

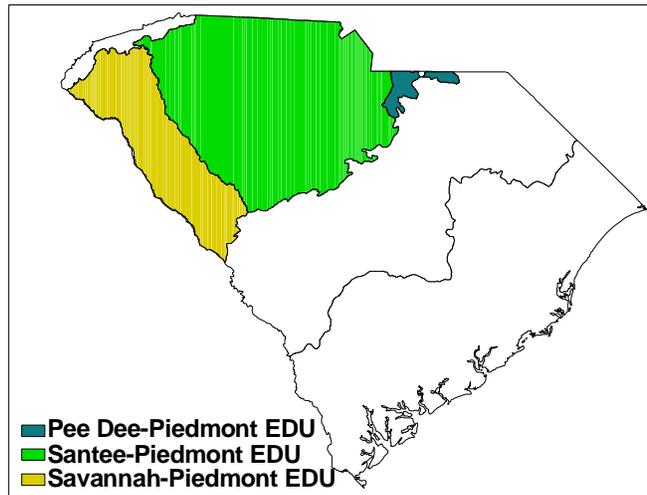
Piedmont Ecoregion Aquatic Habitats

Description and Location

The piedmont ecoregion extends south of Blue Ridge to the fall line near Columbia, South Carolina and from the Savannah River east to the Pee Dee River.

Encompassing 24 counties and 10,788 square miles, the piedmont is the largest physiographic province in South Carolina. The piedmont is an area with gently rolling hills dissected by narrow stream and river valleys. Forests, farms and orchards dominate most of the land. Elevations range from 375 to 1,000 feet. The

Piedmont Ecoregion cuts across the top of three major South Carolina drainages, the Savannah, the Santee and the Pee Dee, forming three ecobasins: the Savannah-Piedmont, Santee-Piedmont and Pee Dee-Piedmont.



Savannah-Piedmont Ecobasin

The Savannah River drainage originates in the mountains of North Carolina and Georgia. The Savannah River flows southeast along the border of South Carolina and Georgia through the piedmont for approximately 131 miles on its way to the Atlantic Ocean. Major tributaries to the Savannah River in the South Carolina portion of this ecobasin include the Tugaloo River, Seneca River, Chauga River, Rocky River, Little River and Stevens Creek.

The ecobasin encompasses 36 watersheds and approximately 2,879 square miles. The vast majority of the land is privately owned with only 239 square miles protected by federal, state and private entities. Most of the protected land (192 square miles) occurs in Sumter National Forest. The ecobasin contains 3,328 miles of lotic habitat with 143 square miles of impoundments. Most of the impounded water occurs in four large reservoirs, Lake Keowee (17,010 acres), and the South Carolina portions of Lake Hartwell (35,187 acres), Lake Russell (15,207 acres) and Thurmond Reservoir (21,297 acres).

Primary conservation targets within the ecobasin include the Stevens Creek watershed in Greenwood and McCormick Counties, the Turkey Creek watershed in Edgefield County and the mainstem Savannah River in Edgefield and Aiken Counties (Smith et al. 2000). The Stevens Creek and Turkey Creek watersheds are home to several mussels on South Carolina's Priority Species List including the brook floater, yellow lampmussel, creeper and the federally endangered Carolina heelsplitter. At least 13 priority fish species are also found in this ecobasin, including the Christmas darter, redeye bass, Savannah darter and turquoise darter. The mainstem of the Savannah River in Edgefield and Aiken Counties is home to the robust redhorse and federally endangered shortnose sturgeon as well as several other priority fish species. Several

priority mussel species (barrel floater, pod lance, Roanoke slabshell, yellow lampmussel, reyed pink fatmucket and Savannah lilliput) are also found in the mainstem Savannah River.

