



mitigation involving the use of large tracts of land with linked upland/wetland riparian systems that would provide greater ecological value to the mitigation site. The Draft MOA was presented to the ACT in December 2007, and the proposed provisions of the MOA were discussed. Comments received from the ACT were incorporated into the Draft MOA and redistributed. MOA coordination is currently an ongoing process with the ACT and the regulatory and commenting agencies. Once the type of mitigation that will be used has been determined, a final mitigation plan or mitigation MOA would be submitted along with a permit application for unavoidable wetland and stream impacts.

### 3.13 Invasive Species

#### 3.13.1 What are invasive species?

Invasive species are plants and animals that have been introduced by man into an area where they are not native and they reproduce by either seed or spreading vegetatively by cuttings or roots successfully enough to “invade” the natural landscape to become established or “naturalized.” These plants range in size from simple algae to large shade trees. While there are various definitions for invasive species, most federal agencies have adopted the invasive species definition found in Executive Order 13112, *Invasive Species*. Executive Order 13112 requires that the species meet two criteria: the plant must be non-native to the particular landscape, and that it may possibly cause economic harm, environmental harm, or harm to human health if introduced into an ecosystem.<sup>110</sup>

Commonly called “weeds,” invasive species were introduced by the early European settlers inadvertently as part of grain shipments and other products of early trade.<sup>111</sup> Other invasive plant species were introduced intentionally for their ornamental value, medicinal properties, for making dyes, and for use as food/forage.<sup>112</sup>

#### 3.13.2 What is FHWA policy on invasive species?

Executive Order 13112 prohibits federal agencies from authorizing, funding, or performing actions that may introduce or spread invasive species without fully considering reasonable measures that could be implemented to limit the risk of harm.<sup>113</sup> The analysis required in the Executive Order

<sup>110</sup> Executive Order 13112, *Invasive Species*, February 3, 1999, <http://www.nepa.gov/nepa/regs/eos/eo13112.html> (May 29, 2008).

<sup>111</sup> U.S. Forest Service, Region 6, “Regional Invasive Plant Environmental Impact Statement: Frequently Asked Questions,” <http://www.fs.fed.us/r6/invasiveplant-eis/faq/#05> (May 29, 2008).

<sup>112</sup> *Ibid.*

<sup>113</sup> Executive Order 13112, *Invasive Species*, Section 2(a)(3), February 3, 1999, <http://www.nepa.gov/nepa/regs/eos/eo13112.html> (May 29, 2008).



compliments the analysis requirements found in NEPA, as well as the requirements to prevent and minimize impacts found in the *Endangered Species Act* of 1973 and the *Federal Noxious Weed Act* of 1974.<sup>114</sup>

In response to Executive Order 13112, the FHWA issued policy guidance to address invasive species control. In order to conform with Executive Order 13112, the FHWA is prohibited from financing construction, landscaping, or re-vegetation projects that intentionally use known invasive plant species with Federal-aid and Federal Lands Highway Program funds.<sup>115</sup> Known invasive plant species are currently those found on the state's official noxious weed list where the project takes place.<sup>116</sup> However, a national list is being developed by the National Invasive Species Council, and will be used in the future once it is approved.<sup>117</sup>

### 3.13.3 What are FHWA recommendations regarding invasive species?

In its policy guidance, the FHWA makes many recommendations for the prevention and control of invasive species along roadways. During the project development phase, the NEPA analysis should identify invasive species located in the project's study area, and the potential impacts to habitats due to the disturbance resulting from the project's construction.<sup>118</sup> Prevention and control measures that would be performed as part of the project should also be included as part of the analysis.

The FHWA guidance proposes other ways of controlling and preventing invasive plant species, including the following:

- helping State DOT's to develop a statewide inventory of known infestations of invasive plants and vegetation management plans;
- using construction and landscaping methods as well as equipment that minimize the introduction and spread of invasive species;
- assisting State DOT's to provide more training of its landscape and maintenance workers in identifying, controlling and preventing invasive species; and,
- using Federal-aid funds to help improve control efforts of invasive plants through roadside vegetation management programs at the State DOT level.

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<sup>114</sup> FHWA, *Federal Highway Administration Guidance on Invasive Species*, August 10, 1999, [http://www.fhwa.dot.gov/environment/inv\\_guid.htm](http://www.fhwa.dot.gov/environment/inv_guid.htm) (May 29, 2008).

<sup>115</sup> *Ibid.*

<sup>116</sup> *Ibid.*

<sup>117</sup> *Ibid.*

<sup>118</sup> *Ibid.*



### 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. Some plant 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. Specifically introduced invasive species found within the project study area include thorny elaeagnus (*Elaeagnus pungens*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), kudzu (*Pueraria lobata*), and sericea (*Lespedeza cuneata*).<sup>119</sup>



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

Some plant species originally introduced as ornamentals for landscaping have since escaped and established themselves in natural areas. Those observed within 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*).<sup>120</sup>

Other plant species were either accidentally introduced or the method of introduction is not known. Invasive species with unknown origins found in the project study area include Brazilian 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*), and Brazilian elodea (*Egeria densa*).<sup>121</sup>

### 3.13.5 How do invasive plant species affect the environment?

As previously mentioned, species are partly defined as invasive due to their likelihood to negatively impact the natural environment, the economy, and human health. When invasive plants are introduced into an ecosystem, they can outcompete native plants for food and resources, as well take advantage of attributes of the ecosystem that are considered limiting factors for native plants.<sup>122</sup> Due to this,

<sup>119</sup> Miller, James H. 2003. *Nonnative Invasive Plants of Southern Forests: A Field Guide for Identification and Control*, <http://www.invasive.org/eastern/srs/> (May 29, 2008).

<sup>120</sup> *Ibid.*

<sup>121</sup> *Ibid.*

<sup>122</sup> USFWS, "Invasive Species: Frequently Asked Questions About Invasive Species," <http://www.fws.gov/invasives/faq.html> (May 29, 2008)



invasive species can repopulate quickly, outcompeting the native plant species, sometimes to the point of extinction, thereby lowering diversity within the ecosystem and making it more susceptible to plant diseases, fire/other natural disasters, or for establishment of other invasive species.<sup>123</sup> The ecosystem can change over time due to the establishment of invasive plant species, since it alters the natural plant communities and the ecological processes that had evolved over time within the ecosystem.<sup>124</sup> While some invasive plants provide cover for wildlife, many invasive plants are unpalatable, and can be poisonous to animals if ingested.<sup>125</sup>

Invasive species can have negative economic impacts to agriculture, timber, and recreation, as well as impacts to landowners. Invasive species can become established in agricultural fields and pastures, causing lower crop and forage yields, increased soil erosion, and greater costs for production and management due to the costs of herbicides and other control measures.<sup>126</sup> Similarly, timber stands can become infested with invasive species, resulting in lower yields during harvest.<sup>127</sup> Recreational activities such as fishing, hiking, hunting, photography, and wildlife viewing can be affected by the presence of invasive species influencing changes to an ecosystem.<sup>128</sup> Landowners controlling invasive species on their properties must spend time and money to implement control measures to minimize/eradicate invasive species.



*Kudzu scrambles over multiple trees, shading and eventually killing them.*

Many invasive plant species are poisonous to humans if ingested, others have sharp spines that can cause injury, and some may even cause allergic reactions, such as respiratory problems or skin rashes, due to the pollen they produce being different from native species.<sup>129</sup>

<sup>123</sup> *Ibid.*

<sup>124</sup> *Ibid.*

<sup>125</sup> U.S. Forest Service, Region 6, “Regional Invasive Plant Environmental Impact Statement: Frequently Asked Questions,” <http://www.fs.fed.us/r6/invasiveplant-eis/faq/#05> (May 29, 2008).

<sup>126</sup> *Ibid.*

<sup>127</sup> USFWS, “Invasive Species: Frequently Asked Questions About Invasive Species,” <http://www.fws.gov/invasives/faq.html> (May 29, 2008).

<sup>128</sup> U.S. Forest Service, Region 6, “Regional Invasive Plant Environmental Impact Statement: Frequently Asked Questions,” <http://www.fs.fed.us/r6/invasiveplant-eis/faq/#05> (May 29, 2008).

<sup>129</sup> *Ibid.*



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

Without control and best management practices in place, construction, landscaping, and maintenance activities associated with the proposed project could cause the establishment of invasive plant species within the Preferred Alternative's construction limits. Roadways can also be considered as pathways for transporting invasive species and spreading them throughout an area.

During construction, invasive plant seeds/roots can be transported by construction equipment, and in topsoil, mulch, or gravel used to make the roadbed and for erosion control. Construction equipment that has not been properly washed prior to entering a new site may carry invasive plant species from prior locations that were infested.<sup>130</sup> Imported soil, sand, or gravel from areas where invasive species are established may spread seeds and roots into a new construction site.<sup>131</sup> Disturbing soils may spread and intensify infestations due to roots and stems being chopped into many segments and dispersed into new areas.<sup>132</sup>

Landscape and maintenance activities, such as mowing, that are done when seeds are present on invasive species can lead to further infestation into other areas.<sup>133</sup> Inadvertent use of invasive species in seed mixes or non-certified mulches in erosion control or landscaping activities may establish invasive species along a roadway.<sup>134</sup> Failure to implement control measures along the roadways can also cause establishment and infestation of invasive species.<sup>135</sup>

Roadways can also transfer invasive species from one area to another. Vehicles and their loads traveling on roadways may contain invasive species that can be carried from one area to another, or fall off during transit and end up along the side of a roadway.<sup>136</sup> Additionally, roadways cross through geologic features or waterways, normally barriers to the spread of invasive species, which spread them to other places that would not usually be infested.<sup>137</sup>

<sup>130</sup> American Association of State Highway and Transportation Officials, "Invasive Species/Vegetation Management," [http://environment.transportation.org/environmental\\_issues/invasive\\_species/](http://environment.transportation.org/environmental_issues/invasive_species/) (May 29, 2008).

<sup>131</sup> Transportation Research Board, *NCHRP Synthesis 363: Control of Invasive Species, 2006*, [http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_syn\\_363.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_363.pdf) (May 29, 2008).

<sup>132</sup> *Ibid.*

<sup>133</sup> American Association of State Highway and Transportation Officials, "Invasive Species/Vegetation Management," [http://environment.transportation.org/environmental\\_issues/invasive\\_species/](http://environment.transportation.org/environmental_issues/invasive_species/) (May 29, 2008).

