Chapter 5. Virginia's Southern Appalachian Piedmont

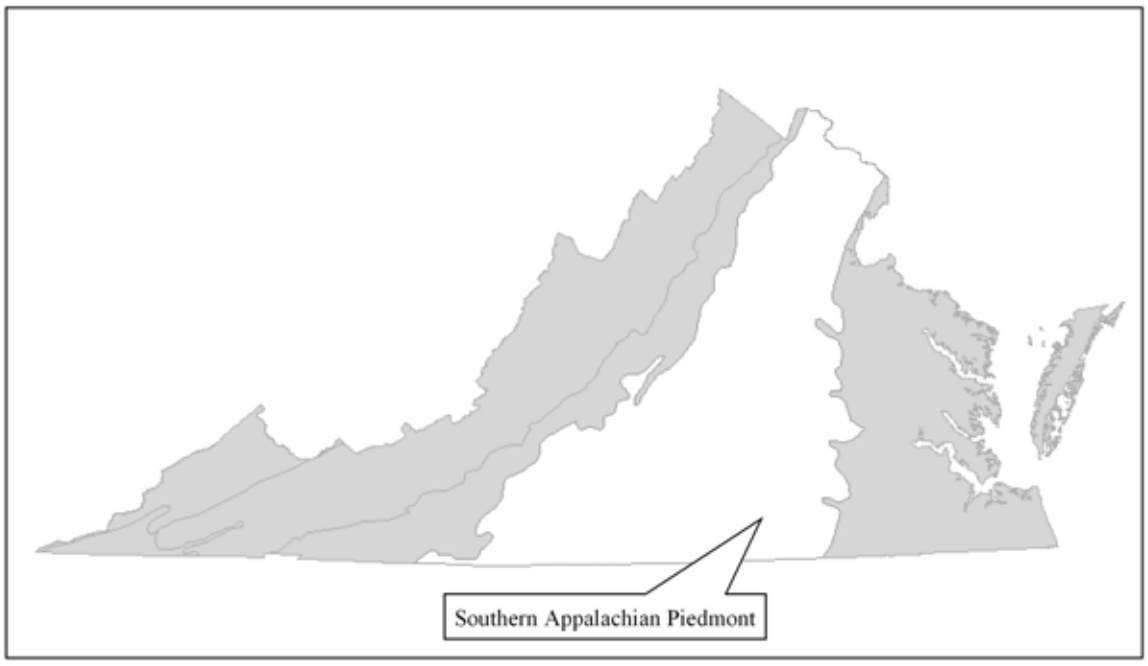

Figure 5.1. The Southern Appalachian Piedmont ecoregion.

5.1. Introduction

5.1.1. Description

The Southern Appalachian Piedmont (Piedmont, Figure 5.1) corresponds to what other classification systems call the Piedmont (Table 5.1). It provides the transition from the low, flat, coastal plain to the mountains. The terrain is mostly flat to rolling hills, but varies from hills and ridges in the west to a relatively flat plateau in the east. This province is bounded by the Blue Ridge escarpment to the west and the Fall Line to the east. The soils of the Piedmont are predominantly Udults with a clayey or loamy subsoil, underlain by metamorphic rock. Rainfall in the region ranges from 114 to 140cm per year, and the average temperature ranges from 14.4 to 17.8°C. The growing seasons generally last between 205 and 235 days. The northern part of the province is dominated by oak-hickory forest, while the southern part is dominated by pines. Most streams are small to intermediate in size and have low to intermediate flow rates. Historical disturbance regimes were primarily fire, drought, and ice storms. The primary land use has been agriculture. Cotton and tobacco farming converted most of the land from its natural state during the 1800s.

Table 5.1. Names for the Piedmont as used in other ecoregional schemes and planning efforts. The following at least roughly correspond to the same area as "Piedmont" as used in this document.

Planning Effort/Regional Scheme	Name of Ecoregion	Reference
NABCI	BCR 29, Piedmont	NABCI 2000
PIF	Physiographic Area 10, Mid-Atlantic Piedmont [1]	Kearney 2003
United States Shorebird Conservation	Planning Region 29, Southern Coastal Plain/Piedmont [2]	Brown et al. 2001

Planning Effort/Regional Scheme	Name of Ecoregion	Reference
Waterbird Conservation for the Americas	Southeast U.S. [3]	Kushlan et al. 2002
Freshwater Ecoregions	Ecoregions 41, Chesapeake Bay, and 40, South Atlantic [4]	Abell et al. 2000
TNC, Ecoregional Planning Units	Piedmont	Groves et al. 2000
Omernik's Ecoregions (Level III)	Ecoregions 45, Piedmont, and 64, Northern Piedmont [5]	Omernik 1987
Bailey's Ecoregions (Sections)	Section 231A, Southern Appalachian Piedmont	Bailey 1995

[1] PIF has recently adopted BCRs for its planning units.
[2] Planning Region 29 is made up of the land area that corresponds to the Piedmont and Mid-Atlantic Coastal Plain as used in this document.
[3] Southeast U.S. is a large region including all of Virginia. The regional scheme used by Kushlan et al. (2002) is based on composites of the BCRs used by NABCI.
[4] Virginia's Piedmont is mostly within Ecoregion 41, but a significant portion of the southern Piedmont is within Ecoregion 40.
[5] Virginia's Piedmont is mostly within Ecoregion 45, but a significant portion of the northern Piedmont is within Ecoregion 64. In addition, a small amount overlaps Ecoregion 65, Southeastern Plains.

5.1.2. Land Cover Areas

Approximately 95% of the land area is considered submontane and 5% is montane. The small amount of montane occurs in the western edge of the Piedmont and is the foothills of the Blue Ridge. Most of the land cover in the Piedmont is forest, followed by agriculture and open habitats (Figure 5.2). Approximately 5% of the land area is within a Conservation Land and therefore has some degree of conservation protection. Wetlands, forest, and water areas are protected in a higher proportion than they occur overall, while agriculture/open and developed land cover types are protected at a lower proportion (Figure 5.2).

5.1.3. Human Population in the Piedmont

The Southern Appalachian Piedmont is the most populous ecoregion, containing 3.16 million people, almost 45% of Virginia's population (USCB 2003), in just over 39% of the land area. The average population density is 78.9 people per km^2. This is the second densest region in Virginia. Northern Virginia (Fairfax, Prince William, and Loudon Counties, along with the surrounding cites) and the Richmond metro area (Chesterfield and Henrico Counties) are the major high density areas (Figure 5.3). The Cities of Charlottesville, Lynchburg, Danville, and Martinsville are high density areas in the western and southern portion of the Piedmont. The population in the Piedmont is expected to grow 16.4% over the 9-year period from 2000 to 2009. This is by far the highest growth rate of any ecoregion, almost twice the rate of the Coastal Plain (GeoLytics 2005).

Approximately 19.5% of the land in the Piedmont is within a high impact growth area (Figure 5.4). This is the highest percentage of any ecoregion. Loudoun County contains some of the highest growth in Virginia; the majority of that county is a high impact growth area. This pattern continues south along the I-95 corridor through Prince William, Stafford, Fauquier, Spotsylvania, Louisa, Hanover, Powhatan, and Chesterfield Counties. Culpeper, Greene, and Fluvanna Counties also contain areas of high impact growth, as does the area around Smith Mountain Lake in Franklin and Bedford Counties.

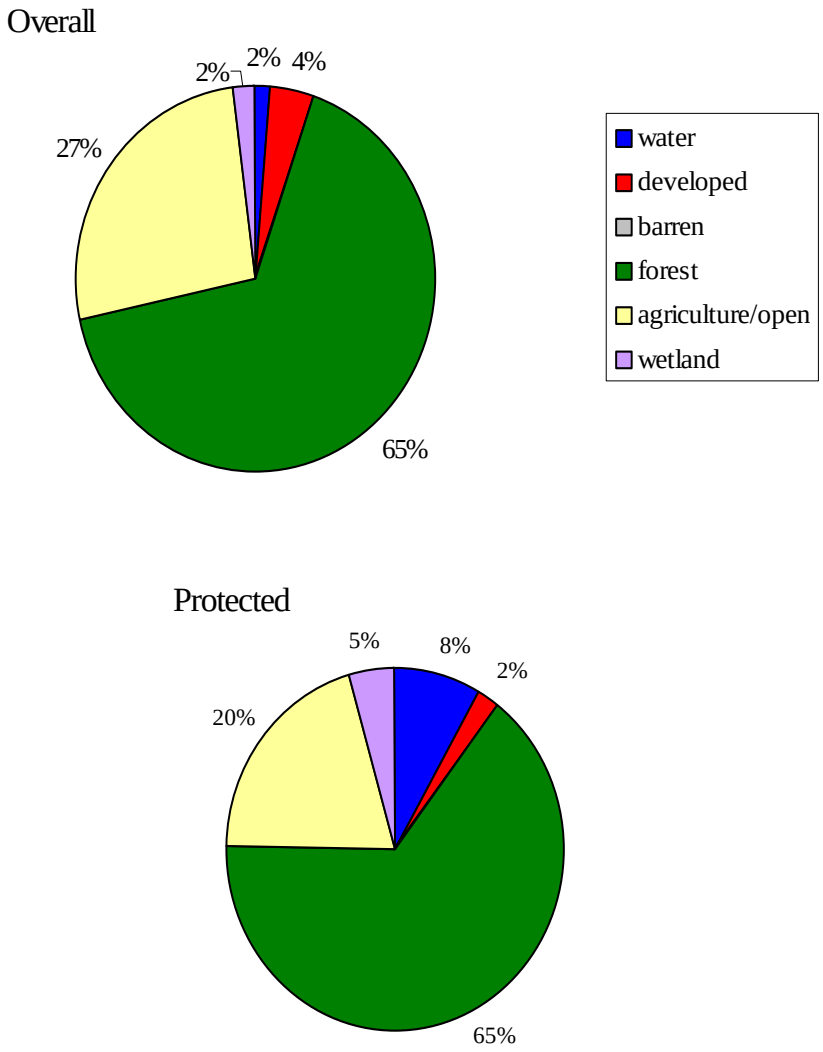

Figure 5.2. Proportional composition of land cover types within the overall Piedmont compared to proportion of land cover types within protected areas in the Piedmont (DGIF 2004a)**.**

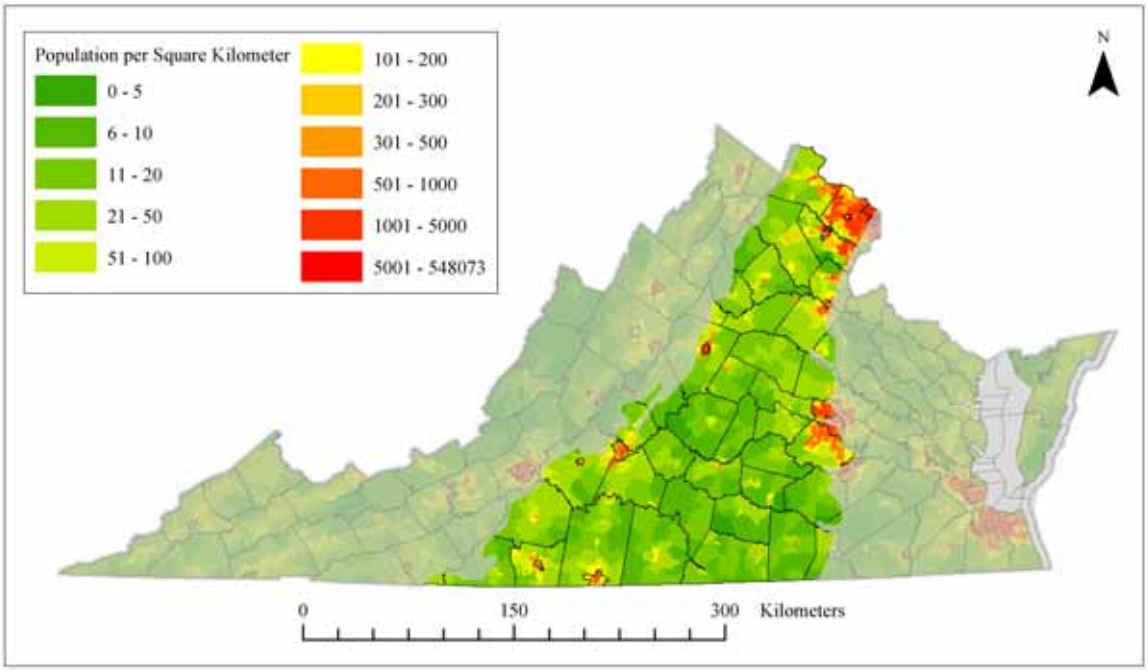

Figure 5.3. Population density from the 2000 census, highlighted for the Piedmont.

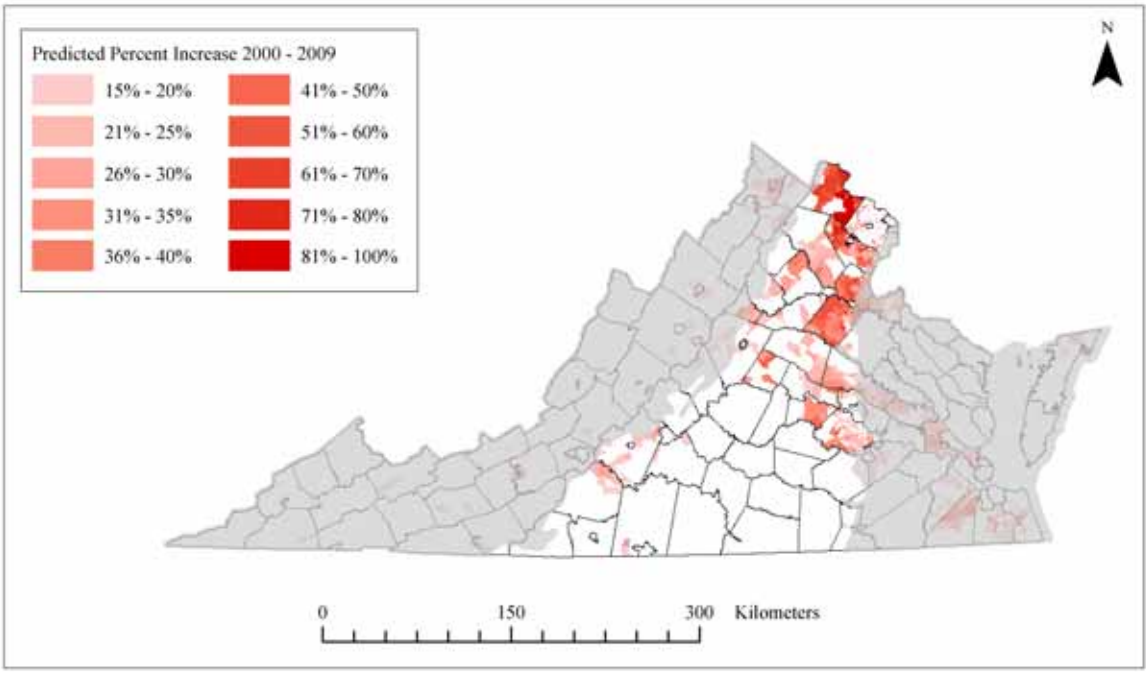

Figure 5.4. High impact growth areas, highlighted for the Piedmont. This figure contains demographic data from GeoLytics, East Brunswick, New Jersey (GeoLytics 2005).

5.2. The Species of Greatest Conservation Need: Piedmont

Of the 157 tiered species that occur in the Piedmont, 13 (8%) are in Tier I, 24 (15%) are in Tier II, 24 (15%) are in Tier III, and 96 (61%) are in Tier IV (Table 5.2).

Table 5.2. The species of greatest conservation need in Virginia's Piedmont.