Santee-Piedmont Ecobasin

The upper Santee River drainage originates mostly in the south central piedmont of North Carolina, but receives some input from the mountains of South Carolina and North Carolina through the Saluda and Catawba River systems, respectively. The Broad River and Catawba-Wateree Rivers are the dominant rivers in this ecobasin. The Broad River flows nearly directly south from North Carolina to Columbia, South Carolina where it merges with the Saluda River at the fall line to form the Congaree River. As the Broad River flows south, it picks up inputs from the Pacolet River, Tyger River and Enoree River along the western portion of the drainage and Kings Creek, Turkey Creek, Sandy River and Cedar Creek from the eastern portion of the drainage. The Catawba River originates on the eastern slope of the Blue Ridge in North Carolina and flows through the inner piedmont and Charlotte, North Carolina before entering South Carolina. The Catawba flows south through South Carolina until it is impounded to form Lake Wateree and thereafter is known as the Wateree River. The Wateree River continues to flow south through the southeastern plains until it merges with the Congaree River to form the Santee River.

The Santee-Piedmont Ecobasin is the largest in the state, containing part or all of 84 watersheds and encompassing 7,604 square miles. The ecobasin contains approximately 7,161 miles of stream habitat and nearly 160 square miles of impoundments. Most of the impounded area (127 square miles) is the result of five large reservoirs, including Lake Greenwood (9,957 acres) and Lake Murray (48,417 acres) on the Saluda River, Monticello Reservoir (6,644 acres) on the Broad River, and Lake Wylie (5,067 acres) and Wateree Lake (11,386 acres) on the Catawba-Wateree River.

Most land in the ecobasin is privately owned with only 298 square miles protected by state, federal and private entities. Most of the protected land (251 square miles) occurs in the Sumter National Forest. Other significant protected areas include the Croft State Natural Area (10.7 square miles), Kings Mountain State Park (9.6 square miles) and the Kings Mountain National Military Park (6.0 square miles).

The Santee-Piedmont Ecobasin contains several areas of conservation priority (Smith et al. 2000). Conservation targets that contain rare, threatened and endemic species include: the Saluda River headwaters, which encompass the North Saluda River, South Saluda River and Oolenoy River watersheds located in the inner piedmont of Greenville and Pickens Counties; the Clouds Creek watershed in the Slate Belt ecoregion in Saluda County; the mainstem of the Broad River from the North Carolina line to Parr Shoals Reservoir in South Carolina; the Kings Creek watershed and the Clarks Fork system in the Bullocks Creek watershed located primarily in the Kings Mountain ecoregion in Cherokee and York Counties; the Sixmile Creek and Waxhaw Creek systems in the Twelvemile Creek watershed in Lancaster County; the Gills Creek system in the Camp Creek watershed in Lancaster County; and the Wateree Creek watershed in Richland County. The Saluda River headwaters contain populations of at least 13 priority fish species including redeye bass, turquoise darter and fantail darter. The Clouds Creek watershed

contains populations of at least five priority fish species including the Saluda darter as well as at least one priority mussel species (Savannah lilliput). The mainstem of the Broad River contains at least 17 priority fish species including several catostomids (notchlip redhorse, V-lip redhorse, quillback and highfin carpsucker) and percids (seagreen darter, fantail darter and Piedmont darter). The Kings Creek watershed and Clarks Fork system contain at least nine priority fish species including the fantail darter, the seagreen darter and the piedmont darter. The Sixmile Creek and Waxhaw Creek systems contain several priority mussel species including the notched rainbow, Carolina creekshell and the federally endangered Carolina heelsplitter. The Gills Creek system also contains Carolina creekshell and Carolina heelsplitter. The Wateree Creek watershed contains several priority fish species including the Carolina darter, the Piedmont darter and the seagreen darter.

Pee Dee-Piedmont Ecobasin

The South Carolina piedmont portion of the Pee Dee drainage originates just across the state line in North Carolina. The Pee Dee–Piedmont Ecobasin is the second smallest ecobasin in the state, encompassing only 276 square miles. Tributaries to the Pee Dee River included in the ecobasin are Lynches River and Thompson Creek. There are approximately 468 miles of stream habitat within the ecobasin and only 337 acres of impounded water. The only two protected areas are Forty Acre Rock Heritage Preserve (1,584 acres) and the Hanging Rock Battleground property (251 acres).

