



3.13 Invasive Species

3.13.1 What are invasive plant species?

While most invasive species were accidentally introduced into natural areas by people, some others were introduced intentionally for economic reasons and then spread. Once a population becomes established, reproducing via seeds or vegetatively by root or stem division, they are considered “naturalized.” The majority of introduced or non-native species do not become invasive.⁹⁴

Invasive Species

Invasive plant species are plants found outside of their native range and due to certain characteristics they possess, are able to dominate ecologically, such as in use of resources or cover.⁹⁵

3.13.2 What is FHWA policy on invasive species?

Under Executive Order 13112 *Invasive Species*, federal agencies cannot authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless all reasonable measures to minimize risk of harm have been analyzed and considered. Federal aid and Federal Lands Highway Program funds cannot be used for construction, revegetation, or landscaping activities that purposely include the use of known invasive plant species under this Executive Order. Until an approved national list of invasive plants is defined by the National Invasive Species Council, “known invasive plants” are defined as those listed on the official noxious weed list of the State in which the activity occurs. The FHWA recommends use of Federal-aid funds for new and expanded invasive species control efforts under each State DOTs’ roadside vegetation management program. The Executive Order compliments the *Federal Noxious Weed Act of 1974* and the *Endangered Species Act of 1973* to prevent the introduction of invasive species, provide for their control, and take measures to minimize economic, ecological, and human health impacts.⁹⁶

3.13.3 What are FHWA recommendations regarding invasive species?

Determinations of the likelihood of introducing or spreading invasive species and a description of measures being taken to minimize their potential harm should be made part of any process conducted to fulfill agency responsibilities under NEPA. Consideration of invasive species should occur

⁹⁴ M. Venner, *Control of Invasive Species: A Synthesis of Highway Practice*, National Cooperative Highway Research Program (NCHRP) Synthesis 363. (Washington, D.C.: Transportation Research Board, 2006).

⁹⁵ *Ibid.*

⁹⁶ Federal Highway Administration Guidance on Invasive Species webpage, http://www.fhwa.dot.gov/environment/inv_guid.htm.



during all phases of the environmental process to fulfill NEPA's requirements. NEPA analyses should rely on each State's noxious weed list to define the invasive plants that must be addressed and the measures to be implemented to minimize their harm.⁹⁷

3.13.4 What invasive plant species occur within the project study area?

A history of disturbance from agriculture and silviculture has provided opportunities for many invasive species to become established in the project study area. As indicated above, some species were deliberately introduced for a specific purpose such as erosion control, wildlife forage, hedgerow fences, windbreaks, or very specialized uses, such as bamboo (*Phyllostachys aurea*) for fishing poles.⁹⁸ Examples of deliberately introduced species that were observed in the project study area include the following: thorny elaeagnus (*Elaeagnus pungens*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), kudzu (*Pueraria lobata*), and sericea (*Lespedeza cuneata*).



Kudzu scrambles over multiple trees, shading and eventually killing them.
Photo by National Park Service.

Some invasive species were originally introduced as ornamentals for

landscaping and have since established themselves in natural areas. Examples observed in the project study area include Chinaberry (*Melia azedarach*), mimosa (*Albizia julibrissin*), Chinese privet (*Ligustrum sinense*), waxleaf privet (*Ligustrum lucidum*), Chinese wisteria (*Wisteria chinensis*), English ivy (*Hedera helix*), and giant reed (*Arundo donax*).⁹⁹

Other invasive species were either accidentally introduced or the method of introduction is not known. The species found in the project study area that fall into these categories are Brazilian

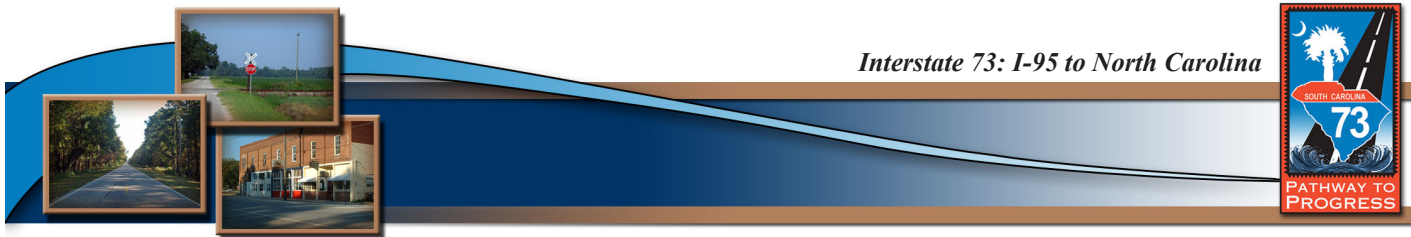


Chinese wisteria, although showy, can quickly choke out native trees.
Photo by Cleek.

⁹⁷ *Ibid.*

⁹⁸ James H. Miller, *Nonnative Invasive Plants of Southern Forest: A Field Guide for Identification and Control*, General Technical Report SRS-62, Asheville, N.C.: (USDA Forest Service Southern Research Station, 2003).

⁹⁹ *Ibid.*



vervain (*Verbena brasiliensis*), devil's-shoestring (*Sida rhombifolia*), field garlic (*Allium vineale*), mugwort (*Artemisia vulgaris*), nut-sedge (*Cyperus rotundus*), plantains (*Plantago lanceolata*, etc.), water-thyme (*Hydrilla verticillata*), alligator-weed (*Alternanthera philoxeroides*), Brazilian elodea (*Egeria densa*), and water-hyacinth (*Eichhornia crassipes*).¹⁰⁰

3.13.5 How do invasive plants negatively impact the land?

Invasive species can dominate a habitat by out-competing native species, leading to degradation of habitat diversity, and reduction of available wildlife habitat. The human-built environment and economy can also suffer great damage. Invasive species can hinder access and diminish the productivity of croplands and timberlands, as well as dominate recreational areas such as parks, golf courses, and waterfronts.

3.13.6 How would actions from the proposed project create impacts from invasive plant species?

Highway corridors provide opportunities for the movement of invasive plant species through the landscape. Once these plants become established at one location along a roadway, they can spread into surrounding woodlands and along the length of the roadway, and the plants continue to spread long after the road construction is complete. Ways invasive plant species seeds can spread is by attaching to vehicles and from mowing operations. Construction equipment that has not been properly washed-off to remove seeds and plant material before leaving a previous construction site is also a potential invasive plant vector. Additionally, the spread of invasive plants is possible when topsoil is stripped from one site where invasive species, such as Chinese privet, were used as ornamental plants, and moved to another site. The top soil is generally used as top-dressing for shoulders and medians. Dormant seeds, roots, and tubers in the soil could then be spread along the new roadway. In addition, grading and grubbing the soil can spread and intensify infestations of woody invasive species by chopping the roots and stems into thousands of segments that can then resprout.¹⁰¹ Some invasive plant species might be deliberately planted in erosion control, landscape, or wildflower projects.¹⁰²

¹⁰⁰ *Ibid.*

¹⁰¹ James H. Miller, *Nonnative Invasive Plants of Southern Forest: A Field Guide for Identification and Control*, General Technical Report SRS-62, Asheville, N.C.: (USDA Forest Service Southern Research Station, 2003).

¹⁰² Federal Highway Administration Guidance on Invasive Species webpage, http://www.fhwa.dot.gov/environment/inv_guid.htm.



3.13.7 What measures have been successful in preventing and/or controlling the spread of invasive plant species?

Measures to prevent the spread of invasive species include the inspection and cleaning of construction equipment, reducing opportunities for invasive species by reducing disturbance of soils in either time or space,¹⁰³ and the use of invasive-free mulches, topsoils and seed mixes. Planting disturbed areas rather than allowing them to revegetate naturally could reduce the likelihood of unwanted species colonizing in the road corridor. Control measures involve eradication, including mechanical removal of the plant material, or the application of herbicides.¹⁰⁴ During the construction of I-73, the aforementioned control measures would be implemented to reduce the likelihood of the spread of non-native invasive plant species along the Preferred Alternative.

3.14 Federally Protected Species

3.14.1 What are federally protected species?

The *Endangered Species Act of 1973*, (ESA) as amended, requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, including the destruction or adverse modification of critical habitat. The USFWS, or NOAA Fisheries in the case of marine species, determines whether a species should be federally listed as threatened or endangered. A listed species is protected under the ESA until its population has recovered to the point that it can be removed from the list. If a federally protected species is present in the project study area, the federal agency responsible for the project must consult with the USFWS or NOAA Fisheries. These agencies determine whether the proposed actions are likely to adversely impact the species or its habitat, which may lead to further decline or extinction.

Threatened and Endangered Species

The USFWS defines a threatened species as a plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. An endangered species is defined as a plant or animal species that is in danger of extinction throughout all or a significant portion of its range.

3.14.2 Which federally protected species may be found in the project study area?

USFWS maintains a list of federal threatened, endangered, and candidate species as well as species of concern for each county in every state. Table 3.52 lists the federally protected species that may be found in the four counties in the project study area.

¹⁰³ R.T.T. Forman et al., *Road Ecology: Science and Solutions*, (Washington D.C., Island Press: 2003).

¹⁰⁴ Federal Highway Administration Guidance on Invasive Species webpage, http://www.fhwa.dot.gov/environment/inv_guid.htm.



Table 3.52
Federally Protected Species in Dillon and Marlboro Counties, South Carolina and Richmond and Scotland Counties, North Carolina

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS	COUNTY
PLANTS			
<i>Lysimachia asperulifolia</i>	Rough-leaved loosestrife	Endangered	Richmond, Scotland
<i>Oxypolis canbyi</i>	Canby's dropwort	Endangered	Marlboro, Scotland
<i>Rhus michauxii</i>	Michaux's sumac	Endangered	Richmond, Scotland
<i>Schwalbea americana</i>	American chaffseed	Endangered	Scotland
ANIMALS			
<i>Haliaeetus leucocephalus</i>	Bald eagle	Threatened	Dillon, Marlboro, and Richmond
<i>Picoides borealis</i>	Red-cockaded woodpecker	Endangered	Dillon, Marlboro, Richmond, and Scotland
<i>Alligator mississippiensis</i>	American alligator	Threatened/SA*	Scotland**
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	Endangered	Dillon, Marlboro, and Richmond
<i>Lasmigonia decorata</i>	Carolina heelsplitter	Endangered	Richmond
Source: USFWS			
* Threatened due to similarity of appearance.			
** Historical record – species last seen in the designated county over 20 years ago.			

3.14.3 What has been done to avoid impacts to federally protected species on this project?

The SCDNR Heritage Trust Program and the NCDENR keep databases of known locations of rare, threatened, and endangered species within their respective state. These databases were added to the GIS data layer during the development of potential roadway alternatives. Buffers of varying widths, dependent on the species habitat requirements, were established around each of the known locations of federally protected species:

- red-cockaded woodpecker sites were buffered 0.5 mile;
- bald eagle sites were buffered 0.25 mile; and,
- federally protected plants were buffered 100 feet.

Bald eagle nests have been documented at Lake Paul Wallace near Bennettsville, and red-cockaded woodpecker are also known to nest in the project study area. These documented locations, as well



as point locations of state rare species in the project study area, were designated as constraints when development alternatives.

Preliminary field visits were conducted along the preliminary Build Alternatives from October 2006 through January 2007 to evaluate whether federally protected species or suitable habitats for the species were present within the study corridors. Habitat types observed during the field visits for federally protected species varied from being potentially suitable to unsuitable, depending on each species. The preliminary field visits were not conducted during the bloom/fruit period for the listed plant species. Intensive field surveys will be conducted along the Preferred Alternative during the reasonable time of year for identification of the listed plant species.

3.14.4 How could federally protected species be affected by the proposed project?

Typically, federally protected species require specific, well-documented habitat conditions to sustain them. A literature search was performed to determine habitat requirements and to find descriptions of the federally protected species, which will aid in identification of suitable habitat and the presence of species during field surveys. Important sources of reference information included natural resource agency data and published reports, various botanical and faunal literature, along with available USFWS Recovery Plans.