<sup>134</sup> *Ibid.*

<sup>135</sup> *Ibid.*

<sup>136</sup> Transportation Research Board, *NCHRP Synthesis 363: Control of Invasive Species, 2006*, [http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_syn\\_363.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_363.pdf) (May 29, 2008).

<sup>137</sup> *Ibid.*



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

Prevention is the most cost-effective and successful method of eliminating invasive plant species in transportation projects. Prevention consists of early detection of invasive plant species, as well as best management practices adopted during the construction, landscaping, and maintenance activities.<sup>138</sup> During construction, equipment should be inspected and washed off as necessary to remove seeds, soils, and other plant material prior to entering new construction sites.<sup>139</sup> Additionally, soil disturbances should be minimized in areas of native plants where possible, and attempts should be made to preserve natural plant communities where possible.<sup>140</sup> To minimize the transport of seeds and plant material, soils and other material necessary for construction as well as during re-vegetation should be from areas that do not have invasive species established.<sup>141</sup> Re-vegetation efforts should be done quickly after construction, and monitoring may be needed in sensitive areas to ensure invasive plants are not being established. If invasive species are present, control measures, such as the application of herbicides, need to be used to eradicate the plants before they establish and spread.<sup>142</sup> Once the roadway is in place, landscaping and maintenance activities need to be conducted to minimize the establishment and spreading of invasive species.

During the construction of the proposed project, the aforementioned prevention and control measures would be implemented to reduce the likelihood of the introduction and spread of non-native invasive plant species along the Preferred Alternative.

## 3.14 Wildlife

### 3.14.1 What types of wildlife and wildlife habitat are found in the Preferred Alternative study corridor?

Wildlife habitat “is a combination of environmental factors that provide food, water, cover and space that living thing needs to survive and reproduce.”<sup>143</sup> The Preferred Alternative study corridor includes many diverse terrestrial and aquatic habitats that provide food, shelter, breeding, and wintering grounds for a wide variety of wildlife. A list of upland and wetland habitats found within

<sup>138</sup> *Ibid.*

<sup>139</sup> *Ibid.*

<sup>140</sup> American Association of State Highway and Transportation Officials, “Invasive Species/Vegetation Management,” [http://environment.transportation.org/environmental\\_issues/invasive\\_species/](http://environment.transportation.org/environmental_issues/invasive_species/) (May 29, 2008).

<sup>141</sup> Transportation Research Board, *NCHRP Synthesis 363: Control of Invasive Species, 2006*, [http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_syn\\_363.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_syn_363.pdf) (May 29, 2008).

<sup>142</sup> *Ibid.*

<sup>143</sup> USFWS, “Habitat,” <http://www.fws.gov/habitat> (May 30, 2008).



the Preferred Alternative study corridor is found in Table 3.52. A discussion of each of these habitats can be found in Uplands, (refer to Section 3.11, page 3-153) and Wetlands, (refer to Section 3.12, page 3-160).

**Table 3.52  
Undisturbed Upland and Wetland Habitats  
in Preferred Alternative Study Corridor**

<b>Upland Habitats*</b>	<b>Wetland Habitats**</b>	
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
	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)

Although several types of natural wildlife habitat were identified during the field investigations, the majority of the Preferred Alternative study corridor is comprised of disturbed areas. These areas have been highly impacted by human activities and mostly converted to agricultural fields and managed pine stands. Since the land within the Preferred Alternative study corridor has been under cultivation for so long, the remaining natural areas are highly fragmented and have dense understories due to fire suppression. Disturbed areas are primarily uplands since wetlands are protected by federal law and are generally avoided for this reason. Therefore, this community type is described under the upland habitats section.

Most animal species move through a variety of upland and wetland communities, and are not restricted to just one environment while some species are restricted to a particular habitat due to specialized habitat requirements. Appendix I contains a comprehensive list of wildlife species that potentially occur within the project study area. Species that are highlighted in bold type on the list were observed within the Preferred Alternative study corridor during wetland and protected species surveys. 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 in this section; for the corresponding scientific names refer to Appendix I.



### 3.14.2 What species are typically found in upland habitats within the Preferred Alternative study corridor?

A large assortment of mammals, birds, reptiles and amphibians (known collectively as herptiles, or herps) and invertebrates utilize uplands for foraging, breeding, nesting and as wintering grounds. Many of most common species will forage, nest and travel through any or all upland types. Following are discussions of typical wildlife species that might be found in the various upland habitats identified within the study corridor. Information about the species habitat requirements were obtained primarily from field guides and personal observations while conducting the wetland delineation and protected species surveys for the project. Field guides used for both upland and wetland species include *Amphibians and Reptiles of the Carolinas and Virginia*,<sup>144</sup> *Mammals of the Eastern United States*,<sup>145</sup> *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*,<sup>146</sup> and *Birds of the Carolinas*.<sup>147</sup>

#### 3.14.2.1 Mesic mixed hardwood forests

Mesic mixed hardwood forests are dry to moist uplands occurring on the Coastal Plain often on the south side of streams and rivers. The diversity of trees and other plants is great and there may be no dominant species.<sup>148</sup> These dense woods offer much potential for shelter: 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 commonly found in mesic mixed hardwoods include the southern short-tailed shrew, evening bat, gray squirrel, flying squirrel, raccoon, long-tailed weasel, and 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, yellow-billed cuckoo and several woodpeckers—pileated, red-

<sup>144</sup> Martof, B.S., W.M. Palmer, J.R. Bailey, and J.R. Harrison III. 1980. *Amphibians and Reptiles of the Carolinas and Virginia*. The University of North Carolina Press, Chapel Hill, NC.

<sup>145</sup> Hamilton, William J. Jr. and John O. Whitaker, Jr., 1979. *Mammals of the Eastern United States*. Cornell University Press. Ithaca, New York.

<sup>146</sup> Rhode, F.C., Rudolf, A.G., Lindquist, D.G., Parnell, J.F. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. The University of North Carolina Press, Chapel Hill, NC.

<sup>147</sup> Potter, E.F., J.F. Parnell, and R.P. Teulings. 1980. *Birds of the Carolinas*. The University of North Carolina Press, Chapel Hill, NC.

<sup>148</sup> Nelson, John B. 1986. *The Natural Communities of South Carolina: Initial Classification and Description*. Columbia, SC: South Carolina Wildlife and Marine Resources Department Division of Wildlife and Freshwater Fisheries.



bellied, hairy and the yellow-bellied sapsucker. Songbirds are in abundance including 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 eastern towhee.

Herps common to mesic mixed hardwoods include the spotted salamander, slimy salamander, box turtle and the five-lined skink. The variety of snakes is extensive, 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 dominated by a canopy of oaks and hickories in combination with other hardwoods and pines. Like the mesic mixed hardwood forest, this community provides ample shelter options. However the variety of food choices is not as great which lowers the species diversity found in this habitat. Mammals found in this habitat 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 red-bellied and downy woodpeckers. The community is also an important breeding ground for neo-tropical migrants, such as 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 herps 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*

Pine flatwoods are uplands with dry, sandy soil and usually flat topography, and are one of the dominant upland communities within the Preferred Alternative study corridor. These communities have a canopy of pines and a relatively open sub-canopy of sapling hardwood trees, scrub oaks, shrubs, and vines. Pine flatwoods often represent an early stage of an old field succession to woods, or abandoned pine plantation, and frequently succeed into oak-hickory



or other hardwood-dominated forest.<sup>149</sup> While there is a limited amount of food and shelter choices, the inhabitants of the pine flatwoods may forage in adjacent, richer communities such as the mesic mixed hardwood forest, bottomland hardwoods, or agricultural fields. Other species have adapted to take advantage of what the pine flatwoods offer 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 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.

Herps found within pine flatwoods include the pine woods treefrog (in habitats 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 Upland pine-wiregrass woodland*

Upland pine-wiregrass woodlands occur in the fall-line sandhills, or on sand ridges associated with rivers in the Coastal Plain, and have deep, well-drained sands. Pines dominate the canopy and several scrub oak species dominate the understory layer, with the herb layer is being minimal. Wildlife is typically sparse in these communities due to the extreme conditions present and lack of plant food and shelter choices.

With the exception of the fox squirrel, there is a limited amount of mammals found within sandhill communities. White-tailed deer pass through or seek temporary cover in these scrubby areas, or browse on the acorns of the many oak species found in this habitat.

Few birds frequent these communities, but bobwhite quail and turkey do forage or pass through. Bachman's sparrow and brown-headed nuthatch are among the few songbirds that can tolerate these dry sandy areas.

Herps 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.

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<sup>149</sup> *Ibid.*



### 3.14.2.5 Disturbed areas

As mentioned previously, the most predominant community type within the Preferred Alternative study corridor are disturbed areas, primarily cropland. Active and abandoned fields, pastures and orchards supply grains, grass and 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. Predators of these small animals are drawn here for obvious reasons. The southeastern, least, and southern short-tailed shrew, eastern mole, eastern cottontail rabbit, hispid cotton rat, eastern harvest mouse, white-footed mouse and woodland vole are normally present in these areas. Hunting for these small prey species are coyote, gray fox, raccoon, and the long-tailed weasel. White-tailed deer also utilize these farmlands for food sources.

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, as well as 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, eastern towhee and several sparrows such as the savannah, chipping, field, white-throated and the song sparrow, flock to these open foraging grounds. The introduced 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 herps like the Carolina anole, southeastern five-lined skink, and the eastern fence lizard. Snakes such as the rat snake and eastern kingsnake frequent these buildings in search of their rodent prey, and the brown snake can be found lurking under piles of debris looking for slugs or worms.

Roadsides and structures can serve as habitat. Under bridges, the evening bat and birds like the barn swallow and eastern phoebe find roosting or nesting sites. 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 bluebird, and various flycatchers.

Rural residences, suburban backyards and even urban parks and yards may harbor mammals such as the opossum, eastern mole, big brown bat, gray squirrel and the raccoon. Birds that occur in these areas 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 species are attracted to birdhouses, birdseed, nectar or other food and even water purposely left out by people wishing to watch them. Herps that have adapted well to human habitations include the Carolina anole and the southern toad. The commercial districts of towns serve as a haven for undesirable introduced birds such as the pigeon, European starling, and house sparrow. However, these commercial buildings also offer flat, pebble-strewn rooftop nesting sites for a native bird, the common nighthawk.

Airport runways, parking lots, golf courses, sod farms and other large expanses of turf or asphalt provide nesting sites for the killdeer, and foraging for ring-billed gull and the house sparrow among discarded fast food scraps and other litter.

