

CHAPTER 3: SOUTH CAROLINA'S LANDSCAPE

Introduction

Atop Sassafras Mountain, the highest peak in the state of South Carolina, a visitor can catch a glimpse of the splendid vistas of this state from above 3,000 feet. Mountains to the sea, South Carolina has a wide diversity of habitats, environmentally important areas and scenic resources within the boundaries of its 19.9 million acres of land and water (USDA 2000). It is the diversity of the lands and waters of South Carolina that create the myriad environments for South Carolina's varied fish and wildlife.

Demographics and Economics

In 1790, South Carolina's total resident population numbered 249,073 people. According to data collected in 2003, the US Census Bureau estimated the population of South Carolina to be 4,147,152 people, a 3.4 percent increase from 2000. South Carolina saw a 15.1 percent population increase from 1990 to 2000. The average population density in this state is 133.2 people per square mile (US Census Bureau 2005).

Of the over 19 million acres of land in the state, seven percent (over 1.3 million acres) is publicly owned, while 93 percent (17,912,789 acres) is privately owned. The vast majority of the state is characterized as nonfederal rural lands ('nonfederal' referring to all lands in private, municipal, state or tribal ownership). Land use on nonfederal lands in the state, which total 18,115,500 acres, is primarily forestland. South Carolina saw a twenty percent increase in developed lands between 1992 and 1997 (USDA 2000) and continues to see similar rates of conversion in land use.

As of 2002, there were approximately 4.85 million acres in agricultural production in South Carolina (USDA 2003). In 1982 there were approximately 5.5 million acres in agricultural production which amounts to a 12 percent drop in twenty years. The average farm in South Carolina was approximately 197 acres in size in 2002; up two percent from an average of 193 acres in 1997 (USDA 2003) The market value of agricultural products sold in 2003 totaled over \$1.6 billion with top outputs in poultry, tobacco and greenhouse/nursery production. Counties in South Carolina with the highest agricultural yields in 2002 were Lexington, Kershaw, York, Dillon and Orangeburg (USDA 2003).

South Carolina is rich in non-fuel raw minerals with a total of over \$506 million produced in 1997 (US Department of the Interior 1998). The most common minerals produced in South Carolina are: cement, clays, gemstones, peat, sand, gravel and crushed stone. In 1997, South Carolina was the top producer of vermiculite, ranked fourth in masonry cement, sixth in common clays, third in kaolin, and fifth in crude mica. Portland cement and crushed stone was estimated at \$193 and \$155 million respectively for 1997.

According to results of the US Forest Service Forest Inventory Analysis (FIA) published in 2000, 12.3 million acres of land in South Carolina is forested (Conner and Sheffield 2000)

(Figure 3-1). Nonindustrial private owners, including individual and corporate timberland owners not associated with the forest product industry, own 74 percent of these lands. Timberland ownership under corporate control has increased in recent years to 19 percent or 2.0 million acres. The percentage of forests managed by the forest products industry has decreased 14 percent, from 2.3 million to 2.0 million acres over the FIA study period. Public land ownership increased to 1.2 million acres. Total softwood production increased 14 percent to 9.2 billion cubic feet while hardwood production increase just over 4 percent to 10.2 billion cubic feet.

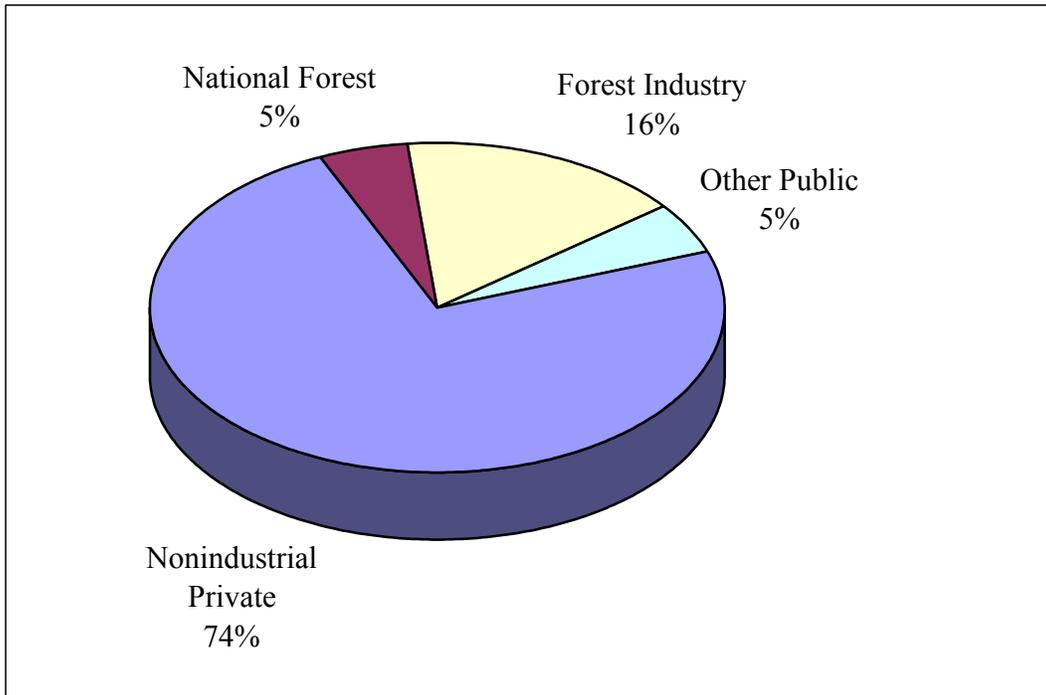


FIGURE 3-1: Distribution of forested land by ownership class in South Carolina (Conner and Sheffield 2000)

Climate

South Carolina has a humid subtropical climate. Average annual precipitation is about 49 inches per year with the coast receiving 48 to 50 inches while the Blue Ridge receives up to 80 inches per year. Average January temperatures range from 50 degrees near the coast to 38 degrees in the mountains; July temperatures average 81 near the coast and 71 in the mountains. The growing season ranges from 200 to 290 growing days. During the winter months, the state is typically under a continental air mass that is cold and dry, while during summer, the Bermuda high-pressure cell in the Atlantic drives much of the weather. Heat and humidity prevail when clockwise circulation around the Bermuda High brings a southerly flow of air from the Gulf of Mexico, a pattern that becomes rather stable as the mountains in the northwestern part of the state block any cool fronts which might arrive from the north.