The Build Alternatives were designed to avoid all known locations of federally protected species and based on preliminary site visits, it is not anticipated that any of the Build Alternatives would impact federally listed species. However, intensive field surveys for all listed federally protected species will be performed for the Preferred Alternative in the identified potentially suitable habitats. If federally protected species are found during field surveys, informal consultation with the USFWS would occur and design modifications would be made to avoid impacts to the extent practicable. If it is determined that unavoidable impacts would occur to a federally protected species, formal consultation with the USFWS would occur.

The following are descriptions of the federally protected species known to occur, or that could possibly occur, within the project study area, their habitat requirements, and the potential direct impacts to each from the Build Alternative.

Suitable Habitat

Suitable habitat indicates that special conditions that a species requires to survive are present.

Marginally suitable habitat is an area that has been altered from its natural condition in some way and the alteration has affected the special conditions that certain species of plants and/or animals need to survive.

Unsuitable habitat means that the special conditions required by species to survive are either not present or has been altered such that protected species can no longer live there.

3.14.4.1 *Rough-leaved loosestrife*

Rough-leaved loosestrife (*Lysimachia asperulifolia*), more accurately called pocosin loosestrife, is a perennial herb with slender stems to one or two feet tall that colonizes an area through its underground stem system. Whorls of three to four bluish-green leaves from a single node encircle the stem at intervals beneath the showy yellow flowers. The leaves of rough-leaved loosestrife are not rough, so the traditional common name is a misnomer.¹⁰⁵ Flowering occurs from mid-May through June, with fruit present from July through October. Rough-leaved loosestrife favors pocosins, especially on the edge between longleaf pine sandhills and pond pine pocosins. Here, the soils are moist to seasonally saturated sands or shallow organic soils overlaying sand. It has been found on deep peat in the low shrub community of large Carolina bays, in roadside depressions, firebreaks, and powerline rights-of-way adjacent to pocosins. This species depends on naturally occurring fires to keep the understory clear. When fires are suppressed from its habitat, shrubby understory growth increases in density and height, expanding to eliminate the open edges that the species requires.



Rough-leaved loosestrife
Photo by Gulf South Research Corporation

Based on information from the USFWS, the species is known to occur in Richmond and Scotland Counties. However, according to the SCDNR and NCDENR databases, rough-leaved loosestrife has not been documented in the project study area. Fire has been suppressed in most of the project study area, which has resulted in the herbaceous and shrubby vegetation being too dense in areas that may otherwise be suitable for this species. Based on a review of the NWI maps, there are small areas of pocosin wetlands indicated in close proximity to the Build Alternatives in Richmond, Scotland, and northern Marlboro Counties that could be suitable habitat for rough-leaved loosestrife. However, potentially suitable habitat for rough-leaved loosestrife was not observed within the 2,500-foot wide study corridors of the Build Alternatives during the preliminary field investigations. Therefore, it is anticipated that the proposed project would not affect the rough-leaved loosestrife.

¹⁰⁵ Alan S. Weakley, *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (draft), (Chapel Hill, N.C.: University of North Carolina, 2006).



3.14.4.2 *Canby's dropwort*

Canby's dropwort (*Oxypolis canbyi*) is a perennial herbaceous plant that grows to approximately four feet tall. It has a slender stem that is purplish at the base and green above, and the stem may branch above the middle. The leaves are long, slender and quill-like while the flowers are tiny (~0.1 inch across), with white petals and arranged in compound umbels.¹⁰⁶ Canby's dropwort favors a high water table, open canopy, and medium- to highly-organic soils found in cypress-pine ponds, sloughs, drainage ditches, wet meadows, and wet pine savannahs.

According to the SCDNR and NCDENR databases, Canby's dropwort has not been documented in the project study area. According to the list of federally protected species obtained from the USFWS, Canby's dropwort "possibly occurs" in Marlboro County. The habitat of the Canby's dropwort has been limited in the project study area since fire suppression has allowed the herbaceous and shrub layers to become thick and overgrown in areas that may otherwise be suitable. In addition, the otherwise most potentially suitable areas have closed canopies which would prevent this species from receiving the proper light it needs to grow. NWI maps indicate that one small area of potential savannah and wet meadow wetlands occurs in close proximity to the Build Alternatives in Scotland County. Potentially suitable habitat is mapped throughout the remainder of the project study area near all of the Build Alternatives. However, suitable habitat was not observed within the 2,500-foot wide study corridors of the Build Alternatives during the preliminary field investigations. Therefore, it is anticipated that the proposed project would not affect Canby's dropwort.



Canby's dropwort
Williamsburg County, South Carolina
Photo by Gordon Murphy

3.14.4.3 *Michaux's sumac*

Michaux's sumac (*Rhus michauxii*) is a densely hairy shrub, with erect stems from one to three feet in height that colonizes an area through its underground stem system. The compound leaves contain coarsely toothed, oblong to lance-shaped leaflets. The greenish-yellow to white

¹⁰⁶ Nora Murdock and Douglas Rayner, *Recovery Plan for Canby's Dropwort* (Asheville Field Office, USFWS, 1990).

flower clusters appear from April to June. The fruits are small dull red drupes typical of sumacs, which are produced in the fall.

In the sandhills region near where the fall line (geologic separation of the Coastal Plain Region from the Piedmont Region) occurs, Michaux's sumac is restricted to slightly loamy, well-drained soils that are scattered through longleaf pine/scrub oak/wiregrass woodlands. These sites are usually found in slight depressions, swales, or along lower slopes. Michaux's sumac historically occurs in sandy or clayey soils on dry upland sites in the Piedmont region. In all of its habitats, the shade-intolerant plant is dependent upon some form of disturbance to maintain the open quality of its habitat. Historically, periodic and naturally occurring fires provided such disturbance. This, in combination with dry soil, maintained open woodlands or savannahs with no dense overstory. Fire suppression has been nearly universal in the Piedmont region and led to vegetative succession of habitats, eliminating the plant. Many recent occurrences of the species are in areas that are artificially disturbed, such as highway and railroad rights-of-ways, powerline clearings, pine plantations, edges of cultivated fields, and other cleared lands.¹⁰⁷



Michaux's sumac
Scotland County, North Carolina
Photo by Ed Smail

According to the SCDNR and NCDENR databases, Michaux's sumac has not been documented in the project study area. Based on data from the USFWS, it is known to occur in Richmond and Scotland Counties. Herbaceous and shrubby vegetation has become thick in areas that are otherwise suitable for the species due to fire suppression throughout the project study area. Suitable habitat for Michaux's sumac occurs in close proximity to all of the Build Alternatives in Richmond and Scotland Counties as well as the northernmost portion of Marlboro County. Potentially suitable habitat may occur within the 2,500-foot wide corridors of the Build Alternatives; however, Michaux's sumac was not observed during the preliminary field visits. Therefore, it is anticipated that the proposed project would not affect Michaux's sumac.

3.14.4.4 *American chaffseed*

American chaffseed (*Schwalbea americana*) is an upright perennial with a stem that is unbranched or only branches at the base of the plant. It grows to a height of one to two feet and has

¹⁰⁷ NatureServe website, <http://www.natureserve.org/explorer/servlet/NatureServe> (February 20, 2007).



alternate, lance-shaped or elliptical leaves that connect directly to the stem. The upper leaves are reduced to small bracts, and the purplish yellow flowers arise from these bracts. The inflorescence is unbranched and indeterminate (or raceme), with many stalked flowers concentrated on the upper portion of an unbranched stem. Individual flowers are tubular, stalked, and 1.2 to 1.4 inches long. Flowering occurs from April to June and fruits begin to mature shortly afterward in early summer. The fruit is a narrow capsule about a half-inch long.

American chaffseed is restricted to longleaf pine flatwoods and savannahs, edges between downhill peaty wetlands and uphill dry sandy soils, mesic loamy-soil slopes or swales in longleaf pine sandhill woodlands, and other open, grass-sedge systems.^{108,109} This species prefers areas with an open or partially open overstory. It requires habitat that is subject to frequent disturbance due to burning or occasional mowing and/or areas with a fluctuating water table. These conditions can impede the growth of some herbaceous species and thereby make the conditions more favorable for chaffseed to grow and compete due to its ability to better tolerate these conditions.



American chaffseed
Williamsburg County, South Carolina
Photo by Gordon Murphy

The USFWS lists this species as being known to occur in Scotland County. According to the SCDNR and NCDENR databases, there are no known occurrences of American chaffseed within the project study area. Fire has been suppressed in a majority of the project study area so that herbaceous and shrubby vegetation is thick in areas that may otherwise be suitable for this species. The use of herbicides in managed pine stands would limit the establishment of this species in areas that would otherwise be suitable. In addition, the majority of potentially suitable areas have closed canopies that would shade out this species. Pine savannah and wet flatwoods are mapped in close proximity to all Build Alternatives in Scotland County and northern Marlboro County. Potentially suitable habitat may occur within the 2,500-foot wide corridors of the

¹⁰⁸ Richard D. Porcher and Douglas A. Rayner, *A Guide to the Wildflowers of South Carolina* (Columbia, SC: University of South Carolina Press, 2001).

¹⁰⁹ Alan S. Weakley, *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (draft), (Chapel Hill, N.C.: University of North Carolina, 2006).

Build Alternatives; however, American chaffseed was not observed during the preliminary field visits. Therefore, it is anticipated that the proposed project would not affect American chaffseed.

3.14.4.5 *Bald eagle*

The bald eagle (*Haliaeetus leucocephalus*) is a large bird of prey with a dark brown body and conspicuous white coloration on the head, neck, and tail. Its wingspan may reach up to seven feet, and it can weigh as much as seven pounds as an adult.

The bald eagle is typically associated with coasts, rivers, and lakes. It requires large trees with an open limb structure for nesting, usually in a transitional area between a forest and marsh within 0.62 mile of open water. Large trees allow bald eagles to build large nests that can support nesting for many years without falling. The open limb structure provides easy access and a clear view of foraging habitat. Nesting habitats initially selected by bald eagles usually have minimal disturbance. Trees suitable for perching and future nesting sites are also important components of stable nesting territories. Fresh, brackish and marine habitats provide suitable foraging sites and these habitats can include open water, marsh and riverine types. Prime habitats are characterized by having shallow, slow moving water with abundant fish and bird prey. Preferred sites have suitable perch and roost sites with minimal disturbance. Large manmade reservoirs have provided many acres of inland bald eagle foraging habitat. Concentrations of bald eagles may be found below hydroelectric dams where they forage on injured fish. Impounded marsh managed for waterfowl is also preferred foraging and nesting habitat. The habitat preferred by bald eagles for nesting, roosting, and foraging, large bodies of water with forest in close proximity, is not common in the project study area.