Common Name	Scientific Name
Tier I	
Fishes	
Bridle shiner	*Notropis bifrenatus*
Roanoke logperch	*Percina rex*
Amphibians	
None	
Reptiles	
Wood turtle	*Glyptemys insculpta*
Birds	
Bachman's sparrow	*Aimophila aestivalis*
Henslow's sparrow	*Ammodramus henslowii*
Upland sandpiper	*Bartramia longicauda*
Loggerhead shrike	*Lanius ludovicianus*
Mammals	
None	
Terrestrial Insects	
None	
Other Terrestrial Invertebrates	
Spirit supercoil	*Paravitrea hera*
Aquatic Mollusks	
Virginia pigtoe	*Lexingtonia subplana*
James spinymussel	*Pleurobema collina*
Piedmont pondsnail	*Stagnicola neopalustris*
Crustaceans	
None	
Aquatic Insects	
Manassas stonefly	*Acroneuria flinti*
Virginia Piedmont water boatman	*Sigara depressa*
Other Aquatic Invertebrates	
None	
Tier II	
Fishes	
Roanoke bass	*Ambloplites cavifrons*
Carolina darter	*Etheostoma collies*
Orangefin madtom	*Noturus gilberti*
Spotted margined madtom	*Noturus insignis* ssp. 1

Common Name	Scientific Name
Amphibians	
Mole salamander	*Ambystoma talpoideum*
Oak toad[1]	*Bufo quercicus*
Reptiles	
None	
Birds	
American black duck	*Anas rubripes*
Cerulean warbler	*Dendroica cerulea*
Bald eagle	*Haliaeetus leucocephalus*
Swainson's warbler	*Limnothlypis swainsonii*
Yellow-crowned night-heron	*Nyctanassa violacea*
Mammals	
None	
Terrestrial Insects	
None	
Other Terrestrial Invertebrates	
A millipede	*Auturus erythropygos*
Aquatic Mollusks	
Dwarf wedgemussel	*Alasmidonta heterodon*
Brook floater	*Alasmidonta varicosa*
Roanoke slabshell	*Elliptio roanokensis*
Atlantic pigtoe	*Fusconaia masoni*
Green floater	*Lasmigona subviridis*
Panhandle pebblesnail	*Somatogyrus virginicus*
Crustaceans	
Pittsylvania well amphipod	*Stygobromus obrutus*
Pizzini's amphipod	*Stygobromus pizzinii*
Aquatic Insects	
Kanawhole springfly	*Diploperla kanawholensis*
Septima's clubtail	*Gomphus septima*
Appalachian snaketail	*Ophiogomphus incurvatus*
Other Aquatic Invertebrates	
Holsinger's groundwater planarian	*Sphalloplana holsingeri*
Bigger's groundwater planarian	*Sphalloplana subtilis*

Common Name	Scientific Name
Tier III	
Fishes	
Steelcolor shiner	*Cyprinella whipplei*
Bigeye jumprock	*Scartomyzon ariommus*
Rustyside sucker	*Thoburnia hamiltoni*
Amphibians	
None	
Reptiles	
Spotted turtle	*Clemmys guttata*
Eastern box turtle	*Terrapene carolina*
Birds	
Northern harrier	*Circus cyaneus*
Least bittern	*Ixobrychus exilis*
Black-crowned night-heron	*Nycticorax nycticorax*
Common tern	*Sterna hirundo*
Barn owl	*Tyto alba*
Mammals	
None	
Terrestrial Insects	
Dusky roadside-skipper	*Amblyscirtes alternata*
Sandpit alydid bug	*Stachyocnemus apicalis*
Other Terrestrial Invertebrates	
Cupped vertigo	*Vertigo clappi*
Aquatic Mollusks	
Yellow lance	*Elliptio lanceolata*
Yellow lampmussel	*Lampsilis cariosa*
Notched rainbow	*Villosa constricta*
Crustaceans	
Chowanoke crayfish	*Orconectes virginiensis*
Aquatic Insects	
Vernal sallfly	*Alloperla idei*
Rock Island springfly	*Isogenoides varians*
Allegheny snaketail	*Ophiogomphus allegheniensis*
A mayfly	*Paraleptophlebia jeanae*
Coppery emerald	*Somatochlora georgiana*
Virginia sallfly	*Sweltsa voshelli*

Common Name	Scientific Name
Other Aquatic Invertebrates	
None	
Tier IV	
Fishes	
Mud sunfish	*Acantharcus pomotis*
Alewife	*Alosa pseudoharengus*
American shad	*Alosa sapidissima*
Snail bullhead	*Ameiurus brunneus*
American eel	*Anguilla rostrata*
Black sculpin	*Cottus baileyi*
Thicklip chub	*Cyprinella labrosa*
Banded sunfish	*Enneacanthus obesus*
Rainbow darter	*Etheostoma caeruleum*
Riverweed darter	*Etheostoma podostemone*
Lined topminnow	*Fundulus lineolatus*
Speckled killifish	*Fundulus rathbuni*
Highback chub	*Hybopsis hypsinotus*
Roanoke hog sucker	*Hypentelium roanokense*
Least brook lamprey	*Lampetra aepyptera*
American brook lamprey	*Lampetra appendix*
Smallfin redhorse	*Moxostoma robustum*
Whitemouth shiner	*Notropis alborus*
Ironcolor shiner	*Notropis chalybaeus*
Redlip shiner	*Notropis chiliticus*
Logperch	*Percina caprodes*
Piedmont darter	*Percina crassa*
Gilt darter	*Percina evides*
Trout-perch	*Percopsis omiscomaycus*
Amphibians	
Jefferson salamander [1]	*Ambystoma jeffersonianum*
Eastern mud salamander	*Pseudotriton montanus*
Eastern spadefoot	*Scaphiopus holbrookii*
Greater siren	*Siren lacertina*
Reptiles	
Scarletsnake	*Cemophora coccinea*
Timber rattlesnake [1]	*Crotalus horridus*
Mudsnake	*Farancia abacura*
Rainbow snake	*Farancia erytrogramma*
Eastern hog-nosed snake	*Heterodon platirhinos*
Eastern slender glass lizard	*Ophisaurus attenuatus*
Queen snake	*Regina septemvittata*
Southeastern crowned snake	*Tantilla coronata*
Common ribbonsnake	*Thamnophis sauritus*

Common Name	Scientific Name
Birds	
Grasshopper sparrow	*Ammodramus savannarum*
Green heron	*Butorides striatus*
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*
Chimney swift	*Chaetura pelagica*
Yellow-billed cuckoo	*Coccyzus americanus*
Northern bobwhite	*Colinus virginianus*
Eastern wood-pewee	*Contopus virens*
Prairie warbler	*Dendroica discolor*
Yellow warbler	*Dendroica petechia*
Gray catbird	*Dumetella carolinensis*
Willow flycatcher	*Empidonax traillii*
Rusty blackbird (winter)	*Euphagus carolinus*
Worm-eating warbler	*Helmitheros vermivorus*
Wood thrush	*Hylocichla mustelina*
Yellow-breasted chat	*Icteria virens*
Black-and-white warbler	*Mniotilta varia*
Kentucky warbler	*Oporornis formosus*
Northern parula	*Parula americana*
Rose-breasted grosbeak	*Pheuctitus ludovicianus*
Eastern towhee	*Pipilo erythrophthalmus*
Scarlet tanager	*Piranga olivacea*
Prothonotary warbler	*Protonotaria citrea*
Virginia rail	*Rallus limicola*
American woodcock	*Scolopax minor*
Ovenbird	*Seiurus aurocapillus*
Louisiana waterthrush	*Seiurus motacilla*
Brown-headed nuthatch	*Sitta pusilla*
Field sparrow	*Spizella pusilla*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Eastern meadowlark	*Sturnella magna*
Brown thrasher	*Toxostoma rufum*
Eastern kingbird	*Tyrannus tyrannus*
Yellow-throated vireo	*Vireo flavifrons*
Canada warbler [1]	*Wilsonia canadensis*
Mammals	
None	
Terrestrial Insects	
Barrens dagger moth	*Acronicta albarufa*
Mississippi turtle bug	*Allopodops mississippiensis*
Frosted elfin	*Callophrys irus*
A tiger beetle	*Cicindela formosa*

Common Name	Scientific Name
Lemmer's pinion moth	*Lithophane lemmeri*
Schaum's ground beetle	*Sphaeroderus schaumi*
Other Terrestrial Invertebrates	
Fine-ribbed striate	*Striatura milium*
Aquatic Mollusks	
Triangle floater	*Alasmidonta undulata*
Alewife floater	*Anodonta implicata*
Gravel elimia	*Elimia catenaria*
Carolina lance mussel	*Elliptio angustata*
Carolina slabshell mussel	*Elliptio congaraea*
Northern lance mussel	*Elliptio fisheriana*
Atlantic spike	*Elliptio producta*
Oblong ancylid	*Ferrissia parallelus*
Ridged lioplax	*Lioplax subcarinata*
Sharp sprite	*Promenetus exacuous*
Creeper	*Strophitus undulatus*
Florida pondhorn	*Uniomerus caroliniana*
Crustaceans	
None	
Aquatic Insects	
Banner clubtail	*Gomphus apomyius*
Piedmont clubtail	*Gomphus parvidens*
A mayfly	*Isonychia arida*
Other Aquatic Invertebrates	
None	

[1] The Piedmont is considered only marginally within the range of this species in Virginia.

5.3. Terrestrial and Wetland Species in the Piedmont

5.3.1. Tier I Species in the Piedmont

5.3.1.1. Wood turtle, *Glyptemys insculpta*

Life History Summary

The wood turtle is known from across northern Virginia, including the Piedmont, Blue Ridge Mountains, and Northern Ridge and Valley ecoregions (Mitchell 1994; see Figure 5.5 for its range in the Piedmont). It is only known from the Potomac drainage in Virginia. It requires clear streams and an adjacent terrestrial habitat (often fields, sometimes forests), because the turtle spends part of each year in each habitat (Mitchell 1994). The wood turtle is omnivorous, consuming a variety of vegetation and invertebrate prey, and occasionally vertebrates (Mitchell 1994). The wood turtle is legally protected, with the status of State threatened. While its correct accepted generic name is *Glyptemys*, this species is still listed as *Clemmys*

insculpta in the Virginia Administrative Code (4 VAC 15-20-130). According to VA-GAP (DGIF 2004a), 7% of its statewide predicted potential habitat is protected.

Location

Potential habitat for the wood turtle includes areas that have certain terrestrial and aquatic components (Figure 5.5). For terrestrial habitat, potential areas were selected based on percent development within watersheds (DCR 2004) according to land cover data (USGS 1992). Potential aquatic habitat was determined using the DGIF aquatic habitat classification where attributes used were stream reach elevation, size and gradient. Confirmed locations are from Collections (DGIF 2004b). For more details on mapping potential habitat, see Appendix D.

Description of Essential Habitat

The wood turtle essentially uses riparian areas and streams in Frederick, Shenandoah, Loudoun, Fairfax and northern Rockingham counties (M. J. Pinder, DGIF, pers. comm.). It is found primarily in and near clear brooks and streams in deciduous woodlands in Virginia, but has been found in woodland bogs and marshy fields at more northern sites. It seems to use quite variable habitats, so long as some critical aquatic and terrestrial components are present. In all cases, it has been found utilizing wet and/or marshy meadows associated with floodplains. Although highly terrestrial, wood turtles must remain in moist habitats (Mitchell 1994). Because of its reliance on stream habitats, an assessment of the DGIF aquatic habitat types used by the wood turtle was also performed (Table 5.3).

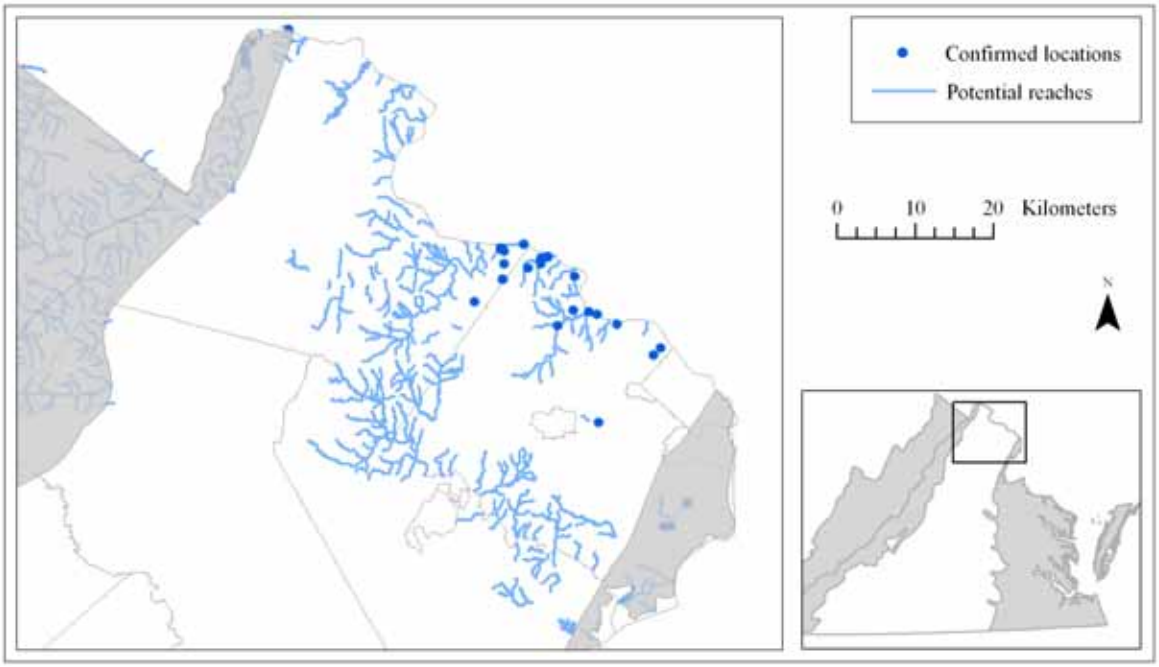

Figure 5.5. Distribution of the wood turtle in the Piedmont (DGIF 2004a).

Table 5.3. DGIF aquatic habitat types used by wood turtle in the Piedmont-Potomac EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small stream connected to another small stream	5
Very low gradient large river connected to another large river	4
Low gradient small stream connected to another small stream	3
Low gradient headwater stream connected to another headwater stream	2

Aquatic Habitat Type	Number of Reaches
Low gradient headwater stream connected to a small stream	2
Very low gradient large stream connected to another large stream	1

Relative Condition of Habitat

Of the 113 Collections locations, 23 occur in the Piedmont within northeast Loudoun and Fairfax Counties (DGIF 2004b). Seven of these observations occur within a Conservation Land, including county or regional parks and Great Falls National Park (DGIF 2004b; DCR-NH 2005). There are six DCR-NH Conservation Sites for wood turtle in the Piedmont. Two of these are mostly covered by a Conservation Land with another three Sites at least partially protected. These Sites contain seven Element Occurrences. One EO is ranked as excellent and another as good for viability. The others are not ranked. Of the reaches considered essential habitat, almost 14% fall within a protected Conservation Land.

An evaluation of the impaired waters in the range of the wood turtle showed that about two-thirds of the habitat known to contain this species in this region is impaired (DEQ and DCR 2004). The impairment in most cases is fecal coliform, though general standard (benthics) and *Escherchia coli* are also listed as impairments. The source of the impairment in all cases is unknown.

Specific Threats and Trends

The main threats to the wood turtle in Virginia are the illegal pet trade and habitat destruction, particularly as related to riparian zones and effects of siltation from construction (Mitchell 1994), forestry (Herpetofauna TAC 2004), and bank stabilization (NESWDTC 2004) (Table 5.4). In addition, NPS should restrict recreational activities in areas inhabited by the wood turtle (Herpetofauna TAC 2004).

The wood turtle is declining across much of its range (Ernst et al. 1994), though specific trend information is not available and would be difficult to acquire.

Table 5.4. Species-specific stresses on the wood turtle (Herpetofauna TAC 2004). For additional stresses on the wood turtle, see Appendix H.

Stress	Source of Stress	Scope	Severity	Comments
Intentional take	Economic use of species	3	4	Pet trade
Shoreline alteration	Forestry	2	3	Forestry practices

Conservation Actions and Strategies

Species-specific actions that are necessary for wood turtle conservation include better enforcement and prosecution of capture laws (the wood turtle is protected from all take by virtue of its State threatened status) (Herpetofauna TAC 2004). In addition, NPS should restrict recreational activities in these areas (Herpetofauna TAC 2004). Protection of known populations and their habitat, and determination of current distribution and population viability in Virginia are critical (Ernst et al. 1994; also see this source for additional conservation actions). Ernst et al. (1994) state that the recovery goal for the wood turtle is downlisting from State threatened to State special concern, but "the rate of habitat loss in northern Virginia and the lack of site(s) for establishment of historical populations...suggests that this objective may be unrealistic (p. 2)." Additional data on conservation actions presented by the Herpetofauna TAC are available in Appendix I.