The precipitation that falls in South Carolina is drained by four major river systems. All the streams and rivers that drain a region are collectively called a drainage basin. The drainage basins of South Carolina and the rivers involved are presented in Box 3-1.

BOX 3-1: MAJOR DRAINAGES OF SOUTH CAROLINA

- *Pee Dee River Basin* - Pee Dee, Lynches, Little Pee Dee, Black, Waccamaw and Sampit Rivers; drains 25 percent of South Carolina at the rate of 10.5 billion gallons per day.
- *Santee River Basin* - Santee, Congaree, Catawba-Wateree, Broad and Saluda Rivers; drains 34 percent of South Carolina at the rate of 7.5 billion gallons per day.
- *Ashley-Combahee-Edisto River Basin* - Ashley, Cooper, Edisto, Combahee, Coosawhatchie and New River; drains 26 percent of South Carolina at the rate of 5 billion gallons per day.
- *Savannah River Basin* - Savannah, Chattooga, Seneca, Little River, Stevens Creek, Rocky and Tugaloo Rivers; drains 15 percent of South Carolina at the rate of 8 billion gallons per day.

Introduction to South Carolina's Ecoregions

Many habitat types in South Carolina are strongly associated with certain geographic areas or physiographic regions within the state. Habitats in this strategy have been grouped according to five widely recognized regions, called "ecoregions" (Figure 3-1). The primary source of information on the ecoregions of South Carolina and surrounding states is the map and accompanying definitions from Griffith et al. (2002), with supplementary information for South Carolina taken from Myers et al. (1986). This chapter provides a summary of the general landscape and current condition of the five ecoregions of South Carolina. Further detailed descriptions of habitats, both terrestrial and aquatic, are provided in a separate volume, Supplement: Species and Habitat Accounts.

Habitat Classification

The principal source of information for terrestrial habitat definitions is Nelson's (1986) classification of South Carolina's natural communities. Since the viewpoint of Nelson's classification is primarily vegetation rather than wildlife, some exceptions are made. For instance, early successional upland habitat (grassland, shrubland, etc.) is extremely important to many species of wildlife. However, as a successional stage, it is not typically treated as a separate type of habitat as it is in the CWCS.

In addition, Nelson's treatment covers only terrestrial habitats, whereas many of the species covered in this plan occupy freshwater, estuarine or marine habitats. Techniques used to classify terrestrial habitats are often inadequate to describe aquatic or marine environments especially for habitats within the water column. For this strategy iteration, South Carolina habitats are divided into terrestrial, freshwater aquatic, and marine treatments. Terrestrial habitats include those found in the Blue Ridge, piedmont, sandhills and coastal plain ecoregions. Freshwater aquatics are classified by individual drainage basins and sub-basins, called ecobasins (see Table 3-1). Finally, all habitats influenced to any degree by saltwater are treated separately within marine descriptions.