Bald eagle
Photo by Kevin Ebi

The USFWS lists this species as being known to occur in Dillon, Marlboro, and Richmond Counties. According to the SCDNR and NCDENR databases, there are no documented bald eagle nest sites within or adjacent to the Build Alternatives. The nearest documented bald eagle nest is over 1.5 miles away from the nearest study corridor (Alternative 2). The documented nest is located near Lake Wallace and Burnt Factory Pond which are both large enough to provide sufficient prey to support an eagle pair and a chick. Other suitable nesting habitat within the project study area includes forested areas along portions of the Pee Dee River northwest of Bennettsville and Wallace that is within 0.62 miles of the River. However, these areas are approximately 1.5 miles from the nearest alternative (Alternative 1). Suitable foraging habitat



within the study corridors can be found at mill ponds; however, no bald eagles or nests were observed within the 2500-foot Build Alternative corridors during the preliminary field visits. Therefore, it is anticipated that the proposed project would not affect the bald eagle

3.14.4.6 *Red-cockaded woodpecker*

The red-cockaded woodpecker (*Picoides borealis*) is a small woodpecker with a wingspan up to 15 inches. The bird has black and white horizontal stripes on its back, white cheeks and breast, black-streaked flanks, and a black cap and throat. Males have small red spots or “cockades” on each side of the cap just behind the eye, which is not easily apparent in the field.¹¹⁰

Preferred nesting habitat of the red-cockaded woodpecker is old-growth pine forest (stems equal to or greater than 60 years old) that is relatively free of hardwood undergrowth. Suitable foraging habitat includes pine and pine/hardwood stands with pine stems equal to or greater than 30 years of age. Foraging habitat is contiguous with nesting habitat; therefore, colonies typically require areas of at least 100 acres of suitable habitat. Threats to this species include loss of old-growth longleaf pine habitat, fire suppression that allows the growth of a dense hardwood and vine understory in areas that would otherwise be suitable for nesting habitat, and timber management practices that result in harvesting of pines before they reach a size that is suitable for establishment of red-cockaded woodpecker nest colonies.¹¹¹



Red-cockaded woodpecker
Sumter County, South Carolina
Photo by Gordon Murphy

The USFWS lists the species as known to occur in all four counties. According to the SCDNR and NCDENR databases, there are no documented red-cockaded woodpecker nest sites within or adjacent to the Build Alternative corridors, nor were any suitable old-growth pine forests observed within the study corridors. Known red-cockaded woodpecker nest sites are near the

¹¹⁰ USFWS Region 4, *Endangered and Threatened Species of the Southeastern United States (The Red Book)* (USFWS, 1993).

¹¹¹ Gary V. Henry, *Guidelines for Preparation of Biological Assessments and Evaluations for the Red-cockaded Woodpecker*. (USFWS Southeast Region, 1989).



intersections of Road S-30E and Road S-464, north of Bennettsville, which is over two miles away from the nearest Build Alternative (Alternative 1). Pine forests within the project study area that are located south of S.C. Route 79 are predominantly managed timberlands and, therefore, are not likely to support red-cockaded woodpeckers.

However, a review of aerial photography indicates that extensive areas of pine forest along all the Build Alternatives north of S.C. Route 79 that resemble the documented nest colony forest. Pine stands are present within the study corridors, but most are less than 30 years of age and/or have dense undergrowth present due to fire suppression and are therefore not suitable for nesting or foraging habitat. No red-cockaded nest cavities or woodpeckers were observed in or adjacent to the 2,500-foot wide Build Alternative corridors during the preliminary site visits. Therefore, it is anticipated that the proposed project would not affect the species.

3.14.4.7 *American alligator*

The American alligator (*Alligator mississippiensis*) is a primitive semi-aquatic reptile that can reach a length of 16 feet. The body is normally olive green to brownish with light yellow to white cross bands on the body. The cross bands are bright yellow in juvenile alligators, and lighten with age. Alligators have a broader, rounded snout, which distinguishes them from the American crocodile (*Crocodylus acutus*), the only other native crocodylian species to the United States.¹¹² American crocodiles are restricted to extreme southern Florida and the Caribbean.

American alligators are found in the Coastal Plain region of the Gulf and Atlantic states, mainly in large river swamps, coastal impoundments, abandoned rice fields, ponds, and other bodies of freshwater or occasionally brackish waters. Females construct nests, usually consisting of a mound of aquatic vegetation and muck, near the water. Nests may be hidden in stands of cattails or other emergent vegetation, but require sunlight exposure for the eggs to incubate.¹¹³



American alligator
Jasper County, South Carolina
Photo by Gordon Murphy

¹¹² Bernard S. Martof et al., *Amphibians and Reptiles of the Carolinas and Virginia* (Chapel Hill, NC: University of North Carolina Press, 1980).

¹¹³ SCDNR website, "Comprehensive Wildlife Conservation Strategy Species," <http://www.dnr.sc.gov/cwcs/species.html> (February 20, 2007).



The American alligator was formerly listed as endangered, but recovered and its status was changed from endangered to threatened in the 1980s. It is currently listed as federally threatened due to its similar appearance to the American crocodile. Currently its population is secure both statewide and globally.¹¹⁴

The occurrence of the American alligator within the project study area is not well-documented. Based on information from the USFWS, the species is listed as known to occur in Scotland County. The species occurrence is listed as “Historic” for Scotland County, meaning the last documented sighting was 20 or more years ago. The Great Pee Dee River and its swamps and bottomlands west of the project study area provide suitable habitat for the species. However, the tributaries of the Great Pee Dee River that are located within the study corridors of the Build Alternatives do not provide suitable habitat for the species.

The American alligator does not venture too far upstream from large deepwater river systems such as the Great Pee Dee River due to lack of sufficient numbers of prey species (large fish, turtles, water fowl, etc.) in the shallow forested wetlands. Therefore, it is anticipated that the proposed project would not affect the species.

3.14.4.8 *Shortnose sturgeon*

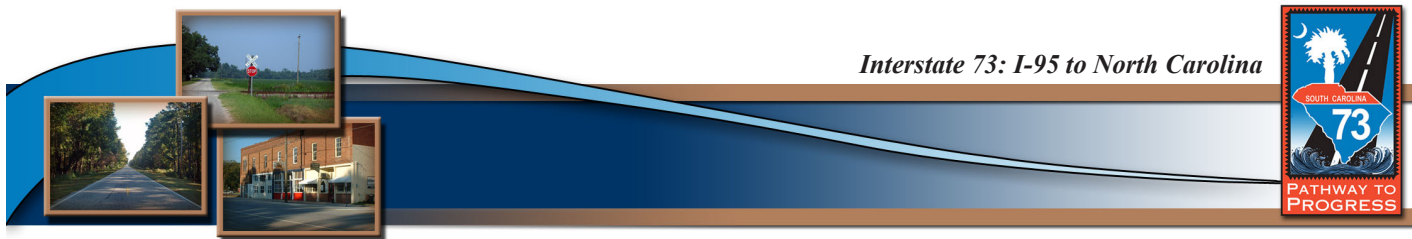
The shortnose sturgeon (*Acipenser brevirostrum*) is a primitive fish that reaches a maximum length of around four feet. Instead of scales, this fish has five rows of boney plates called scutes that run the length of the body. One row is located on each side, one down the back, and two down the belly. Color is olive gray to yellowish brown, with darker coloration along the top of the body, and a pale underside. The upper lobe of the forked tail is longer than the lower. Sturgeons have mouths that protrude from the underside of the snout, enabling foraging along the substrate for prey items such as mussels and crustaceans. The snout of the shortnose sturgeon is shorter and blunter than that of the Atlantic sturgeon (*Acipenser oxyrinchus*).



Shortnose sturgeon
Photo by Johnny Jensen

The shortnose sturgeon is found in riverine, estuarine, and occasionally near-shore marine environments of eastern North America and the Atlantic Ocean. Spawning and larval stages of

¹¹⁴ *Ibid.*



the life cycle typically occur in freshwater channels of large, unobstructed river basins from as far inland as the fall line to the zone of tidal influence in estuarine or brackish channels. Foraging occurs near the freshwater/saltwater interface in riverine and estuarine environments, i.e., sounds and bays of river basin deltas. In South Carolina, the species uses the Pee Dee/Waccamaw drainage basins for spawning and foraging.¹¹⁵ One occurrence of the shortnose sturgeon was documented in the Great Pee Dee River near the I-74 crossing in 1986.¹¹⁶

NOAA Fisheries has designated Reedy Creek, the Little Pee Dee River, and several small tributaries to the Great Pee Dee River as suitable shortnose sturgeon habitat. The USFWS lists the species as being known to occur in Dillon, Marlboro, and Richmond Counties. According to the SCDNR and NCDENR databases, there are no known occurrences of shortnose sturgeon within the study corridors for the Build Alternatives. Suitable habitat was not identified by NOAA Fisheries within the study corridors for Alternatives 1 and 2. Therefore, it is anticipated that construction of Alternatives 1 or 2 would not affect the species. However, Alternative 3 would cross Reedy Creek, which was identified by NOAA Fisheries as potentially suitable nursery habitat. Alternative 3 over Reedy Creek would be primarily built on structure (bridge), therefore impacts would be minimal. However, construction of Alternative 3 may affect, but is not likely to adversely affect, the shortnose sturgeon.

3.14.4.9 Carolina heelsplitter

Carolina heelsplitter (*Lasmigonia decorata*) is a freshwater mussel with an ovate, trapezoidal, unsculptured shell. The color of the outer shell varies from greenish brown to dark brown, with faint, yellowish rays in younger specimens. The mussel feeds by filtering food particles such as plankton, algae, and bacteria from the water.

Carolina heelsplitter is found in clean, relatively shallow (one to four feet deep), free-flowing, and highly oxygenated waters of small to large streams and rivers. Historically, the species were also found in mill ponds on some of the smaller streams in its range. It burrows in the mud, muddy sand, or muddy gravel substrates along the stable, well-shaped stream banks. The stability of the banks appears to be very important to this species.¹¹⁷

¹¹⁵ SCDNR Comprehensive Wildlife Conservation Strategy Program website, <http://www.dnr.sc.gov/cwcs/> (February 20, 2007).

¹¹⁶ NCDENR, Division of Water Quality, "Yadkin-Pee Dee River Basinwide Water Quality Management Plan," (1998) <http://h2o.enr.state.nc.us/basinwide/yadkin/yadch2.doc> (February 20, 2007).

¹¹⁷ Walton Beacham et al., eds., *Beacham's Guide to the Endangered Species of North America*, (Farmington Hills, MI: Gale Group, 2001).



In South Carolina, the currently known populations occur in Edgefield, Greenwood, McCormick, Lancaster, and Chester Counties, none of which are near the project study area¹¹⁸ In North Carolina, the heelsplitter currently is limited to the Pee Dee and Catawba River drainages.

The USFWS lists the Carolina heelsplitter as known to occur in Richmond County. According to the SCDNR and NCDENR databases, there are no known occurrences of Carolina heelsplitter within the project study area, and suitable habitat was not observed within, or in close proximity to, the 2,500-foot study corridors for the Build Alternatives during the preliminary field investigations.



Carolina heelsplitter
Edgefield County, South Carolina
Photo by John Alderman

The Pee Dee-Yadkin River drainage basin west of the project study area does harbor suitable habitat far upstream, but not in tributaries that are within the construction limits of the Build Alternatives. Therefore, it is anticipated that the project would not affect the species.

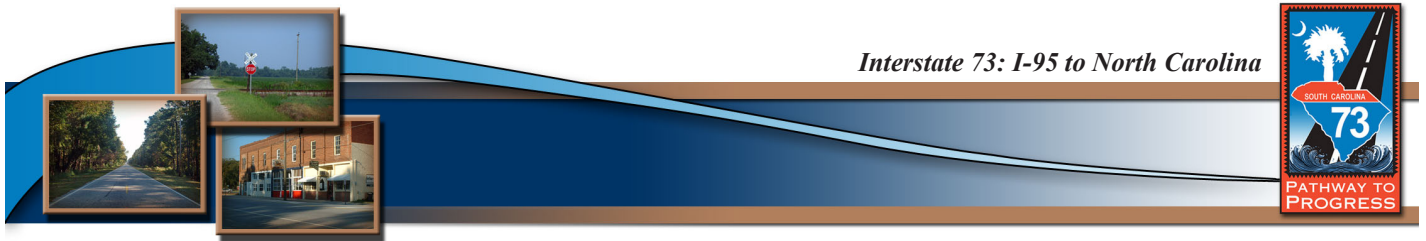
3.14.5 What would happen if a federally protected species was affected by the proposed project?

Section 7 of the ESA requires federal agencies ensure that their activities will not jeopardize the continued existence of federally protected species. If it is determined during the development of the project that the action may jeopardize the continued existence of federally listed, threatened, or endangered species or its designated critical habitat, formal Section 7 consultation would begin. The USFWS would prepare a biological opinion in which practicable alternatives would be identified that could allow potential impacts to be minimized or avoided for the project to be completed. If it is determined that the proposed project would jeopardize the continued existence of a species or modify its critical habit with the implementation of the Preferred Alternative the USFWS may issue an incidental take statement.