The majority of the ecobasin is a primary conservation target, including the Lynches River, Flat Creek and Little Lynches River systems in the upper Lynches River basin located in Lancaster and Chesterfield Counties as well as the Thompson Creek system in the upper Pee Dee basin in Chesterfield County. Several priority fish species occur in the upper Lynches River basin, including the “thinlip” chub, Sandhills chub, and “broadtail” madtom. In addition to those fish species several priority mussel species populate the basin including, the brook floater, creeper, notched rainbow and federally endangered Carolina heelsplitter. The Thompson Creek system contains several priority fish species (“thinlip”chub, Sandhills chub, fantail darter and Piedmont darter) as well as several species whose populations in South Carolina are entirely restricted to that system, including the satinfin shiner, redlip shiner and comely shiner.

General Condition

As of 1990, forests and farms dominated the land cover in the Piedmont Ecoregion. However, the vast majority of piedmont forests were cleared at some point during the last two centuries to develop crop and pasture lands. Most piedmont streams are now heavily silted due to the agricultural development of the piedmont’s modest slopes and highly erodible soils.

	Agriculture	Barren	Developed	Forest	Forested Wetland	Scrub	Water	Protected
Savannah	477.76 16.59%	24.33 0.85%	112.52 3.91%	1,693.92 58.83%	1.30 0.05%	421.86 14.65%	147.43 5.12%	8.31%
Santee	1,060.22 13.92%	39.25 0.52%	543.93 7.14%	5,133.38 67.41%	6.00 0.08%	641.15 8.42%	191.19 2.51%	3.91%
Pee Dee	69.77 25.30%	2.12 0.77%	2.40 0.87%	184.05 66.73%	1.64 0.59%	15.05 5.46%	0.77 0.28%	1.1%
Total area	1,607.75 14.93%	65.70 0.61%	658.85 6.12%	7,011.35 65.10%	8.94 0.08%	1,078.06 10.01%	339.39 3.15%	5.01%

Savannah-Piedmont Ecobasin

Water quality in this ecobasin was designated as impaired at 65 of 138 sites (47 percent) sampled by SCDHEC (SCDHEC 2003). Recreational uses were not supported at 30 sites due to the presence of fecal coliform bacteria. Aquatic life uses were not supported at 28 sites due to copper contamination, paucity of aquatic fauna, low dissolved oxygen concentrations or abnormal pH values. Fish consumption advisories have been listed for seven sites including, Lake Hartwell, Lake Jocassee, Lake Russell and the Chauga River (SCDHEC 2003). Fish consumption advisories are due to mercury and PCB contamination.

Santee-Piedmont Ecobasin

Water quality was impaired at 279 of 468 locations (59 percent) sampled by SCDHEC (SCDHEC 1998; SCDHEC 1999; SCDHEC 2001). Recreational uses were not supported at 151 sites due to the presence of high concentrations of fecal coliform bacteria. Aquatic life uses were not supported at 125 sites primarily due to lack of invertebrate fauna, low pH, low dissolved oxygen concentrations or copper contamination. Fish consumption advisories due to mercury contamination have been issued for the Wateree River below Wateree Dam to its confluence with the Congaree River and the Saluda River from Pelzer to the Congaree River in Columbia. Very few river miles (approximately 11) have been designated as Outstanding Resource Waters by SCDHEC.

Pee Dee-Piedmont ecobasin

Water quality was impaired at 15 of 25 sites (60 percent) sampled by the South Carolina Department of Health and Environmental Control (SCDHEC 2000), representing one of the highest ratios of impairment within the state. Recreational uses were not supported at six sites due to the presence of high concentrations of fecal coliform bacteria. Aquatic life uses were not supported at nine additional sites due to lack of aquatic invertebrate diversity, low dissolved oxygen, copper contamination or high turbidity (SCDHEC 2000).

Major Classifications

Wadeable Streams

Wadeable streams are the dominant habitat in the piedmont and are defined as those with Strahler stream orders of 0 to 3; they are generally streams that can be waded comfortably throughout most of the year. Wadeable streams in the piedmont possess different characteristics based chiefly on their gradient. Streams in the inner piedmont (just below the Blue Ridge) typically have moderate gradients with clear to moderately turbid water. Substrates in those streams are generally sand, gravel and cobble, with boulders and exposed bedrock occurring less frequently. These streams contain a variety of habitats including frequent long stretches of riffles and runs separated by short sections of pools and glides. As one moves south and east through the outer piedmont toward the fall line, wadeable streams have less gradient; runs and riffles become less frequent and shorter in length, while slow flowing pools comprise the majority of habitat. Outer piedmont streams are generally turbid, carrying a heavy sediment load from both historic and current conversion of forested land to agriculture and silviculture. These streams have substrates of mostly sand, silt, clay and detritus.