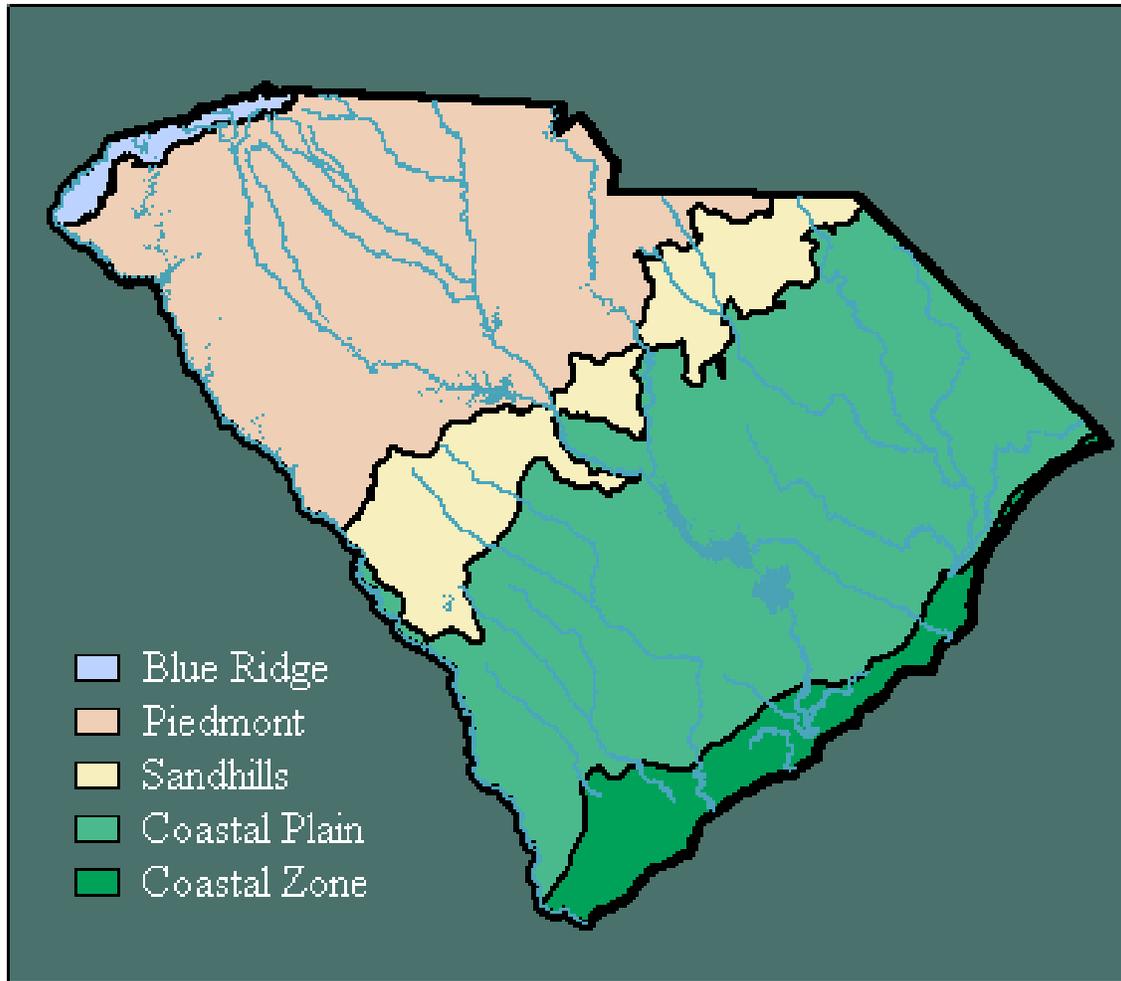


FIGURE 3-2: The five ecoregions of South Carolina. Source: Griffith et al. (2002). The Coastal Plain-Coastal Zone boundary is modified to conform to the legal delineation of the boundary between freshwater and saltwater zones for fisheries management purposes.

TABLE 3-1: Freshwater Aquatic Ecobasins by watersheds

Blue Ridge Watershed	Santee – Blue Ridge Ecobasin Savannah – Blue Ridge Ecobasin
Piedmont Watershed	Santee – Piedmont Ecobasin Savannah – Piedmont Ecobasin PeeDee – Piedmont Ecobasin
Southeastern Plains Watershed	Santee – Southeastern Plains Ecobasin Savannah – Southeastern Plains Ecobasin PeeDee – Southeastern Plains Ecobasin ACE – Southeastern Plains Ecobasin
Coastal Plain Watershed	Santee – Coastal Plain Ecobasin Savannah – Coastal Plain Ecobasin PeeDee – Coastal Plain Ecobasin ACE – Coastal Plain Ecobasin

Location Maps and Data

Ideally, information on the location and relative condition of the state's habitats would be available in the form of maps for all relevant habitats. Despite ongoing work by South Carolina's Gap Analysis Project to provide such a map from satellite-based vegetation data, the results available to date are not sufficiently accurate to provide the required information (Schmidt et al. 2001). Therefore, the descriptions of the locations and relative locations of habitats are mainly in narrative form, supported by maps and aerial photos of local areas where they are available and useful. These descriptions are included in the Supplemental Volume: Species and Habitat Accounts. An early implementation objective for the CWCS will be to make substantial improvements in the state's habitat mapping capabilities.

Blue Ridge Ecoregion

South Carolina's mountains are part of a multi-state region within the Southern Appalachians known as the Southern Blue Ridge Escarpment. The Escarpment forms an abrupt transition between higher mountains in adjoining states and the piedmont. High-gradient streams fed by high annual rainfalls carve the mountain landscape (Griffith et al. 2002). A portion of the region's northern boundary in South Carolina is formed by the Eastern Continental Divide, which provides resource managers with the rare opportunity of working with ecological and jurisdictional boundaries.

Beginning in the mid-twentieth century, a round of land consolidations began, which shifted ownership toward public and quasi-public purposes. In 1963, the Jocassee Gorges property was purchased by the Duke Power Company for hydropower development, a transfer that set the stage for the property's ultimate acquisition by the SCDNR in 1998. Other significant transfers in modern times include: Sumter National Forest, Pickens and Oconee Counties, Poinsett and Table Rock Reservoirs, Greenville County, Table Rock, Jones Gap and Caesars Head State Parks, and several acquisitions by the SCDNR. Comparison of public versus private ownership in the Blue Ridge is illustrated in Figure 3-3.

Although the Blue Ridge in South Carolina constitutes a small portion of the state's land area (328,500 acres or 1.69 percent of the total area), it supports the most extensive upland hardwood forest complex in the state. The region is rich in floral diversity, best expressed in the Mixed Mesophytic Forest vegetation community (Braun 1950), described as moist broadleaved forests that can harbor over 30 different tree species and many more types of fungi and ferns. Other biological resources unique to the region include a viable black bear (*Ursus americanus*) population extending across the North Carolina, Georgia and South Carolina state lines, sustained nesting of peregrine falcons (*Falco peregrinus*) following



FIGURE 3-3. Major public and private lands in conservation status in the Blue Ridge. Management practices vary according to agency missions and goals. Inholdings are not shown

reintroduction in the 1980s and self-sustaining populations of native brook trout (*Salvelinus fontinalis*).

Overstory, understory, shrub and herbaceous plant communities of the Blue Ridge are generally related to topography, elevation, slope, soil type and other particular aspects of a site (Abella 2002). A few specialized habitat types, such as bogs or rock faces, are present due to unique geological formations. Habitat types in the region generally blend from one type to the next with the rare abrupt transition. Because of this integration of communities, very few animal species are strictly associated with any single habitat type. Species-habitat associations are presented in Appendix 7: Terrestrial Species Associations and described in more detail in the species and habitat accounts found in Supplemental Volume: Species and Habitat Accounts.