3.14.6 What would indirect and cumulative impacts to federally protected species be?

Protected species that have more than a minor amount of potential habitat within the project study area, or are known to occur within the project study area, have been evaluated for potential indirect

¹¹⁸ Mark Caldwell, U.S. Fish and Wildlife Service, Ecological Services Division in Charleston, S.C., Email, August 8, 2006.



and cumulative impacts. These species are the red-cockaded woodpecker and bald eagle. Known locations of a bald eagle nest and a red-cockaded woodpecker nest colony were avoided by the Build Alternatives. A GIS analysis was performed within the project study area to determine if projected induced development impacts would affect known occurrences of, or suitable habitat for, these federally protected species.

Potential development predicted by the land use models for all of the Build Alternatives and the No-build alternative would encroach onto forested pine lands. However, much of these lands are similar to the forested pine lands within the footprint of the various Build Alternatives and consist of managed timberland. The trees are not mature enough, or the natural pine stands are not large enough, to support a colony of red-cockaded woodpeckers. Additionally, due to fire suppression in much of the project study area, the mid-story in many of the natural pine stands is too dense. Therefore, the projected induced development is not likely to occur in areas that would adversely impact the red cockaded woodpecker.

Based on a review of aerial photography and preliminary site visits within the project study area, there are forested areas within 0.69 mile of the Great Pee Dee River and Little Pee Dee River that could provide suitable nesting habitat for the bald eagle. Other than the rivers, Lake Wallace is the only other body of water in the project study area large enough to support bald eagles. None of the projected induced development tracts would impact areas suitable for eagle nesting or foraging.

Previously constructed projects such as I-74 in North Carolina, S.C. Route 22 in Horry County, and the current widening along S.C. Route 38 in Dillon County, have contributed to cumulative upland and wetland habitat impacts in the I-73 North and South project study areas; however, none have directly impacted federally protected species. Proposed projects such as the SELL in Horry County, the widening along S.C. Route 9/S.C. Route 38 in Marlboro County, and I-73 South are also anticipated to contribute to cumulative upland and wetland habitat impacts in the project study area. Field surveys for federally listed species were completed as part of the NEPA process within the I-73 South Preferred Alternative study corridor and no federally protected species were found. The SELL project and widening along S.C. Route 9/S.C. Route 38 will involve the use of federal funding. Therefore, NEPA documentation will be prepared for these projects. It is anticipated that during the development of these roadway alignments, field surveys within the project study area would be conducted to identify and avoid impacts to federally listed species. Therefore, it is not anticipated that these projects would contribute to cumulative impacts to protected species.

One other large scale development in the project study area is being developed. A planned privately operated military training facility located in the northwestern portion of the I-73 North project study area could contribute to cumulative impacts to federally-protected species. Based on a review of aerial photography, the approximately 3,100-acre tract, 1,800 acres of which would be utilized,



is predominantly managed timberland. Because the site consists of managed pine, it is not likely that the bald eagle or red-cockaded woodpecker would be impacted.

3.15 State Species of Concern

Table 3.53 (refer to pages 3-222 to 3-228) lists the state rare, threatened, endangered, and species of concern within the respective states, for the counties within the project study area. This list is compiled from the SCDNR and the NCDENR databases. Suitable habitat may be present in the project study area for any of these species. However, according to the state agencies, no known locations of state species of concern occur within the study corridors of the Build Alternatives.

3.16 Wildlife

3.16.1 What types of wildlife habitat are found in the project study area?

Wildlife habitat is a place where a plant or animal species naturally occurs and normally lives and grows. The Coastal Plain of the Carolinas includes a diversity of terrestrial and aquatic habitats that provide food, shelter, breeding, and wintering grounds for a wide variety of wildlife. Table 3.54 (refer to page 3-229) lists the types of upland and wetland habitats found in the project study area.

Although several types of natural wildlife habitat were identified during the preliminary field visits, the majority of the project study area is comprised of disturbed areas. These areas are highly impacted by the activities of man, primarily as agricultural fields and managed pine stands. The land within the project study area has been under cultivation for a long period of time, leaving the remaining natural areas highly fragmented with dense understories due to fire suppression.

While some animals require certain habitat types to survive, many others are not restricted to just one environment, which allows them to use a variety of upland and wetland communities. Appendix E contains a comprehensive list of wildlife species that may occur within the project study area. The descriptions below are of the most typical species found in each community. These representative species are based on literature reviews. Common names are used in the following sections; for the corresponding scientific name, please refer to Appendix E.



Table 3.53
State Listed Rare, Threatened, and Endangered Species
Known to Occur in Dillon County and Marlboro County, South Carolina, and
Richmond County and Scotland County, North Carolina

Scientific Name	Common Name	Status	Habitat	Counties	Suitable Habitat Present?
PLANTS					
<i>Agalinis virgata</i>	Branched gerardia	S2	Pine savannahs.	Scotland	No
<i>Amorpha georgiana</i> var. <i>georgiana</i>	Georgia indigo-bush	S2	Pine savannahs, sandy river terraces, sandy woodland borders, and open woods and fields.	Richmond, Scotland	Yes
<i>Amphicarpum muehlenbergianum</i>	Florida goober grass	S1	Clay-based Carolina bays.	Scotland	No
<i>Campylopus carolinae</i>	Savannah campylopus (moss)	S1	Restricted to scrub oak-longleaf pine, sandhill communities of the Coastal Plain. Grows in almost pure quartz sand with a low organic content.	Scotland	Yes
<i>Carex canescens</i> ssp. <i>disjuncta</i>	Silvery sedge	S1	Bogs, swamps, and often in disturbed areas.	Scotland	Yes
<i>Eleocharis robbinsii</i>	Robbins's spikerush	S2	Quiet waters of limesink (doline) ponds, and natural lakes.	Scotland	No
<i>Eupatorium leptophyllum</i>	Limesink dog-fennel	S1	Limesink depression ponds (dolines) in the outer Coastal Plain, and clay-based Carolina bays in the inner Coastal Plain.	Scotland	No
<i>Eurybia mirabilis</i> (syn. <i>Aster commixtus</i>)	Piedmont aster	S2	Moist, wooded slopes, alluvial woods, and nutrient-rich bottomlands, usually on basic or circumneutral soils.	Richmond	Yes
<i>Gaillardia aestivalis</i>	Sandhills gaillardia	S1	Sandhills and disturbed sandy soils.	Scotland	Yes



Table 3.53, continued
State Listed Rare, Threatened, and Endangered Species
Known to Occur in Dillon County and Marlboro County, South Carolina,
and Richmond County and Scotland County, North Carolina

Scientific Name	Common Name	Status	Habitat	Counties	Suitable Habitat Present?
PLANTS					
<i>Galactia mollis</i>	Soft milk-pea	S2	Sandhills, sandy open woods and clearings.	Scotland	Yes
<i>Liatris squarrulosa</i>	Earle's blazing star	S2	Diabase barrens, other glades and barrens, prairies, and open woodlands.	Scotland	Yes
<i>Lilium pyrophilum</i>	Sandhills lily	S2	Peaty seepage bogs in the Sandhills and peaty swamp margins in the upper Coastal Plain.	Richmond, Scotland	No
<i>Lindera subcoriacea</i>	Bog spicebush	S2	Peaty seepage bogs in headwaters of blackwater streams, with other pocosin shrubs.	Richmond, Scotland	No
<i>Lobelia boykinii</i>	Boykin's lobelia	S1	Cypress ponds and depression meadows.	Scotland	Yes
<i>Ludwigia suffruticosa</i>	Shrubby seedbox	S2	Periodically to seasonally flooded portions of limesink ponds (dolines) and clay-based Carolina bays.	Scotland	No
<i>Luziola fluitans</i>	Southern water grass	S1S2	Water of natural lakes, slow-moving blackwater rivers, and other stagnant waters.	Scotland	Yes
<i>Muhlenbergia torreyana</i>	Pinebarren smokegrass	S2	Moist soils of depression meadows and clay-based Carolina bays, often under or near <i>Taxodium ascendens</i> .	Richmond	No
<i>Nestronia umbellula</i>	Conjurer's nut	S2	Mesic to dry forests with a somewhat open canopy, usually upslope from Pacolet soils.	Marlboro	Yes



Table 3.53, continued
State Listed Rare, Threatened, and Endangered Species
Known to Occur in Dillon County and Marlboro County, South Carolina,
and Richmond County and Scotland County, North Carolina

Scientific Name	Common Name	Status	Habitat	Counties	Suitable Habitat Present?
PLANTS					
<i>Oldenlandia boscii</i>	Bosc's bluet	S1	Clay-based Carolina bays, rivershore and millpond drawdown shores, ponds, other seasonally saturated habitats.	Scotland	Yes
<i>Parnassia caroliniana</i>	Carolina grass-of-parnassus	S2	Wet longleaf pine, pond pine, or pond cypress savannas, often over calcareous substrates.	Scotland	No
<i>Paspalum dissectum</i>	Mudbank crown grass	S1	Mud flats, and in drawdown zones.	Scotland	Yes
<i>Polygala grandiflora</i>	Showy milkwort	S2	Sandhills and the dry sandy soils of roadsides and fields.	Scotland	Yes
<i>Polygonum hirsutum</i>	Hairy smartweed	S1	Pond-cypress savannas and depression ponds in pinelands.	Scotland	Yes
<i>Potamogeton confervoides</i>	Conferva pondweed	S2	Shallow areas of acidic peaty or sandy blackwater pools, ponds, and streams.	Scotland	Yes
<i>Rhexia aristosa</i>	Awned meadowbeauty	S2	Depression meadows in clay-based Carolina bays, pond cypress savannas, and limestone ponds in the Coastal Plain.	Marlboro	No
<i>Rhynchospora macra</i>	Southern white beak sedge	S2	<i>Sphagnum</i> bogs in frequently burned streamhead pocosins, and in sandhill seepage bogs.	Richmond, Scotland	No



Table 3.53, continued
State Listed Rare, Threatened, and Endangered Species
Known to Occur in Dillon County and Marlboro County, South Carolina,
and Richmond County and Scotland County, North Carolina

Scientific Name	Common Name	Status	Habitat	Counties	Suitable Habitat Present?
PLANTS					
<i>Rhynchospora tracyi</i>	Tracy's beaksedge	S2	Cypress savannas, grass-dominated depressions, small clay-based Carolina bays, or shallow limesink ponds (dolines), typically in shallow water or at the lower margins of pond-shores.	Scotland	No
<i>Ruellia ciliosa</i>	Sandhills wild-petunia	S1	Sandhills, particularly in loamy, submesic swales.	Scotland	Yes
<i>Sagittaria isoetiformis</i>	Quillwort arrowhead	S1	Depression meadows in clay-based Carolina bays, lime sinks, marshy shores of impoundments, and pond cypress-swamp gum depression swamps.	Scotland	Yes
<i>Salvia azurea</i>	Azure sage	S1	Sandy or rocky woodlands.	Scotland	Yes
<i>Scleria georgiana</i>	Georgia nutrush	S2	Pine savannas, cypress savannas, and depression meadows.	Scotland	No
<i>Scleria reticularis</i>	Netted nutrush	S2	Margins of limesink ponds, and in clay-based Carolina bays.	Scotland	No
<i>Solidago tortifolia</i>	Twisted-leaf goldenrod	S1	Sandhills and dry pinelands.	Scotland	Yes
<i>Solidago verna</i>	Spring-flowered goldenrod	S1	Moist pine savannas, lower slopes of sandhills, pine barrens, and pineland roadbanks.	Marlboro	Yes
<i>Stylisma aquatica</i>	Water dawnflower	S1	Clay-based Carolina bays and wet savannahs.	Scotland	No
<i>Stylisma pickeringii</i> var <i>pickeringii</i>	Pickering's dawnflower	S2	Coarse, white sands in open sandhills or in other dry, barren, sandy woods with sparse ground cover, scant litter accumulation, and little canopy cover.	Marlboro, Scotland	Yes
<i>Thalictrum macrostylum</i>	Small-leaved meadow-rue	S2	Moist places, perhaps associated with circumneutral soils, moist to dry outcrop barrens (over olivine).	Richmond	No