Research and Monitoring Needs

Like many reptiles, the basic life history and distribution of the wood turtle are poorly known. As such, research and monitoring needs include surveys to determine overall wood turtle distribution in Virginia; studies on wood turtle life history; and demographic studies, including population connectivity and gene flow (Herpetofauna TAC 2004; NESWDTC 2004).

5.3.1.2. Bachman's sparrow, *Aimophila aestivalis*

Life History Summary

Bachman's sparrow occurs in the southeastern portion of Virginia's Piedmont and Coastal Plain (Ridd 1991) (Figure 5.4). It prefers dry, open-canopy pine woods with little woody understory, but a dense grass/forb layer, such as pine savannah (Dunning 1993; Ridd 1991). It also uses old fields and pine clearcuts. It seems to associate strongly with broomsedge *Andropogon virginicus*. Its main foods include ground-dwelling insects and seeds, especially grass seeds of the genus *Panicum* (Dunning 1993; Ridd 1991). Important threats include loss of habitat to intensification of pine plantations and suppression of fire regimes (Dunning 1993; Ridd 1991). Bachman's sparrow is legally protected in Virginia, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 7% of its statewide predicted potential habitat is protected.

Location

The map of Bachman's sparrow habitat (Figure 5.6) consists of confirmed locations from Collections (DGIF 2004b) and CMI (Stanton 2000), and potential habitat as identified by CMI (Stanton 2000). The Fort Pickett Military Reservation boundary is from the Conservation Lands Database (DCR 2003).

Description of Essential Habitat

This species primarily uses open-canopy pine woods/savannah, with a thick herbaceous layer and little shrub. They are also found in oak scrub and recent clearcuts. Frequently burned pine is perfect, and areas maintained for red-cockaded woodpeckers work well (Dunning, 1993; D. J. Schwab, USFWS, pers. comm.; M. D. Wilson, CCB, pers. comm.).

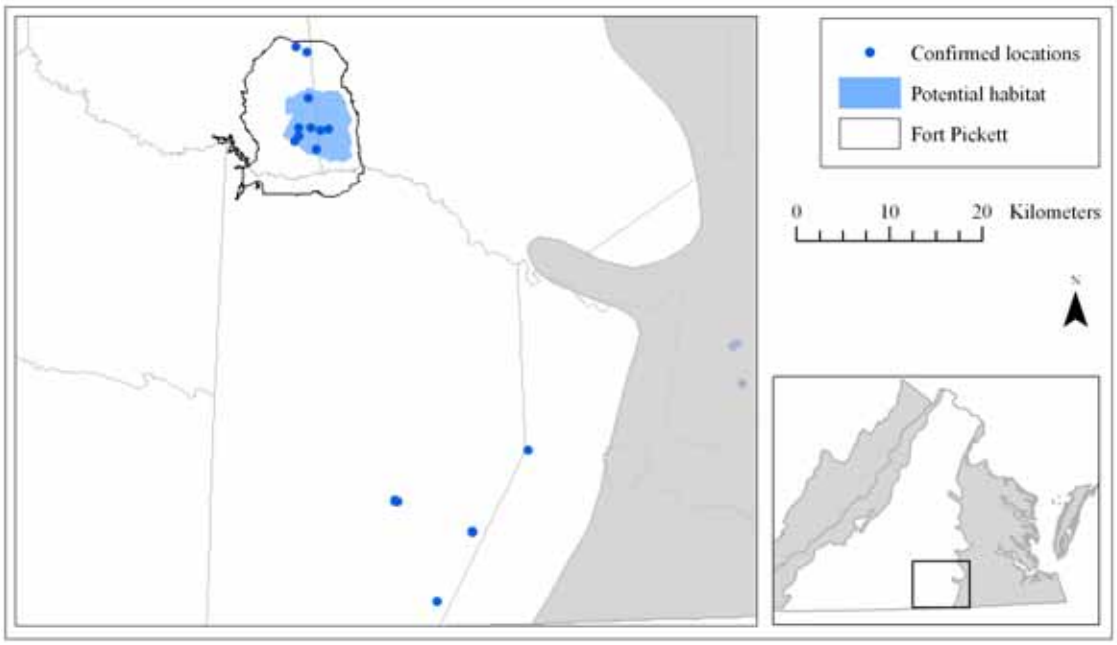

Figure 5.6. Distribution of Bachman's sparrow in Virginia's Piedmont.

Relative Condition of Habitat

Due to the ephemeral nature of the habitat for this species, it is difficult to determine the total area and status of available habitat. There are eight known observations locations in Collections within the Piedmont, grouped within four clusters (14 statewide, DGIF 2004b). None of these Collections occur on a Conservation Land. A population is also known at Fort Pickett Military Reservation. Records from CMI include 10 known observations and an essential habitat area of approximately 4300ha within Fort Pickett. There are six DCR-NH Conservation Sites for Bachman's sparrow (DCR-NH 2005). All except one are within Fort Pickett or co-occuring with Collection records. These sites consist of eight DCR-NH Element Occurrences. These EOs consisted of the following viability rankings: two good, one fair, one fair/poor, three poor, and one not ranked (DCR-NH 2005).

Specific Threats and Trends

Bachman's sparrow has suffered a range-wide decline of > 50% over the last 30 years (Rich et al. 2004). Within Virginia, Rosenberg (2004) reports the same decline, while Bird TAC (2004) reports a stable or undetected trend. Kearney (2003) proposes a goal of 100 individuals throughout PIF Physiographic Area 10. This assumes that individuals from other physiographic regions will colonize appropriate habitat if available, an assumption that may be problematic since dispersal across unsuitable habitat may not regularly occur (Dunning et al. 1995; Liu et al. 1995).

While no species-specific stresses have been identified for Bachman's sparrow (Bird TAC 2004), its savannah habitat is highly stressed (Appendix H). A particularly severe stress is the intensification of pine plantations.

Conservation Actions and Strategies

While no species-specific conservation actions were proposed by Bird TAC (2004), many habitat actions were listed (Appendix I). All involve the restoration and protection of savannah habitat. Especially important is thinning of plantations, along with frequent burns to suppress underbrush and encourage grasses (Dunning 1993). Dunning et al. (1995) showed that habitat connectivity is an important factor in this species' ability to colonize habitat patches. Liu et al. (1995) suggested that clustered harvest of timber at a South Carolina site could be best for this species, as it allows dispersing juveniles to easily find suitable habitat. Bird TAC (2004) estimates the statewide population at < 100 individuals, and proposed a goal of increasing the population while inventory work goes forward.

Research and Monitoring Needs

Little is known about basic life history in this species, including breeding densities, life span and survivorship, and population regulation (Dunning 1993). Effects of hurricanes can be important to this species, as it often breeds in coastal areas, but long-term effects of hurricane damage are not clear (Dunning 1993).

5.3.1.3. Henslow's sparrow, *Ammodramus henslowii*

Life History Summary

Henslow's sparrow occurs in both the Mid-Atlantic Coastal Plain and in the Piedmont of Virginia. In the Piedmont, Henslow's sparrow uses dry to wet fields with dense vegetation but no woody plants, such as early-successional old fields (Brindza 1991; Herkert et al. 2002). During the breeding season, Henslow's sparrow eats mostly crickets, grasshoppers and beetles (Brindza 1991; Herkert et al. 2002). Important threats to this bird in the Piedmont include loss of habitat to natural succession (invasion of woody plants due to disturbance regime change), agricultural intensification, and habitat conversion to residential or industrial uses (Brindza 1991; Herkert et al. 2002). Henslow's sparrow is legally protected in Virginia, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 12% of its statewide predicted potential habitat is protected.

Location

The map of Henslow's sparrow in the Piedmont (Figure 5.7) includes Collections (DGIF 2004b) only, since the type of habitat this species requires in the Piedmont cannot accurately be depicted with spatial data.

Description of Essential Habitat

Essential habitat for populations of Henslow's sparrows in the Piedmont includes large grassland patches (> 40ha), with high litter depth, low forb cover and low bare ground exposure. This species prefers grassland with infrequent disturbance, and dense tall grass (up to 80cm tall) (Swanson 1996; J. L. Cooper, DGIF, pers. comm.).

Relative Condition of Habitat

Due to the ephemeral nature of the habitat of this species, it is difficult to determine the total area and the status of available habitat. There are five known observations locations in Collections within the Piedmont (10 statewide, DGIF 2004b). All of these occur on private property, and are therefore in an unprotected condition. One observation is within a powerline corridor in a populated portion of Fairfax County.

Specific Threats and Trends

Henslow's sparrow has suffered a range-wide decline of > 50% over the last 30 years (Rich et al. 2004). Within Virginia, both Rosenberg (2004) and Bird TAC (2004) report the same trend. Bird TAC (2004) estimates the statewide population at < 50 individuals, with a goal of increasing the population while carrying out further inventory work.

While no species-specific stresses have been identified for Henslow's sparrow (Bird TAC 2004), its grassland habitat is highly threatened (Appendix H). In fact, Herkert et al. (2002) report that "loss of suitable habitat (is) probably (the) major threat to Henslow's sparrow" (p. 15).

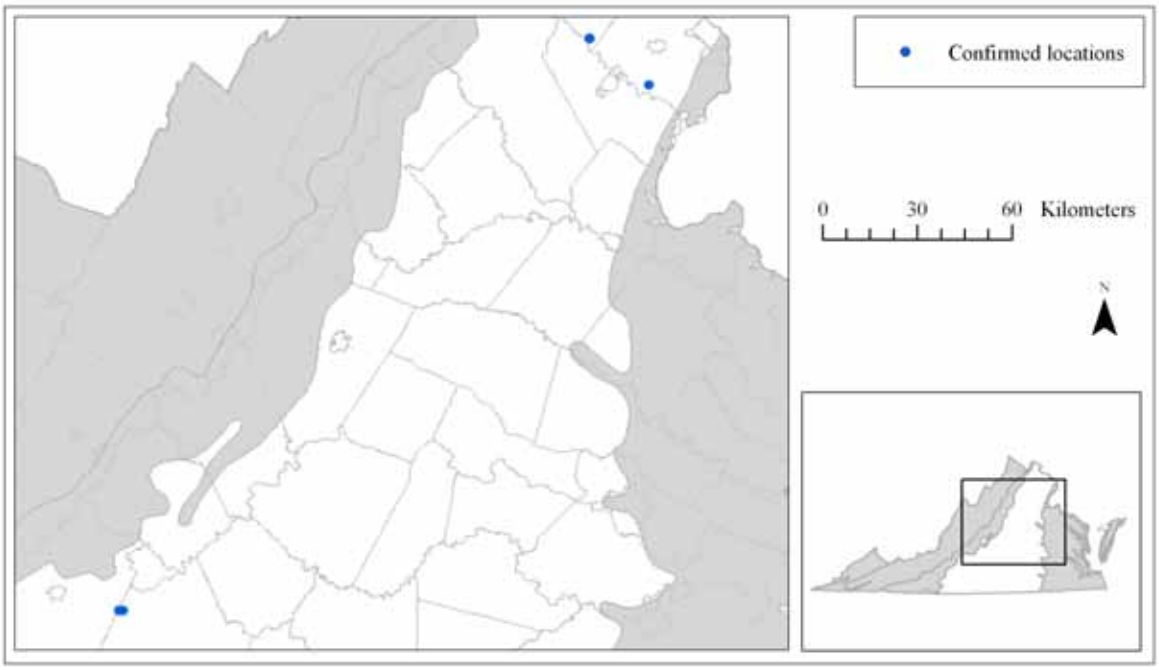

Figure 5.7. Occurrences of Henslow's sparrow in Virginia's Piedmont.

Conservation Actions and Strategies

While no species-specific conservation actions were proposed by Bird TAC (2004), many habitat actions were listed (Appendix I). All involve the restoration and protection of grassland habitat. Herkert et al. (2002) and Kearney (2003) point out that CRP and similar programs are likely to benefit an entire suite of grassland birds like Henslow's sparrow. Kearney (2003) also states that "...Henslow's Sparrow requires immediate conservation action throughout its range to ensure its long-term survival (p. 27)."

Research and Monitoring Needs

No species-specific research or monitoring needs were identified by the Bird TAC (2004) for Henslow's sparrow in Virginia. Targeted surveys for this species should be conducted, though they are probably not adequately detected by many standard survey methods, so new protocols may need to be designed (NESWDTC 2004). Herkert et al.(2002) report that, like many secretive grassland birds, little is known about the natural history of Henslow's sparrow, such as reproductive success and effort. In addition, while abundance related to habitat management has been studied, the relationship of reproductive success to various management regimes has not been (Herkert et al. 2002).

5.3.1.4. Upland sandpiper, *Bartramia longicauda*

Life History Summary

The upland sandpiper is a grassland bird, occurring in the northern Piedmont and the Northern Ridge and Valley. It prefers grasslands such as hayfields, with an herbaceous layer of medium height (Bazuin 1991). It also uses short grass areas, such as grazed fields and the mowed expanses around airports (Houston and Bowen 2001). Its main foods are invertebrates, with a small number of seeds taken as well (Houston and Bowen 2001). Important threats include habitat conversion to residential or industrial uses and the natural succession of old field/hayfield habitats to forest with the decline of small farms (Bazuin 1991). The upland sandpiper is legally protected, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 3% of its statewide predicted potential habitat is protected.

Location

Because of the ephemeral nature of this species' habitat, a map of its essential habitat is not appropriate. Therefore in the species map (Figure 5.8) only Collections (from the breeding season) are shown (DGIF 2004b).

Description of Essential Habitat

Key habitat for upland sandpipers includes medium to large grasslands (> 20ha) where vegetation is typically short (15-35cm), sparse, and located in dry soil conditions. Upland sandpipers will occasionally nest in moist soil situations. This species prefers disturbed grassland with either high fire frequency or moderate grazing and usually avoids tall (> 40cm) undisturbed grasslands. Upland sandpipers will use agricultural fields (oats and wheat) as well as managed grasslands (hayfields, airports, pastures) (Herkert 1991; J. L. Cooper, DGIF, pers. comm.; M. D. Wilson, CCB, pers. comm.).

Relative Condition of Habitat

Due to the ephemeral nature of its habitat, it is difficult to ascertain total area and status of available habitat. There are 13 known locations in Collections (19 statewide, DGIF 2004b). None of these observations occur in a Conservation Land (all are on private property). Eleven of these observations are clustered within approximately a 6km radius. Fourteen are in Loudoun County, one of the most rapidly developing areas in the U.S. One of these observations was at Dulles International Airport. Habitat at another observation site has been converted to low-intensity development, specifically a driveway. A DCR-NH Conservation Site coincides with a dense cluster of Collection locations. This site is unprotected by any Conservation Lands and has an associated Element Occurrence with viability ranked as poor (DCR-NH 2005).

Figure 5.8. Distribution of the upland sandpiper in Virginia's Piedmont.

Specific Threats and Trends

While there exist no known, species-specific stresses for the upland sandpiper in Virginia (Bird TAC 2004), it shares stresses with other grassland birds (Appendix H).

Trends for the upland sandpiper (range-wide) for the last 30 years of the Breeding Bird Survey (BBS) are unknown (Kearney 2003). Bird TAC (2004) reports that the upland sandpiper has declined over 50% in Virginia during the same period, while Rosenberg (2004) reports that "population numbers are unavailable at this time" for this species in Virginia.

Conservation Actions and Strategies

While there exist no species-specific conservation actions for the upland sandpiper in Virginia, it shares those of other grassland birds (Appendix I) (Bird TAC 2004). The goal proposed by Bird TAC (2004) is to increase the population while performing more inventory; their current estimate of statewide population is < 20 individuals. Kearney (2003) gives a goal of doubling the population of upland sandpipers in PIF's Physiographic Area 10, but since the current population within Virginia is not known, it is difficult to propose a specific goal. The upland sandpiper is used in Kearney (2003) as an umbrella species to also manage for vesper and grasshopper sparrows. Houston and Bowen (2001) provide an excellent summary of conservation actions that have been proposed and undertaken in different parts of the upland sandpiper's range. Many of these will be found in Appendix I, and focus on grassland management, including a restoration of historic fire regimes, and preservation and restoration of native grasses (Houston and Bowen 2001).