Navigable Streams

Navigable streams are common in the Piedmont ecoregion and include large rivers like the Savannah River, Saluda River, Broad River and Catawba River, as well as smaller rivers like the Reedy River, Enoree River and Fishing Creek. These streams are generally defined as being large enough to operate watercraft, if only a canoe, and are generally too deep to be waded throughout most of the year. These larger streams are more productive than their smaller counterparts and typically carry a heavy sediment burden. Substrates are typically sand, clay, and detritus, although the high gradient areas produce shoals and riffles that contain gravel, cobble and, occasionally, exposed bedrock and boulders. All of the large rivers (Savannah, Saluda, Broad and Catawba) and many of the smaller rivers (Reedy, Enoree and Tyger) have been impounded somewhere along their course. These impoundments have forever altered the natural hydrographs of these rivers and the habitats they contain.

Priority Species Associations

The Piedmont Ecoregion is home to 79 aquatic priority species including 42 fish, 22 mussels, 14 crayfish and one snail. Of those species, 25 have been identified as being of the highest conservation concern.

Common Name	Scientific Name	Piedmont Ecobasin		
		Savannah	Santee	Pee Dee
Highest Priority				
Fishes				
“Thinlip” chub	<i>Cyprinella spp. (c.f. zanema)</i>			X
Sandhills chub	<i>Semotilus lumbee</i>		X	X
Highfin carpsucker	<i>Carpionodes sp.</i>		X	X

Redeye bass	<i>Micropterus coosae</i>	X	X	
“broadtail” madtom	<i>Noturus spp. (c.f. insignis)</i>			X
Savannah darter	<i>Etheostoma fricksium</i>	X		
Christmas darter	<i>Etheostoma hopkinsi</i>	X		
Saluda darter	<i>Etheostoma saludae</i>		X	
Mussels				
Carolina heelsplitter	<i>Lasmigona decorata</i>	X	X	X
Creeper	<i>Strophitus undulatus</i>	X	X	X
Yellow lampmussel	<i>Lampsilis cariosa</i>	X	X	
Brother spike	<i>Elliptio fraterna</i>	X		
Triangle floater	<i>Alasmidonta undulata</i>	X		
Brook floater	<i>Alasmidonta varicosa</i>	X		X
Notched rainbow	<i>Villosa constricta</i>		X	X
Carolina creekshell	<i>Villosa vaughniana</i>		X	
Southern rainbow	<i>Villosa vibex</i>	X		
Savannah lilliput	<i>Toxolasma pullus</i>		X	
Crayfish				
A crayfish	<i>Cambarus sp. “B”</i>	X		
Red burrowing crayfish	<i>Cambarus carolinus^b</i>		X	
Mimic crayfish	<i>Distocambarus carlsoni^b</i>		X	
A crayfish	<i>Distocambarus hunteri^b</i>		X	
A crayfish	<i>Distocambarus youngineri^b</i>		X	
Oconee stream crayfish	<i>Cambarus chaugaensis*</i>		X	
Snails				
Savannah pebblesnail	<i>Somatogyrys tenax</i> or <i>S. virginicus^a</i>	X	X	

High Priority

Fishes				
Santee chub	<i>Hybopsis zanema</i>		X	
Greenhead shiner	<i>Notropis chlorocephalus</i>		X	X
Quillback	<i>Carpionodes cyprinus</i>	X	X	
"Smoky sculpin"	<i>Cottus bairdii complex</i>	X		
Blackbanded sunfish	<i>Enneacanthus chaetodon</i>			X
Carolina darter	<i>Etheostoma collis</i>		X	
Fantail darter	<i>Etheostoma flabellare</i>		X	X
Turquoise darter	<i>Etheostoma inscriptum</i>	X	X	
Seagreen darter	<i>Etheostoma thalassinum</i>		X	
Piedmont darter	<i>Percina crassa</i>		X	X
Mussels				
Roanoke slabshell	<i>Elliptio roanokensis</i>		X	
Rayed pink fatmucket/ Eastern lampmussel ^c	<i>Lampsilis splendida/radiata</i>		X	
Eastern pond mussel	<i>Ligumia nasuta</i>		X	