At higher elevations, the present Blue Ridge landscape consists of large tracts of unbroken forest. Overall condition of the forest trends toward mid-successional; both early- and late-successional ("old growth") stages tend to be lacking in the Blue Ridge. Major biological changes to forest community composition within historic times include removal of the American chestnut (*Castanea dentata*) as the dominant canopy tree species, removal of the Eastern cougar (*Felis concolor*) as the top predator and extinction of the Carolina parakeet (*Conuropsis carolinensis*).

Forest condition and age on public lands varies with ownership. Although the Sumter National Forest is managed under a multiple-use approach, recent legal challenges have significantly altered forestry operations. Current plant community composition on the National Forest is primarily a mixture of mid-successional pine-hardwood stands and managed pine-dominated stands of various ages. The SCDNR-owned Jocassee Gorges tract was heavily logged before acquisition by the SCDNR and US Forest Service was completed in 1998. Greenville Watershed and SC PRT lands have a long history of passive management.

Fire management practices also occur variably across the region, ranging from regular use of prescribed fire on the Sumter National Forest to total fire exclusion on Greenville Watershed and SC PRT lands. Current burning practices are contradictory to historic descriptions of widespread wildfires that created relatively open forest stands with sparse woody understory vegetation (Brose et al. 2001).

Habitats at lower elevations in the Blue Ridge are ecologically similar to those of the adjoining Piedmont Ecoregion. Settlement and land use patterns at these elevations are also similar to those of the piedmont; most land is in private ownership and, as such, land uses have become highly fragmented with agriculture, managed woodlands and residential uses separating tracts of natural forests. Further, many historic farming communities are undergoing rapid development as land values are increase rapidly. Amenities such as Highway 11, a scenic highway running along the base of the escarpment, SC PRT properties and Lakes Keowee and Jocassee contribute to the Blue Ridge region's popularity for recreation and development.

TABLE 3-2: Summary and brief description of habitat types found in the Blue Ridge Ecoregion

Habitat Type	General Description and Location
Appalachian Oak & Oak-Pine Forest.	Important to wildlife as the most extensive cover type in the region; vegetation composition and structure highly variable.
High-elevation Forest.	Limited in SC to the highest peaks; supports numerous species at their Southern range limits.
Moist or wet types due to unique landform	Wet places embedded within primary habitat types such as spray zones at the bases of waterfalls, waterslides, and bogs.
Vertical or Horizontal Rock Outcrop	Open rock faces ranging from nearly horizontal to nearly vertical, embedded within primary habitat types.
Riverbanks, Stream-banks, and Alder Zones	Restricted to scattered locations on relatively stable alluvium, generally along larger, lower-gradient streams; supports several riparian wildlife species.
Basic Mesic Forest	Well-developed hardwood forest on rich sites; limited in extent; important habitat for certain priority species. Equivalent to the Mixed Mesophytic Forest of Braun (1950).
Acidic Mesic Forest	Dominated by hemlock and rhododendron; common along streams and lower slopes; key habitat for wildlife species associated with riparian habitats.

Piedmont Ecoregion

The Piedmont Ecoregion occupies a hundred-mile-wide area between the Southern Blue Ridge Escarpment and the Sandhills Ecoregion. The northwestern boundary is generally considered to be the base of the Blue Ridge Escarpment; the division between the crystalline rocks of the piedmont and the sedimentary rocks of the sandhills represents the southeastern boundary of this ecoregion. The piedmont-sandhill contact zone is marked in many river channels by shoals and rock ledges that collectively form the “fall line.” Gently rolling hills with many stream-cut valleys characterize the region with only a few level floodplains. In the lower piedmont, there are relatively few sharp breaks in topography except along major river valleys.

A considerably smaller portion of forestland is in public ownership in the piedmont than in the Blue Ridge region. The U.S. Forest Service is the primary agent of land protection in the piedmont, with two large Ranger Districts of the Sumter National Forest, the Long Cane and the Enoree, located within the region. Most of the land in the piedmont is held by corporate or other private ownerships not associated with the forest product industry (Conner and Sheffield 2000).

To a greater degree than in other regions, the vegetation in the piedmont has been altered by human activity. Cotton agriculture changed much of the original hardwood and shortleaf pine (*Pinus echinata*) forests into fields. Subsequently, fields eroded due to poor agricultural practices, often losing all topsoil. By the 1930's, various factors including the Great Depression and boll weevil outbreaks as well as severe erosion led to widespread farmland abandonment. Although agricultural practices improved while farming declined during the 20th century, floodplain sediments persist, overlying former piedmont wetlands. These wetlands probably featured numerous depressions of swamp tupelo (*Nyssa biflora*) and Willow oak (*Quercus*

phellos) that served as natural ‘green-tree reservoirs’ for ducks and other wildlife (Ron Ahle, SCDNR, pers. comm.). Loblolly pine (*Pinus taeda*) was introduced to the piedmont during the nineteenth century as a cash lumber crop; this pine now dominates much of the region.

TABLE 3-3: Summary and brief description of habitat types found in the Piedmont Ecoregion

Habitat Type	General Description & Location
Upland Forest	Oak & hickory-dominated forest with dominant & associated tree species varying with position on slope and soil moisture. This is the primary potential vegetation type on the Piedmont. On a majority of sites it exists mostly in closed canopy pine-dominated stages that are not suitable habitat for many priority species.
Piedmont Small Stream Forest River Bottoms.(See Coastal Plain)	Hardwood-dominated forest occurring on narrow floodplains, includes elements of Coastal Plain River bottoms, although not as well developed as on the broader floodplains of the Coastal Plain. Included within the type are ponds immediately upland or within the floodplain that have some connectivity with the floodplain forest.
Cove Forest	Well-developed hardwood forests on scattered rich, generally small (<200 acre) sites, usually on protected bluffs in association with stream or river bottoms; important habitat for some priority species, notably amphibians.
Grassland & early Successional habitats (See Coastal Plain)	A variety of open-land habitats, including agricultural land, recently abandoned farmland, recently cleared land, and a matrix of managed open pine forest and grassland. Also included are golf courses and urban yards and open spaces. Generally occurs on upland sites, and the potential vegetation on most sites is Upland Forest.