### 3.14.3 What species are typically found in wetland habitats within the Preferred Alternative study corridor?

Many mammals, birds, herps, fish and invertebrates utilize wetlands for foraging, breeding, nesting and as wintering grounds. As with upland species, much of the wetland-dependant wildlife is not limited to one specific wetland community and can be found to forage, nest and travel through multiple wetland types, as well as uplands (refer to Appendix I). Aquatic species are more restricted in their movements than terrestrial species due to their need for permanently inundated habitats. As with the discussion of upland habitats, representative species identified within each wetland community type are based on literature reviews and are not based on actual field observations.

Many different wetland types were found within the Preferred Alternative study corridor. As with the upland habitats, the majority of these wetlands are not considered pristine or ideal natural communities as they have been altered or disturbed.

#### 3.14.3.1 Aquatic beds

Aquatic beds occur at or near the surface of permanent to nearly-permanent bodies of freshwater such as ditches, pools, ponds and slow-moving streams, rivers and canals. The only plants that tolerate this inundation have modified structures to remain submerged or to float. Several



species of fish, otters, muskrats and other animals utilize these beds temporarily, spending most of their lives in the deeper water or their margins. (For further information, refer to Section 3.14.3.5, Ponds and borrow pits, page 3-202; Section 3.14.3.6 Rivers and canals, page 3-203, and Section 3.14.3.8, Wooded swamps, page 3-205).

Since most aquatic beds are permanently flooded, mammalian species are not common year-round inhabitants. However, some mammals, as with other wetland communities, may be found within these habitats as they move 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, semi-aquatic and aquatic species of reptiles are found within aquatic beds. The mud snake, the banded water snake, and the redbelly water snake frequent aquatic beds for food. If debris such as logs are part of the aquatic bed, turtles can be found sunning. Frogs often use floating aquatic plants such as water-lilies for resting and sunning places.

Numerous freshwater fish use aquatic beds as nurseries, including smaller fish such as minnows and darters as well as bream and other larger species. Fish found in aquatic beds feed on the larvae of insects and other invertebrates, along with using this habitat for cover and breeding sites.

#### *3.14.3.2 Bottomland hardwoods*

Bottomland hardwoods are freshwater wetlands generally associated with rivers, creeks, or other drainage systems. These low-lying bottomlands frequently serve as a holding area for waters from the main channel, especially after a heavy rain upstream. Because of the rich sediment spill-over, bottomland hardwoods are a highly productive ecosystem containing a variety of wildlife habitats. Of particular importance is this community's role as a breeding ground for migratory birds.

Mammalian species commonly associated with this wetland type include the opossum, eastern pipistrelle (bat), gray squirrel, cotton and golden mouse, raccoon, bobcat, and the feral hog. White-tailed deer also pass through or use the bottomlands for foraging and cover.

Various birds utilize this community for the variety 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. Throughout the season, these areas harbor 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.



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 use these frequently flooded forests. Common reptiles include the rat snake, redbelly and other water snakes, and the venomous cottonmouth and canebrake rattlesnake.

#### 3.14.3.3 *Deciduous shrub swamp*

Deciduous shrub swamps are the result of a disturbance to a swamp, creek, or other natural wetland, either by clear-cutting by man, beaver activity, or other major physical change.<sup>150</sup> If clear-cut, these areas can quickly become a tangle of stump sprouts, blackberries, briars and weedy growth amid the debris left behind by the heavy machinery. 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 on them. Mammals commonly finding cover here include the eastern cottontail and the cotton mouse. When these habitats are dammed and flooded by beavers, these areas transition into ponds, often with marshy fringes. (Refer to Section 3.14.3.4 Freshwater marsh, page 3-201, and Section 3.14.3.5, Ponds and borrow pits, for more details of species that can be found in these habitats).

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

Reptiles found within these transitional 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.

#### 3.14.3.4 *Freshwater marsh*

Freshwater marshes are open wetlands with a highly variable water level dominated by emergent grasses, sedges, and rushes. This wetland type is usually associated with deeper water wetlands, but can also be found where trees are kept at bay in power line and roadway rights-of-way and other places where man prevents succession into, or back into, wooded wetlands.<sup>151</sup> Wildlife habitat is limited by the water level, but many have adapted to life in the marsh.

<sup>150</sup> L.M. Cowardin, V. Carter, F.C. Golet, and E.T. LaRoe, *Classification of Wetlands and Deepwater Habitats of the United States*, prepared for the USDI-FWS. FWS/OBS-79/31, Washington, D.C., (1979).

<sup>151</sup> Nelson, John B. 1986. *The Natural Communities of South Carolina: Initial Classification and Description*. Columbia, SC: South Carolina Wildlife and Marine Resources Department Division of Wildlife and Freshwater Fisheries.



A wide variety of mammalian species can be found in marshes at least temporarily, using it for foraging or as source of nest material. These 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 such as the redbelly. Many amphibians find freshwater marsh prime breeding ground, especially with seasonal inundations. These opportunistic species include numerous frogs such as 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—eastern mudminnow, lined topminnow, and mosquito fish—as well as pirate perch, swampfish, several species of bream, and bowfin.

#### *3.14.3.5 Ponds and borrow pits*

Ponds and borrow pits are usually manmade, open, freshwater communities, and are created by excavation in uplands (borrow pits, agricultural ponds), or by damming or otherwise altering slow-moving streams by man or beavers (impoundments). Other freshwater systems are often found associated with ponds and borrow pits in the form of fringe wetlands.

Beavers, which are semi-aquatic mammals, can create these ponds to provide a place to raise young, search for food, and as a place to take cover from predators. Muskrats and other mammals also find these ponds ideal for foraging, nesting, and cover. Others use the margins of ponds for what they provide (refer to Section 3.14.3.1, Aquatic beds, page 3-199, and Section 3.14.3.4, Freshwater marsh, for species of 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, and the shores 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. Many frog species such as cricket frogs, treefrogs, chorus frogs, green frog, carpenter frog, leopard frog, and the largest species, the bullfrog, depend upon ponds for breeding and foraging and rarely stray far from their banks. During seasonal warm rains, the narrowmouth toad 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—blue-spotted, banded, redear, flier, pumpkinseed and bluegill—and banded, and Everglades pygmy sunfishes are just some of the various fish that can be found in ponds. Also, largemouth bass, black crappie, and other game species have been stocked in many man-made ponds.

#### 3.14.3.6 Rivers and canals

Rivers and man-made canals are riverine systems that can be seasonally or permanently flooded. The open water and banks of these streams and rivers provide habitat for mammals that find food and shelter here, including river otter, muskrat, mink, and beaver.

Several wading and diving birds use rivers and canals to forage for fish, frogs and other prey, including great blue heron, green heron, common egret, and belted kingfisher. 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 phoebe, and the barn swallow as well as other swallows.

Aquatic salamanders (dwarf mudpuppy, amphiuma), terrestrial salamanders (eastern newt, marbled salamander), treefrogs (gray and green), southern cricket frog, green frog, pickerel frog, leopard frog and bullfrog, as well as the eastern narrowmouth toad are among the many amphibians found 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 venture into the slow moving streams and tributaries of major rivers including gar, American eel, bowfin, shad (American and gizzard), carp, bullhead catfish, madtom catfish, and bluespotted and banded sunfish. Small species such as pygmy sunfish, shiners, suckers, chubsuckers, mosquitofish, darters, mudminnow, pirate perch, and swampfish are also found within tributaries and streams of the Pee Dee River Basin.



Freshwater bivalve mollusks, especially mussels, are found in the substrate of Coastal Plain rivers. SCDNR estimates that there are over 30 different species of freshwater mussel occurring in South Carolina.<sup>152</sup> A freshwater mussel survey was conducted in the Pee Dee River Basin in South Carolina between June 2004 and August 2005 by The Nature Conservancy. Several rivers and streams were sampled at 61 locations within the river basin, and 23 different mussel species were found during the survey, including the Carolina lance, Carolina slabshell, Waccamaw spike, Eastern elliptio, tidewater mucket and the Florida pondhorn were recorded in the Pee Dee River basin.<sup>153</sup> The introduced Asian clam was the most common bivalve found throughout the river basin.

While more than 60 freshwater mussel species occur in North Carolina, fifty percent are listed as either threatened, endangered, or species of special concern.<sup>154</sup> Within the Yadkin-Pee Dee River basin, freshwater mussels such as Carolina creekshell and the Carolina fatmucket can be found.

#### 3.14.3.7 *Streamhead pocosin*

Streamhead pocosins are seasonally to semi-permanently saturated palustrine wetlands underlain by wet, acidic soils occurring along the headwaters of small streams in sandhill areas, and dominated by a thick shrub layer. Streamhead pocosin vegetation may expand uphill into the upland sandhill communities if not subjected to periodic fire. Downstream these habitats generally transition into a bottomland hardwood or wooded swamp communities.<sup>155</sup>

Animals that are found downstream in the more extensive wooded swamp and bottomland hardwoods utilize streamhead pocosins. Mammals such as white-tailed deer, bobcat, and raccoon use these habitats as cover or to forage, while smaller species such as marsh rabbit also find ample sites for dens and/or burrows within the tangle of shrubs.

Because the sandhills forests that are immediately adjacent to this community are usually barren, birds and other animals use the regularly impenetrable tangle of shrubs of the streamhead pocosin as a haven for cover, foraging, and nesting. These birds include the common snipe, pileated woodpecker, white-eyed vireo, tufted titmouse, yellow-throated warbler, common yellowthroat, northern parula, eastern towhee, and swamp sparrow.

<sup>152</sup> SCDNR website: [http://www.dnr.sc.gov/news/Yr2006/jan3006/jan30\\_mussel.html](http://www.dnr.sc.gov/news/Yr2006/jan3006/jan30_mussel.html) Last accessed on June 3, 2008.

<sup>153</sup> The Nature Conservancy, *Freshwater Mussel Surveys of the Pee Dee River Basin in South Carolina*, prepared by the Catena Group, January 3, 2006, [http://www.nature.org/wherewework/northamerica/states/southcarolina/files/mussels\\_of\\_the\\_pee\\_dee\\_in\\_sc\\_final.pdf](http://www.nature.org/wherewework/northamerica/states/southcarolina/files/mussels_of_the_pee_dee_in_sc_final.pdf) (May 30, 2008).