Table 3.53, continued
State Listed Rare, Threatened, and Endangered Species
Known to Occur in Dillon County and Marlboro County, South Carolina, and
Richmond County and Scotland County, North Carolina

Scientific Name	Common Name	Status	Habitat	Counties	Suitable Habitat Present?
PLANTS					
<i>Tridens ambiguous</i>	Pineland triodia	S1	Wet savannahs and clay-based Carolina bays.	Scotland	No
<i>Utricularia olivacea</i>	Piedmont bladderwort	S1	In floating mats (often algal) in water of limesink ponds, artificial lakes or beaver ponds of the Coastal Plain.	Marlboro	Yes
<i>Xyris chapmanii</i>	Chapman's yellow-eyed-grass	S2	Sandhill seepage bogs in areas of copious lateral seepage in deep muck soils.	Scotland	No
<i>Xyris scabrifolia</i>	Roughleaf yellow-eyed-grass	S2	Sandhill seepage bogs and wet pine savannas.	Richmond, Scotland	No
ANIMALS					
<i>Ambystoma tigrinum</i>	Eastern tiger salamander	S2	Adults live in terrestrial habitats such as crayfish holes, root channels, rodent burrows and other subterranean structures. Larvae are aquatic, occurring in breeding ponds (isolated, temporary freshwater wetlands) in Carolina Bays, limesinks, flatwoods, and other pools with an open canopy and abundant grasses and sedges.	Richmond, Scotland	Yes
<i>Anodonta implicate</i>	Alewife floater	S1	Streams, rivers and pools, in a variety of substrates, including silt, sand and gravel. A northern species with a disjunct population in the Chowan and Pee Dee River basins in N.C.	Richmond	No
<i>Atrytone arogos arogos</i>	Arogos skipper (butterfly)	S1	Coastal Plain and Sandhill pine savannahs from xeric and sandy to boggy with a sphagnum substrate.	Richmond	Yes



Table 3.53, continued
State Listed Rare, Threatened, and Endangered Species
Known to Occur in Dillon County and Marlboro County, South Carolina, and
Richmond County and Scotland County, North Carolina

Scientific Name	Common Name	Status	Habitat	Counties	Suitable Habitat Present?
ANIMALS					
<i>Callophrys irus</i>	Frosted elfin (butterfly)	S2	Dry clearings and open areas of the Coastal Plain that are natural (e.g. savannas) or of human origin (e.g. power-line right of ways and roadsides). The presence of food plants <i>Baptisia</i> and <i>Lupinus</i> spp. is also of importance.	Scotland	Yes
<i>Carpiodes velifer</i>	Highfin carpsucker	S2	Rivers in areas with moderate or swift current over sand or gravel substrate.	Richmond	No
<i>Condylura cristata</i>	Star-nose mole	S2	Coastal Plain and Sandhills habitats include pocosins, saturated bottomlands, and other wetlands, as well as long-leaf pine habitat.	Richmond, Scotland	Yes
<i>Corynorhinus rafinesquii</i>	Rafinesque's big-eared bat	S2?	Dilapidated buildings, under bridges, and in large cavity trees near permanent water.	Dillon	Yes
<i>Cyprinella zanema</i>	Santee or Thinlip chub	S2	Small to medium-sized streams with sand and rocky runs or current-swept pools.	Richmond, Scotland	No
<i>Elliptio roanokensis</i>	Roanoke slab shell	S1	Large rivers, but occasionally small creeks. Found in the Pee Dee River.	Richmond	No
<i>Ephemerella argo</i>	Argo ephemerellan mayfly	S1	Ponds and shallow lakes.	Scotland	Yes
<i>Eurycea quadridigitata</i>	Dwarf salamander - silver morph	S2	Bottomland forest, swamps, and the edges of pond savanna pools in the Coastal Plain.	Scotland	Yes
<i>Heterodon simus</i>	Southern hognose snake	S2	Xeric longleaf pine communities and other pine-dominated habitats.	Richmond, Scotland	Yes



Table 3.53, continued
State Listed Rare, Threatened, and Endangered Species
Known to Occur in Dillon County and Marlboro County, South Carolina, and
Richmond County and Scotland County, North Carolina

Scientific Name	Common Name	Status	Habitat	Counties	Suitable Habitat Present?
ANIMALS					
<i>Lampsilis cariosa</i>	Yellow lamp mussel	S1	In gravel bars, margins of the flowing portions of water bodies and cracks in bedrock in both large rivers and small streams. Found in the Pee Dee River.	Richmond	No
<i>Ligumia nasuta</i>	Eastern pond mussel	S1	In lakes, ponds, streams and rivers of variable depths with muddy, sandy or gravelly substrates. Often found in very shallow water near the banks of rivers. Found in the Pee Dee River.	Richmond	Yes
<i>Micrurus fulvius</i>	Eastern coral snake	S1	In the Coastal Plain in sandy flatwoods, maritime forests, and sandhills with pines, scrub oaks, and wiregrass.	Scotland	Yes
<i>Moxostoma robustum</i>	Robust redhorse	S1	In mainstream rivers in riffles, runs and pools. Adults are usually found in association with tree snags, often in deep water near shore. Found in the Pee Dee River.	Richmond	No
<i>Rana capito</i>	Carolina gopher frog	S2	Dry, turkey oak-pine associations and other sandy areas in pine savannahs. Highly terrestrial, enter the water only to breed. When not active on the surface, they occupy burrows. Breeds in pine savanna ponds and Carolina bays.	Scotland	No
<i>Semotilus lumbee</i>	Sandhills chub	S2	In small headwater creeks, where it is often the only fish present, as well as in larger portions of creeks downstream, usually over gravel and /or sand.	Marlboro	Yes
<i>Strophitus undulatus</i>	Creepers	S2	In high quality rivers and streams, including the Pee Dee.	Richmond	No
<i>Villosa vaughaniana</i>	Carolina creek shell	S2	Endemic to the Carolinas in the Cape Fear, Catawba, Pee Dee and Santee-Cooper River basins. Burrows in mud or sand near banks or occasionally in gravelly sand in the main channel.	Richmond	No

Notes:

S1 = Critically imperiled statewide because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation.

S2 = Imperiled statewide because of rarity or factor(s) making it vulnerable.



**Table 3.54
Undisturbed Upland and Wetland Habitats in Project Study Area**

Upland Habitats*	Wetland Habitats**	
Mesic mixed hardwood forest	Aquatic beds	Pine savannah and wet flatwoods
Oak-Hickory Forest	Bay Forest	Ponds and Borrow Pits
Pine Flatwoods	Bottomland Hardwoods	Rivers and Canals
Pine-Scrub Oak Sandhill	Deciduous Shrub Swamp	Savannah and Wet Meadows
Upland Pine-Wiregrass Woodlands	Evergreen Shrub Bogs/Pocosins	Wooded Swamp
Xeric Sandhill Scrub	Freshwater Marsh	

*Source: *The Natural Communities of South Carolina* (Nelson, 1986) and *Classification of The Natural Communities of North Carolina* (Schafale and Wheatley, 1986)
 **Source: *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979)

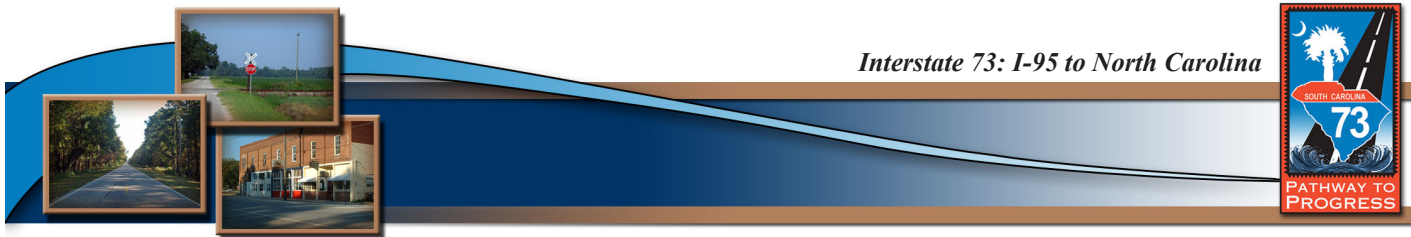
3.16.2 What species are typically found in upland habitats within the project study area?

A large assortment of mammals, birds, reptiles and amphibians (known collectively as herptiles), and invertebrates use uplands for foraging, breeding, nesting and as wintering grounds. Many of the most common species will forage, nest, and travel through any or all upland types.

3.16.2.1 Mesic mixed hardwood forests

Mesic mixed hardwood forests are dry to moist uplands occurring on the Coastal Plain often on north-facing river bluffs. The diversity of trees and other plants is great, and as such determining the dominant species is difficult. These dense woods offer great potential for shelter including large tree limbs, hollow trunks, leafy branches at a variety of heights, tangled vines, shrub thickets, dead snags, wind-thrown root balls, logs, and stumps. All of these choices for roosting, hiding, or nesting, together with the multitude of food choices, make this community rich in animal life. Mammals normally found in mesic mixed hardwoods include the southern short-tailed shrew, evening bat, gray squirrel, flying squirrel, raccoon, long-tailed weasel, and the white-tailed deer.

Many birds find ample nesting sites and food among the large assemblage of plants in these forests, including the American woodcock, common snipe, red-tailed hawk, great horned owl, turkey, chuck-will's-widow, and yellow-billed cuckoo. Several woodpeckers are normally found



in this habitat including the pileated, red-bellied, and hairy woodpeckers, along with the yellow-bellied sapsucker. Songbirds are in abundance, with the more common inhabitants being the eastern wood pewee, Carolina chickadee, tufted titmouse, white-breasted nuthatch, brown creeper, Carolina wren, wood thrush, vireos, black-and-white, yellow-rumped and hooded warblers, brown-headed cowbird, and the towhee.

Herptiles found within mesic mixed hardwoods include spotted salamander, slimy salamander, box turtle, and the five-lined skink. The variety of snakes is great and includes the worm snake, ringneck snake, garter snake, rat snake, and copperhead.

3.16.2.2 Oak-hickory forest

Oak-hickory forests are uplands occurring on slopes between rivers and tributaries and dominated by a canopy of oaks, hickories, and other hardwoods in combination with pines. Like the mesic mixed hardwood forest, this community provides ample shelter options. The variety of food choices is not as great however, which results in lower species richness. Mammals found here include the big brown bat, raccoon, gray fox, and long-tailed weasel. Perhaps the most common mammal here is the gray squirrel, which thrives on the abundance of acorns and hickory nuts.

Oak-hickory forests supply good nesting habitat for many types of birds, including the red-tailed hawk, screech owl, great horned owl, ruby-throated hummingbird, and the red-bellied and downy woodpeckers. The community is also an important breeding ground for neo-tropical migrants, including the wood thrush, the worm-eating warbler, and the eastern wood pewee. Other songbirds nesting or foraging here include the great crested flycatcher, blue jay, brown thrasher, red-eyed vireo, pine warbler, orchard and Baltimore orioles, brown-headed cowbird, summer tanager, purple finch, and American goldfinch. Birds found in this habitat require a partial to completely closed canopy and often spend much of their time on the ground searching for food in the ample leaf litter. Common herptiles of the oak-hickory community include the eastern box turtle, five-lined skink, broad-headed skink, anole, scarlet snake, brown snake, and redbelly snake.

3.16.2.3 Pine flatwoods

The pine flatwoods community type consists of uplands with an essentially flat or rolling terrain, sandy soil, along with a high water table and it is one of the dominant upland types within the project study area. These communities have a canopy of pines and a well-developed sub-canopy of sapling hardwood trees, scrub oaks, and shrub species. While food and shelter choices are greatly reduced in this community type, the inhabitants of the pine flatwoods may forage in adjacent, richer communities such as the mesic mixed hardwood forest, bottomland hardwoods,



or agricultural fields that transitions into this community. Others have adapted to take advantage of using pines for food and shelter. Mammals found within this community include the southern short-tailed shrew, white-footed mouse, fox squirrel, southern flying squirrel, and white-tailed deer.