Research and Monitoring Needs

Houston and Bowen (2001) provide an excellent synopsis for research needs on the upland sandpiper, including mortality causes and rates on its South American wintering grounds. In addition, little is known about basic demography, reproductive success, or survivorship in this species (Houston and Bowen 2001). In Virginia and other eastern states, the species' usage of airports and other grasslands, including bird densities and breeding success in relation to differing management regimes, should be investigated

(Houston and Bowen 2001). Surveys should use a standardized protocol and be regionally coordinated (NESWDTC 2004). Overall, this is a poorly-known species, and most aspects of its life history could be investigated profitably.

5.3.1.5. Loggerhead shrike, *Lanius ludovicianus*

Life History Summary

The loggerhead shrike occurs most frequently in the Blue Ridge Mountains and Northern Ridge and Valley, but also occurs sporadically throughout Virginia's Piedmont (Fraser 1991). It occurs year-round in Virginia (Yosef 1996). This species prefers open habitats with occasional shrubs, such as large grazed pastures (Fraser 1991). The loggerhead is a predator, taking mostly invertebrates but also some vertebrate prey, such as lizards, birds or rodents (Yosef 1996). It is well-known for its habit of impaling its prey on spines of vegetation or barbed wire. Important threats include conversion from pasture to other uses and excessive use of pesticides (Fraser 1991; Yosef 1996). The loggerhead shrike is legally protected, both under MBTA and with the status of State threatened. According to VA-GAP (2004a), 14% of its statewide predicted potential habitat is protected.

Location

The map for this species (Figure 5.9) includes confirmed locations from Collections (DGIF 2004b). Potential habitat was not mapped because it is not possible to identify the essential features with existing spatial data sets.

Description of Essential Habitat

Essential habitat for the loggerhead shrike includes open fields with scattered shrubs, small trees and/or hedges (DeGraff and Rappole 1995). In Virginia, the highest-quality breeding habitat consists of short grass, particularly active pastures with many perches (Luukkonen 1987).

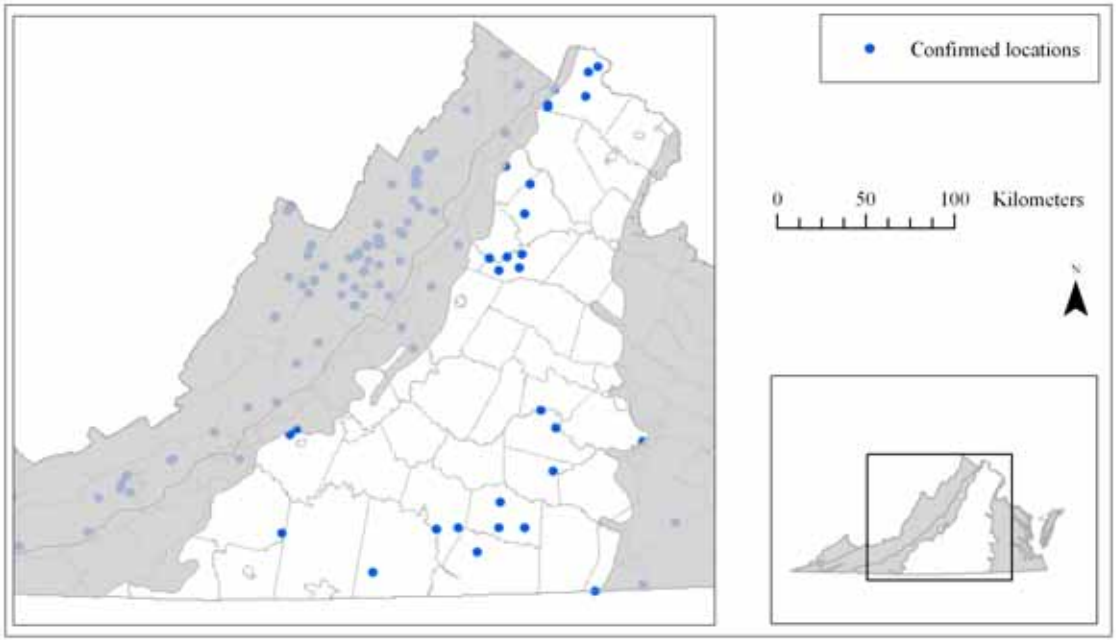

Figure 5.9. Distribution of the loggerhead shrike in Virginia's Piedmont.

Relative Condition of Habitat

Due to the ephemeral nature of habitat for this bird, it is difficult to determine the total area and the status of available habitat. There are 27 known observations locations in DGIF's Collections database within the Piedmont (145 statewide, DGIF 2004b). Two of these observations are within a Virginia Outdoors' Foundations open space easement. The rest occur on private property and are therefore in an unprotected condition. There are three DCR-NH Conservation Sites for loggerhead shrike in the Piedmont (DCR-NH 2005). Two of these coincide with Collection records. All three sites have associated Element Occurrences with viability rankings of good or good/fair (DCR-NH 2005). None of these sites are protected by a Conservation Land.

Specific Threats and Trends

The loggerhead shrike has declined > 50% over the last 30 years range-wide (Rich et al. 2004). Rosenberg (2004) and Bird TAC (2004) report a similar trend in Virginia. A population decline of 87% in the northeast (which includes Virginia) is reported by NESWDTC (2004).

The reasons for the decline of the loggerhead shrike range-wide are unclear (Bird TAC 2004; Yosef 1996). However, threats to its preferred habitat are great, and enumerated in Appendix H. Yosef reports (1996) that the decline of this species corresponded with the increase in organochlorine pesticide use, and these substances are found in the birds in high concentrations. However, the decline also seems to correspond with the decline of pasturelands across its range, though birds do not seem to be habitat-limited in Virginia (that is, habitat exists that is not utilized by shrikes, Bird TAC 2004).

Conservation Actions and Strategies

The primary, species-specific action necessary for loggerhead shrike conservation in Virginia is a concerted, targeted survey effort to determine distribution of the species within the state (Bird TAC 2004) and throughout its breeding range in the northeast U.S. (NESWDTC 2004). This could include following the success of every individual nest (NESWDTC 2004). Other conservation actions are habitat-related, and generally involve grassland management (Appendix I). Yosef (1996) points out that mid-successional grasslands are often overlooked in habitat restoration, in favor of grasslands without the shrubby vegetation that shrikes require for nesting and perching. Bird TAC (2004) estimates the statewide population at < 100 individuals, and suggests a goal of increasing the population while the targeted surveys are carried out.

Research and Monitoring Needs

Little is known about historical distribution of the loggerhead shrike in Virginia, and such information would be useful if compiled (Bird TAC 2004). In addition, due to its spotty distribution across the state, targeted surveys should be considered to determine its true distribution and habitat usage across Virginia (Bird TAC 2004). The cause for the species' decline, both in Virginia and throughout its range, is unclear and needs further research (Bird TAC 2004; Yosef 1996). Certainly the role of pesticides in the decline of this species needs to be better understood.

5.3.1.6. Spirit supercoil, *Paravitrea hera*

Life History Summary

Very little is known about this land snail. It is only known from one location in Pittsylvania County, Virginia, where it inhabits leaf litter on river bluffs (Batie 1991). The spirit supercoil is legally protected in Virginia with the status of State endangered.

Location

The map for the spirit supercoil (Figure 5.10) includes a confirmed location (DGIF 2004b) only, due to lack of information on this species and its essential habitat.

Figure 5.10. Occurrences of the spirit supercoil in Virginia's Piedmont.

Description of Essential Habitat

The limited information on this species indicates that it inhabits leaf litter on river bluffs (Batie 1991).

Relative Condition of Habitat

Not enough is known about this species' habitat to make determine condition. There is one known observation in Collections (DGIF 2004b).

Specific Threats and Trends

Logging on the wooded bluffs occupied by this species is the only known threat (Batie 1991). However, since so little is known about this snail, other stresses could emerge as more is learned.

Conservation Actions and Strategies

Apart from basic research on the distribution of this snail, the forested river bluffs from which it is known must be protected from logging and disturbance (Batie 1991).

Research and Monitoring Needs

This species is only known from shells, and only from one location (Batie 1991). Basic distribution is unknown, as well as all life history information. Batie (1991) calls for "thorough surveys in Virginia and North Carolina" (p. 313).

5.3.2. Forest Species of Greatest Conservation Need in the Piedmont

5.3.2.1. Species of Greatest Conservation Need by Forest Type

Of the 45 tiered species that occur in Piedmont forest, 19 are generalists that occur in all forest types (Table 5.5). Of the remaining 25, 19 occur in deciduous forest (Table 5.6), seven occur in coniferous forest (Table 5.7), and 16 occur in mixed forest (Table 5.8).

Table 5.5. Forest generalist species of greatest conservation need in the Piedmont. "Open woods," throughout Tables 5.5-5.8, unless otherwise indicated, indicates mature, closed canopy, open understory forest, and not open canopy, shrubby understory forests, such as shelterwood cuts.

Common Name	Scientific Name	Tier	Special Habitat Needs
Oak toad	*Bufo quercicus*	II	Savannah
Bald eagle	*Haliaeetus leucocephalus*	II	Large trees near large rivers, lakes, or sea
Eastern box turtle	*Terrapene carolina*	III	Forest generalist
Green heron	*Butorides striatus*	IV	Near streams or wetlands
Chuck-will's-widow	*Caprimulgus carolinensis*	IV	Open woods
Northern bobwhite	*Colinus virginianus*	IV	Open woods
Eastern wood-pewee	*Contopus virens*	IV	Open second-growth to mature woods
Prairie warbler	*Dendroica discolor*	IV	Open woods
Worm-eating warbler	*Helmitheros vermivorus*	IV	Thick understory near water
Eastern hog-nosed snake	*Heterodon platirhinos*	IV	Forest ecotones with sandy soils
Yellow-breasted chat	*Icteria virens*	IV	Open shrubby woods
Black-and-white warbler	*Mniotilta varia*	IV	Forest generalist
Kentucky warbler	*Oporornis formosus*	IV	Thick understory, closed canopy near water
Northern parula	*Parula americana*	IV	Damp or wet woods near water
Eastern towhee	*Pipilo erythrophthalmus*	IV	Shrubby openings and edges
Eastern spadefoot	*Scaphiopus holbrookii*	IV	Forest with sandy or otherwise loose soils
Ovenbird	*Seiurus aurocapillus*	IV	Open mature woods
Brown thrasher	*Toxostoma rufum*	IV	Shrubby clearcuts
Canada warbler [1]	*Wilsonia canadensis*	IV	Thick understory near water

[1] The Piedmont is considered only marginally within the range of this species in Virginia.

Table 5.6. Deciduous forest species of greatest conservation need in the Piedmont.

Common Name	Scientifc Name	Tier	Special Habitat Needs
Wood turtle	*Glyptemys insculpta*	I	Clear streams
Spirit supercoil	*Paravitrea hera*	I	Leaf litter on bluffs
Mole salamander	*Ambystoma talpoideum*	II	Near vernal ponds
American black duck	*Anas rubripes*	II	Near emergent or wooded wetlands
Cerulean warbler	*Dendroica cerulea*	II	Mature forest with complex canopy structure
Swainson's warbler	*Limnothlypis swainsonii*	II	Non-flooding bottomland hardwoods
Jefferson salamander [1]	*Ambystoma jeffersonianum*	IV	Near vernal ponds
Whip-poor-will	*Caprimulgus vociferus*	IV	Open woods near fields
Chimney swift	*Chaetura pelagica*	IV	Large snags or houses with chimneys
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Open woods with dense understory
Timber rattlesnake [1]	*Crotalus horridus*	IV	South-facing ledges and talus slopes

Common Name	Scientifc Name	Tier	Special Habitat Needs
Gray catbird	*Dumetella carolinensis*	IV	Dense thickets in forest openings or edges
Willow flycatcher	*Empidonax traillii*	IV	Shrubby willow or alder near water
Wood thrush	*Hylocichla mustelina*	IV	Mature upland forest with undergrowth
Rose-breasted grosbeak	*Pheuctitus ludovicianus*	IV	Second-growth mesic forest
Scarlet tanager	*Piranga olivacea*	IV	Mature forest, min size 10-12 ha
Prothonotary warbler	*Protonotaria citrea*	IV	Near water
American woodcock	*Scolopax minor*	IV	Moist or wet woods near wetlands
Louisiana Waterthrush	*Seiurus motacilla*	IV	Near water
Yellow-throated vireo	*Vireo flavifrons*	IV	Tall forest with partially open canopy

[1] The Piedmont is considered only marginally within the range of this species in Virginia.

Table 5.7. Coniferous forest species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Bachman's sparrow	*Aimophila aestivalis*	I	Open woods/savannah
Scarletsnake	*Cemophora coccinea*	IV	Sandy forests; largely subterranean
Rainbow snake	*Farancia erytrogramma*	IV	Waterways within woods
Eastern slender glass lizard	*Ophisaurus attenuatus*	IV	Open woods/savannah
Brown-headed nuthatch	*Sitta pusilla*	IV	Open woods/savannah
Southeastern crowned snake	*Tantilla coronata*	IV	Dry forest with decaying logs
Yellow-throated vireo	*Vireo flavifrons*	IV	Tall forest with partially open canopy

Table 5.8. Mixed forest species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Mole salamander	*Ambystoma talpoideum*	II	Near vernal ponds
Jefferson salamander [1]	*Ambystoma jeffersonianum*	IV	Near vernal ponds
Whip-poor-will	*Caprimulgus vociferus*	IV	Open woods near fields
Chimney swift	*Chaetura pelagica*	IV	Large snags or houses with chimneys
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Open woods with dense understory
Timber rattlesnake [1]	*Crotalus horridus*	IV	South-facing ledges and talus slopes
Gray catbird	*Dumetella carolinensis*	IV	Dense thickets in forest openings or edges
Rainbow snake	*Farancia erytrogramma*	IV	Waterways within woods
Wood thrush	*Hylocichla mustelina*	IV	Mature upland forest with undergrowth
Rose-breasted grosbeak	*Pheuctitus ludovicianus*	IV	Second-growth mesic forest
Scarlet tanager	*Piranga olivacea*	IV	Mature forest, min size 10-12 ha
Prothonotary warbler	*Protonotaria citrea*	IV	Near water
American woodcock	*Scolopax minor*	IV	Moist or wet woods near wetlands
Louisiana Waterthrush	*Seiurus motacilla*	IV	Near water
Southeastern crowned snake	*Tantilla coronata*	IV	Dry forest with decaying logs
Blue-winged warbler	*Vermivora pinus*	IV	Dense shrub layer

[1] The Piedmont is considered only marginally within the range of this species in Virginia.

5.3.2.2. Status of Forested Habitats

The 2001 Forest Inventory Analysis (FIA) reported 1.72 million acres (0.70 million ha) of coniferous forest, 3.36 million acres (1.36 million ha) of deciduous forest, 0.85 million acres (0.34 million ha) of mixed forest, and 3.8 million acres (1.54 million ha) of non-forested land in the Piedmont (USFS 2001).

5.3.2.3. Trends in Forested Habitats

According to USDA (2000), non-federal forestland in the Piedmont decreased by > 90,000 acres (> 36,000ha) during the period between 1982 and 1997. Forest trends by type are not available at the ecoregional level. Please see Section 3.2.3.1 for statewide status and trends in forested habitats.

5.3.3. Open Vegetated Habitat Species of Greatest Conservation Need in the Piedmont

5.3.3.1. Species of Greatest Conservation Need by Open Vegetated Habitat Type

Of the 33 tiered species that occur in open habitats in the Piedmont, 16 are generalists that occur in all open vegetated habitat types (Table 5.9). Of the remaining 16, 11 occur in herbaceous open habitats (Table 5.10), and five occur in scrub-shrub (Table 5.11).