<sup>154</sup> North Carolina Wildlife Resources Commission, *North Carolina Mussel Atlas*, [http://www.ncwildlife.org/pg07\\_wildlifespeciescon/pg7b1a.htm](http://www.ncwildlife.org/pg07_wildlifespeciescon/pg7b1a.htm) (May 23, 2008)

<sup>155</sup> Schafale, Michael P. and Alan S. Weakley. 1990. *Classification of the Natural Communities of North Carolina*. Raleigh, NC: North Carolina Natural Heritage Program Division of Parks and Recreation & N.C. Department of Environment, Health, and Natural Resources.



These wetlands are the domain of many amphibians, with a variety of species living there in temporary or semi-permanent pools as larvae, and as adults at least part of the year, particularly 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 utilize the boggy ground and pools to live, attract a mate, breed and deposit their eggs. Reptiles are occasionally found in these habitats, including the spotted turtle, box turtle black rat snake and garter snake.

#### 3.14.3.8 *Wooded swamp*

Wooded swamps are freshwater wetlands associated with brownwater or blackwater rivers, and are frequently flooded deeply and usually stay inundated with water.<sup>156</sup> 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 wooded swamps include the opossum, marsh rabbit, gray squirrel, cotton and golden mouse, raccoon, mink, muskrat and bobcat.

Numerous types of birds live within these habitats, 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 the aquatic salamanders (sirens, amphiuma and the newt's juvenile stage) and several terrestrial salamanders (southern dusky, marbled, two-lined, dwarf, mud, many-lined and Mabee's salamanders), as well as treefrogs (green, barking and chorus), river and leopard frogs, and the eastern narrowmouth toad. Many reptiles also live in the swamp, including several turtles (snapping, yellow-bellied slider and Florida cooter), the rat snake, several non-venomous water snakes, along with the poisonous cottonmouth.

Many fish species can be found within permanent pools in wooded swamps, where they are both temporary and permanent residents. Commonly found species range from the larger species such as gar, American eel, bowfin, pickerel, and bullhead catfish, to the smaller mudminnow, pirate perch, swampfish, mosquitofish, and several species of shiners, darters, and minnows.<sup>157</sup>

<sup>156</sup> Nelson, John B. 1986. *The Natural Communities of South Carolina: Initial Classification and Description*. Columbia, SC: South Carolina Wildlife and Marine Resources Department Division of Wildlife and Freshwater Fisheries.

<sup>157</sup> Arndt, Rudolf G.; Lindquist, David G.; Parnell, James F.; and Rohde, Fred C. (1994) *Freshwater Fishes of the Carolinas, Virginia, Maryland and Delaware* (Chapel Hill, N.C.: The University of North Carolina Press) pp. 67 and 146.



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

Wildlife using habitats 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.

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. 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, 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 makes 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.<sup>158</sup> 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.<sup>159</sup>

<sup>158</sup> 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).

<sup>159</sup> AASHTO, Center for Environmental Excellence Website, [http://environment.transportation.org/environmental\\_issues/construct\\_maint\\_prac/compendium/manual/3\\_13.aspx](http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/3_13.aspx) (May 23, 2008)



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 the roadway and barrier fences.

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 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. Ultimately, barriers to movement may reduce gene flow between individual populations and cause genetic effects, further impacting species.<sup>160</sup>

The total acreage of direct impacts to wildlife habitat that would result from construction of the Preferred Alternative is 980.8 acres, consisting of 57.2 acres of wetlands and 923.4 acres of forested uplands (refer to Table 3.53).

**Table 3.53**  
**Potential Wildlife Habitat Impacts, in Acres**

HABITAT TYPE	Preferred Alternative
Total Wetland Area	57.2
Total Natural Upland Area	923.4
<b>TOTAL HABITAT IMPACT</b>	<b>980.6</b>

Source: The LPA Group Incorporated, 2008.

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

<sup>160</sup> R. T. Forman, et. al., *Road Ecology: Science and Solutions*, Island Press, Washington DC, 2003.



is being impacted.<sup>161</sup> 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 3.54 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 3-32, page 3-210).

**Table 3.54**  
**Relative Roadway Effects on Habitat**

Impact Type	Large Unit		Small Unit		Wide Corridor		Narrow Corridor	
	Bisect	Edge	Bisect	Edge	Perpendicular	Edge	Perpendicular	Edge
<b>Loss</b>	Low	None	High	None	Low	None	Low	None
<b>Degradation</b>	High	Medium	High	High	Low	High	Low	High
<b>Fragmentation</b>	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 the Wetland Section (refer to Section 3.12, page 3-160), riparian systems are the highest quality habitat type identified within the Preferred Alternative study corridor. The Preferred Alternative would cross riparian habitats associated with 12 streams that serve as wildlife movement corridors as well as nesting habitat for several neo-tropical migratory bird species. The Preferred Alternative would not be constructed immediately adjacent or 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. 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. The Preferred Alternative would cross 12 riparian corridors of varying size and result in the loss of approximately 53 acres of direct habitat loss and approximately 234 acres of adjacent habitat impact due to roadway noise. GIS analysis indicates that there are 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.

<sup>161</sup> 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.



### 3.14.5 What has been 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.<sup>162,163</sup> 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.

### 3.14.6 What indirect and cumulative impacts could 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 Preferred Alternative. Based on a review of aerial photographs, the projected location of these developments does not appear to contribute to habitat fragmentation. Land use modeling indicated some of the projected development for the Preferred Alternative would occur in Blenheim, Bennettsville, Clio, and McColl and along S.C. Route 9 and S.C. Route 177 N, north of Bennettsville. Projected development outside of the town limits would be clustered around the proposed interchanges with existing roadways and would occur predominantly in agricultural fields and the edges of forested patches (refer to Sections 3.11 and 3.12, pages 3-153 and 3-160, respectively). The projected development associated with the No-build Alternative would generally be close to I-95 and I-74, existing major routes at either end. Projected development overlain onto aerial photography shows that impacts to wildlife due to projected growth would be predominantly habitat degradation due to the proximity of the development to wildlife habitat and direct habitat loss, instead of habitat fragmentation.

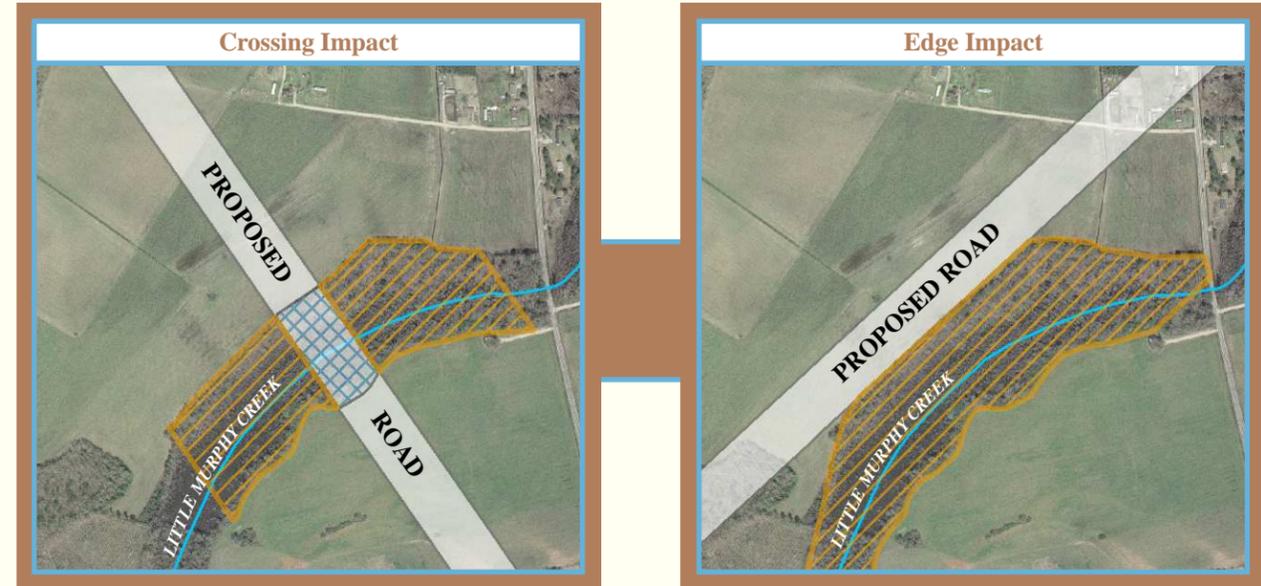
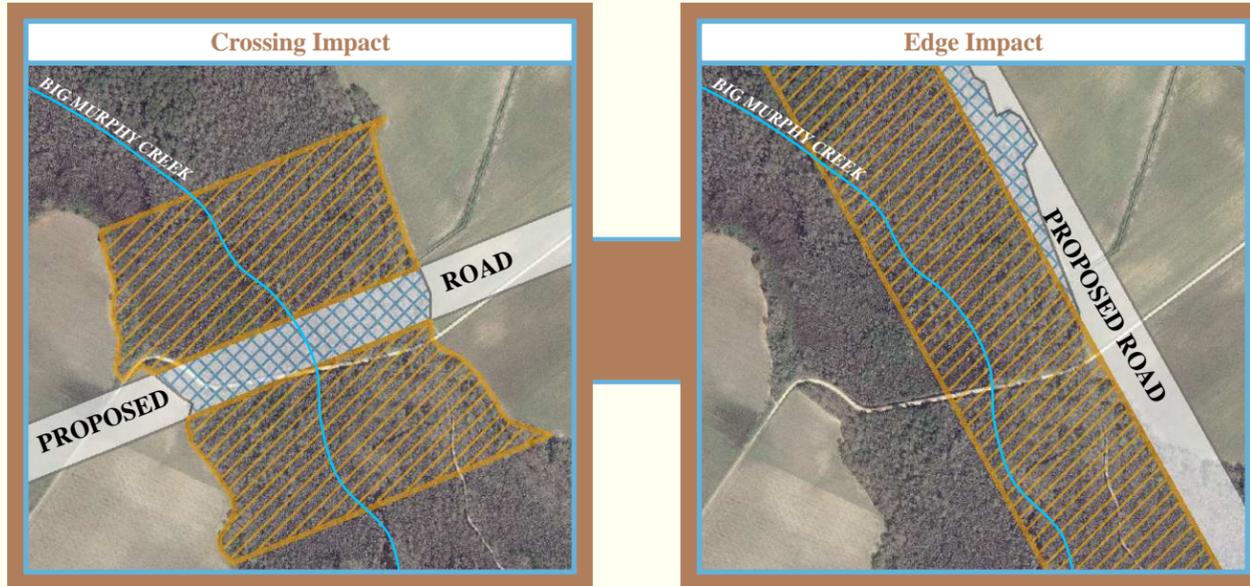
<sup>162</sup> R.T. Forman, et. Al., *Road Ecology: Science and Solutions*, (Washington, D.C.: Island Press, 2003).

