striped Bass *(Morone saxatilis),* Chain Pickerel *(Esox niger),* Redfin Pickerel *(Esox americanus americanus),* Longnose Gar *(Lepisosteus osseus)* , Bowfin *(Amia calva),* White Catfish *(Ameirus catus),* and Yellow Bullhead *(Ameirus natalis)* call the Forest home and feed on the shiners, darters, minnows, etc. that also occur in the habitat.

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15. Biogeography (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation): Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

a) biogeographic region:
Francis Beidler Forest is in the Eastern Temperate Forest Region, according to CEC's *Ecological Regions of North America.*

b) biogeographic regionalisation scheme (include reference citation):
Commission for Environmental Cooperation. 1997. *Ecological Regions of North America.* CEC, Montreal.

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16. Physical features of the site:
Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

Francis Beidler Forest, part of Four Holes Swamp, occupies a broad, flat-bottomed, alluvial valley incised into the loose marine or coastal sediments of the Atlantic coastal plain. The upper zones of these sediments, those that occur aside the present valley and form its bounding walls, are mostly sandy and permeable. Deeper sediments include finer-grained silts, clays, and marls. Below these lies the shallowest major aquifer, the regional Tertiary limestone aquifer. The valley, judged by its morphology and uppermost sediments, clearly was formed by fluvial erosion, but that occurred under

hydrologic conditions notably different from those of today. No deep subsurface investigation has yet been conducted within the swamp itself, so the depth and age of incisement and of the stages of sediment infilling are not yet known. The present swamp has no continuous open-water (non-forested) stream and thus the origin of the present wetland in the form that it exists today and was known in historic times is comparatively recent geologically and young compared to the valley formation. The several substantial ox-bow lakes are evidence that a stream of considerable width and depth flowed through and continuously reshaped the valley bottom and this in the not distant past because these shallow lakes have not completely filled in. Some limited shallow stratigraphic evidence shows fine-grained typical river bottomland sediments above a sandier zone at a few foot depth, as might be expected of a bottomland with a meandering stream. Aerial photography clearly shows vegetational evidence of a complex network of swales, which in turn evidences the former locations of the stream, either as it meandered or perhaps as a braided-stream network in the final stages before the continuous stream disappeared. Presently the bottomland is essentially a severely underfit stream, not only much smaller than that which originally produced and shaped the valley but no longer even of continuous open water. This is an unusual, if not unique environment.

The hydrology of the wetland and its tributary swales and adjacent and contributing water-table aquifer are little altered from natural conditions. Farming has replaced forest over much area in the adjacent uplands but fields are neither widely drained nor irrigated heavily. The hydrology has not been investigated intensively but conditions in this part of the coastal plain are relatively well understood. In heavy rains and in prolonged rainy periods surface runoff can contribute to the wetland, but other water that enters throughout the year has probably traveled at least a short distance shallowly underground—mainly laterally—impeded from moving downward by deeper clayey layers, before seeping to the surface in the sides of tributary swales and the Four Holes Swamp valley itself. A shallow ground-water input stabilizes the input of water and makes the hydrology slower in reacting, not as “flashy” as piedmont streams farther inland than the coastal plain. The width of the swamp provides that direct rainfall is an important input too. The wetland receives ground-water discharge and does not act as a recharge area. The discharge is mainly from the water-table aquifer in the uppermost sands of the surrounding uplands and is recharged there. While there is an upward hydraulic gradient from the regional Tertiary limestone aquifer (limestone-aquifer wells at the edge of the swamp are free-flowing artesian) there may not be a substantial amount of upward discharge diffusely through the wetland and underlying sediments. The regional limestone aquifer is confined in this area by the Cooper Marl, which lies above it. If ancient valley incisement cut through the marl, there might be some slow upward seepage, but this has to be limited: it cannot exceed the evapotranspiration demands of the forest in drought times because Four Holes Swamp has gone to zero flow at the gauged bridge culvert just downstream of the sanctuary.

