3.13 INVASIVE PLANT SPECIES

3.13.1 What are invasive plant species?

Invasive plant species are non-indigenous plants that invade and can cause environmental, ecological, and economic harm to ecosystems beyond their historic native range. Their invasion can threaten native ecosystems or commercial, agricultural, or recreational activities dependent on these ecosystems. Human actions, both unintentional and intentional, are the primary means of invasive species introductions and spread to new locations.[77] See Section 3.14 (refer to page 3-175), for a discussion of invasive wildlife species.

Invasive Plant Species

Invasive 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.*

***M. Venner, *Control of Invasive Species: A Synthesis of Highway Practice* (2006).**

While most invasive species were accidentally introduced into natural areas by people, some others were introduced intentionally for economic reasons and then spread widely. 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, however, do not become invasive.[78]

3.13.2 What is FHWA policy on invasive plant 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, re-vegetation, 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.[79]

[77] USFWS, The Environmental Quality Program Webpage, http://www.fws.gov/contaminants/Issues/InvasiveSpecies.cfm (September 24, 2007).

[78] 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).

[79] Federal Highway Administration, Guidance on Invasive Species Webpage, http://www.fhwa.dot.gov/environment/inv_guid.htm (September 11, 2007).

3.13.3 What are FHWA recommendations regarding invasive plant 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 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.[80]

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

English Ivy
Photo by Swearingen

A history of disturbance from agriculture and silviculture has provided opportunities for many invasive species to become established in the project study area. Observations of invasive species were recorded during the field investigations and are included in the discussions below. 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.[81] Other species included in these categories are thorny elaeagnus (*Elaeagnus pungens*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), kudzu (*Pueraria lobata*), and sericea (*Lespedeza cuneata*).

Some invasive species were originally introduced as ornamentals for landscaping, have since escaped, and established themselves in natural areas. Species in this category 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*).

Other invasive species were either accidentally introduced or the method of introduction is not known. These species found in the study corridor are Brazilian vervain (*Verbena brasiliensis*), devil's-shoestring (*Sida rhombifolia*), field garlic (*Allium vineale*), mugwort (*Artemisia vulgaris*), nut-sedge (*Cyperus rotundus* and *C. esculentus*), plantains (*Plantago lanceolata,* etc.), water-thyme (*Hydrilla verticillata*), alligator-weed (*Alternanthera philoxerioides*), Brazilian elodea (*Egeria densa*), water-hyacinth (*Eichhornia crassipes*), and common reed (*Phragmites communis*).

[80] *Ibid.*
[81] 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).

3.13.5 How do invasive plant species negatively impact the land?

Invasive plant species impact the natural community by out-competing native species, thereby diminishing habitat diversity, reducing available wildlife habitat, and causing economic harm to agricultural and recreational areas.

While all species compete to survive, invasive species appear to have specific traits or combinations of specific traits that allow them to out-compete and eliminate native species. Sometimes they just have the ability to grow and reproduce more rapidly than native species, and other times, there are no natural consumers or competitors in the invaded habitat. With the introduction of a species that can multiply and spread faster on open ground than the native species, the balance of the ecosystem is changed. Resources that would have been used by the native species are now being utilized by an invader, thus impacting the ecosystem and changing its composition of organisms and their use of available resources.[82]

Invasive species alter available wildlife and fish habitat primarily by becoming dominant monocultures as explained above. They reduce nesting and cover choices by growing over and often killing native trees and shrubs entirely, many of which were superior for fruit and other food production. Since invasive plants are often unpalatable, toxic, or have thorns or other physical barriers, they can be poor wildlife food sources, thereby reducing the amount of desirable foraging areas available for wildlife.