<sup>163</sup> Brodziewska, Iadwiga, "Wildlife Tunnels and Fauna 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.



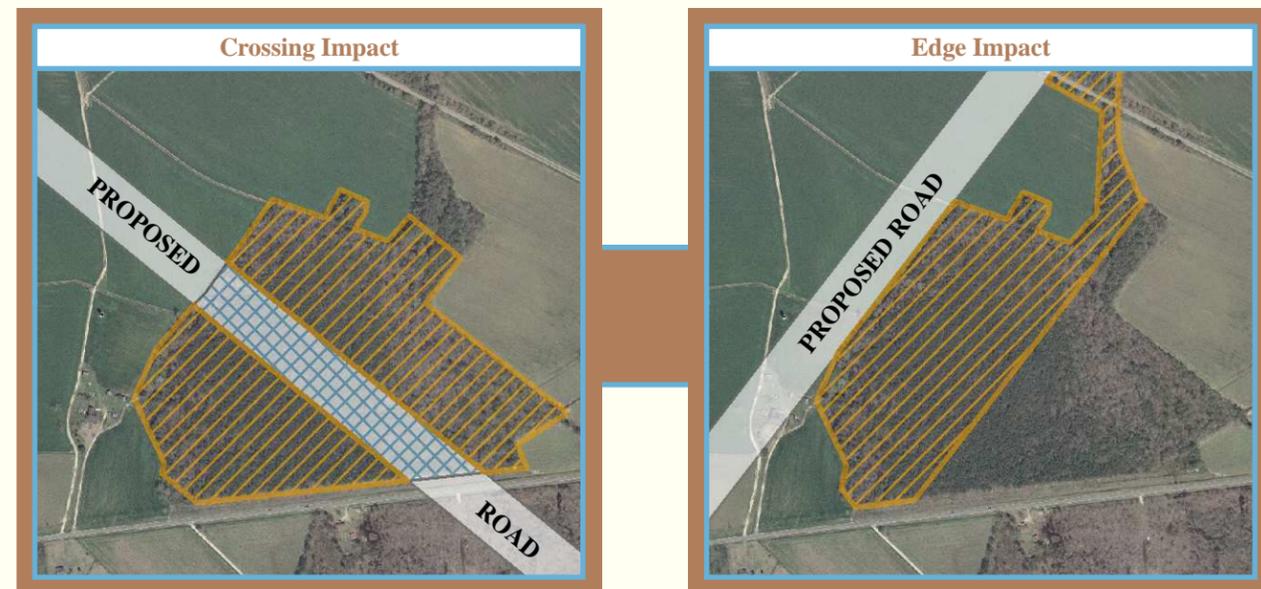
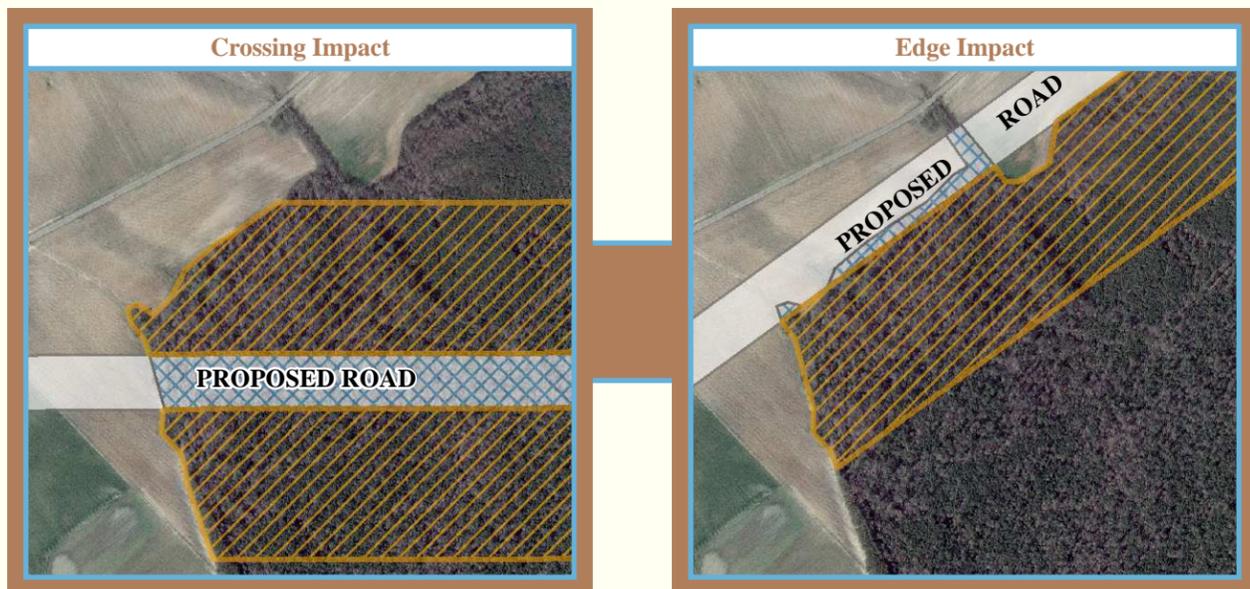
### Wide Habitat Corridor

### Narrow Habitat Corridor



### Large Habitat Area

### Small Habitat Area



**Legend**

- Potential Degradation Zone
- Habitat Loss
- Proposed Road



**FIGURE 3-32**

POTENTIAL ROADWAY IMPACTS TO WILDLIFE HABITAT



Cumulative impacts to wildlife species are also anticipated. Cumulative direct wildlife habitat loss from construction of the Preferred Alternative, coupled with projected development from both the No-build Alternative and the Preferred Alternative, would be approximately 1,182 acres including, 1,112 acres of forested upland habitat and 70 acres of wetland habitat by 2030.

Cumulative impacts could occur to the black bear population in Horry County as the result of the construction of I-73 South. The Horry County population of black bears has the highest number of automobile/bear collisions according to data obtained from SCDNR. All 26 of the collisions within the I-73 South project study area have occurred south of Conway. Eight of these occurred along S.C. Route 22 and it is anticipated that increased traffic on this roadway due to the construction of I-73 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 the 10,000-acre Lewis Ocean Bay Heritage Preserve more important. Connections between Lewis Ocean Bay and the Waccamaw River, such as Sterrit Swamp and Tilly Swamp, become more important to avoid increased wildlife /vehicle collisions. The increased traffic on S.C. Route 22 may result in an increase in the number of collisions with other species, such as white-tailed deer and raccoons. Measures to minimize wildlife roadway mortality such as wildlife crossing culverts and warning signs for motorists are discussed in Section 3.14.5 (refer to page 3-209).

Impacts associated with the introduction and spread of non-native invasive plant species could occur and cause degradation of wildlife habitat as a result of the proposed project. This is discussed in detail in Section 3.13.7, page 3-193. Management practices as described in Section 3.13.7 could reduce the likelihood of the spread of non-native invasive plant species along the Preferred Alternative.

Wildlife species require various habitats to meet their food and nesting needs. Wetlands and natural forested uplands provide the most valuable habitat within the project study area because of higher wildlife species diversity, while agricultural fields and managed pine plantations are generally less diverse. The diversity and abundance of wildlife associated with the various aquatic and terrestrial habitats within the project study area are localized due to habitat fragmentation as the result of historic and current agriculture practices within the project study area. The greatest concentrations of wildlife within the project study area are anticipated to be found along the forested riparian wetlands and forested uplands associated with the major streams. Wildlife species typically use these linear forested habitats not only as foraging areas but also as travel corridors throughout their home range. Migratory birds, such as the eastern kingbird, northern parula warbler, and prothonotary warblers rely on the mid-story of these forested riparian habitats as nesting and foraging areas as well.



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 17 miles of I-74 in North Carolina;
- 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 44-mile long portion of I-73 from I-95 to S.C. Route 22; and,
- the proposed 22-mile long Southern Evacuation Lifeline (SELL).

The proposed new I-73 South bridges over the Little Pee Dee River and its adjacent wetlands would be longer than the existing bridges on S.C. Route 917. The replacement S.C. Route 917 bridges would be the same length as the I-73 South bridges, therefore, an incremental net improvement of wildlife habitat and wildlife movement corridors would result.

### 3.15 Protected Species

#### 3.15.1 What are protected species?

Protected species are plants and animals whose protection is mandated by specific acts of the United States Congress, and managed and enforced by various federal authorities. The following four federal acts are important in conservation that are pertinent to the project study area and that need to be addressed for the proposed project:

- the *Endangered Species Act of 1973* (ESA);
- the *Bald and Golden Eagle Protection Act of 1940* (as amended);
- the *Migratory Bird Treaty Act of 1918*; and,
- the *Magnuson-Stevens Fishery Conservation and Management Act of 1976* (as amended).

These acts and the species protected under them are described in more detail in the sections to follow.

The states of South Carolina and North Carolina, under the authority of the SCDNR and NCDENR (respectively), have identified species worthy of conservation due to their rarity or decline within state borders. These state species of concern are described in more detail in Section 3.15.8, (refer to page 3-230).



### 3.15.2 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:

- known 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 eagles have been documented at Lake Paul Wallace near Bennettsville, and red-cockaded woodpeckers are also known to nest in the project study area, and these locations were designated as constraints, or areas to avoid, when developing alternatives.

Aerial photographs were reviewed to identify potentially suitable habitat for plants and animals within the corridors. Preliminary field surveys were conducted from October 2006 to January 2007 in a 2,500-foot wide corridor along each of the Reasonable Build Alternatives to evaluate whether potential habitat for federally protected species existed along the alignments. Habitat types varied from potentially suitable to unsuitable, depending on the species. All the Reasonable Build Alternatives, including the Preferred Alternative, were designed to avoid all known locations of federally protected species.

### 3.15.3 What is the *Endangered Species Act* and how would species protected under this Act be impacted by the Preferred Alternative?

According to the USFWS:

the Endangered Species Act (ESA) directs all Federal agencies to participate in endangered species conservation. Specifically, Section 7 of the ESA charges Federal agencies to aid in the conservation of listed species (Section 7 (a)(1)), and requires Federal agencies to ensure that their activities are not likely to jeopardize the continued existence of listed species or adversely modify designated critical habitats (Section 7 (a)(2)).<sup>164</sup>

<sup>164</sup> USFWS, “Consultations with Federal Agencies: Section 7 of the Endangered Species Act,” <http://www.fws.gov/endangered/factsheets/consultations.pdf> ( May 20, 2008)



The USFWS, or NOAA Fisheries in the case of anadromous and diadromous marine species, determines whether a species should be federally protected 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 jeopardize the continued existence of 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.