Pine flatwoods also serve as a suitable environment for many bird species including red-tailed hawk, screech owl, great horned owl, bobwhite, turkey, red-bellied woodpecker, and the yellow-bellied sapsucker. Songbirds here include the great crested flycatcher, blue jay, common crow, brown-headed nuthatch, brown thrasher, ruby- and golden-crowned kinglets, pine warbler, common grackle, summer tanager, and Bachman's sparrow.

Herptiles found within pine flatwoods include the pine woods treefrog (when near savannahs or pools), eastern fence lizard, ground skink, eastern glass lizard, corn snake, brown snake, scarlet snake, redbelly snake, and earth snake.

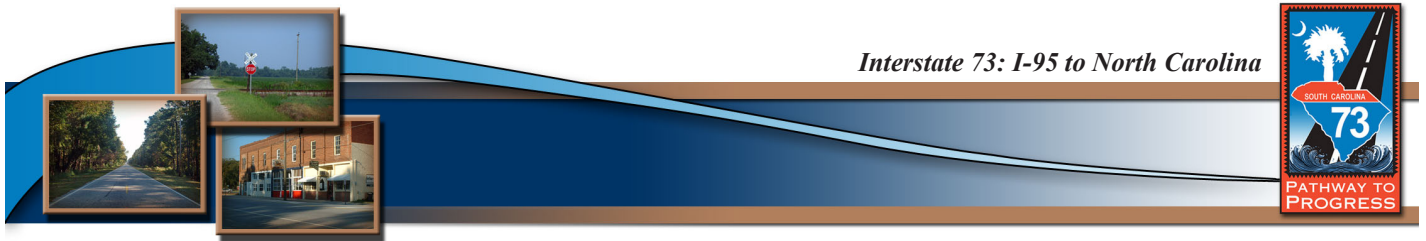
3.16.2.4 Xeric sandhill scrubs, Pine-scrub oak sandhill, and Upland pine-wiregrass woodland

Xeric sandhill scrubs, pine-scrub oak sandhill and upland pine-wiregrass woodlands can be flat or hilly areas in the fall-line sandhills or Coastal Plain and generally occur in the driest parts of deep, well-drained sands. These are pine-dominated communities with several scrub oak species dominating the understory layer and a sparse herb layer. Since the three community types are very similar ecologically, they are grouped here. Wildlife is typically sparse in these communities due to the extremely dry conditions present and lack of plant food and shelter choices.

Mammals found within sandhill communities are limited, with the fox squirrel being a notable exception. White-tailed deer pass through or seek temporary cover in these scrubby areas, or browse on the acorns of the many oak species found here. Few birds frequent these communities, but bobwhite quail and turkey do forage or pass through. Bachman's sparrow is one of the few songbirds that can tolerate these dry, sandy areas. Herptiles including the southern toad, six-lined racerunner (lizard), eastern fence lizard, corn snake, eastern hognose snake, and the earth snake find habitat in the sandhill communities.

3.16.2.5 Disturbed areas

As mentioned previously, the most predominant community type within the project study area are disturbed areas, primarily cropland. Active and abandoned fields, pastures, and orchards supply grains, grass, weed seeds, insects, and other food sources for many animals, particularly rodents and birds. The ubiquitous and contiguous hedgerows adjacent to these open areas offer generous cover and nesting options nearby as well. The southeastern shrew, least shrew, and



southern short-tailed shrew, eastern mole, eastern cottontail rabbit, hispid cotton rat, eastern harvest mouse, white-footed mouse, woodland vole are normally found in disturbed areas. Predators of these small animals are drawn here for obvious reasons. Predator species such as the coyote, gray fox, raccoon, and the long-tailed weasel also normally occur in disturbed areas. White-tailed deer also use these farmlands for food sources in both planted crops and naturally occurring vegetation.

Ground-dwelling birds such as killdeer, American woodcock, bobwhite, turkey, and mourning dove frequent these open areas. Raptors such as the red-tailed and red-shouldered hawks, along with the American kestrel, find these areas prime hunting ground for rodents and other small prey. The common flicker and songbirds such as eastern phoebe, eastern wood pewee, mockingbird, eastern bluebird, cedar waxwing, common yellowthroat, bobolink, orchard oriole, brown-headed cowbird and blue grosbeak also take advantage of these areas. Ground-foraging birds such as the common crow, American robin, eastern meadowlark, rusty blackbird, common grackle, American goldfinch, and the rufous-sided towhee flock to these open foraging grounds along with several sparrows including the savannah, chipping, field, white-throated and the song sparrows. The non-native European starling and house sparrow joins these ground-foragers in abundance. Reptiles such as the eastern glass lizard, black racer (snake), and eastern hognose snake are inhabitants as well.

Abandoned buildings provide a home for bats such as the eastern pipistrelle, big brown bat, evening bat, and Brazilian free-tailed bat. The house mouse and other rodents, birds such as the barn swallow, and several herptiles like the Carolina anole, southeastern five-lined skink, and the eastern fence lizard can also be found in abandoned buildings. Snakes such as the rat snake and eastern kingsnake frequent these buildings in search for their rodent prey, and the brown snake can be found lurking under piles of debris looking for slugs or worms.

In addition, roadsides serve as habitat. Evening bats, and birds like the barn swallow and eastern phoebe, find suitable roosting or nesting sites under bridges. Both turkey and black vultures find carrion along the shoulders of roads, and grass and weed seeds are eaten by songbirds such as eastern meadowlark, cardinal, chipping sparrow, and the field sparrow. Powerlines along highways supply almost unlimited roosting sites for a number of birds, especially the mourning dove, American kestrel, eastern kingbird and other flycatchers, and the eastern bluebird.

Rural residences, suburban backyards and urban parks may harbor mammals such as the opossum, eastern mole, big brown bat, gray squirrel, and the raccoon. Birds that thrive or co-exist with humans include the chimney swift, Ruby-throated hummingbird, mourning dove, red-bellied and downy woodpeckers, eastern kingbird, purple martin, Carolina wren, mockingbird, gray catbird, brown thrasher, American robin, cedar waxwing, cardinal, purple finch, and the chipping sparrow. Many songbirds are offered birdhouses, birdseed, nectar or other food, and even



water by humans who purposely attract them within view. Herptiles that have adapted well to human habitations include the Carolina anole and the southern toad. The commercial sections of towns serve as a haven for introduced birds such as the pigeon, European starling, and house sparrow. However, these buildings also offer flat, pebble-strewn rooftop nesting sites for a native bird, the common nighthawk.

Open areas such as airport runways, parking lots, golf courses, sod farms, and other large expanses of turf or asphalt provide nesting sites for the killdeer. The ring-billed gull and the house sparrow also forage among human food scraps.

3.16.3 What species are generally found in wetland habitats within the project study area?

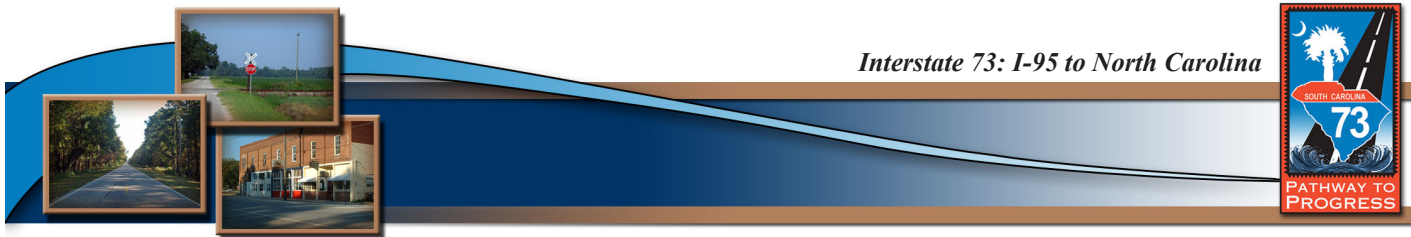
Many mammals, birds, herptiles, fish, and invertebrates utilize wetlands for foraging, breeding, nesting, and as wintering grounds. Similar to upland species, much of the wetland dependent wildlife is not limited to one specific wetland community and can forage, nest, and travel through multiple wetland types, as well as uplands (refer to Appendix E). Aquatic species are restricted to permanently inundated habitats. Representative species identified within each wetland community type in the following paragraphs are based on literature reviews.

3.16.3.1 *Aquatic beds*

Aquatic beds are freshwater wetlands with dense mats of vegetation that grow on or below the surface of water, in ditches, pools, ponds and slow-moving streams, rivers and canals. Several species of fish, otters, muskrats, and other animals use these beds temporarily, spending most of their lives in the deeper water or shores that contain these aquatic beds. These are described in more detail under “Ponds and borrow pits”, “Rivers and canals”, and “Wooded swamps” sections that follow.

Mammalian species are not common year-round inhabitants as inundation is usually permanent. However, some mammals may be found within these areas as they transition from one community to another. Wading birds and waterfowl use aquatic beds for foraging and many over-winter in nearby areas.

Generally, only semi-aquatic and aquatic species of reptiles are found within these areas. The mud snake, the banded water snake, and the redbelly water snake frequent aquatic beds for food. Turtles can be found sunning on debris on the aquatic bed, such as logs. Frogs often use floating aquatic plants such as water lilies to rest and sun themselves.



Numerous freshwater fish use aquatic beds as nurseries. Smaller fish such as minnows and darters are commonly found here, as well as bream and other larger species. Fish that frequent aquatic beds use them for cover and breeding sites as well as feed on the larvae of insects and other invertebrates found in the beds.

3.16.3.2 *Bottomland hardwoods*

Bottomland hardwood wetlands are freshwater wetlands frequently flooded by and associated with river systems, creeks, or other drainages. Bottomland hardwoods are a highly productive ecosystem containing a variety of wildlife habitats. This community is particularly important as a breeding ground for migratory birds.

Mammalian species commonly found associated with this wetland type include the opossum, eastern pipistrelle (bat), gray squirrel, cotton mouse, golden mouse, raccoon, bobcat, and the feral hog. Deer also pass through or use the bottomlands for foraging and cover. The presence of larger animal species such as black bear may be limited by the size of the forest, since they require a larger range.¹¹⁹

Various birds use this community for the multitude of food and nesting choices. Hardwood trees within these areas serve as excellent nesting sites for barred owls and for woodpeckers such as pileated and hairy. During seasonal periods of inundation, wood ducks, common egret, and white ibis can be found. The Mississippi kite, red-tailed and red-shouldered hawks, Acadian flycatcher, white-breasted nuthatch, blue-gray gnatcatcher, prothonotary warbler, northern parula, yellow-throated warbler, American redstart, rusty blackbird, and swamp sparrow can be found in this habitat throughout the season.

Bottomland hardwoods serve as crucial habitat for many salamanders such as eastern newt, southern dusky salamander, dwarf salamander, two- and three-lined salamanders, and the mud salamander. Frogs such as the barking treefrog, Brimley's chorus frog, and the river frog also find a home in these frequently flooded forests. Common reptiles include the rat snake, redbelly and other water snakes, and venomous snakes including the cottonmouth and canebrake rattlesnake.

3.16.3.3 *Deciduous shrub swamps*

Deciduous shrub swamps are the early successional stage, usually due to clear-cutting, of the wooded swamp community. These areas quickly become a tangle of stump sprouts, blackberries,

¹¹⁹The University of Florida, http://www.sfrc.ufl.edu/4h/Ecosystems/Bottomland_Hardwoods/oottomland_hardwoods.html (October 27, 2006).



briars, and weedy growth amid the debris left behind by the clearing. Although the above-ground shelter and food sources are gone, the ground and understory layers become prime habitat for many small animals and the predators that prey upon them. Mammals commonly finding ample cover in this habitat include the eastern cottontail and the cotton mouse among others.

Birds that favor moist thickets, such as the catbird, white-eyed vireo, common yellowthroat, towhees, and the white-throated sparrow, are often found foraging for food among the rotting logs and weedy undergrowth so indicative of these areas.