Seasonal and shorter-term fluctuation in water level is the norm for Four Holes Swamp. Any given year will have periods of flooding and periods of soil exposure, the former lengthened and the latter shortened within the network of swales of true swamp crisscrossing the bottomland. Four Holes Swamp occurs in a transitional area between inland locations. Further inland winter tends to be the high-water season due to greatly lowered evapotranspiration losses (by cool temperatures and leafless condition) under a fairly even monthly rainfall regime. Closer to the coast winter months have less rainfall and the summers more. Water level fluctuations are tempered compared to more inland bottomland forests, especially those on major rivers. There, late-winter water levels may be high and water deep, while late summer often has prolonged drying. Similarly, while warm season deluges such as those associated with major storm systems (up to hurricanes) may quickly and occasionally deeply flood the Four Holes Swamp wetland, the areally limited headwaters of its basin and the lack of an open channel to quickly deliver this water tends to moderate the depth of the most severe flooding compared to more inland river-valley wetlands. Droughts over the past several decades have triggered interest by farmers in damming tributary swales as emergency sources of irrigation water and this will pose a threat to the still-largely natural flow regime.

Water quality is not severely affected by pollutants from surrounding or upstream activities. The uplands surrounding the basin are farmed, but are not generally drained artificially, and little area is urbanized. Some water from the limestone aquifer is added to the swamp by discharge of cooling and other waters from cement plants upstream of the sanctuary. The impacted quality of this discharge water is regulated but because of unusual local geochemical conditions in this aquifer the pH is naturally very high. An unusual water-quality aspect of this bottomland forest is the relative paucity of mud (fine minerals) in the water, especially notable at high-water periods of greatest flow when stream and river valleys that extend into in the piedmont (e.g., Congaree, Savannah) will have very muddy water pushed out into the bottomland forest. Four Holes Swamp instead is relatively starved of such sediment, which must further influence its surface micro-topography and nutrient status. Starved systems are often ecologically interesting and sensitive ones.

The climate for the Francis Beidler Forest is basically humid subtropical, with a slight bias to the more monsoonal type of the coast, with a rainier summer and sometimes slightly drier late-winter or spring. The historic low temperature for the area was –20 C (February 12, 1899). The historic high temperature was 41 C (August 18, 1954).

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17. Physical features of the catchment area:
Describe the surface area, general geology and geomorphological features, general soil types, and climate (including climate type).

The Four Holes Swamp watershed lies on the middle coastal plain, a relatively flat terrain of mostly sandy sediments. The uppermost (farthest inland) reaches of its tributaries extend to near the edge of the upper-coastal-plain sandhills, but do not penetrate them. This has large influence on the wetland's hydrology. The important lateral contribution of shallow ground water into the tributaries of Four Holes Swamp is driven by low hydraulic gradients because of the low relief. Inflow thus is slow and in droughty times surface water flow down the valley is very low. Nearby coastal plain streams that head up in the sandhills (e.g., Edisto) have higher baseflows and will continue to flow even in droughts. The middle coastal plain uplands in the Four Holes Swamp watershed are relatively flat-topped or plain-like (unlike the rounded-top sandhills) and are dissected shallowly by the natural stream network of the tributaries and by Four Holes Swamp valley itself. The uppermost major strata of the catchment basin are of Tertiary age and shallow marine origin. The soils, sandy in the geological sense (sand rich), are often loams in the agronomic sense. Row crops, and pine-dominated forests ultimately for wood products, cover much of the land. The climate is basically humid subtropical, with a slight bias to the more monsoonal type of the coast, with a rainier summer and sometimes slightly drier late-winter or spring. The historic low temperature for the area was –20 C (February 12, 1899). The historic high temperature was 41 C (August 18, 1954).

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18. Hydrological values: Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

The most important hydrological value of the swamp area is its ability to improve and maintain the water quality of the waters flowing through it. The swamp drains into the Edisto River and is also linked to the ACE Basin NWR further southeast. The Four Holes Swamp area has little groundwater recharge value due to its bottomland hardwood swamp nature. In this location groundwater seeps into the swamp, instead of the other way around.