Pod lance	<i>Elliptio folliculata</i>		X	
Crayfish				
A crayfish	<i>Distocambarus crockeri</i>		X	
Broad River spiny crayfish	<i>Cambarus spicatus</i>		X	

Moderate Priority

Fishes

Central stoneroller	<i>Campostoma anomalum</i>	X	X	
Satinfin shiner	<i>Cyprinella analostana</i>			X
Greenfin shiner	<i>Cyprinella chloristia</i>		X	X
Whitetail shiner	<i>Cyprinella galactura</i>	X		
Fieryblack shiner	<i>Cyprinella pyrrhomelas</i>		X	X
Highback chub	<i>Hybopsis hypsinotus</i>		X	X
Thicklip chub	<i>Hybopsis labrosa</i>		X	
Rosyface chub	<i>Hybopsis rubrifrons</i>	X	X	
Warpaint shiner	<i>Luxilus coccogenis</i>	X		
River chub	<i>Nocomis micropogon</i>	X		
Comely shiner	<i>Notropis amoenus</i>			X
Whitemouth shiner	<i>Notropis alborus</i>			X
Redlip shiner	<i>Notropis chiliticus</i>			X
Sailfin shiner	<i>Notropis hypselopterus</i>	X	X	
Tennessee shiner	<i>Notropis leuciodus</i>	X		
Mirror shiner	<i>Notropis spectrunculus</i>	X		
Blacknose dace	<i>Rhynchithys atratulus</i>	X	X	
Notchlip redhorse	<i>Moxostoma collapsum</i>	X	X	X
V-lip redhorse	<i>Moxostoma pappillosum</i>		X	
Snail bullhead	<i>Ameiurus brunneus</i>	X	X	X
White catfish	<i>Ameiurus catus</i>	X	X	X
Flat bullhead	<i>Ameiurus platycephalus</i>	X	X	X
Brook trout	<i>Salvelinus fontinalis</i>	X	X	
Banded darter	<i>Etheostoma zonale</i>	X		

Mussels

Carolina lance	<i>Elliptio angustata</i>		X	X
Eastern elliptio	<i>Elliptio complanata</i> complex	X	X	X
Variable spike	<i>Elliptio icterina</i> complex	X	X	
Carolina slabshell*	<i>Elliptio congarea</i>	X	X	
Pod lance*	<i>Elliptio folliculata</i>	X		
Atlantic spike	<i>Elliptio producta</i>	X		
Eastern creekshell	<i>Villosa delumbis</i>	X	X	X

Crayfish

Ditch fencing crayfish	<i>Faxonella clypeata</i>	X		
Pee Dee Crayfish	<i>Procambarus blaningii</i> ^a			
A crayfish	<i>Procambarus pubescens</i>	X		

Rocky river crayfish	<i>Cambarus hobbsorum</i>	X
Ditch fencing crayfish	<i>Foxonella clypeata</i>	X

* needs confirmation

^b Primary burrowing crayfish, which spend most of their lives in burrows beneath the ground. They are included here, because they may depend upon soils with a high water table, and hydrologic modifications may affect their survival. However, very little is known about the habitat requirements of these species.

^a Identity uncertain

^c taxonomic uncertainty in distinguishing species.

Region-wide Challenges

Challenges to conservation of aquatic fauna in these two ecobasins are similar to other ecobasins in the state and primarily include impacts associated with impoundments, nonpoint source pollution, point source pollution, poorly planned development and introductions of non-native species.