### *3.15.3.1 What Threatened and Endangered Species may occur within the Preferred Alternative study corridor?*

USFWS maintains a list of the threatened and endangered species for each state. Those species known to occur or possibly occur in Dillon and Marlboro Counties in South Carolina, and Richmond and Scotland Counties in North Carolina, are shown in Table 3.55. The list for South Carolina was last updated by USFWS in March of 2008, while the North Carolina list was last updated in January 2008.

### *3.15.3.2 How could Threatened and Endangered Species be affected by the proposed project?*

Typically, federally protected species require specific conditions to sustain them. Those conditions, or requirements, are well documented for protected species. A literature search was performed to determine habitat requirements and to find descriptions of the federally protected species that would aid in identification 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.

## 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.**



**Table 3.55**  
**Federally protected Species in Dillon County and Marlboro County, South Carolina, and Richmond County and Scotland County, North Carolina**

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	COUNTY
<b>Plants</b>			
American chaffseed	<i>Schwalbea americana</i>	Endangered	Scotland
Canby's dropwort	<i>Oxypolis canbyi</i>	Endangered	Marlboro, Scotland
Michaux's sumac	<i>Rhus michauxii</i>	Endangered	Richmond, Scotland
Rough-leaved loosestrife	<i>Lysimachia asperulifolia</i>	Endangered	Richmond, Scotland
<b>Animals</b>			
American alligator	<i>Alligator mississippiensis</i>	T/SA*	Scotland**
Carolina heelsplitter	<i>Lasmigonia decorata</i>	Endangered	Richmond
Red-cockaded woodpecker	<i>Picoides borealis</i>	Endangered	Dillon, Marlboro, Richmond, and Scotland
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	Endangered	Dillon, Marlboro, and Richmond

Source: USFWS.

\* Threatened due to similarity of appearance.

\*\* Historical record - species last seen in the designated county over 20 years ago.

Intensive field surveys were conducted between September 2007 and May 2008 within a 600-foot-wide Preferred Alternative corridor concurrent with the wetland delineation. No federally protected species were found within or adjacent to the Preferred Alternative study corridor during the surveys.

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

### *American chaffseed*

American chaffseed (*Schwalbea americana*) is an upright perennial with a stem that is unbranched or only has branches at the base of the plant. It grows to a height of one to two feet, and has alternate, lance-shaped or elliptic 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 (raceme), with many stalked flowers concentrated on the upper



*American chaffseed*  
Williamsburg County, South Carolina  
Photo by Gordon Murphy

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, narrow capsules about a half-inch long, begin to mature shortly afterward in early summer.

American chaffseed is restricted to “savannas, sandhill-pocosin ecotones (in the uphill portions), mesic loamy-soil slopes or swales in sandhill longleaf pine woodlands,”<sup>165</sup> and “ecotonal areas between peaty wetlands and xeric sandy soils, and other open, grass-sedge systems.”<sup>166</sup> These specific habitat requirements are narrowed further by the plant’s fire-dependence.

According to the SCDNR and NCDENR databases, there are no known occurrences of American chaffseed within the Preferred Alternative study corridor, and suitable habitat for American chaffseed was not observed. Based on these findings, it is anticipated that the proposed project would not affect American chaffseed.

#### *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. Flowers of Canby’s dropwort are small (~0.1 inches across), with white petals and are arranged in compound umbels.

Canby’s dropwort favors the high water table, open canopy, and medium- to highly-organic soils found in pond-cypress savannas in Carolina bays dominated by grasses and sedges or the ditches next to these bays, or in borders and shallows of cypress-pond pine ponds and sloughs.

According to the SCDNR and NCDENR databases, there are no known occurrences of Canby’s dropwort within the Preferred



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

<sup>165</sup> Weakley, Alan S. 2006+ (draft). *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas*. Chapel Hill, NC: University of North Carolina, p. 489.

<sup>166</sup> Porcher, Richard D. and Douglas A. Rayner. 2001. *A Guide to the Wildflowers of South Carolina*. Columbia, SC: University of South Carolina Press, p. 249.

Alternative study corridor and suitable habitat for Canby's dropwort was not observed during the field investigations. Based on these findings, it is anticipated that the proposed project would not affect Canby's dropwort.

### *Michaux's sumac*

Michaux's sumac (*Rhus michauxii*) is a rhizomatous, densely hairy shrub, with erect stems from one to three feet in height. The compound leaves contain coarsely toothed, oblong to lance-shaped leaflets, and greenish-yellow to white flower clusters appear from April to June. The fruits, small dull red drupes typical of sumacs, are produced in the fall.

In the fall line sandhills region, Michaux's sumac is restricted to dry, slightly loamy, well-drained sites, which are scattered through longleaf pine/scrub oak/wiregrass woodlands. These sites are usually found in slight depressions, swales, or along lower slopes. In all of its habitats, the shade-intolerant plant depends upon some form of disturbance to maintain the open quality of its habitat. Historically, naturally occurring fires, usually lightning-set, provided such disturbance. However, in recent times the exclusion of fire has led to vegetative succession, eliminating the plant. Many occurrences of the plant are found in areas that are artificially disturbed, such as highway and railroad rights-of-way, powerline clearings, pine plantations, edges of cultivated fields, and other cleared lands.<sup>167</sup>



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

According to the SCDNR and NCDENR databases, there are no known occurrences of Michaux's sumac within the Preferred Alternative study corridor. Potentially suitable habitat for Michaux's sumac was observed within the Preferred Alternative study corridor in Richmond and Scotland Counties. However, special field investigations were conducted in these areas during the bloom period on May 15, 2008 to look for the plant and it was not found. Based on these findings, it is anticipated that the proposed project would not affect Michaux's sumac.

<sup>167</sup> NatureServe, NatureServe Explorer Website, <http://www.natureserve.org/explorer/servlet/NatureServe> (May 23, 2008).



### *Rough-leaved loosestrife*

Rough-leaved loosestrife (*Lysimachia asperulifolia*), more accurately called pocosin loosestrife, is a rhizomatous, perennial herb with slender stems to one or two feet tall. Whorls of three to four bluish-green leaves encircle the stem at intervals beneath the showy yellow flowers. The leaves are smooth, as Weakley states, “the leaves of *L. asperulifolia* are not rough; the common name ‘rough-leaf loosestrife’ is a misnomer.”<sup>168</sup> Flowering occurs from mid-May through June, with fruits present from July through October.

Rough-leaved loosestrife favors pocosins, especially on the edges (ecotones) between longleaf pine sandhills and pond pine pocosins. The soils in these areas are “moist, seasonally saturated sands or of shallow organic soils overlaying sand. It has also been found on deep peat in the low shrub community”<sup>169</sup> of Carolina bays.

It has been found in roadside depressions, firebreaks, and powerline rights-of-way adjacent to these pocosins. These habitats depend on naturally occurring fires to keep the understory clear, and when these fires are excluded, the shrubby understory growth increases in density and height, expanding to eliminate the open edges that it requires.<sup>170</sup>



*Rough-leaved loosestrife*  
Photo by Gulf South Research Corporation

According to the SCDNR and NCDENR databases, there are no known occurrences of rough-leaved loosestrife within the Preferred Alternative study corridor. Fire has been excluded from these areas so that herbaceous and shrubby vegetation is too dense in areas that may otherwise be suitable for this species. Suitable habitat for rough-leaved loosestrife was not observed within the Preferred Alternative study corridor during the field investigations. Based on these findings, it is anticipated that the Preferred Alternative would not affect rough-leaved loosestrife.

### *American alligator*

The American alligator (*Alligator mississippiensis*) is a primitive semi-aquatic reptile that reaches a length of 16 feet. It is typically olive green to brownish with light yellow-white cross bands on the body. Juvenile alligators have bright yellow bands on the body that fade with age.

<sup>168</sup> Weakley, Alan S. 2006+ (draft). *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas*. Chapel Hill, NC: University of North Carolina. Page 504.

<sup>169</sup> Beacham, Walton, et. al., editors. *Beacham's Guide to the Endangered Species of North America*. Vol. 5, 2001. Farmington Hills, MI: Gale Group.

<sup>170</sup> *Ibid.*



*American alligator*  
Jasper County, South Carolina  
Photo by Gordon Murphy

Alligators differ from the American crocodile, the only other native crocodylian species to the United States, in having a broader, rounded snout.<sup>171</sup>

American alligators are found in large river swamps, coastal impoundments, abandoned rice fields, ponds, and other bodies of freshwater, and occasionally brackish waters, in the Coastal Plain region of the Gulf and Atlantic states.

The American alligator was formerly listed as endangered, both on the federal and state lists, but recovered well enough to be de-listed in the 1980s. Today, its population is secure both regionally and globally, and it is currently listed as federally threatened by similarity of appearance to the American crocodile (*Crocodylus acutus*), which is restricted to extreme southern Florida and the Caribbean.<sup>172</sup>

The occurrence of American alligator is not well documented within the project study area. In North Carolina, the species occurrence is listed as “Historic” for Scotland County meaning the last sighting was documented 20 or more years ago. For the other counties, 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 that are located within the Preferred Alternative study corridor do not provide suitable habitat for the species. Based on these findings, it is anticipated that the proposed project would not affect the American alligator.

### *Carolina heelsplitter*

Carolina heelsplitter (*Lasmigonia decorata*) is a freshwater mussel with an ovate, trapezoidal, unsculptured shell that varies from greenish brown to dark brown in color, with faint, yellowish rays in younger specimens. The mussel feeds by filtering food particles such as plankton, algae, and bacteria from the water. To breathe, it filters oxygen from the water with its gills.<sup>173</sup>

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 was

<sup>171</sup> Martof, Bernard S., et.al. 1980. *Amphibians and Reptiles of the Carolinas and Virginia*. Chapel Hill, NC: University of North Carolina Press.