Economic costs due to invasive species can be separated into direct costs due to production loss in agriculture and forestry, and indirect costs due to efforts to manage them. Most invasive species were accidental introductions with crop seeds and imported plant material, and these agricultural weeds cause an overall reduction in crop yield. Those that invade pastures compete with native forage plants, and are often non-palatable. The unintentional introduction of forest pest species and plant pathogens via infected living plants or their parts can change forest ecology and negatively impact the timber industry.[83] Invasive species can also have impacts on recreational activities such as fishing, hunting, hiking, wildlife viewing, and water-based recreation. They negatively affect a wide array of environmental attributes that are important to support recreation, including but not limited to water quality, plant and animal diversity, and species abundance. Water bodies of all sizes are invaded by exotic aquatic plants making fishing and boating difficult.[84] Invasive species can also degrade residential, commercial, and other human environments. In this case, invasive species hinder access, lessen productivity, and diminish the beauty of residential ornamental plantings, roadside and commercial landscapes, parks, golf courses, and waterfronts.

[82] M.A. Davis, J.P. Grime, and K. Thompson. 2000. "Fluctuating resources in plant communities: A general theory of invisibility." *Journal of Ecology.* 88(3): 28-534.
[83] D. Pimentel, R. Zuniga, and D. Morison. 2005. "Update on the environmental and economic costs associated with alien-invasive species in the United States." *Ecological Economics*. 52: 273-288.
[84] Esiwerth, M.E. 2005. "Input-output modeling, outdoor recreation, and the economic impacts of weeds." *Weed Science*. 53: 130-137.

3.13.6 How may actions from the 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. Invasive plant species can be moved by vehicles and in the loads they carry, or can be moved from site to site during mowing operations. Weed seeds can be inadvertently introduced into the corridor during construction from equipment and through the use of mulch, imported soil or gravel, and sod. One common source for the introduction of seeds or plants that root easily is from the construction equipment itself. Construction equipment that has not been properly washed-off to remove seeds and plant material before leaving a previous construction site is an invasive plant vector. Additionally, the spread of invasive plants that already occur at the road construction site is possible when topsoil is stripped at sites where invasive species, such as Chinese privet, were used as ornamental plants. The top soil is generally stockpiled, since it is not suitable for construction purposes, and used as top-dressing for shoulders and medians. Dormant seeds, roots, and tubers in the topsoil could then be spread along the new roadway. The ground disturbance that occurs during road construction enables long-dormant weed seeds to germinate, while 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.[85] Some invasive plant species may also be deliberately planted in erosion control, landscape, or wildflower projects.[86]

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 plant species include the inspection and cleaning of construction equipment, reducing opportunities for invasive species by reducing disturbance of soils in either time or space,[87] 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.[88] 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 project corridor.

[85] Miller, James H., *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).
[86] Federal Highway Administration Guidance on Invasive Species Webpage, http://www.fhwa.dot.gov/environment/inv_guid.htm (September 11, 2007).
[87] R.T.T. Forman et al., *Road Ecology: Science and Solutions*, (Washington D.C., Island Press: 2003).
[88] Federal Highway Administration Guidance on Invasive Species Webpage, http://www.fhwa.dot.gov/environment/inv_guid.htm (September 11, 2007).

3.14 WILDLIFE

3.14.1 What types of wildlife habitat are found in the study corridor?

Wildlife habitat is a place where a plant or animal species naturally occurs and normally lives and grows. The Coastal Plain of South Carolina includes a variety of terrestrial and aquatic habitats that provide food, shelter, breeding, and wintering grounds for a wide variety of wildlife. Table 3.48 lists the types of upland and wetland habitats found in the Preferred Alternative study corridor.

Table 3.48
Undisturbed Upland and Wetland Habitats in Project Study Corridor
I-73 FEIS: I-95 to the Myrtle Beach Region

Upland Habitats*	Wetland Habitats**	
Mesic mixed hardwood forest	Aquatic beds	Pine 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	
Xeric Sandhill Scrub	Freshwater Marsh	Wooded Swamp

*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)

Although several types of natural wildlife habitat were identified during the field surveys, the majority of the study corridor is comprised of disturbed areas. These areas are highly impacted by the activities of man, primarily as agricultural fields and managed pines. The land within the study corridor 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 I contains a comprehensive list of wildlife species that may occur within the project study area. Species that are highlighted in bold type in the list were observed during the wetland and protected species surveys within the Preferred Alternative study corridor. The descriptions below are of the most typical species found in each community. These representative species are based on literature reviews and not based on actual field observations. Common names are used in the sections that follow. For the corresponding scientific name, please refer to Appendix I.