Table 5.9. Open vegetated habitat generalist species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Bachman's sparrow	*Aimophila aestivalis*	I	Dense grass with scattered trees
Henslow's sparrow	*Ammodramus henslowii*	I	Native warm season grasses
Loggerhead shrike	*Lanius ludovicianus*	I	Scattered perches over short vegetation
Northern harrier	*Circus cyaneus*	III	Damp to wet fields with few trees/shrubs
Eastern box turtle	*Terrapene carolina*	III	Dense groundcover, some shrubs
Whip-poor-will	*Caprimulgus vociferus*	IV	Forages over open fields
Northern bobwhite	*Colinus virginianus*	IV	Grassy fields with shrubby cover, also agricultural fields (active and fallow)
Eastern wood-pewee	*Contopus virens*	IV	Forest openings of all kinds for foraging
Prairie warbler	*Dendroica discolor*	IV	Open habitat with some trees or shrubs
Eastern hog-nosed snake	*Heterodon platirhinos*	IV	Ecotonal areas with sandy soils
Yellow-breasted chat	*Icteria virens*	IV	Dense tall vegetation
Eastern towhee	*Pipilo erythrophthalmus*	IV	Dense tall vegetation
American woodcock	*Scolopax minor*	IV	Fields for foraging and in winter
Field sparrow	*Spizella pusilla*	IV	Weedy fields with scattered shrubs
Brown thrasher	*Toxostoma rufum*	IV	Dense tall vegetation
Eastern kingbird	*Tyrannus tyrannus*	IV	Scattered perches (shrubs, trees, fences)

Table 5.10. Herbaceous habitat species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Upland sandpiper	*Bartramia longicauda*	I	Short to medium height grassland
Wood turtle	*Glyptemys insculpta*	I	Fields near streams
Barn owl	*Tyto alba*	III	Dense grass near human structures
Grasshopper sparrow	*Ammodramus savannarum*	IV	Grassy fields with few to no shrubs
Chuck-will's-widow	*Caprimulgus carolinensis*	IV	Near pine forest (forages over fields)
Rusty blackbird (winter)	*Euphagus carolinus*	IV	Croplands in winter

Common Name	Scientific Name	Tier	Special Habitat Needs
Rainbow snake	*Farancia erytrogramma*	IV	Dry sandy fields
Eastern slender glass lizard	*Ophisaurus attenuatus*	IV	Sunny grassland with few trees
Queen snake	*Regina septemvittata*	IV	Open riparian areas
Northern rough-winged swallow	*Stelgidopteryx serripennis*	IV	Stream banks in open areas
Eastern meadowlark	*Sturnella magna*	IV	Grassy fields (pastures, etc.)

Table 5.11. Scrub-shrub species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Dense shrubby thickets
Gray catbird	*Dumetella carolinensis*	IV	Ecotonal thickets and shrubby clearings
Willow flycatcher	*Empidonax traillii*	IV	Willow thickets near water
Wood thrush	*Hylocichla mustelina*	IV	Shrubby clearings within deciduous forest
Black-and-white warbler	*Mniotilta varia*	IV	Sapling stage of forest clearings

5.3.3.2. Status of Open Vegetated Habitats

According to USDA (2000), the Piedmont contains > 0.5 million acres (> 0.2 million ha) of cultivated cropland, > 1.9 million acres (> 0.76 million ha) of pasture, noncultivated cropland, and CRP, and > 160,000 acres (> 65,000ha) of other rural land.

5.3.3.3. Trends in Open Vegetated Habitats

According to USDA (2000), during the period from 1982 through 1997, cultivated cropland decreased by > 500,000 acres (> 200,000ha) and pastureland and non-cultivated cropland increased by > 200,000 acres (> 100,000ha) in the Piedmont. These totals do not include a total of 147,000 acres (59,500ha) of federal land in the Piedmont. See Section 3.2.3.2 for statewide status and trends in open habitats in Virginia.

5.3.4. Barren Habitat Species of Greatest Conservation Need in the Piedmont

5.3.4.1. Species of Greatest Conservation Need by Barren Habitat Type

Of 10 tiered species that occur in barren or developed habitats in the Piedmont, seven occur primarily in developed residential areas (Table 5.12). The remaining three have more specialized barren habitat requirements (Table 5.13).

Table 5.12. Developed habitat generalist species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Eastern box turtle	*Terrapene carolina*	III	Occurs in residential areas
Chuck-will's-widow	*Caprimulgus carolinensis*	IV	Occurs in residential areas
Chimney swift	*Chaetura pelagica*	IV	Occurs in residential areas
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Occurs in residential areas
Eastern wood-pewee	*Contopus virens*	IV	Occurs in residential areas
Gray catbird	*Dumetella carolinensis*	IV	Occurs in residential areas
Brown thrasher	*Toxostoma rufum*	IV	Occurs in residential areas

Table 5.13. Other barren habitat species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Sandpit alydid bug	*Stachyocnemus apicalis*	III	Sandpits
Timber rattlesnake [1]	*Crotalus horridus*	IV	Rocky ledges
Northern rough-winged swallow	*Stelgidopteryx serripennis*	IV	Sandpits

[1] The Piedmont is considered only marginally within the range of this species in Virginia.

Beach Species of Greatest Conservation Need in the Piedmont

No tiered species occur in beach habitats in Virginia's Piedmont. Common tern *Sterna hirundo* occurs in the Piedmont, and utilizes beach areas in the Mid-Atlantic Coastal Plain. However, where it occurs in the Piedmont, it is limited to marsh breeding.

Balds Species of Greatest Conservation Need in the Piedmont

Balds do not occur in the Piedmont.

5.3.4.2. Status of Barren Habitats

According to USGS (1999), the Piedmont contains only 8 acres (3.2 ha) of bare soil or rock, and 11,214 acres (4,538ha) of mine or quarry. Note that most of the species in this section do not occur in either of these habitat types, but rather occur in developed residential areas.

5.3.4.3. Trends in Barren Habitats

Trends for most barren areas are not available at any scale. However, the NRI (USDA 2000) does track developed areas. Developed areas in the Piedmont increased by > 300,000 acres (>100,000ha) during the period 1982-1997. Please see Section 3.2.3.3 for statewide status and trends of barren and developed areas in Virginia.

5.3.5. Wetland Species of Greatest Conservation Need in the Piedmont

5.3.5.1. Species of Greatest Conservation Need by Wetland Type

Of the 43 tiered species that occur in Piedmont wetlands, eight are generalists that may occur in either wetland type (Table 5.14). Of the remaining 35, nine occur primarily in emergent wetlands (Table 5.15). The remaining 26 occur in wooded wetlands (Table 5.16).

Table 5.14. Wetland generalist species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Wood turtle	*Glyptemys insculpta*	I	Adjacent to clear streams
American black duck	*Anas rubripes*	II	Any wetland
Bald eagle	*Haliaeetus leucocephalus*	II	Large trees for nesting
Spotted turtle	*Clemmys guttata*	III	Shallow wetlands
Black-crowned night-heron	*Nycticorax nycticorax*	III	Nest in any vegetated wetland
Green heron	*Butorides striatus*	IV	Nests in wooded wetlands, forages in any wetland but avoids open water
Rainbow snake	*Farancia erytrogramma*	IV	Access to American eel for prey
Common ribbonsnake	*Thamnophis sauritus*	IV	Access to semi-permanent or permanent water bodies

Table 5.15. Emergent wetland species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Bog turtle	*Glyptemys muhlenbergii*	I	Spaghnum bogs or sedge meadows
Northern harrier	*Circus cyaneus*	III	Fresh or brackish marshes
Least bittern	*Ixobrychus exilis*	III	Dense emergent vegetation (*Typha/Carex/Scirpa*)
Common tern	*Sterna hirundo*	III	Fresh or brackish marshes
Mississippi turtle bug	*Allopodops mississippiensis*	IV	Sedges (*Carex* spp.)?, largely unknown
Yellow warbler	*Dendroica petechia*	IV	Willow thickets near water
Willow flycatcher	*Empidonax traillii*	IV	Willow thickets near water
Virginia rail	*Rallus limicola*	IV	Shallow water, dense emergent cover
Eastern spadefoot	*Scaphiopus holbrookii*	IV	Vernal/temporary pools with sandy soil

Table 5.16. Wooded wetland species of greatest conservation need in the Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Mole salamander	*Ambystoma talpoideum*	II	Vernal pools in wooded areas
Oak toad [1]	*Bufo quercicus*	II	Vernal pools over sandy soils
Swainson's warbler	*Limnothlypis swainsonii*	II	Dense river swamp
Yellow-crowned night-heron	*Nyctanassa violacea*	II	Wooded wetland with open understory
Eastern box turtle	*Terrapene carolina*	III	Forest generalist
Jefferson salamander [1]	*Ambystoma jeffersonianum*	IV	Shallow wooded ponds with no fish
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Dense thickets in deciduous bottomland
Eastern wood-pewee	*Contopus virens*	IV	Seasonally-flooded bottomland forest
Gray catbird	*Dumetella carolinensis*	IV	Dense shrubs near water
Willow flycatcher	*Empidonax traillii*	IV	Willow thickets near water
Rusty blackbird (winter)	*Euphagus carolinus*	IV	Trees near marshes or wooded swamps
Mudsnake [1]	*Farancia abacura*	IV	Wooded swamps
Wood thrush	*Hylocichla mustelina*	IV	Mature forest
Black-and-white warbler	*Mniotilta varia*	IV	Hardwood swamps and bottomlands
Kentucky warbler	*Oporornis formosus*	IV	Dark, wooded swamps
Northern Parula	*Parula americana*	IV	Wooded swamps with tree moss present
Rose-breasted grosbeak [1]	*Pheuctitus ludovicianus*	IV	Deciduous wooded swamps
Scarlet tanager	*Piranga olivacea*	IV	Mature bottomland forest
Prothonotary warbler	*Protonotaria citrea*	IV	Open wooded swamps with snags
Eastern mud salamander	*Pseudotriton montanus*	IV	Wooded swamps
Queen snake	*Regina septemvittata*	IV	Water with overhanging branches
Eastern spadefoot	*Scaphiopus holbrookii*	IV	Vernal/temporary pools with sandy soil
American woodcock	*Scolopax minor*	IV	Moist or wet woods near wetlands
Louisiana waterthrush	*Seiurus motacilla*	IV	Wooded streams or wooded swamps
Blue-winged warbler	*Vermivora pinus*	IV	Edges of wooded swamps
Yellow-throated vireo	*Vireo flavifrons*	IV	Wooded swamps

[1] The Piedmont is considered only marginally within the range of this species in Virginia.

5.3.5.2. Status and Trends of Wetlands

According to the 1999 NLCD (USGS 1999), the Piedmont contains 70,400ha of forested and shrubby wetland and 10,100ha of emergent wetland.

Trends of wetlands are not currently available at an ecoregional level for Virginia. Please see Section 3.2.3.4 for statewide status and trends of wetlands in Virginia.

5.4. Aquatic Species in the Piedmont

5.4.1. Piedmont-Roanoke EDU

The headwaters of the Roanoke River drain the Northern Ridge and Valley and Blue Ridge Mountains of Virginia. In Virginia, a majority of the watershed drains the Piedmont ecoregion (Figure 5.11). The Roanoke crosses into North Carolina before entering the Mid-Atlantic Coastal Plain. Several rivers within the drainage are significant on their own and include the Dan, Smith, Mayo, and Banister Rivers.

The Roanoke joins the Pee Dee and Chowan drainages to form the South Atlantic freshwater ecoregion, which is considered "globally outstanding" in terms of biological distinctiveness (Abell et al. 2000). The South Atlantic freshwater ecoregion is home to 48 endemic aquatic species including fish, mussels, and amphibians.

5.4.1.1 Tier I Species in the Piedmont-Roanoke EDU

5.4.1.1.1. Roanoke logperch, *Percina rex*

Life History Summary

The Roanoke logperch is a Federal and State endangered species found only in the Roanoke and Nottoway river systems of Virginia. It is usually rare or uncommon. The populations are disjunct, separated by large stretches of unsuitable river habitat or impoundments (Burkhead and Jenkins 1991). It feeds on immature benthic invertebrates and exhibits a feeding behavior of flipping rocks to expose prey items (Jenkins and

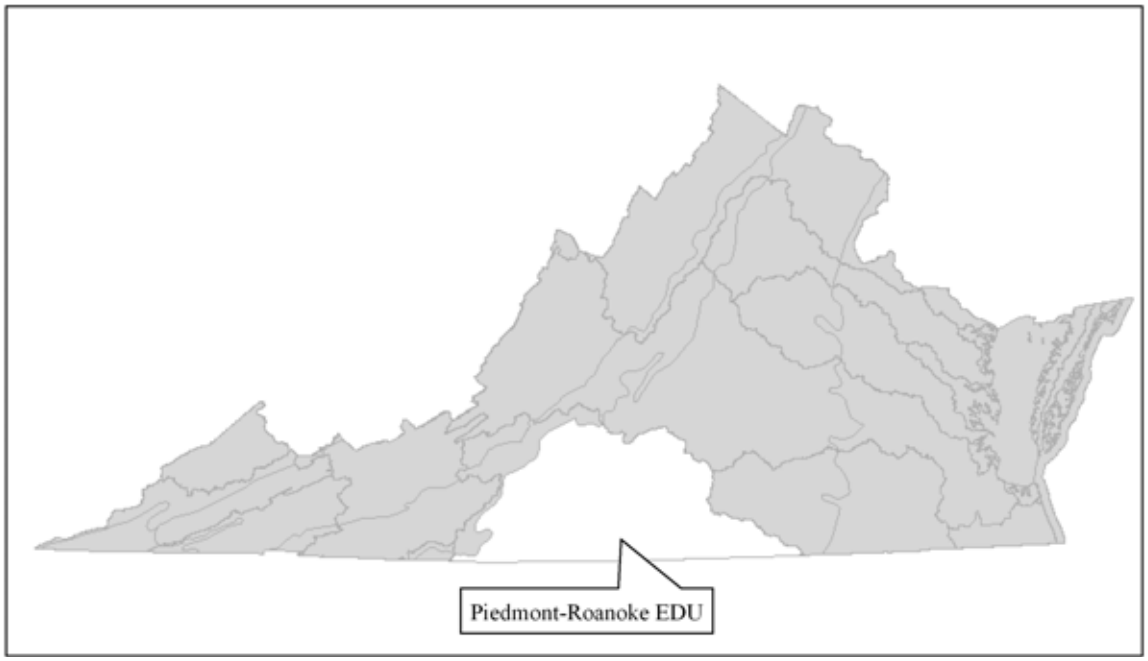

Figure 5.11. Location of the Piedmont-Roanoke EDU.

Burkhead 1994). The Roanoke logperch spawns in spring and early summer. Recent work by Rosenberger and Angermeier (2003) revealed that throughout its life, the Roanoke logperch inhabits a changing and varied array of habitats. An overall preference for relatively silt-free substrates and its restricted distribution have made it vulnerable to extinction. The Roanoke logperch is legally protected with the status of Federal and State endangered.

Location

The map of Roanoke logperch habitat (Figure 5.12) includes confirmed reaches based on Collections (DGIF 2004b) and potential reaches using stream size, connectivity, gradient and reach elevation in the DGIF aquatic habitat classification. For more details on mapping potential reaches, see Appendix D.

Description of Essential Habitat

The most "essential" aspect of Roanoke logperch habitat is silt-free, unembedded substrate including clean sand as well as larger particles. (P. L. Angermeier, VCFWRU, pers. comm.). In the Roanoke River, this species occupies warm, moderate to large streams and small rivers. Rosenberger and Angermeier (2003) found that there were shifts in habitat use across life stages and between drainages. Adult and subadult logperch were found in runs, riffles, and pools, in order of preference, while YOY were found exclusively in backwaters and secondary channels. Adults were observed in the deepest water (mean of 52.5cm) of significantly higher velocity than subadults or YOY.

The Roanoke logperch is intolerant of moderately to heavily silted areas except in winter periods of inactivity (Jenkins and Burkhead 1994). In the warmer months, the adults are usually on gravel and rubble in runs and riffles, occasionally pools. When the water temperature drops below 8°C, this species becomes quiescent under rocks in pools. Prior to spawning, the adults segregate, with the males going to the riffles and the females to deeper runs.