<sup>172</sup> *Ibid.*

<sup>173</sup> USFWS, North Carolina Ecological Services Website, “Carolina Heelsplitter in North Carolina Webpage,” <http://www.fws.gov/nc-es/mussel/carolheel.html> (May 23, 2008)



*Carolina heelsplitter*  
Edgefield County, South Carolina  
Photo by John Alderman

also found in millponds (impoundments of small streams) in its range. It burrows “in mud, muddy sand, or muddy gravel substrates along stable, well-shaped stream banks. The stability of the streambanks appears to be very important to this species.”<sup>174</sup>

In South Carolina, populations of the mussel have been found in the Savannah River drainage, the Saluda River drainage, and the Catawba River drainage well outside the project study area boundary. In the North Carolina Pee Dee-Yadkin River basin, which is traversed by the Preferred Alternative study corridor, the heelsplitter has been documented in one location, at Goose Creek in Union County near the city of Charlotte, North Carolina, which harbors a small and precarious population.<sup>175</sup> In South Carolina, the Lynches River and one of its tributaries, Flat Creek in Lancaster County contain a population. These drainages are 45 miles or more west and upstream of the Preferred Alternative study corridor.

According to the SCDNR and NCDENR databases, there are no known occurrences of Carolina heelsplitter within the Preferred Alternative study corridor, and suitable habitat was not observed during the field investigations. Based on these findings, it is anticipated that the proposed project would not affect the Carolina heelsplitter.

### *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 are almost impossible to spot in the field.<sup>176</sup>

Selected nesting habitat of the red-cockaded woodpecker is old-growth pine forest (stems at least 60 years old) that is relatively free of hardwood undergrowth. Suitable foraging habitat includes pine and pine hardwood stands with pine stems at least 30 years of age. Foraging habitat is contiguous with nesting habitat; therefore, colonies typically require areas of at least

<sup>174</sup> Beacham, Walton, et. al., editors. *Beacham’s Guide to the Endangered Species of North America*. Vol. 2, 2001. Farmington Hills, MI: Gale Group.

<sup>175</sup> USFWS, North Carolina Ecological Services Website, “Carolina Heelsplitter in North Carolina Webpage,” <http://www.fws.gov/nc-es/mussel/carolheel.html> (May 23, 2008)

<sup>176</sup> Potter, Eloise E., et. al. 1980. *Birds of the Carolinas*. Chapel Hill, NC: University of North Carolina.

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.<sup>177</sup>

According to the SCDNR and NCDENR databases, there are no documented red-cockaded woodpecker nest sites within the Preferred Alternative study corridor and suitable habitat was not observed during the field surveys. Based on these findings, it is anticipated that the proposed project would not affect the red-cockaded woodpecker.

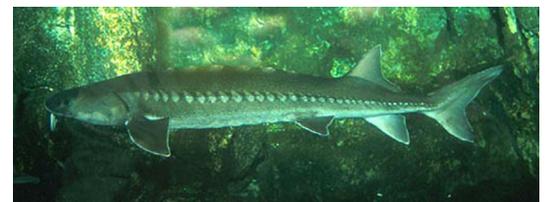


*Red-cockaded woodpecker*  
Sumter County, South Carolina  
Photo by Gordon Murphy

### *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 bony 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 shortnose sturgeon is shorter and blunter than that of the Atlantic sturgeon.

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 the life cycle typically occur in freshwater channels of large, unobstructed river basins from as far inland as the lower Piedmont 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



*Shortnose sturgeon*  
Photo by Johnny Jensen

<sup>177</sup> Henry, Gary V. 1989. *Guidelines for Preparation of Biological Assessments and Evaluations for the Red-cockaded Woodpecker*. USFWS Southeast Region.



bays of river basin deltas. In South Carolina, the drainage basins utilized for spawning and foraging are the Pee Dee/ Waccamaw, Santee, Cooper, ACE Basin (Ashepoo, Combahee, and Edisto rivers), and Savannah.<sup>178</sup>

According to the SCDNR and NCDENR databases, there are no known occurrences of shortnose sturgeon within the Preferred Alternative study corridor, and suitable habitat was not observed during the field investigations. The Great Pee Dee River, located west of the project study area, represents a suitable spawning migration corridor for the species. However, the tributaries to the Great Pee Dee River within the Preferred Alternative study corridor are not suitable for spawning migration. One occurrence of the sturgeon was documented in the Great Pee Dee River near the U.S. Route 74 bridge in the Pee Dee-Yadkin River basin in North Carolina, over 12 miles west of the Preferred Alternative study corridor.<sup>179</sup> Based on these findings, it is anticipated that the proposed project would not affect the shortnose sturgeon.

#### 3.15.4 What is the *Bald and Golden Eagle Protection Act*, and how would species protected under this Act be impacted by the Preferred Alternative?

The *Bald and Golden Eagle Protection Act*, enacted in 1940, makes it illegal to harass, disturb, poison, kill, buy, sell, or possess an eagle or any talons, feathers, eggs, or nests of eagles, including all eagle species native to the United States.<sup>180</sup> The U.S. Congress passed the Act after the noticeable reduction in the number of bald eagles (*Haliaeetus leucocephalus*), the nation's symbol, in the 1930s from overhunting and habitat fragmentation.<sup>181</sup> Protection under this Act was extended to other native eagle species, particularly the golden eagle (*Aquila chrysaetos*), in 1962.<sup>182</sup>

On July 9, 2007, a final rule was issued declaring that the bald eagle populations had recovered to the point that the species would be removed (de-listed) from the federal list of threatened and endangered wildlife on August 8, 2007.<sup>183</sup> After delisting, the *Bald and Golden Eagle Protection Act* (BGEPA) has become the primary law protecting eagles. However, bald and golden eagles are also protected under the *Migratory Bird Treaty Act* (MBTA) which is discussed in Section 3.15.5.

<sup>178</sup> SCDNR, "Sturgeon," <http://www.dnr.sc.gov/cwcs/pdf/Sturgeon.pdf> (May 23, 2008).

<sup>179</sup> North Carolina Division of Water Quality, 1998, Yadkin- Pee Dee River Basinwide Water Quality Management Plan, <http://h20/enr/state/nc/us/basinwide/yadkin/yadch2.doc> (May 23, 2008).

<sup>180</sup> 16 U.S.C. §668(a).

<sup>181</sup> Wisch, Rebecca F., Michigan State University, Animal Legal and Historical Center, "Overview of the Bald and Golden Eagle Protection Act," 2002, <http://www.animallaw.info/articles/ovusbgepa.htm> (June 2, 2008).

<sup>182</sup> *Ibid.*

<sup>183</sup> 72 F.R. 37346 (2007) (to be codified at 50 CFR Part 17).



*Bald eagle*  
Photo by Kevin Ebi

The bald eagle is the only eagle species documented to nest in the project study area. The bald eagle 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, and requires large trees with an open limb structure for nesting, usually in a forest/marsh ecotone within one kilometer (0.62 mile) of open water. Large trees allow bald eagles to build large nests that can support nesting for many years without falling, while the open limb structure provides easy access and a clear view of foraging habitat. Nesting habitats initially selected by eagles usually have limited 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 man-made reservoirs in South Carolina have provided many acres of new inland eagle foraging habitat. Concentrations of 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.

Bald eagles were known to nest at Lake Paul Wallace near Bennettsville, and these sites were buffered 0.25-mile during the development of alternatives to minimize impacts. According to the SCDNR and NCDENR databases, there are no documented bald eagle nest sites within the Preferred Alternative study corridor or within the 0.25-mile of the corridor. Potentially suitable foraging habitat observed within the Preferred Alternative study corridor consisted of farm ponds. While these ponds offer foraging opportunities for eagles, none were large enough to support a pair of eagles and no eagle nests or eagles were observed during the field investigations. Therefore, it is anticipated that the proposed project would not affect the bald eagle.

### 3.15.5 What is the *Migratory Bird Treaty Act*?

The *Migratory Bird Treaty Act of 1918* (MBTA) prohibits a person “to pursue, hunt, take, capture, kill,” or “possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner,” or attempting to do any of those things to any extent to a migratory bird,



migratory bird parts, nests, or eggs.<sup>184</sup> The MBTA includes a list of the protected species of birds that can be found in 50 C.F.R §10.13. The USFWS interpretation of migratory bird protection under the MBTA extends to structures and trees that are being actively used by migratory birds for nesting. It would therefore be illegal to destroy bird nests (including trees with nests) that contain eggs or young or to cause an adult to abandon its nest due to disturbances from any sort of construction. However, it is not illegal to remove nests that do not contain eggs or young, nor is it illegal to prevent birds from nesting during or prior to the construction period.



*White-throated sparrow*  
Photo by Gordon Murphy

Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, requires federal agencies to take actions to implement the MBTA.<sup>185</sup> Primarily these actions are to evaluate agency actions on migratory birds and to identify impacts with a measurable negative effect on migratory bird populations. If such impacts are identified, then the federal agency must mitigate the effects and consult with the USFWS prior to initiating the action.

#### *3.15.5.1 What are migratory birds, and which ones may potentially occur within the project study area?*

Migratory birds are those that fly long distances from their winter habitat to summer nesting grounds and back to their over-wintering grounds annually. Migration generally occurs in the spring and fall. Some species use areas temporarily as roosting and foraging habitat while on their way to more northern nesting or southern wintering grounds. These temporary residents are referred to as transients. The majority, however, utilize various areas not as seasonal stopovers, but as “long-term destinations”. These visitors stay for the winter (overwinter) or breed and nest in the summer months. The I-73 project study area is within the Atlantic Flyway, which is the migration route along the eastern seaboard of the United States used by waterfowl and other birds.<sup>186</sup> As a result, numerous migratory bird species can be found within the project study area at any given time of year. Examples of some of the more common species and when they are present are indicated in Table 3.56.

<sup>184</sup> 16 U.S.C. § 703.

<sup>185</sup> Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Bird*, 2001, <http://www.nepa.gov/nepa/regs/eos/eo13186.html> (June 2, 2008).

<sup>186</sup> USFWS, Conservation Library Website, [http://library.fws.gov/Pubs/atlantic\\_flywaymap%20\\_bw.pdf](http://library.fws.gov/Pubs/atlantic_flywaymap%20_bw.pdf) (June 4, 2008).