Reptiles found within these transitional, moist wetlands include lizards such as the southeastern five-lined skink and snakes such as the earth snake, garter snake, rat snake, copperhead, and the canebrake rattlesnake. Clear-cut shrub swamps offer ample cover opportunities for these reptiles as well as an abundance of small prey.

3.16.3.4 Bay forests and evergreen shrub bogs/pocosins

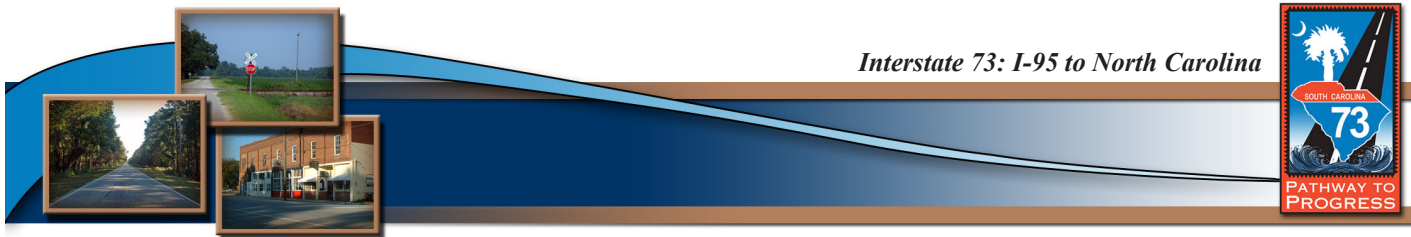
Pocosins are wetlands underlain by peat moss and dominated by several evergreen shrub species. Canopy trees are sparse or absent completely. When dry, these habitats are extremely vulnerable to fire. Some pocosins are very large and difficult to develop and therefore, they remain largely undisturbed. As a result, they are a haven for species adapted to living in unaltered forests.¹²⁰

Bay forests are wetlands that are seasonally or intermittently saturated and support the three “bay” tree species: sweetbay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), and red bay (*Persea borbonia*). These trees are frequently associated with pocosins, but not always. Wildlife within the two community types is very similar. Many mammals find cover in the extremely dense vegetation of these areas, ranging from the southern short-tailed shrew to the bobcat.

Bay forests provide excellent wintering grounds for numerous species of birds. Some Carolina bays contain bay forests; however, not all bay forests are Carolina bays. Bird species found here include the barred owl, blue-gray gnatcatcher, and Carolina wren. The common snipe also finds refuge in the thick tangle of shrubs that make up a pocosin.

When inundated, amphibians such as the Mabee’s salamander, the marbled salamander, pine woods treefrog, little grass frog, southern chorus frog, pickerel frog, and the carpenter frog may utilize these boggy areas for breeding, especially the more open areas. Since these areas usually

¹²⁰ USEPA Website, Wetlands Webpage, <http://www.epa.gov/owow/wetlands/types/bog.html#pocosins> (December 14, 2006).



have no standing water present, and a shallow water table that leaves the soil saturated for much of the year, breeding among amphibians occurs in the deeper waters of adjacent pools.¹²¹ Snakes such as the copperhead and worm snake can be found in these boggy areas as well.

3.16.3.5 Freshwater marsh

Freshwater marshes are open wetlands with a widely fluctuating water level dominated by emergent grasses and sedges. This type of wetland is common in power line rights-of-way where trees have been removed from previously forested wetlands. Wildlife habitat is limited by the water level, but many species have adapted to life in the marsh.

A wide variety of mammalian species can be found in marshes at least temporarily, using it for foraging or as a nest material source. These species include the least shrew, marsh rabbit, marsh rice rat, muskrat, raccoon, and mink.

Birds foraging in freshwater marsh include the green heron, yellow-crowned night heron, pied-billed grebe, common snipe, common yellowthroat, and the bobolink. Many nest in the marsh as well, including ducks and other waterfowl, the king rail, and red-winged blackbird.

Reptiles finding prey in the marsh include ribbon snake, and water snakes like the redbelly water snake. Amphibians find freshwater marsh prime breeding ground, especially with seasonal inundations. These opportunistic species include numerous frogs such as the northern cricket frog and green treefrog among others.

Sometimes sufficient water depth is present in permanent marshes or marshy, expansive roadside ditches to support fish. These include several minnows such as the eastern mudminnow, lined topminnow, and mosquito fish, as well as pirate perch, swampfish, several species of bream, and bowfin.

3.16.3.6 Ponds and borrow pits

Ponds and borrow pits are usually manmade, open, freshwater communities. These ponds are generally created by excavation activities, or altering stream or surface drainage flow. Beavers also create ponds by damming slow-moving streams. Other freshwater systems are often found associated with ponds and borrow pits in the form of fringe wetlands.

Beavers and muskrats are semi-aquatic mammals living within these ponds while others forage or nest near the margins of ponds (see “Freshwater marsh” and “Aquatic beds” for species found along pond margins).

¹²¹ *Ibid.*



Assorted birds use ponds for foraging, including the familiar wading birds such as the great blue heron, green heron, common egret, and the yellow-crowned night-heron. The anhinga can be found roosting on snags sticking out of the water to dry its wings after a dive for its fish prey. Waterfowl use ponds and lakes for resting, food, and courtship, while the shores are used for overwintering, nesting, and cover. These include Canada goose, pied-billed grebe, American coot, and several species of duck such as the mallard, black duck, wood duck, ring-necked duck, and the lesser scaup.

Aquatic amphibians such as sirens and the amphiuma can be found in ponds, as well as the larva stage of the eastern newt. An abundance of frog species include the cricket frogs, treefrogs, chorus frogs, green frog, carpenter frog, leopard frog, and the bullfrog that depend upon ponds for breeding and foraging, and rarely stray far from their banks. During seasonal warm rains, the narrowmouth toad also uses ponds for breeding. Turtles such as the eastern mud turtle, the eastern musk turtle, the yellowbelly slider, chicken turtle, and the spiny softshell turtle are common pond dwellers. Semi-aquatic snakes like the banded water snake are also found in or near ponds.

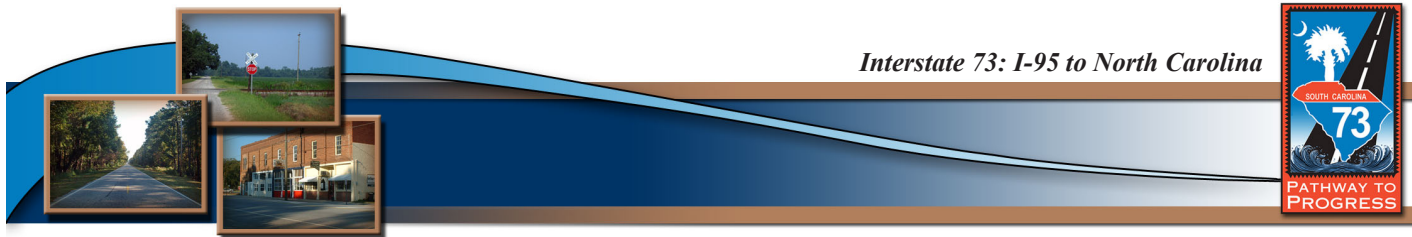
American eel, common carp, shiners, chubsuckers, bullheads and other catfishes, redbfin pickerel, mudminnow, swampfish, topminnow, mosquitofish, an assortment of bream species, and banded and Everglades pygmy sunfishes are just some of the various fish that can be found in ponds. In addition, largemouth bass, black crappie, and other game species have been stocked in many manmade ponds for sport fishing.

3.16.3.7 Rivers and canals

The project study area is located within the Pee Dee River Basin in South Carolina (called the Yadkin-Pee Dee River Basin in North Carolina), which contains numerous streams and tributaries that serve as habitat for various freshwater aquatic species. Mammals that live within these bodies of water or along the banks include the river otter, mink, and beaver.

Several wading and diving birds use rivers and canals to forage for fish, frogs, and other prey. These birds include the great blue heron, green heron, common egret, and belted kingfisher. The solitary sandpiper and common snipe find the soft mud on the banks of rivers and streams good for probing for prey. Bridges over these bodies of water often supply important nesting habitat for the eastern phoebe, the barn swallow, and other swallows.

Aquatic salamanders such as the dwarf mudpuppy and amphiuma, as well as terrestrial salamanders such as the eastern newt and marbled salamander are commonly found in this



habitat. Treefrogs (gray and green), southern cricket frog, green frog, pickerel frog, leopard frog, and bullfrog along with the eastern narrowmouth toad are among the many amphibians thriving in these drainages. Reptiles are abundant, especially turtles (mud, musk, softshell and cooter) and the non-venomous water snakes (banded and brown).

An array of larger freshwater fish are found in the slow-moving streams and tributaries of major rivers such as those within the project study area, including *gar*, *American eel*, bowfin, shad (American and gizzard), carp, bullhead catfish, madtom catfish, and the bluespotted and banded sunfish. Small species such as pygmy sunfish, shiners, suckers, chubsuckers, mosquitofish, darters, mudminnow, pirate perch, and swampfish are common within tributaries and streams of the Pee Dee River Basin.

Freshwater bivalve mollusks, especially mussels, are found in the substrate of Coastal Plain rivers. The Nature Conservancy recently completed a freshwater mussel survey of the Pee Dee River Basin in South Carolina. Several rivers and streams were sampled at 61 locations within the river basin from June 2004 to August 2005,¹²² and at least 23 mussel species were found during the survey.¹²³ Species recorded in the Little Pee Dee River were the Carolina lance, Carolina slabshell, Waccamaw spike, Eastern elliptio, tidewater mucket, and the Florida pondhorn. The non-native Asian clam was also recorded, and was found to be the most common bivalve in the Pee Dee River Basin.

The State of North Carolina is home to more than 60 freshwater mussel species, with fifty percent of these listed as either threatened, endangered, or of special concern.¹²⁴ Within the Yadkin-Pee Dee River basin, freshwater mussels such as Carolina creekshell and the Carolina fatmucket can be found.

3.16.3.8 Pine savannahs and wet flatwoods & savannahs and wet meadows

Pine savannahs and wet flatwoods are wetlands with a thin canopy of pines that has sparse to no understory and a rich herbaceous flora. The ground is usually saturated for at least a part of the year. Savannahs and wet meadows are also wetlands that commonly occur in poorly drained areas such as shallow lake basins, low-lying farmland, and the land between shallow marshes and upland areas.¹²⁵ Mammals like the southern short-tailed shrew and the meadow jumping mouse are generally found within wet meadows and deer graze in tall grasses found in these

¹²² The Nature Conservancy, http://www.nature.org/wherewework/northamerica/states/southcarolina/files/mussels_of_the_pee_dee_in_sc_final.pdf (November 27, 2006).

¹²³ *Ibid.*

¹²⁴ North Carolina Nongame and Endangered Wildlife Program, *North Carolina Atlas of Freshwater Mussels and Endangered Fish*, http://www.ncwildlife.org/pg07_wildlifespeciescon/pg7b1a.htm (December 15, 2006).

¹²⁵ USEPA, Wetlands webpage, <http://www.epa.gov/owow/wetlands/types/wmeadows.html> (December 14, 2006).



habitat types. The tall grasses also offer cover for many bird species such as the common snipe, Henslow's sparrow, common grackle, and common yellowthroat.

These wetlands are the domain of many amphibians, with many species living in temporary or semi-permanent pools as larvae, and part of the year when adults, especially during the mating season. Salamanders (Mabee's, many-lined, and dwarf), frogs (pine woods treefrog, barking treefrog, little grass frog, southern chorus frog, ornate chorus frog, pickerel frog and carpenter frog), and the oak toad use the boggy ground and pools to live, initiate courtship, breed, and deposit their eggs. Reptiles are occasionally found in these habitat types, including the spotted turtle, box turtle, and the garter snake.