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19. Wetland Types
a) presence:
Circle or underline the applicable codes for the wetland types of the Ramsar "Classification System for Wetland Type" present in the Ramsar site. Descriptions of each wetland type code are provided in Annex I of the *Explanatory Notes & Guidelines*.

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K • Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp Ts • U • Va •
Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:
List the wetland types identified in a) above in order of their dominance (by area) in the Ramsar site, starting with the wetland type with the largest area.

Xf- Freshwater Swamp Forest- 75%
N- Seasonal/intermittent creeks- 15%
O- Permanent freshwater lakes- 4%
Tp- Permanent freshwater pools- 5%
Y- Freshwaters springs- 1%

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20. General ecological features:
Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

The Francis Beidler Forest in Four Holes Swamp is the world's largest virgin cypress-tupelo swamp forest. A number of different plant communities comprise the Forest including: swamp forest, hardwood bottom, ridge bottom, seepage bogs and, along the bluffs above the floodplain, mixed mesophytic hardwood. Elevation changes are subtle and there are temporal hydrological variations. Neotropical migrants and raptors find the Forest prime nesting and migratory stopover habitat. More than 300 vertebrate species use the Forest in some way. Many are on the State and Federal Endangered/Threatened Species lists.

The wetlands of the Francis Beidler Forest provide important habitat functions for a majority of the 140 bird species that depend on Four Holes Swamp for migrating, breeding, nesting and roosting habitat. Beidler Forest's bottomland hardwood and cypress tupelo swamp provides nesting and foraging habitat to 49 species, including imperiled Partners in Flight (PIF) species such as the Swainson's Warbler (*Limnothlypis swainsonii*), Hooded Warbler (*Wilsonia citrina*), Kentucky Warbler (*Oporornis formosus*) and Prothonotary Warbler (*Protonotaria citrea*). Thirty-eight neotropical migrant species depend on Beidler Forest for breeding habitat, many of these such as the Northern Parula (*Parula americana*) and the Wood Thrush (*Hylocichla mustelina*), are experiencing hemispheric population declines. Data from twenty-five years of breeding bird surveys at Beidler Forest reveal that the forest hosts six to seven pairs of nesting songbirds per acre, including Prothonotary, Swainson's, Kentucky and Hooded Warblers, making Beidler one of the densest breeding habitats in the southeast.

Francis Beidler Forest provides seasonal or year-round food and cover habitat for a range of other birds, including raptors and wading birds. Wood Duck nest and forage throughout the wetland portions of Beidler Forest. The forested wetlands provide complex, multitiered forests, essential as breeding and migration habitat for numerous species of migratory and resident songbirds. Specific forest structure niches and associated species are: 1) ground story- Swainson's Warbler, Hooded Warbler, 2) intermediate layer- Acadian Flycatcher (*Empidonax virescens*), 3) subcanopy- Northern Parula, Red-eyed Vireo (*Vireo olivaceus*) and Great Crested Flycatcher (*Myiarchus crinitus*), 4) canopy- Yellow-throated Warbler (*Dendroica dominica*). The fully intact complex forest structure, together with an abundance of soft-bodied insects required as protein sources for breeding birds, make the forested wetlands of the proposal area critical sites for achievement of PIF and South Atlantic Migratory Bird Initiative (SAMBI) habitat conservation goals. In addition to providing critical songbird habitat, Beidler Forest provides important nesting and foraging habitat for 400-500 Yellow-crowned Night Heron (*Nyctanassa violacea*) and 2,000-3,000 White Ibis (*Eudocimus albus*) and other wading birds.