The DGIF aquatic habitat classification was also used to identify the diversity of habitat types used by the Roanoke logperch and to assess patterns of distribution (Table 5.17). Neither headwaters nor large rivers

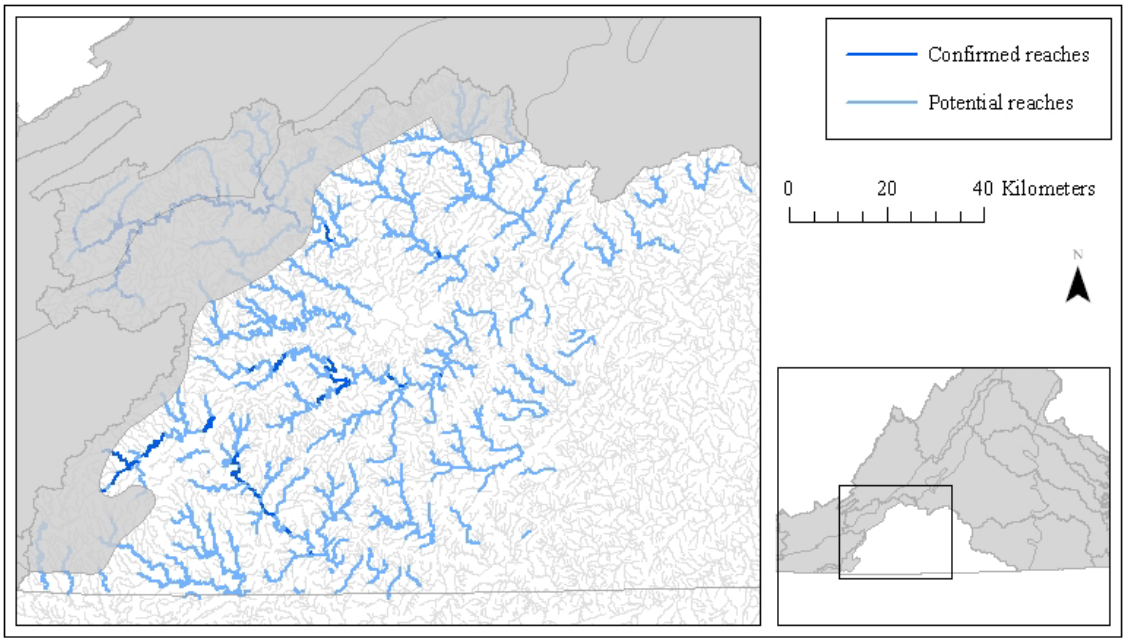

Figure 5.12. Location of confirmed and potential Roanoke logperch habitat in the Piedmont-Roanoke EDU.

were used by Roanoke logperch. Most of the specimens were collected from reaches characterized as small streams to small rivers with very low gradient across the length of the reach. Three reaches within impoundments were found to contain this species; however, this is not believed to be a part of the species' core habitat.

Table 5.17. DGIF aquatic habitat types used by the Roanoke logperch in the Piedmont-Roanoke EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient large stream connected to another large stream	18
Very low gradient small stream connected to another small stream	10
Low gradient small stream connected to another small stream	5
Very low gradient small stream connected to a small river (impoundment)	1
Very low gradient large stream connected to a small river	1
Very low gradient large stream connected to a small river (impoundment)	1
Very low gradient small river connected to another small river	1
Very low gradient small river connected to another small river (impoundment)	1

Relative Condition of Habitat

All but three reaches in the range of the Roanoke logperch in the Piedmont-Roanoke ecological drainage unit are affected by 303d impaired waters. Bacteria levels with urban and agricultural sources are the main impairment (DEQ and DCR 2004).

Specific Threats and Trends

Burkhead and Jenkins (1991) list channelization, siltation, chronic pollution of various types, catastrophic chemical spills, impoundment and dewatering as major stresses to this species. In addition, a report by Wheeler et al. (2003) describes many potential direct and indirect effects, including those mentioned above, from the proposed construction of I-73 on the Roanoke logperch and other aquatic biota. No species-specific threats were listed by the Fish TAC (2004) for the Roanoke logperch. A summary of the stresses and sources of stress identified for the Roanoke River drainage is available in Appendix H.

Conservation Actions and Strategies

Burkhead and Jenkins (1991) list several specific conservation actions and generally recommend long-term bank stabilization and better monitoring and enforcement of regulations regarding silt control in construction projects to reduce sedimentation. They also recommend the review of discharge permits to evaluate cumulative concentration of effluents in the Roanoke drainage. The USFWS identified four actions needed to meet the recovery objectives listed in this species' recovery plan (USFWS 1992). They include: using existing legislation to protect it; developing educational programs and other resources to inform the public about the species and its status; determining feasibility of re-establishing or reintroducing populations where appropriate; and implementing measures to reduce sedimentation and other identified threats. More conservation actions related to threats were identified by Fish TAC (2004) (Appendix I).

Research and Monitoring Needs

Three research or monitoring activities were identified by USFWS to meet the recovery objectives listed in this species' recovery plan (USFWS 1992). These include surveys for additional populations and habitats for possible reintroduction; characterization of the species habitat requirements and population viability including monitoring of threats; and surveys to monitor population levels and habitat conditions.

5.4.1.1.2. James spinymussel, *Pleurobema collina*

Life History Summary

Most of the work regarding the Federal and State endangered James spinymussel has involved the James River drainage population. It is a short-term brooder. Hove (1990) identified several fish hosts for this species from work in Craig Creek including: rosyside dace *Clinostomus funduloides*, bluehead chub *Nocomis leptocephalus*, mountain redbelly dace *Phoxinus oreas*, blacknose dace *Rhinichthys atratulus*, central stoneroller *Campostoma anomalum*, rosefin shiner *Lythrurus ardens*, satinfin shiner *Cyprinella analostana*, and swallowtail shiner *Notropis procne*. In the James River drainage, this species occupies a wide range of habitats, which suggests that it used to be much more widespread and that its current rarity is due to decline from habitat loss or other external threats, rather than an innate feature of the species.

Recently (2000-2002), R. J. Neves discovered a population in the Dan River (R. J. Neves, VCFWRU, unpublished data). Little is known about the life history, distribution, or even precise taxonomy of this population. Currently it is considered *Pleurobema collina*, however, research is underway to validate its taxonomy. For management purposes, the populations are currently considered different management units of the same species (B. T. Watson, DGIF, pers. comm.).

The James spinymussel is legally protected with the status of Federal and State endangered.

Location

The map of the James spinymussel (Figure 5.13) includes confirmed reaches based on Collections (DGIF 2004b) and potential reaches using size, connectivity and gradient attributes from DGIF's aquatic habitat classification. For more details on mapping potential reaches, see Appendix D.

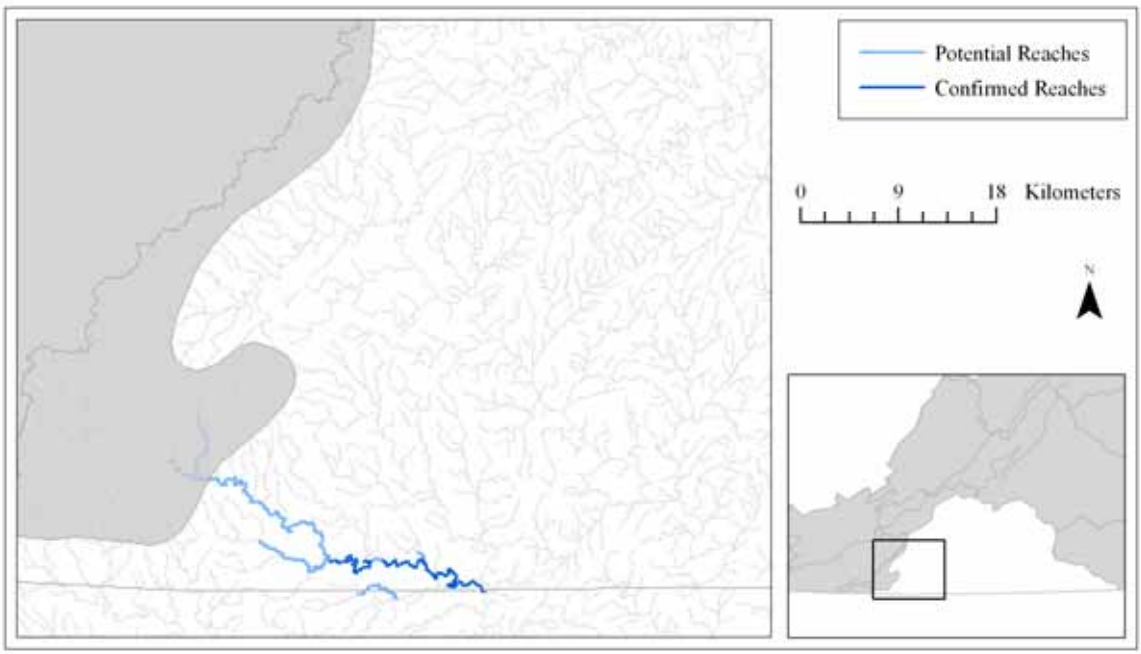

Figure 5.13. Location of confirmed and potential James spinymussel habitat in the Piedmont-Roanoke EDU.

Description of Essential Habitat

This species is found in unpolluted, well-oxygenated, second and third order streams of moderate hardness ($CaCO_3$ > 50mg/l). It is found in runs with moderate current and with a sand, gravel, and cobble substrate (Clarke and Neves 1984). Streams containing James spinymussel range from 0.3 to 2m deep and 1 to 20m wide (Hove 1990). They seem to prefer bottom sediments of sand and cobble, with or without boulders, pebbles or silt. They are usually buried in the substrate near stagnant riffle-run flows (Hove 1990).

Extirpated populations may have occurred in larger rivers with sandy bottoms. This species was once more widely distributed throughout the James River drainage and has been significantly reduced to approximately 5-10% of its historic distribution (B. T. Watson, DGIF, pers. comm.). Neither its historic nor its current distribution in the Dan River is known. Determining the location of potential habitat was based upon the DGIF habitat classification attributes in the Dan River locations only. The DGIF aquatic habitat classification was also used to identify the diversity of habitat types used by the James spinymussel and to assess patterns of distribution (Table 5.18). Only five reaches have been identified thus far as containing this mussel. They are all small streams of low or very low gradient. However, because of the lack of information on this species in this drainage, it is difficult to thoroughly discuss its habitat preferences.

Table 5.18. DGIF Aquatic habitat types used by the James spinymussel in the Piedmont-Roanoke EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small stream connected to another small stream	3
Low gradient small stream connected to another small stream	1
Very low gradient small stream connected to a large stream	1

Relative Condition of Habitat

A significant portion of the range of the James spinymussel in the Dan River system is considered impaired by DEQ and DCR (2004). The sources of impairment are agriculture, urban, wildlife and unknown, which have caused unsatisfactory bacteria and temperature levels.

Specific Threats and Trends

Neves (1991) suggests that habitat degradation and reproductive isolation have caused the decline of the James spinymussel. Clarke (1986) also lists competition from the Asian clam *Corbicula fluminea* as a possible threat. Table 5.19 summarizes the data on stresses received from Mussel TAC (2004). These cover the threats to both the James River and the Dan River populations, but some of the stresses pertaining to municipal development are not as widespread or severe in the Dan River system.

Table 5.19. Stresses on the James spinymussel (Mussel TAC 2004).

Stress	Source of Stress	Scope	Severity	Comments
Hydrologic regime alteration	a) dam b) water withdrawal c) municipal development d) beaver activity	a) 2 b) 2 c) 2 d) 1	a) 4 b) 2 c) 3 d) 1	Dam building also floods habitat, causing habitat destruction
Sediment load alteration	Municipal development	4	3	
Insecticides	Municipal development	2	1	Molluscicides possible on lawns
Nutrient regime alteration	Agriculture	3	2	Livestock
Complications due to small populations (inbreeding, stochastic fluctuation, etc.)		4	4	
Toxins	Industrial, other	1	4	Spills (trucks and industrial accidents)

Conservation Actions and Strategies

The recovery plan for the James spinymussel identified two initial conservation actions: investigation of specific threats such as siltation, pesticides, municipal and industrial effluents, and Asian clam interactions; and assessment of projects that pose potentially negative effects on the species or its habitat (USFWS 1990). Following the implementation and assessment of these actions and monitoring actions listed below, other secondary actions should be undertaken: implement methods to control Asian clams; implement appropriate protection strategies as identified; and re-establish populations as appropriate.

Mussel TAC (2004) identified conservation actions specific to the threats outlined above (in no particular order):

- Dam removal and/or installation of fish passage for necessary fish host migration and habitat restoration
- Stormwater management
- More efficient use of water
- Education of regional and county planning administrators
- Education of homeowners regarding the use of fertilizers and pesticides (especially molluscicides)
- Work with VDOT to develop possible solutions to salt application and subsequent runoff
- Implementation of appropriate best management practices for agriculture and stormwater management
- Augment population where possible
- Increase hazardous materials response to spills
- Improve enforcement of existing water quality and permitting regulations

Research and Monitoring Needs

The recovery plan for the James spinymussel identified the following research or monitoring needs: determination of essential habitat; threats monitoring; life history and ecology studies to establish the feasibility and methods to re-introduce this species to its historic range; and monitoring of existing and introduced populations (USFWS 1990). Mussel TAC (2004) listed other research needs tied to stress reduction. These include: researching and subsequently implementing minimum flow requirements; investigating the amount of sediment reduction needed to see a positive effect on mussel community; researching the impacts of biocide runoff from residents, investigating the toxicity of creosote contamination from wood bridges and road salts.

5.4.1.2. Aquatic SGCN by Habitat Group: Piedmont-Roanoke EDU

Of the 22 tiered species occurring in the Piedmont-Roanoke EDU, 15 are fishes and seven are mussels. They are distributed among four habitat groups and one group of unknown or generalist species (Tables 5.20-24).

Table 5.20. Aquatic species of greatest conservation need in headwaters and small streams with low to moderate gradient.

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Carolina darter	*Etheostoma collis*	II	96	8
Rustyside sucker	*Thoburnia hamiltoni*	III	64	5
Whitemouth shiner	*Notropis alborus*	IV	91	5
Ironcolor shiner	*Notropis chalybaeus*	IV	100	2

Table 5.21. Aquatic species of greatest conservation need in small streams with very low or low gradient.

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
James spinymussel	*Pleurobema collina*	I	100	3
Orangefin madtom	*Noturus gilberti*	II	82	5
Notched rainbow mussel	*Villosa constricta*	III	100 (1 occurrence)	1
Triangle floater	*Alasmidonta undulates*	IV	100 (1 occurrence)	1
Redlip shiner (may be introduced)	*Notropis chiliticus*	IV	81	7

Table 5.22. Aquatic species of greatest conservation need in small to large streams with very low gradient.

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Roanoke logperch	*Percina rex*	I	94	8
Roanoke bass	*Ambloplites cavifrons*	II	96	12
Spotted margined madtom	*Noturus insignis* ssp. 1	II	87	2
Riverweed darter	*Etheostoma podostemone*	IV	88	19
Speckled killifish	*Fundulus rathburni*	IV	69	6

Table 5.23. Aquatic species of greatest conservation need in medium to large rivers.

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Snail bullhead	*Ameiurus brunneus*	IV	73	4

Table 5.24. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
Roanoke slabshell	*Elliptio roanokensis*	II	N/A (indeterminate)
Bigeye jumprock	*Moxostoma ariommum*	III	17 (generalist)
American eel	*Anguilla rostrata*	IV	14 (generalist)
Gravel elimia	*Elimia catenaria*	IV	1 (1 occurrence, indeterminate)
Roanoke hogsucker	*Hypentilium roanokense*	IV	31 (generalist)
Creeper	*Strophtus undulatus*	IV	2 (indeterminate)
Florida pondhorn	*Uniomerus caroliniana*	IV	N/A (indeterminate)

Relative Condition of Habitat

In the Piedmont-Roanoke EDU, over 1500km of stream have been identified as impaired. This represents approximately 12% of the riverine habitat in this EDU. Causes of the listings included bacteria, fecal coliform, temperature, general standard (benthics), PCB-contaminated fish tissue, and VDH health advisories (DEQ and DCR 2004). Sources of these contaminants include various non-point sources, including agriculture, urban, and wildlife, and point sources, including water releases and municipalities. There are several areas where the source of the contaminant is unknown. An assessment of the disturbed land cover within this EDU indicates that about 2% of the area is developed, and 25% is agriculture. Within the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15%.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups decided upon at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

5.4.2. Piedmont-Chowan EDU

The Chowan drainage is comprised of three smaller watersheds in southeastern Virginia (Figure 5.14). These watersheds are the Blackwater (entirely within the Coastal Plain), the Nottoway, and the Meherrin. The Chowan River itself is formed at the border with North Carolina by the confluence of the Blackwater and Meherrin. The Chowan empties into the Albemarle Sound, and is considered very similar zoogeographically to the Roanoke.