3.14.2 What species are typically found in upland habitats within the project study corridor?

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

3.14.2.1 Mesic mixed hardwood forest

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.

3.14.2.2 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.

3.14.2.3 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 transition 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.

3.14.2.4 Xeric sandhill scrub and Pine-scrub oak sandhill

Xeric sandhill scrubs, and pine-scrub oak sandhill 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 two community types are very similar ecologically, they are grouped together. 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 earth snake find habitat in the sandhill communities.

3.14.2.5 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, southern short-tailed shrew, eastern mole, eastern cottontail rabbit, hispid cotton rat, eastern harvest mouse, white-footed mouse, and 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 join 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. Introduced rodents (rats, *Rattus rattus* and *R. norvegicus*) have become serious pests on farms by destroying stored grains. 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. Introduced birds (e.g. pigeons) and rodents can serve as vectors and reservoirs of human diseases.

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.

3.14.3 What species are typically 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 I). 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.

3.14.3.1 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 utilize these beds temporarily, spending most of their lives in the deeper water or shores that these beds are found within. These are described in more detail under "Ponds and borrow pits", "Rivers and canals" and "Wooded swamps" that follow.

Mammalian species are not commonly year-round residents as water is usually permanent. However, some mammals, as with other wetland communities, may be found within these areas as they transition from one community to another. Birds such as 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. If logs and other debris are part of the aquatic bed, turtles can be found sunning. Frogs often utilize floating aquatic plants such as water lilies for resting and sunning places.

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 feed

on the larvae of insects and other invertebrates that live there, or more importantly, use them for cover and breeding sites.

3.14.3.2 Bay forest

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 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.[89] Snakes such as the copperhead and worm snake can be found in these boggy areas as well.

3.14.3.3 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.[90]

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

[89] USEPA Website, Wetlands Webpage, http://www.epa.gov/owow/wetlands/types/bog.html#pocosins (September 11, 2007).
[90] The University of Florida, Florida 4-H Forest Ecology Website, Bottomland Hardwoods Webpage, http://www.sfrc.ufl.edu/4h/Ecosystems/Bottomland_Hardwoods/bottomland_hardwoods.html (September 24, 2007).

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.

3.14.3.4 Deciduous shrub swamp

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, briars, and weedy growth amid the debris left behind by the clearing. Although the aboveground 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 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.

3.14.3.5 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.

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.

3.14.3.6 Pine wet flatwoods

Pine 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.[91] 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 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.

3.14.3.7 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).

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

[91] USEPA, Wetlands webpage, http://www.epa.gov/owow/wetlands/types/wmeadows.html (September 11, 2007).

cover. These waterfowl 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, redfin 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.

3.14.3.8 Rivers and canals

The study corridor is located within the Pee Dee River Basin in South 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,[92] and at least 23 mussel species were found during the survey.[93] 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.

3.14.3.9 Wooded swamp

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.[94]

[92] The Nature Conservancy. http://www.nature.org/wherewework/northamerica/states/southcarolina/files/mussels_of_the_pee_dee_in_sc_final.pdf (September 11, 2007).
[93] *Ibid*.
[94] Rudolf G. Amdt, David G. Lindquist, James F. Parnell, and Fred C. Rhode, *Freshwater Fishes of the Carolinas, Virginia, Maryland and Delaware,* (Chapel Hill, N.C.: The University of North Carolina Press, 1994) pp. 67 and 146.

3.14.4 How would wildlife and their habitat be impacted by the proposed project?

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

- loss of habitat and habitat displacement due to construction of the proposed new roadway and clearing of right-of-way;
- degradation of habitat caused by vehicle noise and activity, 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.[95]

During construction, potential impacts include disruption of wildlife activities due to noise, and hazards to small animals during clearing and grading. 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.

Upon completion of the Preferred Alternative, habitat will have been converted to roadway and wildlife/vehicle collisions are likely to occur. Mammals, amphibians, and reptiles would most likely be impacted by wildlife/vehicle collisions because their movement patterns for food and/or habitat make them more susceptible. 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.[96] 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 can be a 20 to 98 percent reduction in bird densities in an 820-foot wide zone along each side of busy roadways.[97]

Fish and aquatic invertebrates would be most sensitive to degradation of water quality conditions potentially caused by the addition of impervious surfaces. They would also be the most impacted by the fragmentation of their habitat resulting from the construction of causeways through wetlands.