Upland Habitat & Associated Wildlife Habitat

In addition, the forested uplands that buffer the wetlands provide important habitat to support many other game and non-game species. Wild Turkey (*Meleagris gallopavo*) and white-tailed deer (*Odocoileus virginianus*) are common in Beidler Forest. Deer weighing 200 pounds or more are not uncommon on this and other Four Holes tracts. Fur-bearers such as River Otter (*Lontra canadensis*) and Bobcat *(Lynx rufus*) also abound on the tract. Many of the uplands surrounding Beidler Forest are dominated by loblolly pine (*Pinus taeda*) plantations and pine-mixed hardwoods. In areas where trees have been harvested in the last 20 years, the habitat is in a current condition of shrub-scrub habitat and provides necessary habitat for the American Woodcock (*Scolopax minor*), Prairie Warbler (*Dendroica discolor*) and Bachman's Sparrow (*Aimophila aestivalis*) and nesting habitat for the Wood Thrush. Transitional upland habitats are also important for other species such as the State-listed Spotted Turtle (*Clemmys guttata*), which is being threatened throughout most of its range, and species such as the Yellow-bellied Slider (*Trachemys scripta scripta*) and Water Moccasin (*Agkistrodon piscivorus*) that need this upland habitat to complete their life cycle.

Herpetofauna

In addition, wetlands and associated uplands on Francis Beidler Forest support a rich herpetofauna including 63 species (9 salamanders, 16 frogs/toads, 9 turtles, 8 lizards, 20 snakes and 1 crocodilian).

Fish

Resident freshwater game include the Redbreast Sunfish (*Lepomis auritus*) that uses the Swamp as breeding ground, the Bluegill Sunfish (*Lepomis macrochirus*), Redear Sunfish (*Lepomis microlophus*), Warmouth (*Chaenobryttus gulosus*), Black Crappie (*Pomoxis nigromaculatus*), Largemouth Bass (*Micropterus salmoides*), Yellow Perch (*Perca flavescens*) and 3 catfish species. Bream, bass, pickerel, gar, bowfin and catfish call the Swamp home and feed on the shiners, darters, dace, minnows, chubs and gambusia that share the Swamp.

Aquatic Insects

The aquatic insect fauna of Francis Beidler is noteworthy in its diversity. Based on light-trap studies in 1976-77, an unusually high number of at least 125 species was recorded. Three of these species were new to science, including two species of *Stenelmis* (Coleoptera: Elmidae) and one species of *Triaenodes* (Trichoptera: Leptoceridae). A surprisingly high number of caddisfly (Trichoptera) species (61 spp.) was reported, including 15 species that were at the time new records for the state of South Carolina. Clearly, the waterways of the Francis Beidler Forest are a refugium for persisting populations of many species that have been extirpated by sedimentation and pollution in other parts of their range.

Ecosystem Services

The Forest's broad, shallow floodplain and slow moving water is an excellent water filter, assimilating nutrients and other pollutants. The rough surface provided by logs, trees and other smaller plants attenuates floodwaters as they move through the forest. Carbon is sequestered and stored for long periods in the diverse and abundant forest trees, logs, and coarse woody debris.

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21. Noteworthy flora: Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in 14, Justification for the application of the Criteria) indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

The Beidler Forest Sanctuary contains within its boundaries 5 distinct plant communities that are in general determined by subtle changes in elevation that ultimately affects the hydroperiod. They are the 1) Mixed Mesophytic Hardwood Forest (Swamp Bluff), 2) Seepage Slope Wetlands, 3) Swamp