**Table 3.56**  
**Migratory Bird Species Potentially Occurring Within the Project Study Area**

HABITAT	WINTER RESIDENTS	SUMMER RESIDENTS
<b>WATER RELATED</b> (Marshes, Lakes, Rivers, Swamps, Bottomland Hardwoods, etc.)	American bittern Canada goose Mallard American black duck Gadwall Ring-necked duck Canvasback Lesser scaup Green-winged teal Common goldeneye Hooded merganser Northern harrier Bald eagle American coot Virginia rail Common snipe	Green heron Mississippi kite Acadian flycatcher Northern parula warbler Prothonotary warbler Louisiana waterthrush Kentucky warbler Hooded warbler
<b>FORESTED</b> (Mixed Woodlands, Pine Woodlands, etc.)	Yellow-bellied sapsucker Blue-headed vireo Brown creeper Red-breasted nuthatch House wren Winter wren Golden-crowned kinglet Ruby-crowned kinglet Hermit thrush Yellow-rumped warbler Fox sparrow White-throated sparrow Dark-eyed junco Purple finch Pine siskin	Broad-winged hawk Chuck-will's-widow Ruby-throated hummingbird Yellow-billed cuckoo Eastern wood pewee Great crested flycatcher Yellow-throated vireo Red-eyed vireo White-eyed vireo Blue-gray gnatcatcher Wood thrush Summer tanager Yellow-throated warbler American redstart Ovenbird
<b>OPEN</b> (Roadsides, Hedgerows, Farmlands, Fallow Fields, etc.)	Cedar waxwing American pipit Song sparrow Swamp sparrow Savannah sparrow Vesper sparrow Rusty blackbird American goldfinch	Cattle egret Common nighthawk Chimney swift Eastern kingbird Purple martin Rough-winged swallow Barn swallow Blue grosbeak Indigo bunting Orchard oriole Prairie warbler Yellow-breasted chat

Sources: Potter, Parnel, and Tueulings, *Birds of the Carolinas* and Peterson, R.T., *A Field Guide to the Birds of Eastern and Central North America*.



### 3.15.5.2 *What are the potential impacts of roadways to migratory birds?*

General threats to migratory bird species include habitat loss, habitat degradation, and to a lesser extent, habitat fragmentation. The construction of new roadways or the widening of existing ones can contribute directly or indirectly to these. Clearing forests for the construction of a new roadway results in a direct loss of habitat utilized by forest birds. However, brushy habitat created along the edges of right-of-ways generates nesting and foraging areas for forest birds as well as other species. Other direct impacts that could potentially occur to wildlife and birds are discussed in greater detail in Section 3.14.4, (refer to page 3-206).

### 3.15.6 *What is the Magnuson-Stevens Fishery Conservation and Management Act?*

According to the National Oceanic and Atmospheric Administration (NOAA) Fisheries, the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended, gives NOAA Fisheries the authority to regulate fisheries for long term sustainable use of United States marine resources. Specifically, the Magnuson-Stevens Act provides for the establishment of regional fishery management councils to work with NOAA Fisheries to describe and identify Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC).<sup>187</sup>

#### 3.15.6.1 *What is EFH and HAPC?*

According to NOAA Fisheries,

EFH can consist of both the water column and the underlying surface (e.g. seafloor) of a particular area. Areas designated as EFH contain habitat essential to the long-term survival and health of our nation's fisheries. Certain properties of the water column such as temperature, nutrients, or salinity are essential to various species. Some species may require certain bottom types such as sandy or rocky bottoms, vegetation such as seagrasses or kelp, or structurally complex coral or oyster reefs. EFH includes those habitats that support the different life stages of each managed species. A single species may use many different habitats throughout its life to support breeding, spawning, nursery, feeding, and protection functions. EFH encompasses those habitats necessary to ensure healthy fisheries now and in the future.<sup>188</sup>

<sup>187</sup> NOAA Fisheries, Office of Habitat Conservation's Habitat Protection Division website, "Essential Fish Habitat: Essential Fish Habitat" [http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/index\\_a.htm](http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/index_a.htm) (June 2, 2008).

<sup>188</sup> *Ibid.*



HAPC are areas within EFH “that provide extremely important ecological functions or are especially vulnerable to degradation. The HAPC designation does not confer additional protection or restrictions upon an area, but can help prioritize conservation efforts.”<sup>189</sup>

According to NOAA Fisheries, each regional fishery management council describes and identifies the EFH for their region. Approved Council EFH descriptions and identifications are available on each regional council’s web page. Federal agencies may use this information to determine if EFH will be impacted by an action, thereby requiring consultation with NOAA Fisheries Service. EFH includes “waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.”<sup>190</sup>

### *3.15.6.2 What EFH may occur within the Preferred Alternative study corridor and what direct impacts would occur to it as a result of this project?*

No designated EFH is located in the Preferred Alternative study corridor; therefore, no impacts would occur. The Great Pee Dee River was identified as spawning habitat for shortnose sturgeon, but this is at the western limits of the project study area, approximately 10 miles at the closest point from the Preferred Alternative. Some freshwater systems, such as Crooked Creek, a tributary to the Great Pee Dee River, may serve as nursery habitat for the sturgeon at its confluence with the Great Pee Dee River. The Preferred Alternative does cross several small tributaries to Crooked Creek at or near their headwaters, where they are wide freshwater marshes or narrow streamhead pocosins. However, these wetlands are not sufficiently deep to serve as nursery habitat for shortnose sturgeon.

Although no EFH would be crossed by the Preferred Alternative, NOAA Fisheries has expressed concern about diadromous fish species, such as the American eel, that may use the perennial tributaries to the Great Pee Dee and Little Pee Dee Rivers as habitat for juvenile and adult fish maturation or nursery habitat. As discussed in the Wetlands Section (refer to Section 3.12.9, page 3-174), hydrologic studies would be performed to determine where the use of pipes or box culverts would be appropriate. The installation of pipes or box culverts would require water body modification and could affect aquatic species movement. Where practicable, stream channels could be relocated outside of the fill limits of the roadway and cross pipes and culverts could be placed perpendicular to the roadway to reduce the length of pipe or culvert required. This would reduce the distance that aquatic species would have to travel through the structures. Additionally, pipe and culvert bottoms would be recessed below the bottom of the perennial stream channels to help maintain movement of aquatic species through the structure.

<sup>189</sup> NOAA Fisheries, Office of Habitat Conservation’s Habitat Protection Division website, “Essential Fish Habitat: What are habitat areas of particular concern?,” [http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/index\\_b.htm](http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/index_b.htm) (June 2, 2008)

<sup>190</sup> NOAA Fisheries, Office of Habitat Conservation’s Habitat Protection Division website, “Essential Fish Habitat: What is essential fish habitat?,” <http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/index.htm> (June 2, 2008)



### 3.15.7 What indirect and cumulative impacts may occur to federally protected species?

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, were evaluated for potential indirect 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 during the development of 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 species.

Potential development predicted by the land use modeling for the Preferred Alternative would encroach onto forested pinelands. However, much of these areas are similar to the forested pinelands within the footprint of the Preferred Alternative, which are managed timberlands. The trees are not mature enough, or the natural pine stands are not large enough, to support a colony of red-cockaded woodpeckers. In addition, 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 these 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 protected 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 protected 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.

The current widening of S.C. Route 38, the past construction of U.S. Route 74 and S.C. Route 22, and the future construction of the SELL project, S.C. Route 917 bridge replacements, the widening of S.C. Route 9/S.C. Route 38, and I-73 South could contribute to cumulative impacts to migratory bird habitat. Cumulative impacts to migratory birds may also result from the construction of cell towers along new roadways such as SELL and I-73 North and South. Studies indicate that migratory birds frequently collide with lighted cell towers taller than 200 feet and their guy wires when flying at night and during inclement weather when visibility is hindered. It is generally accepted that the birds are attracted to the red warning lights more so than white strobe lights on the towers during periods of low visibility.<sup>191</sup>

A review of the Federal Aviation Administration GIS data layer for potential aircraft obstructions and the Federal Communication Commission cell tower data layer indicates that there are 5 cell towers located within the I-73 North project study area, four of which are greater than 200 feet tall, all of these have red warning lights. The average cell tower height in the I-73 North project study area is 285 feet. In the I-73 South project study area there are 23 cell towers, 17 of which are greater than 200 feet in height. The average height of cell towers in the I-73 South project study area is 279 feet. Of these 17 towers, 13 have red lights, three have strobe lights, and one is unknown. Currently there are 143 other structures such as television and radio towers that are 200 feet or greater in height within the I-73 North and South project study areas that could affect migratory birds.

Measures recommended by the USFWS to minimize impacts to migratory birds due to cell towers include the following:

- Using existing structures instead of constructing new cell towers and design of new towers to accommodate multiple future antennas;
- Constructing towers less than 200 feet when possible; design new towers such that guy wires are not required;
- Clustering towers in areas outside migratory bird flight paths or in areas where fog and/or low cloud ceilings are common;
- Using the minimum number of lights as allowed by the FAA; use white strobe lights when possible; and,
- Removing towers that are no longer needed.

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<sup>191</sup> S.A. Gauthreaux and C.G. Belser, "The behavioral responses of migrating birds to different lighting systems on tall towers." *Remarks at 1<sup>st</sup> Conference of Avian Mortality at Communication Towers*, (Cornell University, Ithaca, NY August 1999).



There is the potential for cell towers to be constructed along the Preferred Alternative especially in the more rural areas. However, there is no way to predict how tall the towers would be or how many would be erected. Other direct impacts that could potentially occur to wildlife and birds are discussed in greater detail in Section 3.14.4, page 3-206. Although cumulative impacts to migratory birds may occur as the result of the construction of I-73, the FHWA is not required to mitigate for these impacts.

### 3.15.8 What are State Species of Concern, and which ones may occur within the project study area?

SCDNR and NCDENR maintain a list of plants and animals considered rare, threatened, and endangered in their respective states. The lists comprise species, beyond those federally protected, thought to have populations that are rare, declining, or of unknown status. The species are called “Species of Concern”. These lists do not carry the weight of law and so are used only as a conservation tool to assist in protection planning and to direct research and survey efforts. However, point locations of known state rare species were used as constraints during alternative development.

Table 3.57 (refer to pages 3-231 to 3-237) lists the state species of concern within the respective state, known to occur or possibly occur in the four counties within the project study area. Suitable habitat may be present in the Preferred Alternative study corridor for some of these species; however, according to the SCDNR and NCDENR, no known occurrences of state species of concern are located within the Preferred Alternative study corridor.



**Table 3.57**  
**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?
<b>PLANTS</b>					
<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 3.57, 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?
<b>PLANTS</b>					
<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 3.57, 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?
<b>PLANTS</b>					
<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 3.57, 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?
<b>PLANTS</b>					
<i>Rhynchospora tracyi</i>	Tracy's beakseed	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 daisy	S1	Clay-based Carolina bays and wet savannas.	Scotland	No
<i>Stylisma pickeringii</i> var <i>pickeringii</i>	Pickering's daisy	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 3.57, 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?
<b>PLANTS</b>					
<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
<b>ANIMALS</b>					
<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 3.57, 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?
<b>ANIMALS</b>					
<i>Collophrys 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 ephemereullan 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