Impacts from hydropower development have substantially altered and degraded a significant portion of habitat for most native aquatic species. Nearly 970 miles of streams within the ecoregion have been impounded. Roughly 57 dams have been constructed on navigable streams during the last two centuries and more than 900 smaller impoundments, including farm ponds, pepper the landscape, disrupting and fragmenting smaller streams. Dams result in a loss of connectivity and negatively affect aquatic biota both above and below the impoundment (Doeg and Koehn 1994; Kanehl et al. 1997; Tiemann et al. 2004) through direct loss of habitat as lotic habitat is converted to lentic habitat, which favors competitive and often predacious species including largemouth bass and other centrarchids. In addition to direct loss of habitat, impoundments often impact the unimpounded stream reaches downstream through altered hydrologic and thermal regimes (Cushman 1985), modified stream channel morphology and increased erosion and sedimentation (Watters 1996); all of which ultimately reduce suitable habitat for native aquatic fauna (Helfrich et al. 1999; Tiemann et al. 2004). Impoundments on the Savannah River, Saluda River, Broad River and Catawba-Wateree River have disrupted the historic migrations of anadromous species (American shad and striped bass) that once represented culturally and economically important fisheries. Fish passage is also critical in allowing the dispersal of mussels, since larval mussels are parasitic on the gills of host fishes and are dispersed by the fish prior to settlement.

Although a large portion of the ecoregion is currently forested, most of the forests were cleared at some point during the last two centuries to develop crop and pasture lands. Forest and tilling of the Piedmont's highly erodible soils has resulted in streams that are still heavily silted. Modern soil conservation practices have reduced those impacts, but sedimentation from nonpoint and point sources remains a significant detriment to piedmont streams today. Farmers that have neglected to implement soil conservation practices further compound sedimentation problems in piedmont streams. Ground disturbance from development activities, agriculture and silviculture are primary sources of erosion that lead to sedimentation in piedmont streams. Corporate and private timber managers that fail to follow best management practices (BMPs) further contribute significant siltation and other nonpoint source pollution within the ecoregion. Streambank erosion due to loss of riparian areas, livestock grazing and altered hydrology also contribute to sedimentation in piedmont streams.

Excessive nutrients and other chemical contamination also negatively affect water quality in the ecoregion. Point source discharges from industrial, municipal and community sources add nutrients and other pollutants to the receiving streams, rivers and lakes. In addition to those sources of pollution, agricultural operations also impact water quality. Nationwide, pollution from agricultural sources is the greatest impairment to streams and lakes (SCDHEC 2003). The piedmont has the highest density of permitted discharges within the state and the second highest density of concentrated animal feeding operations (CAFOs) with nearly five agricultural operations per 100 square miles. Water quality in the piedmont was impaired at 57 percent of the sites sampled by the SCDHEC, which is the second highest impairment rate among the four aquatic ecoregions in the state. Recreational uses were impaired at nearly 30 percent of the sites sampled due to the presence of high concentrations of fecal coliform bacteria. Fecal coliform bacteria are present in the digestive tract of warm-blooded animals; although fecal coliform bacteria are not generally harmful to humans they do indicate that surface waters may contain disease-causing pathogens (SCDHEC). More than one quarter of the streams sampled by SCDHEC within the ecoregion did not support aquatic life uses. Those stream sites do not possess sufficient water quality to maintain a balanced aquatic community of plants and animals.

Introductions of non-native fish species may threaten native aquatic fauna in the piedmont. Smallmouth bass, spotted bass, muskellunge, flathead catfish and blue catfish are established in portions of the ecoregion. The effects of these introduced species on native game and nongame species is not currently well known. Flathead catfish introductions into the Savannah River, Saluda River and Catawba River basins as well as blue catfish introductions into the Savannah River, Broad River and Catawba River basins likely pose the greatest risks to native fauna. Flathead catfish have been shown to prey on bullheads, darters, shad, suckers and sunfish. Severe declines in native species, particularly bullheads and sunfish, have been observed after the introductions of flathead catfish (Guire et al. 1984; Jenkins and Burkhead 1994; Bart et al. 1994). The introduced spotted bass and smallmouth bass in the Savannah River and its tributaries threaten the native redeye bass through competition and hybridization.