[95] R. T. Forman, et. al., *Road Ecology: Science and Solutions,* Island Press, Washington DC, 2003.
[96] 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).
[97] AASHTO, Center for Environmental Excellence Website, http://environment.transportation.org/environmental_issues/invasive_species/ (September 24,2007).

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 and has 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. Birds may also be impacted if the width of the corridor exceeds the distance that they will fly between forested areas. However, for smaller species that cannot 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 on one side of the road. 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. Ultimately, barriers to movement may reduce gene flow between individual populations and cause genetic effects, further impacting species.[98]

Table 3.49
Potential Wildlife Habitat Impacts in Acres
Interstate73 FEIS: I-95 to the Myrtle Beach Region

	Preferred Alternative
Total Wetland Area	313.0
Total Natural Uplands	576.5
Total Habitat Impact	**889.5**

Source: THE LPA GROUP INCORPORATED, 2007.

Table 3.49 provides the total acres as a metric for estimating potential loss of natural habitat that could occur along the Preferred Alternative.

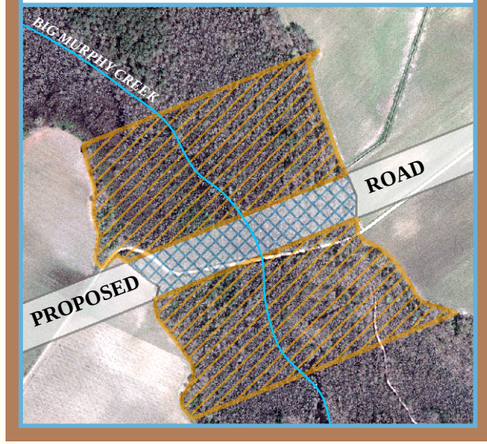
The extent of potential impacts to wildlife depends on how the habitat is impacted by the roadway (bisected versus constructed along the edge), and the size of the habitat unit or habitat corridor that is being impacted.[99] For example, a roadway that is constructed through the middle of a large habitat 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. Figure 3-30 (refer to page 3-184) provides a comparison of the relative effects of highway placement on large and small habitat units and wide and narrow habitat corridors (refer to Table 3.50, page 3-185).

As described in the Wetlands Section (refer to Section 3.12, page 3-144) riparian systems are the highest quality habitat type identified within the study corridor. The Preferred Alternative would cross riparian habitats associated with 15 streams that could serve as wildlife movement corridors as well as nesting habitat for several neo-tropical migratory bird species. The two largest riparian systems crossed are associated with the Little Pee Dee River and Lake Swamp, and efforts were made to reduce impacts to

[98] R. T. Forman, et. al., *Road Ecology: Science and Solutions,* (Washington, D.C.: Island Press, 2003).
[99] 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.