Sandhills Ecoregion

The Sandhills Ecoregion is the inland portion of the coastal plain that borders the fall line. This ecoregion is frequently recognized as a physiographic province distinct from the coastal plain, although some researchers incorporate the sandhills within a broader area known as the “inner coastal plain.” The sandhills form a discontinuous belt of varying width of deep sands across the middle of the state (Porcher and Rayner 2001).

Pliocene and Pleistocene sands deposited up to ten million years ago by strong southwest prevailing winds form the top layer of the sandhills (Murray 1995). These sands are a very pure and high quality source of silica; they are mined throughout the sandhills, especially in Lexington County (Murray 1995). These deep sands have created a xeric environment that supports a distinctive type of vegetation dominated by longleaf pines (*Pinus palustris*) and turkey oaks (*Quercus cerris*). This fire-adapted community burns with a frequency interval of 5 to 10 years and may be one of the oldest communities of this type in the southeast (Wharton 1978).

Major brownwater rivers that cut their way through the sandhills on their way from the mountains and piedmont to the sea include the Lynches, Wateree, Congaree and Savannah Rivers. The North and South Forks of the Edisto River are the only major rivers that originate in the sandhills.

Deep sand ridges ranging from 300 to over 600 feet above mean sea level are one of the most striking and dominant features of the Sandhills. Ridge tops of pure Lakeland and Kershaw Sands, some up to 30 feet deep (Wharton 1978), support the most extreme xeric scrub communities of longleaf pine and turkey oaks. The sandy soils on the ridges, excessively drained with low available water capacity, are low in fertility due to rapid leaching and possess little to no leaf litter (Lawrence 1976). The drier sand ridges are suitable for agriculture only when managed through fertilization and irrigation. These ridges can support timber production, particularly of longleaf pine, which is well adapted to deep, dry sandy soils.

Fire is a dominant factor in the ecology of this region. Sandhills pine forests are a fire climax community; as such, these forests are dependent on frequent ground fires to reduce hardwood competition and to perpetuate pines and grasses.

Sand ridges that have more clay and silt mixed with sand support subxeric sandhill scrub vegetation and mesic pine flatwoods. Increased plant diversity is a result of the more moderate growing conditions. Due to the increase in leaf litter, fire is an important factor in the maintenance of the subxeric scrub forest and woodlands. These subxeric to mesic communities can grade into oak-hickory forests or, in the absence of fire, they may succeed to oak-hickory forests.

Rainwater rapidly percolates through the sand ridges until it reaches hardpan, at which point it moves laterally until emerging at the surface on side slopes or near the base of sand ridges. These natural seepage areas result in distinctive wetland habitats embedded within the xeric forests and woodlands. The community type that develops is determined by the amount of water, the position on the slope and, especially, by fire. In the absence of fire, this wetland habitat can be forested with longleaf or pond pines (*Pinus serotina*) growing over a dense evergreen pocosin-like shrub layer or, with frequent fire, it can be an open hillside herb bog. Seepage accumulating at the base of the sand ridges results in a saturated zone that supports a streamside pocosin forest.

Compared to the adjoining Piedmont and Upper Coastal Plain Ecoregions, upland forest cover in the sandhills is relatively unbroken. However, numerous cycles of pine removals and exclusion of fire have left a vast, rather monotonous forest cover on much of the landscape, consisting of small longleaf pines, turkey oak and other oaks such as scrub oak (*Quercus berberidifolia*). Forests in this condition are not only unsuitable habitat for the priority species considered in this Strategy, the prevalence of forest in this condition is a primary source of concern for priority species.

Considerable effort is being made by the forestry community to encourage production of saw timber-size longleaf pines and more liberal application of fire. Encouraged by successful efforts to restore the red-cockaded woodpecker (RCW) (*Picoides borealis*) populations on public lands and extensive enrollment of private lands in the RCW Safe Harbor program, landowner interest in longleaf pine-wiregrass forest restoration seems to be increasing. Longleaf pine seedlings and technical guidance for establishing longleaf stands are also increasingly becoming more available.

Significant public land holdings in the sandhills include the US Army base Fort Jackson and the Army National Guard Leesburg Training Site; the Sandhills National Wildlife Refuge; Sandhills State Forest; major portions of the Savannah River Site; and Hitchcock Woods (operated by a private foundation). Although the impetus for conservation-oriented management on many of these facilities stems from the listing status of the RCW, the intended future condition of many forested tracts on these lands is a longleaf pine wiregrass community, with a significant portion of longleaf pine stands attaining older age classes.