Forest, 4) Hardwood Bottom, and 5) Hardwood Ridge. The Swamp Bluff is home to several noteworthy herbaceous species growing up in the shade of the canopy. This includes: Little Sweet Betsy *(Trillium cuneatum),* Bloodroot *(Sanguinaria Canadensis),* Cherokee Bean *(Erythina herbacea)* Mayapple *(Podophyllum peltatum),*Indian Pink *(Spigelia marilandica)* and six species of orchids; Florida Adders Mouth *(Malaxis spicata),* Green Adders Mouth *(Malaxis uniflora),* Cranefly Orchid *(Tipularia discolor),* Spring Coral Root *(Corallorhiza wisteriana),* Crested Coral Root *(Hexelectris spicata),* Shadowitch Orchid *(Ponthieva racemosa).* The Seepage Slope Wetlands are fed by year-round spring flow and as such possess bog-like conditions that never dry out. Three species of emergent herbs appear to be confined to the seepage slope wetlands: Hedge Hyssop *(Gratiola virginiana),Micanthemum umbrosum,* and Bitter Cress *(Cardimine pennsylvanica)* The Swamp Forest community consists of the deepest, most constantly flooded portions of the sanctuary. Within the old growth stand of the sanctuary the most noteworthy species is the Baldcypress *(Taxodium distichum),* many of which are over 1000 years old. The oldest known tree on the sanctuary was estimated to be approximately 1,500 years old! The slightly elevated Hardwood Bottom's most notable species is the abundant and completely healthy population of American Elm *(Ulmus americanus),* which for unknown reasons has escaped the Dutch Elm disease. The Ridge Bottom, another notch higher than the Hardwood Bottom, also contains American Elms and is also home to the potentially endangered and previously mentioned Dwarf Trillium *(Trillium pusillum* var. *pusillum).*

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22. Noteworthy fauna:

Both the Little Blue Heron (*Egretta caerulea*) and the Wood Stork (*Mycteria americana*) are uncommon spring/summer visitors. The Little Blue Heron (*Egretta caerulea*) is being monitored by the South Carolina Department of Natural Resources (SCDNR), Partners in Flight (PIF), United States Fish and Wildlife Service (USFWS) and the National Audubon Society (NAS). Swainson's Warbler (*Limnothlypis swainsonii*) is an uncommon spring/summer resident nester and is being monitored by the USFWS, PIF and NAS. The Black-throated Green Warbler (*Dendroica virens)* is a rare, spring transient being monitored by the SCDNR, USFWS and PIF. The SCDNR and USFWS are monitoring the Loggerhead Shrike (*Lanius ludoviciarus),* an occasional permanent resident and rare or uncommon in the State. An occasional spring/summer visitor, the Coopers Hawk (*Accipiter cooperii*) is rare or uncommon in the State. The Red-headed Woodpecker (*Melanerpes eryhrocephalus*) is an uncommon permanent resident nester in Beidler Forest and USFWS, PIF and NAS are monitoring its status.

The following bird species are not on any endangered or threatened species list but are being monitored by USFWS, SCDNR, PIF or NAS: Rare Spring/Summer Resident- Whip-poor-will (*Caprimulgus vociferus*) (USFWS); Common Spring/Summer Resident nesters- Northern Parula Warbler (*Parula americana*) (USFWS), Prothonotary Warbler (*Protonotaria citrea*) (USFWS, SCDNR, NAS), Acadian Flycatcher (*Empidonax virescens*) (USFWS); Fairly Common Permanent Resident nester- Brown-headed Nuthatch (*Sitta pusilla*) (USFWS, PIF, NAS); Fairly Common Spring/Summer resident nester- Wood Thrush (*Hylocichla mustelina*) (USFWS, PIF, NAS); Occasional Transient- Worm-eating Warbler (*Helmitheros vermivorus*) (USFWS, PIF, NAS); Occasional Spring/Summer resident nester- Kentucky Warbler (*Oporornis formosus*) (USFWS, NAS); Fairly Common Spring/Summer visitor- Swallow-tailed Kite (*Elanoides forficatus*) (USFWS, SCDNR, PIF); Occasional Winter Resident- American Woodcock (*Scolopax minor*) (NAS); Uncommon Spring/Summer Resident- Chuck-wills-widow (*Caprimulgus carolinensis*) (USFWS); Common Winter visitor- American Kestrel (*Falco sparverius*) (USFWS, SCDNR).

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23. Social and cultural values:

a) Describe if the site has any general social/cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Dis-tinguish between historical/archaeological/religious significance and current socio-economic values:

Historical: There was once a Revolutionary War outpost in the area, and several skirmishes occurred in and around the forest.
Evidence of Prohibition-era whiskey stills can be found in the area.
Local Native Americans also used the area for several millenia as it was a source of fresh water, with good hunting and fishing. The Kusso Natchez tribe is the most recent inhabitant of the area.
Local churches performed baptisms in the swamp in the past.