Wide Habitat Corridor

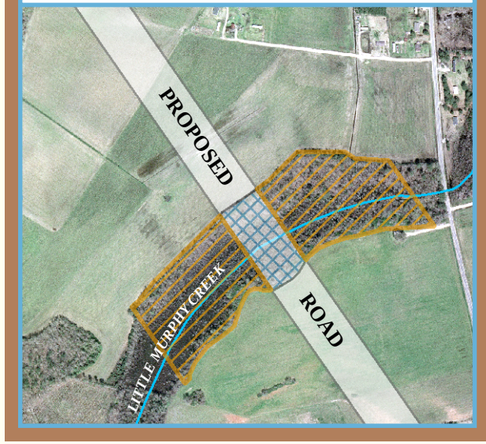
Crossing Impact



Edge Impact

Narrow Habitat Corridor

Crossing Impact



Edge Impact

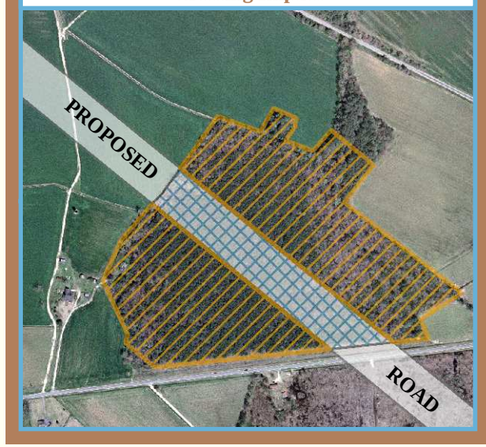
Large Habitat Area

Crossing Impact

Edge Impact

Small Habitat Area

Crossing Impact



Edge Impact

Legend

- Potential Degradation Zone
- Habitat Loss
- Proposed Road

0 1000 2000 Feet

FIGURE 3-30

POTENTIAL ROADWAY IMPACTS TO WILDLIFE HABITAT

Table 3.50
Relative Roadway Effects on Habitat
Interstate 73 FEIS: I-95 to the Myrtle Beach Region

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

Source: 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*

these systems (refer Section 3.14.5 below). Efforts were made to provide perpendicular crossings of riparian corridors to the extent practicable to minimize impacts. Other habitat units that would be impacted are predominantly large timberland tracts and small woodlots that were previously fragmented by agricultural practices and residential development.

3.14.5 What has been done to minimize impacts to wildlife?

As previously mentioned in the wetlands section, the highest quality wildlife habitats identified within the study corridor are the forested upland and wetland riparian habitats associated with streams. Two proposed large riparian system crossings within the corridor are the Little Pee Dee River and Lake Swamp crossings. Alignment modifications were made to both crossings that reduced potential wildlife impacts.

The original alignment of the Preferred Alternative crossing the Little Pee Dee River and its associated wetlands would have been on new location, which would have created additional impacts to important wildlife habitat. Riparian systems and their adjacent forested uplands are important corridors for wildlife movement and extensive bottomland hardwood/wooded swamp systems, such as those along the Little Pee Dee River, provide nesting habitat for migratory bird species. For the original crossing, direct habitat loss and degradation of habitat important to migratory bird species that would occur would have been greater than the re-aligned route adjacent to S.C. Route 917.

The shift in the alignment reduced the overall direct loss of upland and wetland riparian habitat between Road S-34-31 (Old Stage Road), north of the river, to Road S-26-423 (Pee Dee Road), south of the river, by approximately 11 acres simply by providing a more perpendicular crossing. Additionally, habitat immediately adjacent to the S.C. Route 917 crossing was previously impacted by residences and access roads whereas the original alignment would have impacted undisturbed high quality habitat on new alignment.

By applying the 820-foot wide zone of bird habitat degradation along both edges of the Preferred Alternative, it is estimated that the original alignment would have impacted approximately 760 acres of bird habitat at this crossing while the new alignment would impact approximately 738 acres. When coupled with the direct habitat impact, the new alignment would impact a total of approximately 33 less acres of bird habitat.

The new alignment would include sections of causeway through upland and wetland habitats in close association with the existing S.C. Route 917 causeways. The bridges for the Preferred Alternative would be longer than, and situated adjacent to, the existing bridges. However, the existing S.C. Route 917 bridges are scheduled for replacement and will be constructed to match the length of the Preferred Alternative bridges, thereby improving the situation regarding fragmentation created by S.C. Route 917.

Similar to the Little Pee Dee River crossing, the original crossing at Lake Swamp was through the swamp on new alignment. The alignment was modified to cross Lake Swamp immediately adjacent to the Road S-26-23 (Nichols Highway) crossing, which is a more perpendicular crossing. This resulted in a four-acre decrease in direct habitat impact at Lake Swamp.

After applying the 820-foot wide zone of bird habitat degradation along both edges of the proposed Lake Swamp Crossing, it is estimated that the original alignment would have impacted approximately 150 acres of bird habitat at this crossing while the new alignment would impact approximately 131 acres, which would result in 23 acres less of impacted habitat.

3.14.6 What else could 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.[100,101] 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. 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 could help direct them to culverts for safe passage under the roadway.

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 the potential for wildlife/vehicle collisions with large mammals by alerting motorists to the possibilities of wildlife being present.