Introduction of nonnative invertebrates also pose a threat to the native fauna. The Asian clam, *Corbicula fluminea*, has been introduced and has spread throughout the United States, including South Carolina. The effects of *Corbicula* on native species are not well understood. A review of the literature on the interactions between *Corbicula* and native mussels (Dillon 2000) indicated that most field studies failed to find any significant negative effects on native species, although a few detected reductions in growth of mussels. The red swamp crayfish has been introduced to South Carolina and has been observed at several locations in the coastal plain, but has yet to be identified in the piedmont; however, there have been very few crayfish inventories conducted, none of which have been initiated on a statewide basis. In North Carolina, the red swamp crayfish has become established in all drainages of the coastal plain and eastern piedmont plateau and appears to have extirpated all the native crayfish at one location (Cooper 2003). Introduced crayfish are believed to be the biggest threat to native crayfish species (Lodge et al. 2000 a,b), and the risk to our native species is great if further introductions or if extensive spread of nonnative crayfish occurs.

Rapid development in the piedmont, especially in the upstate, has included substantial highway construction. The requirement for sand in road construction has resulted in sand mining operations in the mainstem or riparian areas of many piedmont rivers and streams. Sand mining not only causes bank stability problems and loss of riparian areas at the mining site, but instream impacts as well. Mining operations affect physical and chemical habitat and can negatively affect biological communities (Nelson 1993) and recreational uses (Hartfield 1993). Physical impacts on instream habitat include increasing bedload materials and turbidity, changing substrate type and stability and altering stream morphology (Nelson 1993). Physical habitat alterations associated with sand mining can adversely affect the biological community by decreasing reproduction and survival of fishes (Stuart 1953; Newport and Moyer 1974) and distribution and composition of other aquatic organisms (Buck 1956; Trautman 1957; Newport and Moyer 1974).

Savannah–Piedmont Ecobasin

Approximately 457 miles of streams within the Savannah-Piedmont Ecobasin have been impounded. Seven dams have been erected on navigable streams to form large impoundments and 210 smaller dams have impounded smaller streams (small reservoirs and farm ponds). Approximately 110 miles of the 131 miles of the Savannah River that occur within the ecobasin have been impounded by mainstem reservoirs including Lake Hartwell, Lake Russell and Thurmond Reservoir. The Stevens Creek hydroelectric dam on the Savannah River represents an impediment to diadromous fish movement within the basin. Notable species affected include striped bass, American shad, blueback herring and American eels. Passage is needed to accommodate both upstream migration of adults and outmigration of adult and juvenile fishes. Priority mussel species will also benefit from fish passage, as fish are a dispersal mechanism for mussels.

Excessive inputs of nutrients and other chemicals also degrade water quality. There are 128 active discharges permitted by SCDHEC within the ecobasin (SCDHEC 2003). Of those, the majority (70 discharges) are industrial, while the remainder are from municipal (31 discharges) and community sources (27 discharges). CAFOs also add nonpoint source pollution. There are 120 agricultural facilities permitted by SCDHEC within the ecobasin, the majority of which are poultry operations (eight small farms, 54 medium farms, and 27 large farms). The remaining facilities include dairy farms (16 small and one medium operation), and eight small swine farms. On a statewide basis the amount of agricultural activity within the ecobasin is moderate (just over four agricultural operations per 100 square miles) which probably doesn't significantly threaten water quality throughout the ecobasin. However, within the Tugaloo River/Lake Hartwell watershed there are many agricultural facilities (55, or approximately 41 per 100 square miles). These are primarily poultry operations that may significantly impact water quality within the watershed. Other agricultural operations such as row crops (corn and wheat) and pastureland also contribute to nonpoint source pollution of sediments and nutrients.

Poorly planned industrial, residential and commercial development has resulted in significant negative impacts to aquatic resources within the ecobasin. Overall, a moderate amount of industrial, residential and commercial growth can be expected for the ecobasin (SCDHEC 2003). Moderate to high levels of growth are expected in the upper third of the ecobasin along the I-85 corridor. Areas likely to experience high growth include Clemson, Easley and Anderson.

Growth in the lower portion of the ecobasin will be slower because the Sumter National Forest encompasses much of the land, limiting development opportunities.