TABLE 3-4: Summary and brief description of habitat types found in the Sandhills Ecoregion

Habitat Type	General Description & Location
Grassland and early successional habitats (See Coastal Plain)	Grasslands or early successional fields, with cover provided by grasses and/or weeds and with few, if any, trees. Also managed open areas such as meadows, pastures, golf courses, or expansive lawns with or without damp depressions.
Sandhills Pine Woodland	A complex of xeric pine and pine-hardwood forest types adapted to sandy soils. Principally in the Sandhills but also on fluvial sand ridges in the Coastal Plain. Absent frequent fire, a canopy of longleaf pine and a sub canopy of turkey oak prevails, interspersed with scrub oak species and scrub-shrub cover. Frequent burning leads to development of longleaf pine-wiregrass communities. On lower slopes sufficiently protected from fire, succession can proceed to oak-hickory forests similar to those of the Piedmont
Seepage Slopes	Steep slopes with a hard clay pan or fragipan below the sandy soil. Water percolating downhill is forced to the surface, which results in seasonally or permanently saturated soils. Vegetation is variable, depending on position on the slope, the amount of peat accumulation and fire history. Pond pine shrubland is representative, intergrading with fire-maintained hillside herb bogs on wetter seeps
Ponds and Depressions (See Coastal Plain)	A variety of permanently and semi-permanently flooded isolated freshwater wetlands, with open or closed canopy forest cover, including Depression Meadows, Pond Cypress Ponds, Swamp Tupelo Ponds, Pocosins, and Pond Pine Woodlands. Landforms include natural and artificial ponds dominated by cypress and/or swamp tupelo, and Carolina Bays.
Blackwater Stream Systems	Hardwood forests of narrow floodplains on tributary streams rising in the sandhills and coastal plain, supporting variants of bottomland hardwood and cypress-tupelo swamps. Headwaters and wet flats immediately above the floodplain can support dense, pocosin-like shrub thickets, or under suitable fire conditions, pure stands of Atlantic white cedar.
River Bottoms (See Coastal Plain)	Hardwood-dominated woodlands with moist soils that are usually associated with the floodplains of major rivers that dissect sandhills strata and form a floodplain on underlying sediments extending into the Coastal Plain. As in the coastal plain, characteristic trees include sweetgum, loblolly pine, water oak, willow oak, laurel oak, cherrybark oak, and American holly. The Cypress-tupelo swamp subtype occurs on lower elevation sites as seasonally flooded swamps. It is usually transected by tannic-acid rivers and creeks and contain oxbow lakes and pools. Dominant trees are bald cypress and water tupelo swamp gum, water elm and red maple .

Coastal Plain Ecoregion

The coastal plain is the largest ecoregion in South Carolina. Land elevation in this ecoregion begins at 270 to 300 feet at the inland boundary with the sandhills and reaches nearly to sea level at the coastal zone boundary. Although the Sandhills Ecoregion shares some of the geological history and physical features and is included in some definitions of the coastal plain, wildlife habitats in the two regions differ in some important respects. Therefore, the coastal plain and sandhills are treated as separate regions in the CWCS.

From a land use standpoint, the coastal plain consists of two significantly different landscapes. An inner belt is predominantly composed of cropland, with forest limited to small patches and hardwood “stringers” along creeks. An outer belt, sometimes called the “flatwoods” is primarily pine-dominated forest. Bisecting both belts are major floodplains, which are largely forested.

Eight major habitat types are defined for the coastal plain, of which six are either unique to the region or reach their greatest extent there. The predominant habitat types that most casual observers associate with the coastal plain are 1) grassland and early successional habitats, 2) pine woodland, and 3) river bottoms. Although the remaining types are less extensive, they provide habitat diversity that is important to a number of species, especially wetland species.

Grasslands or early successional fields include those with cover provided by grasses and/or weeds and with few, if any, trees. These sites also include managed open areas such as meadows, pastures, golf courses, or expansive lawns with or without damp depressions. These fields occur throughout the region; more extensively in the inner “agriculture belt.” Pine woodlands include all pine-dominated forests throughout the ecoregion. They include tracts that occupy a variety of soil moisture characteristics except floodplains. The canopy is dominated by one or several species of pine, generally loblolly (*Pinus taeda*), or longleaf (*Pinus palustris*), depending on elevation, soil type and silvicultural history. Dense shrub thickets of hollies (*Ilex* spp.) and wax myrtle (*Morella cerifera*) may be found throughout stands. Finally the river bottoms of the coastal plain include a variety of hardwood and hardwood-pine communities occupying the floodplains of small streams and infrequently flooded flats in association with streams or rivers. These flats are often characterized by the presence of American beech (*Fagus grandifolia*) and occur in scattered locations on sheltered sites with moist soils, particularly on north-facing river bluffs and on slopes of drains and creeks.

The coastal plain has been predominantly used for agricultural purposes since settlement by Europeans in the 18th century. Uplands and the better-drained terraces were cleared for fields at the same time that extensive longleaf pine and swamp hardwood forests on mesic and wet sites were cleared to supply timber, generally for export to the north. Several cycles of short-rotation pine forest were favored, along with agricultural practices that often provided substantial edge habitat for game species such as quail, but also deep woods or swamp habitat for deer, turkey, and waterfowl. By the late 20th century, economic conditions began to favor consolidation of land into larger holdings and the practice of clean field agriculture, along with shorter rotations of both upland and lowland timber. Extensive holdings in the flatwoods belt were also assembled as recreational hunting reserves and managed primarily for production of game species, with timber production to offset management expenses.

TABLE 3-5: Summary and brief description of habitat types found in the Coastal Plain Ecoregion