3.14.7 What indirect and cumulative impacts would occur to wildlife?

Indirect impacts to wildlife could occur due to the loss and degradation of habitat associated with development that would occur as the result of the construction of the Preferred Alternative. Based on the predictions of the land use modeling, indirect impacts to wildlife habitat associated with projected growth upon construction

[100] R. T. Forman, et. al., *Road Ecology: Science and Solutions,* (Washington, D.C.: Island Press, 2003).
[101] Brodziewska, Iadwiga, "Wildlife Tunnels and Fuana Bridges in Poland: Past, Present, and Future, 1997-2003," *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.

of the proposed project would total approximately 1,346 acres. This would include 272 acres of wetland impact and 1,074 acres of forested upland habitat impact.

Based on the results of the land use models, most of the projected development would occur in the fragmented forested upland areas with some impacts to fragmented wetland habitats (refer to Sections 3.11 and 3.12, pages 3-138 and 3-144, respectively). Many amphibian species rely on seasonally wet depressions, located in uplands, for breeding and development. Often times these wetland depressions are considered "isolated" and would not be protected by state and federal regulations, and therefore, could be more vulnerable to habitat loss. Due to the protection of wetlands through the Section 404 permit process, impacts to riparian wetlands are anticipated to occur primarily along the edges of these systems, while uplands habitats would have the highest potential for development. These impacts could restrict the movement of terrestrial wildlife species along the forested corridors and may result in the loss of nesting and foraging habitat for migratory birds.

Cumulative impacts to wildlife species are also anticipated. Cumulative wildlife habitat loss from construction of the Preferred Alternative coupled with projected development from the No-build Alternative would be approximately 2,597 acres, including 1,651 acres of forested upland habitat and 946 acres of wetland habitat.

The Horry County population of black bears appears to have the highest density south of Conway as indicated by automobile/bear collision data obtained from SCDNR, since all of the collisions have occurred in this area. Several collisions have occurred along S.C. Route 22, and it is anticipated that increased traffic on this roadway could increase the number of automobile/bear collisions. Additionally, as the area between Conway and the Atlantic Intracoastal Waterway continues to develop, bear habitat would be lost and/or fragmented, making protected habitat areas such as the 10,000-acre Lewis Ocean Bay Heritage Preserve, Sterrit Swamp, Tilly Swamp, and other connections between Lewis Ocean Bay and the Waccamaw River more important as corridors to allow movement. The increased traffic on S.C. Route 22 could result in an increase in the number of collisions with other species, such as white-tailed deer and raccoons.

SCDNR's Little Pee Dee Heritage Preserve offers protection for a portion of the riparian habitats within the project study area. However, there are gaps between preserves that have no other protection than the Section 404 permit and wetland mitigation process. Other heritage preserves, state parks, and natural areas are present in the project study area; however, isolated "islands" of habitat are less than ideal for supporting healthy wildlife populations.

Another potential for cumulative impacts to birds would result from the construction of cell towers along the Preferred Alternative. Studies indicate that migratory birds frequently collide with lighted cell and radio towers that are greater than 200 feet in height when flying at night and during inclement weather when visibility is hindered. An in-depth discussion on cumulative impacts to migratory birds can be found in Section 3.15.4 (refer to page 3-198).

Cumulative impacts associated with the introduction of nonnative invasive plant species could occur from the Preferred Alternative. Highways tend to serve as conduits for the spread of invasive plant species which out-compete native species and eventually dominate a habitat. 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. A detailed discussion of invasive plant species can be found in Section 3.13 (refer to page 3-168).

Other projects in or in the vicinity of the project study area that have been constructed or are in the planning stages that could result in cumulative wildlife impacts such as wildlife habitat loss, habitat degradation, and fragmentation impacts include the following:

- past construction of approximately 28.5 miles of S.C. Route 22;
- seven miles of current road widening along S.C. Route 38 in Dillon County;
- three miles of future widening along S.C. Route 9/S.C. Route 38 in Marlboro County;
- the future replacement of the S.C. Route 917 bridges over the Little Pee Dee River and its associated wetlands;
- the future construction of the 37-mile long portion of I-73 from I-95 to I-74; and,
- the proposed 22-mile long Southern Evacuation Lifeline (SELL).