The Chowan joins the Pee Dee and Roanoke drainages to form the South Atlantic freshwater ecoregion, which is considered "globally outstanding," in terms of biological distinctiveness (Abell et al. 2000). The South Atlantic freshwater ecoregion is home to 48 endemic aquatic species including fish, mussels, and amphibians.

5.4.2.1. Tier I Species in the Piedmont-Chowan EDU

5.4.2.1.1. Roanoke logperch, *Percina rex*

Life History Summary

The Roanoke logperch is a Federal and State endangered species found only in the Roanoke and Nottoway river systems of Virginia. It is usually rare or uncommon. The populations are disjunct, separated by large stretches of unsuitable river habitat or impoundments (Burkhead and Jenkins 1991). It feeds on immature benthic invertebrates and exhibits a feeding behavior of flipping rocks to expose prey items. The Roanoke logperch spawns in spring and early summer. Recent work by Rosenberger and Angermeier (2003) revealed that throughout its life, the Roanoke logperch inhabits a changing and varied array of habitats. An overall preference for relatively silt-free substrates and its restricted distribution have made it vulnerable to extinction. The Roanoke logperch is legally protected with the status of Federal and State endangered.

Location

The map of Roanoke logperch habitat (Figure 5.15) includes confirmed reaches based on Collections (DGIF 2004b) and potential reaches using stream size, connectivity and gradient attributes in the DGIF aquatic habitat classification. For more details on mapping potential reaches see Appendix D.

Description of Essential Habitat

As in the Roanoke River, this species prefers silt free conditions in the Nottoway River. Roanoke logperch adults and subadults are found primarily in deep, low-velocity pools and runs with sand and gravel substrate (Rosenberger and Angermeier 2003). Here they are only occasionally found in riffles and runs, which is different from habitat preferences observed in the Roanoke River. Rosenberger and Angermeier (2003) found that ontogenetic shifts in habitat use were less pronounced in the Nottoway than in the Roanoke River.

The DGIF aquatic habitat classification was also used to identify the diversity of habitat types used by the Roanoke logperch and to assess patterns of distribution (Table 5.25). Neither headwaters nor large rivers were used by the Roanoke logperch. Most of the specimens were collected from reaches characterized as large streams to small rivers, with very low gradient across the length of the reach. Three reaches within impoundments or other lentic habitats were found to contain this species; however, this is not believed to be a part of the species' core habitat.

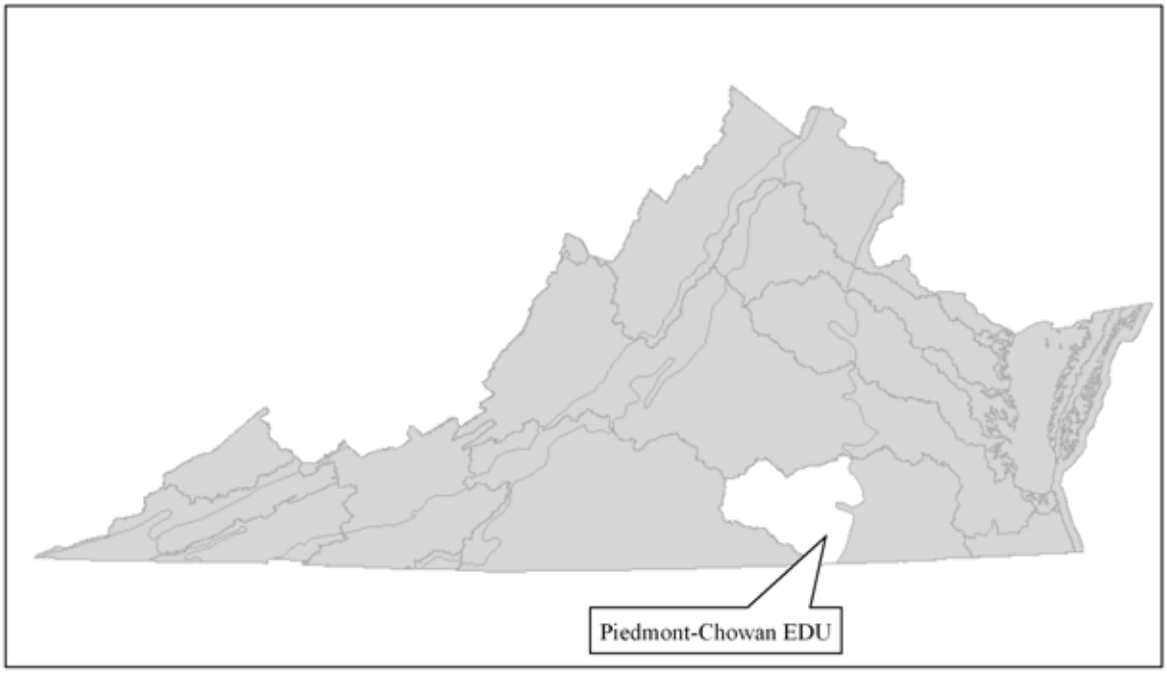

Figure 5.14. Location of the Piedmont-Chowan EDU.

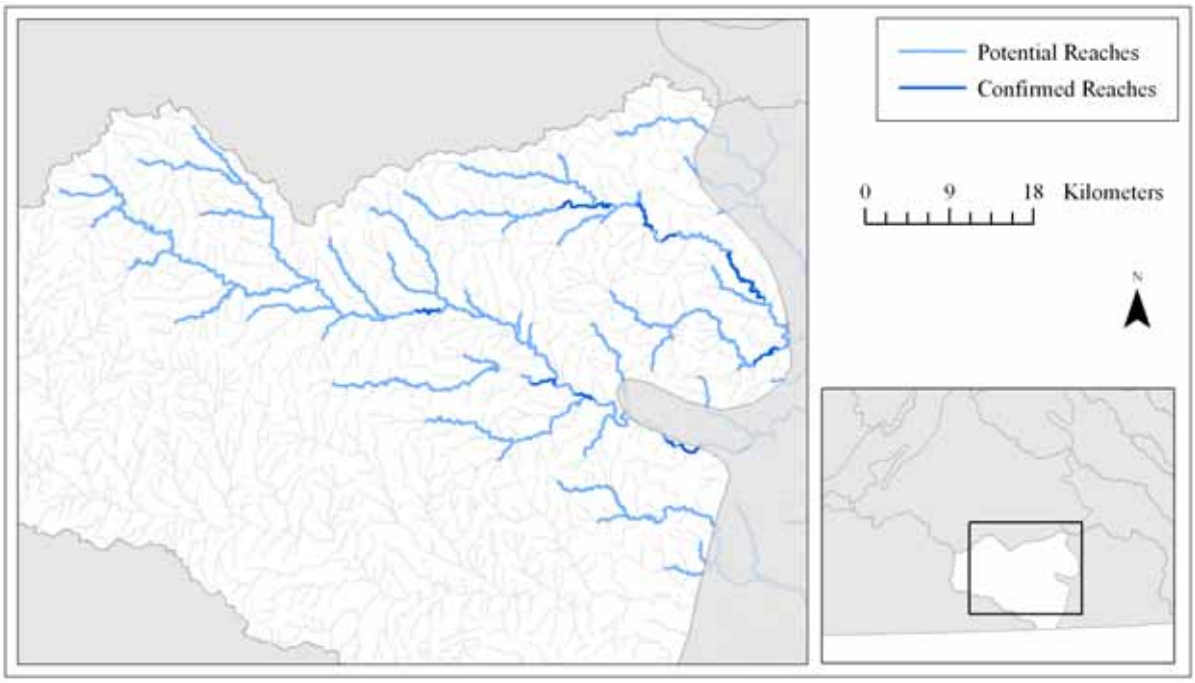

Figure 5.15. Location of confirmed and potential Roanoke logperch habitat in the Piedmont-Chowan EDU.

Table 5.25. DGIF aquatic habitat types used by the Roanoke logperch in the Piedmont-Chowan EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small river connected to another small river	14
Very low gradient large stream connected to another large stream	7

Aquatic Habitat Type	Number of Reaches
Very low gradient large stream connected to another large stream (impoundment or wetland)	2
Very low gradient small stream connected to another small stream	3
Very low gradient small river connected to another small river (impoundment or wetland)	1
Very low gradient small stream connected to a small river	1

Relative Condition of Habitat

Most of the range of the Roanoke logperch in the Piedmont-Chowan EDU is distributed within impaired waters (DEQ and DCR 2004). The impairments include bacteria, fecal coliform, dissolved oxygen, pH, and *Escherichia coli*. Sources are largely unknown or attributable to natural conditions.

Specific Threats and Trends

Burkhead and Jenkins (1991) list channelization, siltation, chronic pollution of various types, catastrophic chemical spills, impoundment and dewatering as major stresses to this species. No species-specific threats were listed by Fish TAC (2004) for the Roanoke logperch; however, stresses and sources of stress were identified for the Roanoke River drainage (Appendix H).

Conservation Actions and Strategies

Burkhead and Jenkins (1991) list several specific conservation actions, and generally recommend long term bank stabilization and better monitoring and enforcement of regulations regarding silt control in construction projects to reduce sedimentation. They also recommend the review of discharge permits to evaluate cumulative concentration of effluents in the Roanoke drainage. Four actions were identified by USFWS (1992) to meet the recovery objectives listed in this species' recovery plan. They include: using existing legislation to protect it; developing educational programs and other resources to inform the public about the species and its status; determining feasibility of re-establishing or reintroducing populations where appropriate; and implementing measures to reduce sedimentation and other identified threats. More conservation actions related to threats were identified by Fish TAC (2004) (Appendix I).

Research and Monitoring Needs

Three research or monitoring activities were identified by USFWS (1992) to meet the recovery objectives for this species. These include surveys for additional populations and habitats for possible reintroduction; characterization of the species habitat requirements and population viability including monitoring of threats; and surveys to monitor population levels and habitat conditions.

5.4.2.2. Aquatic SGC N by Habitat Group: Piedmont-Chowan EDU

Of the 28 tiered species occurring in the Piedmont-Chowan EDU, there are 14 mussels, 11 fishes, one crayfish, one insect, and one snail. We identified two habitat groups and one generalist or unknown category (Tables 5.26-28).

Table 5.26. Aquatic species of greatest conservation need in small to large streams with very low gradient connected to similarly sized streams (DGIF classification types 221, 221w, and 331).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Dwarf wedgemussel	*Alasmidonta heterodon*	II	100	2 (5 occurrences)
Yellow lance	*Elliptio lanceolata*	III	89	4

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Notched rainbow mussel	*Villosa constricta*	III	74	8
Mud sunfish	*Acantharchus pomotis*	IV	69	5 (also in headwaters)
Triangle mussel	*Alasmidonta undulata*	IV	82	4
Lined topminnow	*Fundulus lineolatus*	IV	100	2 (5 occurrences)
Ironcolor shiner	*Notropis chalybaeus*	IV	100	2 (6 occurrences)
Creeper mussel	*Strophitus undulatus*	IV	77	6

Table 5.27. Aquatic species of greatest conservation need in large streams to small rivers with very low gradient connected to similarly sized streams (DGIF classification types 331, 331w, 441 and 441w).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Bridle shiner	*Notropis bifrenatus*	I	100	1 (4 occurrences, 1967-8)
Roanoke logperch	*Percina rex*	I	85	6
American shad	*Alosa sapidissima*	IV	83	3 (6 occurrences)
Roanoke bass	*Ambloplites cavifrons*	IV	79	6

Table 5.28. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
Roanoke slabshell	*Elliptio roanokensis*	II	N/A (indeterminate)
Septima's clubtail	*Gomphus septima*	II	N/A (indeterminate)
Yellow lampmussel	*Lampsilis cariosa*	III	6
Chowanoke crayfish	*Orconectes virginiensis*	III	N/A (indeterminate)
American eel	*Anguilla rostrata*	IV	16
Alewife floater	*Anodonta implicate*	IV	N/A (indeterminate)
Gravel Elimia	*Elimia catenaria*	IV	1 (1 occurrence)
Carolina lance mussel	*Elliptio angustata*	IV	N/A (indeterminate)
Carolina slabshell mussel	*Elliptio congaraea*	IV	1 (1 record)
Northern lance mussel	*Elliptio fisheriana*	IV	N/A (indeterminate)
Banded sunfish	*Enneacanthus obesus*	IV	N/A (indeterminate)
American lamprey	*Lampetra appendix*	IV	8
Ridged lioplax	*Lioplax subcarinata*	IV	N/A (indeterminate)
Whitemouth shiner	*Notropis alborus*	IV	N/A (indeterminate)
Sharp sprite	*Promenetus exacuous*	IV	N/A (indeterminate)
Florida pondhorn	*Uniomerus caroliniana*	IV	N/A (indeterminate)

Relative Condition of Habitat

Within the Piedmont-Chowan EDU, approximately 614km, or 15%, of riverine habitat have been identified as impaired (DEQ and DCR 2004). Most of the impaired streams were listed due to fecal coliform levels

from unknown sources, or due to pH and dissolved oxygen levels from natural conditions. An assessment of the disturbed land cover within this EDU indicates that about 1% of the area is developed, and 21% is agriculture. Within the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15%.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups decided upon at the workshops. The level of detail within these groups does not correspond to that used in the DGIF aquatic habitat classification.

5.4.3. Piedmont- James EDU

The James River drainage occurs almost wholly within Virginia and covers over 25% of the land area of the state (Jenkins and Burkhead 1994). It crosses the Ridge and Valley, Blue Ridge, Piedmont, and Coastal Plain. The Piedmont-James EDU (Figure 5.16) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). As its name implies, this ecoregion encompasses all of the drainages of the Chesapeake Bay. This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including the roughhead shiner *Notropis semperasper* found only in the headwaters of the James River. It is also home to several migratory fish including the American shad, alewife, and American eel. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness.

5.4.3.1. Tier I Species in the Piedmont-James EDU

5.4.3.1.1. Bridle shiner, *Notropis bifrenatus*

Life History Summary

The bridle shiner is thought to be a sight predator. Main prey items include invertebrates associated with open water, plants, or benthos (Burkhead and Jenkins 1991). Spawning occurs largely between mid-May and mid-June in pools over submerged aquatic vegetation. The bridle shiner has the status of State special concern.

Location

The map of bridle shiner habitat (Figure 5.17) includes confirmed reaches based on known locations in Collections (DGIF 2004b). We were not able to determine potential habitat for this species because of few confirmed reaches and the importance of aquatic vegetation, which we cannot identify with existing datasets.

Description of Essential Habitat

This is a slackwater shiner, found in quiet pools in streams and creeks. It is also found in ponds and lakes, where it prefers slow current but not standing water. This species occurs over mud, silt or detritus-covered bottoms, usually in association with aquatic vegetation. It will rarely enter tidal fresh and brackish water (Jenkins and Burkhead 1994). Many upland and lowland records are from large marshes or marsh-fringed shores. In such areas the bridle shiner's specific affiliation may be with submerged vegetation. It is a freshwater oligohaline fish with a propensity for clear water (Burkhead and Jenkins in Terwilliger 1991). It tolerates salinity levels generally < 2ppt and is not believed to be acid tolerant, preferring water with pH > 7.0 (Jenkins and Burkhead 1994).