Archaeological: Native American artifacts dating to 6000 B.C. have been found in the sanctuary. A prehistoric fossil bed was found at a nearby limestone quarry on the site of a prehistoric riverbed in a tributary system that feeds the Four Holes Swamp.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

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24. Land tenure/ownership:
a) within the Ramsar site:

Private Organizations: the National Audubon Society and the Nature Conservancy co-own Francis Beidler Forest
One landowner, Carl Dinge owns 105 ha in between two sections of the Francis Beidler Forest co-owned by Audubon and The Nature Conservancy. We may expand the designated Ramsar site in the future as Audubon acquires land and as adjacent landowners protect their portions of Four Holes Swamp.

b) in the surrounding area:

Private Organizations: Low Country Open Land Trust has 3 easements on 42.6 ha
Federal Agencies: Natural Resources Conservation Service has six conservation easements totalling more than 2,428 ha of wetlands in the Four Holes Wetlands Restoration Program.

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25. Current land (including water) use:
a) within the Ramsar site:

Forested wetlands: 5,232 hectares
Upland Forest, Evergreen, Deciduous and Mixed: 649 hectares
Non-Forested Wetlands: 495 hectares
Cropland/Pasture: 34 hectares
Infrastructure, including Roads and ROWs: 13 hectares
Shrub/Brush: 6 hectares
Other (including open water): 9 hectares
In addition, several private fishing and hunting clubs lease land for fishing and deer and hog hunting. Students, birders and nature enthusiasts can access portions of the Francis Beidler Forest via a 2.8 km-long boardwalk trail, other walking trails or canoe.

b) in the surroundings/catchment:

Adjacent to the Forest there are dozens of close-knit families that live in the area and have for generations. These families are seeking zoning changes that would provide the area with greater protection. Land uses on neighboring lands include row-crop production (corn, cotton, tobacco and soybeans), grazing and haying, pine tree production and very low-density homesites. Much of the land is leased for the hunting of deer and turkey and management for those

species is integrated with the other uses. Two cement plants and their quarries and one landfill lie immediately adjacent to the swamp.

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26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) within the Ramsar site:

There was logging of the area in the past since the area was, in large part, owned by timber companies or timberland owners.

There are high levels of mercury found in the fish of Four Holes Swamp (as well as many other Coastal Plain waterways); enough that the SC Department of Health and Environmental Control has issued warnings about fish consumption especially for children and pregnant women. The mercury is both naturally occurring and the result of air pollution from points west of the Forest.

Three large electricity lines cross the site, fragmenting the forest. Building new lines or widening the existing right-of-ways would destroy more forest interior habitat and exacerbate the fragmentation. However, the utility companies have been very understanding of the sensitive nature of the site and have been very willing to work with us to maintain the greatest ecological integrity on their rights of ways, while clearing only the absolute minimum required.

The US Highway 78 bridge and causeway have constricted the flow of the swamp, altering the natural flow and distribution of water above and below the them.

Several miles of logging roads constructed in the 1960s alter the natural flow and distribution of water across the flood plain just upstream from I-26. However, in 2008 those roads will be breached with numerous swales to restore more natural hydrology to the area.

Where US Highways 78 and 15 and State Roads 453 and 210 cross the swamp, significant amounts of wetland were filled and hydrology was altered. Also, a railroad track paralleling SC 453 resulted in filling of the swamp and alteration of natural hydrology. Widening of these roads would exacerbate their impacts.

b) in the surrounding area:

There are several concerns outside the Beidler Forest boundaries. These include; logging; two large and expanding limestone quarries; non-point source water runoff from surrounding farms; farming on the bluff above the floodplain could potentially impact several species' life cycles; urban sprawl from Charleston and Summerville to the east; both residential development due to sprawl and industrial development as a result of I-26's proximity; development or potential development of large commercial and/or industrial sites upstream, which are ongoing, pose the dual threat of habitat loss and water quality degradation; and poorly designed or maintained private septic systems that pose a risk of fecal coliform bacteria and nutrient contamination to the Four Holes Swamp and its tributaries. In an effort to mitigate the potential harm from several of the abovementioned threats, Audubon continues to acquire additional sanctuary land, especially upland edge and bluff to put "space" between the swamp and any future development or agricultural practices. In addition, sanctuary staff have been working with Orangeburg County to include swamp edge protection and water quality maintenance measures into their long range industrial site planning.

South Carolina has one of the fastest rates of land development in the country, ranking 10th in the rate of conversion of farmland and forestland to urban uses, averaging 200 acres of land converted daily. Berkeley and Dorchester Counties, a portion of which is within Four Holes watershed, are two of the

fastest growing counties. The Edisto River Basin Project Report (SCDNR, 1996) identified the primary threats to the Edisto Basin as:

1) rural sprawl, involving primary residences from the Charleston-Berkeley-Dorchester, tri-county area, fragmenting forests and habitat;
2) increasing river corridor development including second homes and recreational dwellings;
3) expansion of pine plantations replacing native hardwood and mixed forest stands;
4) vulnerability of rare and endangered plants to incompatible land use;
5) degradation of water quality, associated with incompatible land use, adversely impacting aquatic biodiversity.

Additionally, Beidler Forest is imminently threatened by commercial development radiating from the nearby intersection of Interstates 26 and 95, and elsewhere along I-26.

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27. Conservation measures taken:

a) List national and/or international category and legal status of protected areas, including boundary relationships with the Ramsar site: In particular, if the site is partly or wholly a World Heritage Site and/or a UNESCO Biosphere Reserve, please give the names of the site under these designations.

Francis Beidler Forest is a globally significant Important Bird Area, a Society of American Foresters Natural Area, and a National Natural Landmark.

b) If appropriate, list the IUCN (1994) protected areas category/ie. which apply to the site (tick the box or boxes as appropriate):

Ia ☑;Ib ❑; II ❑; III ❑; IV ❑; V ❑; VI ❑

c) Does an officially approved management plan exist; and is it being implemented?:

Yes, a plan exists, and, yes, it is being implemented.

d) Describe any other current management practices:

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28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

In 2006 $1.5 million was granted to the National Audubon from South Carolina Conservation Bank, and $1 million from NAWCA to buy 971 ha. In surrounding areas the National Resources Conservation Service is going to restore 2428 ha with six permanent, adjoining easements through the Wetlands Reserve Program and Low Country Open Land Trust has acquired three easements totalling 173 ha in the surrounding area. The current version of the conservation plan for Four Holes Swamp (the watershed that Francis Beidler Forest is in) is included as part of this nomination package.

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29. Current scientific research and facilities:

e.g., details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

1) There are quarterly studies of aquatic invertebrates with samples sent to Dr. John C. Morse of Clemson University for identification and analysis.
2) A multi-year study of seepage slope wetlands is currently in progress in Beidler Forest. Study parameters include flora, hydrology, water quality, herpetology, and temperature mediated micro-habitat. Initial results have shown these small wetlands are important habitat for salamander species of concern in South Carolina and more intensive research has begun.
3) Resident and migratory bird nesting is monitored on two permanent 8 hectare spring breeding bird census plots, one each on alternating years. The Census determines nesting density and species composition.30 years of results are stored at the Cornell Laboratory of Ornithology and contribute to their global bird database.

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:
e.g. visitors' centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

There is a visitor's center and a 2,300 m. boardwalk. The Francis Beidler Forest sees approximately 12,000 visitors each year. There are also three meeting facilities: meeting tree, outdoor classroom, and conference room. A full range of children's and adult environmental and conservation education programs are conducted at the Center and elsewhere on the site, all to increase environmental literacy and support the site's conservation.