The Stevens Creek watershed in Edgefield, McCormick and Greenwood Counties is known to be a unique aquatic resource. Priority fish species such as the Christmas darter and imperiled mussels such as the Carolina heelsplitter reside in streams of this watershed. Tributaries such as Hard Labor Creek drain the region around metropolitan Greenwood, South Carolina. This is an area of rapid urban growth and increased human population. Impacts to the watershed from point and nonpoint sources can have a degrading effect on the aquatic community downstream.

Santee-Piedmont Ecobasin

Nearly 500 miles of streams within this ecobasin have been impounded. Roughly 50 dams have been constructed on navigable streams during the last two centuries and nearly 700 smaller impoundments (small reservoirs and farm ponds) pepper the landscape, disrupting and fragmenting smaller streams. The Lake Murray Dam, which impounds the Saluda River to form Lake Murray has degraded aquatic habitat in the Saluda River below the dam.

Excessive nutrient and other chemical inputs also degrade water quality within the ecobasin. There are 454 point source contributors permitted by SCDHEC within the ecobasin (SCDHEC 1998; SCDHEC 1999; SCDHEC 2001). Of those, 261 are associated with industry, 119 are associated with municipalities and the remainder are associated with community discharges. Saluda River studies conducted by Hayes and Penny (2002) implicated the Ware Shoals Waste Treatment Plant (WTP) as having a depressing effect on the downstream fish community. The study indicated that species richness and abundance were reduced in the stretch of river between Ware Shoals and Lake Greenwood. CAFOs are abundant in the ecobasin as well, with 245 facilities permitted by SCDHEC (SCDHEC 1998; SCDHEC 1999; SCDHEC 2001). Agricultural facilities throughout the ecobasin are relatively sparse in most areas and on a statewide basis there is only a moderate amount of agricultural activity with approximately three facilities per 100 square miles. However, in the upper Lake Murray area, including the Clouds Creek, Little Saluda River and Bush River watersheds, there is significant agricultural activity (86 sites) with nearly 14 agricultural facilities per 100 square miles.

The Saluda River basin drains much of the Greenville-Spartanburg metropolitan area. The rapidly increasing population and accompanying development have led to significant urban sprawl and resulted in associated aquatic impacts such as stormwater runoff, nonpoint source chemical inputs and stream channel alterations. Although improvements in municipal waste treatment have occurred in this area, point source pollutants add unnatural coloration and increase nutrient levels that sometime lead to noxious algal blooms downstream in Lake Greenwood (SCDNR, unpublished data).

The I-85 corridor from Anderson, South Carolina to Charlotte, North Carolina is one of the most rapidly developing areas of the state. Impacts of road construction, residential and commercial development and general urban sprawl have been felt in most of the major river systems (Saluda, Reed, Pacolet, Enoree, Tyger and Broad Rivers) in this area. Water quality degradation and stream channel alteration are probably the most obvious impacts to these aquatic systems.

Pee Dee–Piedmont Ecobasin

Impoundments do not currently pose a great threat to aquatic fauna in the Pee Dee-Piedmont ecobasin. There are only 15 dams permitted by SCDHEC within the ecobasin and only six miles of impounded streams, none of which are navigable.

As with most ecobasins, especially in the Piedmont Ecoregion, erosion and sedimentation have substantially degraded aquatic habitat. Ground disturbance from development activities, agriculture and silviculture are primary sources of erosion that lead to sedimentation in piedmont streams. In the Pee Dee-Piedmont ecobasin more than 25 percent of the land within the ecobasin is agricultural, which may contribute significantly to stream sedimentation.

Excessive nutrient and other chemical inputs may degrade water quality within the ecobasin. There are nine active point source discharges permitted by SCDHEC (2000) within the ecoregion including, two industrial and four municipal (e.g. waste water treatment plant) discharges. With 35 CAFOs, the ecobasin has the highest density of CAFOs in the state, nearly 13 per 100 square miles. Most of the CAFOs are turkey (22) and poultry (12) farms. In addition to the CAFOs, other agricultural operations (row crops and pastureland) may significantly impact water quality within the ecobasin.

There is low to moderate potential for growth within the ecobasin (SCDHEC 2000). The greatest potential for development occurs in the northwestern portion of the ecobasin, which is part of the Charlotte Metroplex. Future development will pose new threats to aquatic habitats and biota, particularly if those developments are not carefully planned.