3.16.3.9 *Wooded swamps*

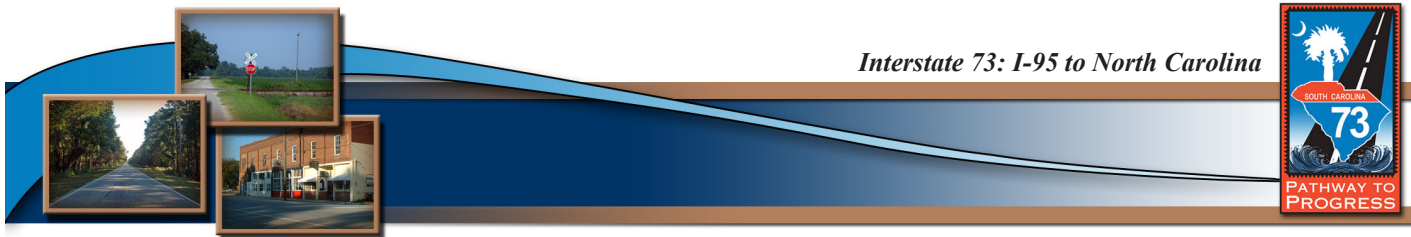
Wooded swamps are freshwater wetlands associated with black or brownwater rivers in both North and South Carolina, are frequently deeply flooded, and seldom dry out. The variety of shelter and food choices for wildlife is somewhat limited to canopy- or mud-dwellers, but the remoteness of these communities results in a wide variety of species. Common mammalian species within these areas include the opossum, marsh rabbit, fox squirrel, cotton and golden mouse, raccoon, mink, and bobcat.

Numerous types of birds live within this environment, including the great blue heron, common egret, yellow-crowned night heron, white ibis, wood duck, barred owl, pileated woodpecker, white-eyed vireo, prothonotary warbler, yellow-throated warbler, and northern parula.

Amphibians are plentiful due to the abundant water and mud for breeding and include inhabitants such as aquatic salamanders (sirens, amphiuma, and the juvenile newt) and several terrestrial ones (southern dusky, marbled, two-lined, dwarf, mud, many-lined, and Mabee's salamanders). Treefrogs (green, barking and chorus), river frog, leopard frog, and the eastern narrowmouth toad are also common in wooded swamps. Many reptiles, including several different turtle species (snapping turtle, yellow-bellied slider and Florida cooter) and snakes (the rat snake, non-venomous water snakes, and the cottonmouth) can be found in swamps.

A large number of fish species can be found within permanent pools in wooded swamps as temporary to permanent inhabitants. Common species found in this habitat range from the larger species such as gar, American eel, bowfin, pickerel and bullhead catfish, to the smaller mudminnow, pirate perch, swampfish, mosquitofish, shiners, darters, and minnows.¹²⁶

¹²⁶ Rudolf G. Amdt, David G. Lindquist, James F. Parnell, and Fred C. Rohde, *Freshwater Fishes of the Carolinas, Virginia, Maryland and Delaware* (Chapel Hill, N.C.: The University of North Carolina Press, 1994) pp. 67 and 146.



3.16.4 How would wildlife and their habitat be impacted by this project?

Wildlife along the Build Alternatives could be directly impacted by the proposed action as a result of the following:

- loss of habitat due to construction of the proposed new roadway and clearing of right-of-way;
- degradation of habitat caused by traffic noise, air quality impacts, water quality impacts, and, changes in wetland and stream hydrology; and,
- fragmentation of habitat by creating wildlife movement barriers that can limit access to critical foraging or nesting habitat and, in turn, create population isolation that may result in interruptions in breeding and affect gene flow in the population.

During construction, potential impacts include disruption of wildlife activities due to noise, and hazards to small animals during clearing and grading. Upon completion, habitat will have been converted to roadway. The degradation of habitat adjacent to the roadway could affect nesting and feeding habitats of birds, mammals, amphibians, and reptiles. Studies have demonstrated that there is typically a decline in bird populations along high traffic roadways that is generally attributed to highway noise.¹²⁷ A reduction in bird densities along highways with 10,000 vehicles per day has been measured in an approximately 0.93-mile wide zone along either side of the roadway. Bird densities are reduced within an approximately 1.8-mile wide zone along either side of the roadway where highways carry 60,000 vehicles per day. Studies have shown that there is can be a 20 to 98 percent reduction in bird densities in an 820-foot wide zone along each side of busy roadways.¹²⁸

Fish and aquatic invertebrates would be most sensitive to degradation of water quality conditions potentially caused by the addition of impervious surfaces. Mammals, amphibians, and reptiles would most likely be impacted by wildlife/vehicle collisions because their movement patterns for food and/or habitat makes them more susceptible. In order to provide a method for comparison of potential direct wildlife habitat loss, Table 3.55 (refer to page 3-241) provides the total acres as a metric for estimating potential loss of natural habitat that could occur along each of the Build Alternatives.

¹²⁷ G.L. Evink, *Interaction Between Roadways and Wildlife Ecology: A Synthesis of Highway Practice*, National Cooperative Highway Research Program (NCHRP) Synthesis 363 (Washington, D.C.: Transportation Research Board, 2002).

¹²⁸ AASHTO Center for Environmental Excellence website, http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/3_13.aspx (May 30, 2007).



**Table 3.55
Potential Direct Wildlife Habitat Impacts in Acres**

HABITAT TYPE	Build Alternatives		
	1	2 (Preferred)	3
Total Wetland Area	167.7	114.3	116.0
Total Natural Upland Area	746.6	755.0	552.4
TOTAL HABITAT IMPACT	914.3	869.3	668.4

Source: THE LPA GROUP INCORPORATED, 2007

Habitat fragmentation occurs as the result of subdividing larger parcels of wildlife habitat into smaller parcels. Habitat fragmentation can impact wildlife species by limiting access to the total area available for resources. Roadways can fragment habitats and have varying degrees of impact on different species. Larger species such as deer, bears, and coyotes may be able to cross the barrier created by a roadway with little or no impact. However, for smaller species that can not cross wide stretches of hot pavement, such as amphibians, the greater the potential impact due to fragmentation. For these species, the roadway may be a complete barrier, in effect confining them to the remaining habitat within the smaller parcel. The remaining habitat may not supply enough resources to support the population. Or, as in the case of many amphibians, the adults live in upland drier habitats but must return to wetland habitats to breed. If the barrier prevents access to the breeding habitat, the adults will be unable to reproduce.

In order to provide a method for comparison of potential direct wildlife habitat loss, Table 3.55 provides the total acres as a metric for estimating potential loss of natural habitat that could occur along each of the Build Alternatives.

As indicated in Table 3.55, Alternative 3 would impact the least amount of potential wildlife habitat. Alternative 2 would have the next lowest impact and Alternative 1 with the highest potential impact to wildlife habitat. Based on a review of aerial photography and GIS analysis, it appears that there is more upland habitat being actively farmed along Alternative 3 than Alternatives 2 and 1, which would account for low habitat impact ranking. This ranking is based on the total amount of potential habitat available along the Build Alternatives, but does not take into consideration low quality habitats such as isolated woodlots surrounded by agricultural fields or housing developments. However, these low quality areas do provide refuge and nesting habitat for some species of birds, mammals, reptiles, and amphibians.

The extent of potential impacts to wildlife depends on how the habitat is impacted by the roadway (bisected versus constructed along the edge), and the size of the habitat unit or habitat corridor that



is being impacted.¹²⁹ For example, a roadway that is constructed through the middle of a large habitat unit may result in more habitat degradation than a roadway that is constructed adjacent to the unit because the zone of habitat degradation would occur on both sides of the roadway instead of only along one side of the roadway. A roadway that has a perpendicular crossing of habitat corridors, such as riparian habitat adjacent to streams, would result in less habitat loss and degradation than one that is adjacent and parallel to the habitat corridor. Table 3.56 provides a comparison of the relative effects of highway placement on large and small habitat units and wide and narrow habitat corridors (refer to Figure 3-40, page 3-244).

Table 3.56
Relative Roadway Effects on Habitat

Impact Type	Large Unit		Small Unit		Wide Corridor		Narrow Corridor	
	Bisect	Edge	Bisect	Edge	Perpendicular	Edge	Perpendicular	Edge
Loss	Low	None	High	None	Low	None	Low	None
Degradation	High	Medium	High	High	Low	High	Low	High
Fragmentation	High	None	High	None	High	None	High	None

R.T. Forman , “Good and Bad Places for Roads: Effects of Varying Road and Natural Pattern on Habitat Loss, Degradation, and Fragmentation,” *Proceedings of the 2005 International Conference on Ecology and Transportation*

As described in Section 3.17, (refer to page 3-201) of this document, all of the Build Alternatives would cross riparian habitats associated with streams that serve as wildlife movement corridors as well as nesting habitat for several neo-tropical migratory bird species. None of the Build Alternatives would be constructed immediately adjacent and parallel to the riparian corridors within the project study area and efforts were made to provide perpendicular crossings to the extent practicable to minimize impacts. Alternative 1 would impact the least number of these corridors with seven riparian wetland system crossings. However, it would have the highest habitat impacts with approximately 70 acres of direct riparian habitat loss. It would also have roughly 350 acres of adjacent habitat degradation where bird densities could be affected by highway noise. Alternative 2 would cross 12 systems and would result in approximately 53 acres of habitat loss and approximately 275 acres of adjacent habitat where bird densities could be affected by highway noise. Alternative 3 would also cross 12 riparian corridors and result in the loss of approximately 53 acres of habitat loss but would have the lowest impacts to adjacent habitat with approximately 234 acres of impact. GIS analysis

¹²⁹ R.T. Forman , “Good and Bad Places for Roads: Effects of Varying Road and Natural Pattern on Habitat Loss, Degradation, and Fragmentation,” *Proceedings of the 2005 International Conference on Ecology and Transportation*, eds. C.L. Irwin, P. Garret, and K.P. McDermott. (Raleigh, NC: Center for Transportation and the Environment, North Carolina State University, 2006), pp. 164-174.



indicates that there is over 40,000 acres of riparian corridor habitat within the project study area, therefore, these habitat corridor crossings would result in relatively low habitat loss and degradation impacts overall, but would have higher fragmentation impacts.

3.16.5 What impacts would occur to wildlife from construction?

Staging and stockpiling operations during construction could result in possible disruption to the resident wildlife population. Both the clearing of habitats, as well as the noise and vibration from construction operations could displace mobile wildlife species. Construction activities would stimulate competition between displaced species and the resident wildlife population adjacent to the construction site. Biotic impacts would be temporary, since staging and stockpiling areas would be returned to their natural state.

3.16.6 What can be done to minimize impacts to wildlife?

Potential impacts to wildlife could be minimized by timing of construction activities to avoid fish breeding periods, bridging suitable aquatic spawning and feeding areas where feasible, and limiting clearing outside the fill limits. Past studies show that habitat fragmentation and disruption of migration corridors have been reduced by providing safe wildlife crossings either over or under roadways. It has been demonstrated that a variety of wildlife will utilize culverts of various sizes for crossing roadways. Increasing culvert sizes beyond that required for stormwater flow could provide necessary access for many small to medium-sized species. Additional pipes or box culverts could be installed where high quality upland forested areas are bisected to provide safe passage of wildlife. Pipes placed in floodplains for stream and wetland mitigation purposes may also serve as wildlife passages. Fences along the right-of-way would prevent medium-sized animals from venturing onto the roadway surface and help direct them to culverts for safe passage under the roadway.

As previously mentioned, bridging associated with larger streams that have riparian corridors would also minimize habitat fragmentation impacts. The installation of animal crossing signs where the roadway crosses large areas of forested habitat or at documented wildlife movement corridors may reduce wildlife/vehicle collisions with large mammals by alerting motorist to the possibilities.

3.16.7 What indirect and cumulative impacts would occur to wildlife?

Indirect impacts to wildlife could result due to the loss of habitat and habitat degradation associated with development that would occur as the result of the construction of the Build Alternatives and the No-build Alternative. Based on a review of aerial photographs, the projected location of these developments does not appear to contribute to habitat fragmentation. Based on the results of the land use models, some of the projected development for the Build Alternatives would occur in