Habitat Type	General Description & Location
Grassland and early successional habitats	Grasslands or early successional fields, with cover provided by grasses and/or weeds and with few, if any, trees. Also managed open areas such as meadows, pastures, golf courses, or expansive lawns with or without damp depressions. Occurs throughout the region; more extensively in the inner “agriculture belt.”
Pine Woodland	Includes all pine-dominated forests throughout the region, including those occupying a variety of soil moisture characteristics except floodplains. The canopy is dominated by one or several species of pine, generally loblolly (<i>Pinus taeda</i>), or longleaf (<i>Pinus palustris</i>), depending on elevation, soil type and silvicultural history. Dense shrub thickets of hollies (<i>Ilex</i> spp.) and wax myrtle (<i>Morella cerifera</i>) may be. Higher elevation Pine Woodlands have abundant grasses and herbs, particularly when burning is frequent.
Sandhill Pine Woodland (See Sandhills)	A complex of xeric pine and pine-hardwood forest types adapted to sandy soils. Occurs principally in the Sandhills but also on fluvial sand ridges in the Coastal Plain. Absent frequent fire, a canopy of longleaf pine and a subcanopy of turkey oak prevails, interspersed with scrub oak species and scrub-shrub cover. Frequent burning leads to development of longleaf pine-wiregrass communities.
Upland Forest (See Piedmont)	Forests dominated by hardwoods, primarily with oaks and hickories, and typically on fire-suppressed upland slopes near river floodplains or between rivers and tributaries. Vegetation composition is similar to oak-hickory forest in the Piedmont, where it is a major vegetation type. Upland forest is rare in the Coastal Plain. It Intergrades with River Slopes and is lumped with this type for species treatments (see below). Representative canopy trees are: white oak (<i>Quercus alba</i>), black oak (<i>Quercus velutina</i>), post oak (<i>Quercus stellata</i>), mockernut hickory (<i>Carya tomentosa</i>), pignut hickory (<i>Carya glabra</i>), loblolly pine (<i>Pinus taeda</i>), flowering dogwood (<i>Cornus florida</i>) and black gum (<i>Nyssa sylvatica</i>).
Ponds and Depressions	A variety of permanently and semi-permanently flooded isolated freshwater wetlands, with open or closed canopy forest cover, including Depression Meadows, Pond Cypress Ponds, Swamp Tupelo Ponds, Pocosins, Limestone Sinks and Pond Pine Woodlands. Landforms include natural and artificial ponds dominated by cypress and/or swamp tupelo, limestone sinks, and Carolina Bays. Occur extensively throughout the region, more extensively in the outer “Atlantic Coast Flatwoods” belt.
River Bottoms	Hardwood-dominated woodlands with moist soils that are usually associated with major river floodplains and creeks. May contain small creeks or pools and may be seasonally flooded. Characteristic trees include: sweetgum (<i>Liquidambar styraciflua</i>), loblolly pine (<i>Pinus taeda</i>), water oak (<i>Quercus nigra</i>), willow oak (<i>Quercus phellos</i>), laurel oak (<i>Quercus laurifolia</i>), cherrybark oak (<i>Quercus pagoda</i>) and American holly (<i>Ilex opaca</i>). In the Southern coastal counties on drier sites, spruce pine (<i>Pinus glabra</i>) may be an associate. The Cypress-tupelo swamp subtype occurs on lower elevation sites as seasonally flooded swamps. It is usually transected by tannic-acid rivers and creeks and contains oxbow lakes and pools. Dominant trees are bald cypress (<i>Taxodium distichium</i>) and water tupelo (<i>Nyssa aquatica</i>), swamp gum (<i>Nyssa biflora</i>), Carolina ash (<i>Fraxinus caroliniana</i>), water elm (<i>Planera aquatica</i>) and red maple (<i>Acer rubrum</i>).

Habitat Type	General Description & Location
<p>River Slopes and Stream Bottoms</p>	<p>A variety of hardwood and hardwood-pine communities occupying the floodplains of small streams and infrequently flooded flats in association with streams or rivers. Several mixed mesophytic subtype characterized by the presence of American beech occur in scattered locations on sheltered sites with moist soils, particularly on north-facing river bluffs and on slopes of drains and creeks. The calcareous cliff and marl forest subtype occurs on circumneutral soils derived from limestone or unconsolidated calcareous substrates such as marl.</p>

Coastal Zone and Marine Ecoregion

The coastal zone is that portion of the lower coastal plain that lies seaward of US Highway 17. This region includes a small portion of the mainland, but is primarily comprised of tidal marshlands and associated uplands that include large sea islands that are greater in size than 1,000 acres (404.69 hectares) and extends eastward to include barrier islands, Atlantic Ocean beaches and the Atlantic Ocean shallow continental shelf offshore to South Carolina’s 4.8-kilometer (3-mile) jurisdictional boundary. The lower approximately 32 to 48 kilometers (20 to 30 miles) of all of the State’s coastal rivers is included in the coastal zone.

The inland boundary of the coastal zone is somewhat arbitrary relative to mainland habitats, but is particularly relevant to riverine and alluvial habitats since Section 50-5-80 of the Code of Laws of South Carolina establishes boundaries for fresh and ‘marine’ waters that generally are associated with US Highway 17. These boundaries were established primarily for wildlife law enforcement concerns related to the enforcement of freshwater and marine fishery laws and regulations. The actual point at which riverine waters change from fresh (less than 0.5 parts per thousand salt) to brackish or ‘marine’ (greater than 0.5 parts per thousand salt) is highly variable, even daily, depending on the combined impacts of tides and river discharge as determined by rainfall or water releases from dams. During each approximately six-hour tide cycle from maximum ebb or low tide to maximum flood or high tide, the point of change from fresh to slightly brackish water may move several miles upriver, only to return downriver during the next ebb tide period.

The coastal zone contains the most diverse myriad of habitats of any of the ecoregions of the state and is treated somewhat separately from the other ecoregions because of this complexity. Many habitats within the region that are very important to wildlife species are completely dependent upon the influence of salt water and direct management action, such as coastal impoundments. In some cases it was inappropriate to classify the habitats solely based on vegetation. Further detail on habitats within the ecoregion are included in the Supplemental Volume: Species and Habitat Accounts.

Diverse forest types are distributed throughout the extreme eastern portion of the lower coastal plain mainland that is adjacent to estuaries and tidal river basins. Due to this proximity, large coastal zone islands, including barrier islands, sea islands and many hammock islands, also support forested habitats very similar to those found in the lower coastal plain. Forested habitats distributed within both the coastal zone and coastal plain include the following: bottomland hardwood, pine woodland, oak-hickory or hardwood dominated, mixed mesic hardwood and bald cypress-tupelo gum swamp. Larger landmasses within the coastal zone also contain

grassland and early successional habitats and wet flatwood. Ponds and depressions, or wetlands isolated from tidal waterways, occur in the coastal zone as well, including interdune ponds that are restricted to dune systems along the Atlantic Ocean beaches.