Landowner conservation easement education programs are conducted throughout the Forest's watershed.

The South Carolina Aquarium partnered with the local National Audubon Society office, the Beidler Forest Sanctuary, South Carolina Departments of Natural Resources (SCDNR) and Health and Environmental Control (SCDHEC), the Orangeburg County Soil and Water Conservation District and the Clemson Extension Service to involve local students in a study of local oral histories and prevailing water quality conditions in the Four Holes Swamp area in 1999.

31. Current recreation and tourism:
State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

Approximately 12,000 visitors per year tour the Beidler Forest. 95% of these tour the boardwalk, which only encompasses about 50 acres of the entire preserve. The other 5% take advantage of our guided Canoe/Kayak tours along about a 2-mile stretch of one of the swamp creeks. The vast majority of the sanctuary is off limits to the public.

The majority of the swamp outside the Beidler Forest is accessible by canoe or kayak and birders and nature enthusiasts are free to go without a guided tour. Walking tours are also available on the boardwalk. Each year, as previously stated in the land use section, several thousand acres are rented to hunting and fishing clubs.

The site is an important stop on the SC Heritage Corridor, an entity created and operated to promote visitation to numerous historical, cultural and natural sites, from the mountains to the sea of South Carolina.

32. Jurisdiction:
Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept of Agriculture/Dept. of Environment, etc.

The Francis Beidler Forest is in the United States, in South Carolina. Since the Forest is owned by a private organization it is not under other authority. It lies in Berkeley, Dorchester and Orangeburg Counties, South Carolina, USA. The management of most of the site is conducted in concert with restrictive covenants held by the US Army Corps of Engineers (Mitigation Tracts) and US Department of Agriculture (Wetlands Reserve Program Tracts). These perpetual agreements direct all management to protect and/or enhance the wetland functions and values provided by the Forest. Under certain conditions, with specific prior approval, specific areas of the Forest can be managed to benefit specific species or groups of species when they are in need.

33. Management authority:
Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title/name of the person or persons in this office with responsibility for the wetland.

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34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see 15 above), list full reference citation for the scheme.

Articles / reports / websites

Commission for Environmental Cooperation. 1997. Ecological Regions of North America. CEC, Montreal.

IUCN, 2007. IUCN Red List of Threatened Species. Accessed May 2007. http://www.iucnredlist.org/

Porcher, Richard D., 1981. The vascular flora of the Francis Beidler Forest in Four Holes Swamp, Berkeley and Dorchester Counties, South Carolina. Castanea: The Journal of the Southern Appalachian Botanical Club 46:248-280.

SCDNR, 1996. Managing Resources for a Sustainable Future: The Edisto River Basin Project Report. SC Department of Natural Resources, Water Resources Division, Columbia, SC. 226 p.

SCDNR, 2007. South Carolina Rare, Threatened, & Endangered Species Inventory. Accessed May 2007. https://www.dnr.sc.gov/pls/heritage/county_species.list?pcounty=all

Tufford, D.L., S.H. Bennett, J.B. Nelson, N.L. Brunswig, J.R. Harrison, submitted. Seepage slope wetlands on the South Carolina Coastal Plain. Southeastern Naturalist.

USFWS, 2007. US Fish and Wildlife Endangered Species Program. Accessed May 2007. http://www.fws.gov/endangered/

Published abstracts

Morse, J.C., D.R. Jones, and N.L. Brunswig, 2002. Twenty-five Years of Biomonitoring in Francis Beidler Forest, South Carolina. Presented at North American Benthological Society Annual Meeting 2002.

Tufford, D.L., 2006. Hydrology and water quality of seepage slope wetlands on the South Carolina Coastal Plain. International Conference on Hydrology and Management of Forested Wetlands. New Bern, NC, April 8-12.

Tufford, D.L., S.H. Bennett, and J.B. Nelson, 2007. A descriptive ecology of seepage wetlands on the South Carolina Coastal Plain. Association of Southeastern Biologists annual meeting, April 18-21, Columbia, SC.