Much of the South Carolina coastal zone ecoregion has been affected by human population growth and associated development. By the early 1990’s, about 50 percent of the total United States’ human population lived in coastal areas (Moore et al. 1995); the trend of concentrated growth along coasts is expected to continue into the next century (Cullitan et al. 1990). About 88 miles (48.6 percent) of South Carolina’s beachfront is currently developed (Kana 1988). The high concentration of human population growth and development in the coastal zone has fragmented forests and reduced other valuable habitats, such as shrub thickets and isolated wetlands.

TABLE 3-6: Summary and brief description of habitat types found in the Marine and Coastal Zone Ecoregion

Habitat Type	Habitat Definition
Forested Habitats of the Coastal Plain	Typical Coastal Plain pine and hardwood forests that extend into the Coastal Zone, sometimes with variations due to coastal influences or land management practices peculiar to the Coasts: Included Pine Woodland, Bottomland Hardwoods, Upland Oak-hickory forest, Southern Mixed Hardwood Forest, Marl Forest and Calcareous Cliff, and Cypress-tupelo swamp types. Cypress-tupelo swamps within the Coastal Zone may be influenced more by tidal activity than by river flows, but the water is typically fresh or nearly so. Cypress-Tupelo swamps may also be isolated from rivers and may be remnants of relict ricefield reserves.
Maritime Forest	Forests of the immediate Coastal Zone and typically occurring on barrier islands and immediately inland of dune systems and the Atlantic Ocean coast. Characteristic trees include live oak, laurel oak, cabbage palmetto, southern magnolia and southern red cedar. These evergreen-dominated forests are salt-tolerant and often support shrub thickets with yaupon holly, red bay and wax myrtle.
Early successional habitats of the Coastal Plain	Typical Coastal Plain upland grasslands or early successional fields extending into the Coastal Zone, with cover provided by grasses and/or weeds and with few, if any, trees. Also Meadows, pastures, golf courses, or expansive lawns with or without damp depressions.
Ponds & Depressions	Isolated wetlands including both natural and manmade ponds, pools, ditches and depressions. Some pools, called vernal pools, hold water only temporarily or seasonally vernal pools. Depression pools may occur in low areas or depressions. Interdune ponds are associated with Atlantic Coast beach dune systems. This is a highly variable habitat group in both water quality and vegetation. Such isolated wetlands may be imbedded within forest or other upland habitats.
Managed Impoundments	Impounded marshlands that are generally relict ricefields. Most of such impoundments are managed for waterfowl. Water quality, seasonality of water coverage and vegetation type are dependent upon management activity. Relict impoundments with breached or eroded, nonfunctional dikes are considered tidal marshlands.
Tidal Fresh and Brackish Systems	A complex of marshlands, sandbars, mud flats, sand flats, and waterways that are subject to mixing of salt and freshwater flows, usually in association with a freshwater source such as a river delta. Marsh vegetation is predominantly grasses, sedges and herbs with few trees; species makeup depends on salinity. Submerged vegetation may occur as well.

Habitat Type	Habitat Definition
Estuarine systems	A complex of marshlands, exposed flats of sand and/or mud, and tidal creeks that make up the coast’s estuarine zone. Smooth cordgrass (<i>Spartina alterniflora</i>) is the dominant marsh plant, with black needlerush (<i>Juncus roemerianus</i>) and various shrub species occupying zones of slightly higher elevation and lower salinity. Salt flats vegetated with various salt-tolerant plant species are interspersed throughout the marsh. Oyster Bars or reefs composed primarily of live and dead eastern oysters occur throughout, usually in flats between tidal channels and salt marsh.
Isolated nonforested uplands	Generally small islands of mostly sand and isolated within sounds and bays or inlets. ‘Inlet islands’ usually have beaches and variably developed dune systems. ‘Bay islands’ are more protected from salt spray and wave action and may support slat-shrub plants. Can include manmade or man-altered islands with dikes to contain dredged material. Can also include sandbars and shell rakes that are at least partially exposed during all tide cycles and river stages, except under unusually high tides or flows. More stable sandbars may be partly colonized by grasses and shrubs.
Hammock Island	Vegetated islands within tidal marshlands that are <1000 acres in size. These islands, and particularly larger islands of higher elevation and variable topography, often support diverse habitat types, including isolated low-salinity wetlands.
Ocean beaches and transition zones	That portion of the Atlantic Ocean beach dune system vegetated by grasses and herbs or by a maritime shrub thicket. Dune habitat includes sand dunes and swales, flats and pools between dunes and between dunes and other features. Characteristic plants include sea oats, bitter panicgrass, seabeach evening primrose and dune waterpennywort. Seaward of the dune system, sandy flats may occur in areas where dunes have been eroded. These areas are influenced by windblown salt spray and sand and may be occasionally flooded, particularly during storms.
Marine Ecosystem	Habitats directly influenced by Atlantic Ocean seawater, including the intertidal beach, the surf zone, and the waters, sediments and structures of the Atlantic continental shelf extending offshore to the 3-mile State territorial limit. The surf zone, or submerged portion of the beach area is heavily influenced by turbulence from wave action. . Seaward of the surf zone, the shallow shelf is composed of soft bottom, live (hard) bottom and pelagic (water column) habitats.
Man-made structures	Submerged structures including piles, jetties and artificial reefs. In estuarine and fresh and brackish systems, a broad variety of manmade items may occur in submerged or intertidal areas and/or extend above the water