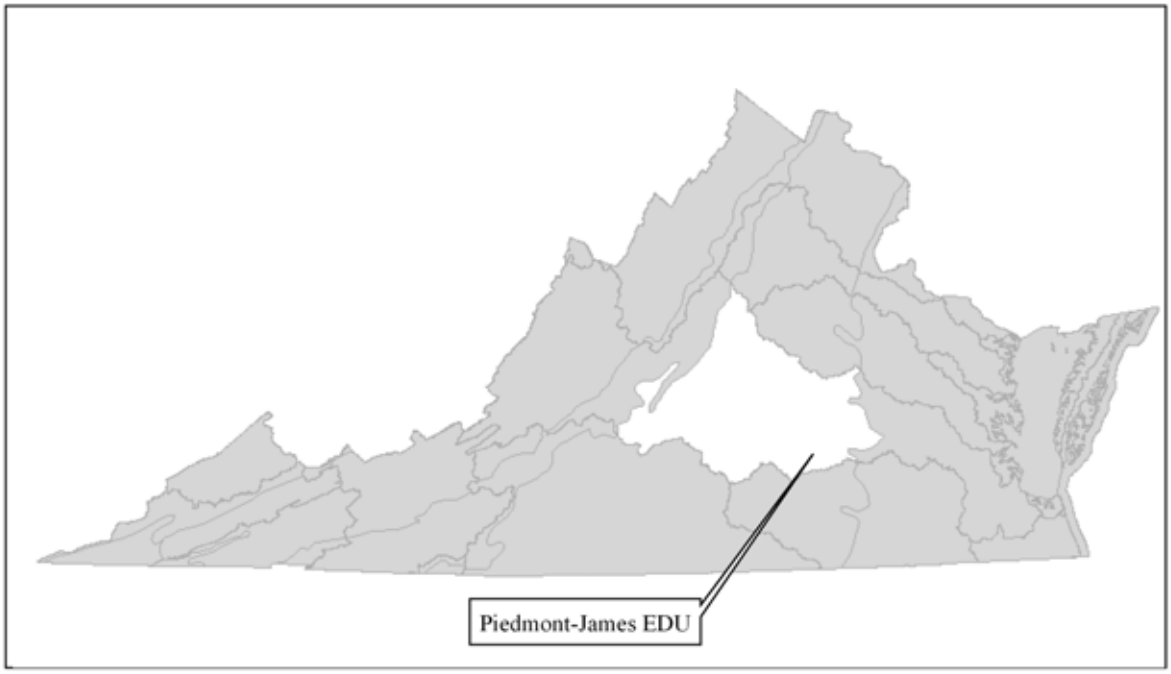

Figure 5.16. Location of the Piedmont-James EDU.

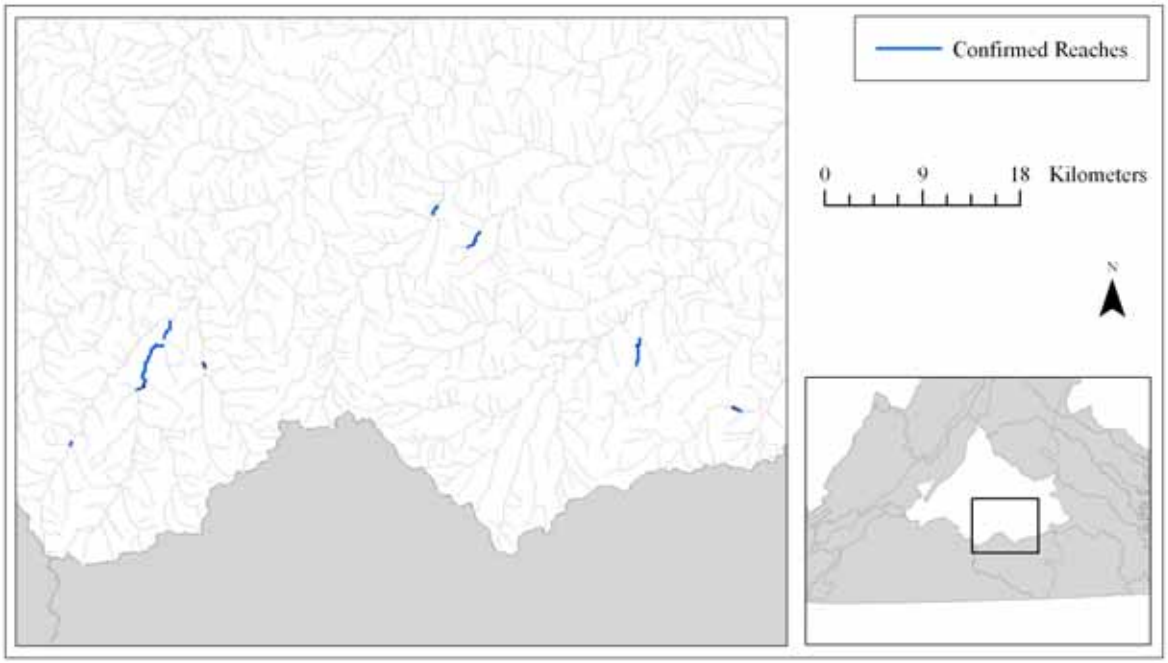

Figure 5.17. Location of confirmed bridle shiner habitat in the Piedmont-James EDU.

Table 5.29. DGIF aquatic habitat types used by the bridle shiner in the Piedmont-James EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small stream connected to another small stream	5
Very low gradient small stream connected to another small stream (impoundment or wetland)	

Aquatic Habitat Type	Number of Reaches
Very low gradient headwater connected to another headwater (impoundment or wetland)	1
Very low gradient headwater connected to a small stream	1
Very low gradient small stream connected to a large stream	1

Relative Condition of Habitat

A predictive map was not produced for this species, due to a lack of data, so only the known habitats were reviewed. Only a small portion of this species' habitat is affected by impairment as defined in the DEQ and DCR water quality report (2004). This impairment is from fecal coliform of an unknown source.

Specific Threats and Trends

Burkhead and Jenkins (1991) list increased turbidity and sedimentation as the primary threats to this species. These stresses affect the sight feeding abilities of this species and reduce populations of submerged aquatic vegetation. Agricultural pollution may also be a threat to this species. Fish TAC (2004) did not identify any specific threats for the bridle shiner; however, stresses and sources of stress were identified for the James River drainage (Appendix H).

Conservation Actions and Strategies

Fish TAC (2004) did not identify any specific conservation strategies for the bridle shiner; however, conservation actions were identified for the James River drainage (Appendix I).

Research and Monitoring Needs

Burkhead and Jenkins (1991) recommend that the existing populations of bridle shiner be monitored, and that surveys should be completed to determine the range of the species in Virginia.

5.4.3.1.2. Virginia pigtoe, *Lexingtonia subplana*

Life History Summary

The taxonomy of this species is in question. It may be lumped with the Atlantic pigtoe *Fusconaia masoni* (Mussel TAC 2004). As a species, this organism is extremely rare. It was found in the early 1900s in the upper James River drainage (Gerberich 1991). It is thought to be a short-term brooder. Fish hosts are unknown. The Virginia pigtoe has been designated a species of concern by the Virginia Field Office of USFWS.

Location

The map of Virginia pigtoe habitat (Figure 5.18) includes confirmed reaches based on Collections (DGIF 2004b). Because there is only one confirmed reach for this species, we do not know enough to determine potential habitat. Additionally, the confirmed reach shown represents a historic collection.

Description of Essential Habitat

This species prefers cool, rapidly flowing headwaters with sand and gravel substrates that are clean and undisturbed (Gerberich 1991). The DGIF aquatic habitat classification was also used to identify the diversity of habitat types used by the Virginia pigtoe and to assess patterns of distribution (Table 5.30). The reach in which it was located contradicts its general habitat description. There may be some mapping error involved in these data. More work is needed to understand its distribution and habitat needs, as well as taxonomy.

Figure 5.18. Confirmed habitat for the Virginia pigtoe in the Piedmont-James EDU.

Table 5.30. DGIF aquatic habitat types used by *Lexingtonia subplana* in the Piedmont-James EDU.

Aquatic Habitat Type	Number of Reaches
Low gradient large river connected to another large river	1

Relative Condition of Habitat

The DCR-NH SCUs identified for the Virginia pigtoe are affected mostly by large sections of impaired waters upstream of the specific locations (DEQ and DCR 2004). The impairment for most of the waters is fecal coliform from a variety of sources, including nonpoint urban, but sources are largely unknown.

Specific Threats and Trends

Gerberich (1991) discusses the limiting effects of urban development and water pollution from paper mills and other industry on Virginia pigtoe. Mussel TAC (2004) identified species-specific threats largely representing water quality stresses (Table 5.31).

Table 5.31. Species-specific threats listed for the Virginia pigtoe (Mussel TAC 2004).

Stress	Source of Stress	Scope	Severity
Sediment load alteration	Forestry	4	2
Sediment load alteration	Agriculture	3	2
Organic matter input regime alteration	Forestry	3	1
Turbidity alteration	Forestry	3	1
Turbidity alteration	Agriculture	3	1
Toxins	Roadways	2	2
Hydrologic regime alteration	Municipal development	2	2
Nutrient input regime alteration	Agriculture	2	2
Habitat fragmentation	Agriculture	3	2

Conservation Actions and Strategies

No species-specific conservation actions or strategies have been identified. However, for this particular suite of stresses and sources of stress, the following actions have been identified: implementation of appropriate agricultural, forestry, and urban BMPs; improved spill response by state response team; and education of regional and county planners regarding land use planning and its effects on water quality and wildlife (Mussel TAC 2004).

Research and Monitoring Needs

Very little is known about this species, including taxonomy. Some evidence suggests it should be lumped with the Atlantic pigtoe *Fusconaia masoni* (Mussel TAC 2004). Repeated surveys at known locations have produced no specimens; a detailed survey is needed to assess its status and distribution (Gerberich 1991). Mussel TAC (2004) identified the need to understand what levels of sedimentation and nutrient reduction are needed to initiate a response in the mussel assemblage. They also discussed a lack of knowledge regarding what impact various BMPs actually have on the habitat and species.

5.4.3.1.3. James spinymussel, *Pleurobema collina*

Life History Summary

Most of the work regarding the Federal and State endangered James spinymussel (*Pleurobema collina*) has involved the James River drainage population. It is a short-term brooder. Hove (1990) identified several fish hosts for this species from work in Craig Creek including: rosyside dace *Clinostomus funduloides*, bluehead chub *Nocomis leptocephalus*, mountain redbelly dace *Phoxinus oreas*, blacknose dace *Rhinichthys atratulus*, central stoneroller *Campostoma anomalum*, rosefin shiner *Lythrurus ardens*, satinfin shiner *Cyprinella analostana*, and swallowtail shiner *Notropis procne*. In the James River drainage, this species occupies a wide range of habitats, which suggests that it used to be much more widespread and that its current rarity is due to decline from habitat loss or other external threats rather than an innate feature of the species.

Recently (2000-2002), R. J. Neves discovered a population in the Dan River (R. J. Neves, VCFWRU, unpublished data). Little is known about the life history, distribution, or even precise taxonomy of this population. Currently it is considered to be *Pleurobema collina*; however, research is underway to validate its taxonomy. For management purposes, the populations are currently considered different management units of the same species (B. T. Watson, DGIF, pers. comm.).

The James spinymussel is legally protected with the status of Federal and State endangered.

Location

The map of the James spinymussel (Figure 5.19) includes confirmed reaches based on Collections (DGIF 2004b) and potential reaches using size, connectivity and gradient attributes from the DGIF aquatic habitat classification. For more information on mapping potential habitat for this species, see Appendix D.

Description of Essential Habitat

This species is found in second and third order streams that are unpolluted, well-oxygenated, and of moderate hardness ($CaCO_3$ > 50mg/l). It is found in runs with moderate current and sand, gravel, and cobble substrate (Clarke and Neves 1984). Streams containing the James spinymussel range from 0.3 to 2m deep and 1 to 20m wide (Hove 1990). They seem to prefer bottom sediments of sand and cobble, with or without boulders, pebbles or silt. They are usually buried in the substrate near stagnant riffle-run flows (Hove 1990). The DGIF aquatic habitat classification was also used to identify the diversity of habitat types used by the James spinymussel and to assess patterns of distribution (Table 5.32). This species has been documented in nine different reach types. These types are characterized as small to large streams of very low to low gradient. Extirpated populations may have occurred in larger rivers with sandy bottoms. This

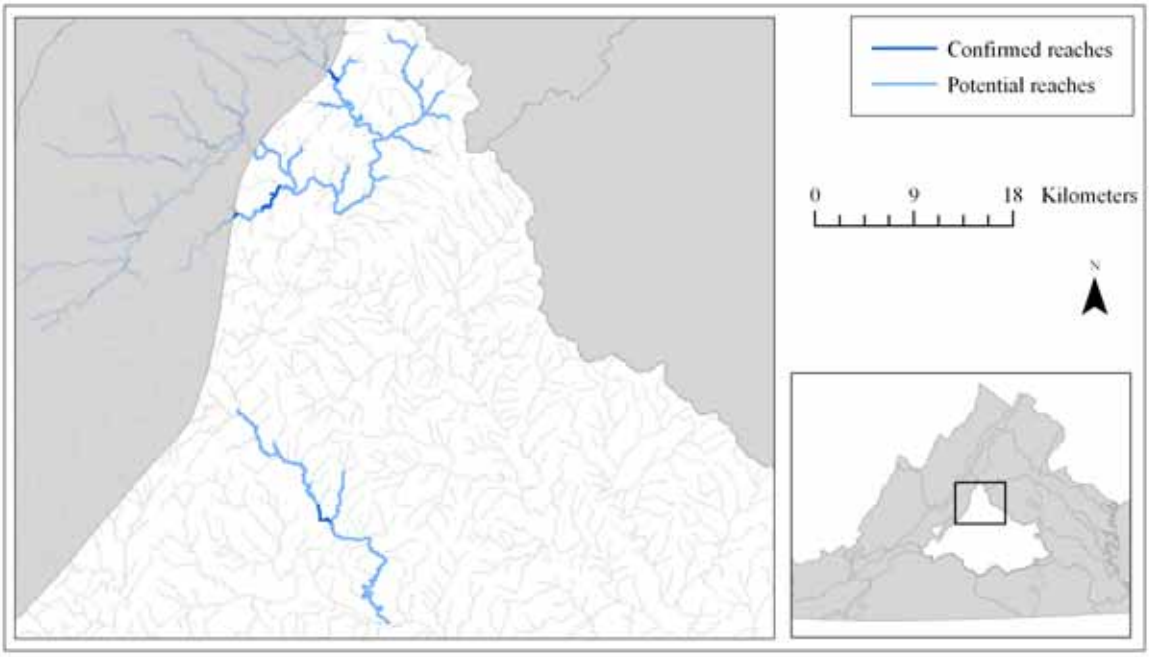

Figure 5.19. Location of confirmed and potential James spinymussel habitat in the Piedmont-James EDU.

species was once more widely distributed throughout the James River drainage and has been significantly reduced to approximately 5-10% of its historic distribution (B. T. Watson, DGIF, pers. comm.).

Table 5.32. DGIF aquatic habitat types used by the James spinymussel in the Piedmont-James EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small stream connected to another small stream	4
Very low gradient large stream connected to another large stream	1

Relative Condition of Habitat

Two large sections of the James spinymussel's habitat in this EDU, the Hardware and North Fork Rivanna Rivers, are impaired (DEQ and DCR 2004). The impairment in the North Fork Rivanna is from general standard (benthics). The source of that impairment is unknown. The Hardware River is impaired by nonpoint source fecal coliform.

Specific Threats and Trends

Neves (1991) suggests that habitat degradation and reproductive isolation have caused the decline of the James spinymussel. Clarke (1986) also lists competition from the Asian clam *Corbicula fluminea* as a possible threat. Table 5.33 summarizes the data on stresses received from Mussel TAC (2004). These cover the threats to both the James River and the Dan River populations.

Table 5.33. Stresses on the James spinymussel (Mussel TAC 2004).

Stress	Source of Stress	Scope	Severity	Comments
Hydrologic regime alteration	a) dam	a) 2	a) 4	Dam building also
	b) water withdrawal	b) 2	b) 2	floods habitat,
	c) municipal development	c) 2	c) 3	causing habitat
	d) beaver activity	d) 1	d) 1	destruction

Stress	Source of Stress	Scope	Severity	Comments
Sediment load alteration	Municipal development	4	3	
Insecticides	Municipal development	2	1	Molluscicides possible on lawns
Nutrient regime alteration	Agriculture	3	2	Livestock
complications due to small populations (inbreeding, stochastic fluctuation, etc.)		4	4	
Toxins	Industrial, other	1	4	Spills from trucks and industrial accidents

Conservation Actions and Strategies

The recovery plan for the James spinymussel identified two initial conservation actions: investigation of specific threats such as siltation, pesticides, municipal and industrial effluents, and Asian clam interactions; and assessment of projects that pose potentially negative effects on the species or its habitat (USFWS 1990). Following the implementation and assessment of these actions and the monitoring actions listed below, other secondary actions should be undertaken: implementation of methods to control Asian clams; implementation of appropriate protection strategies as identified; and re-establishment of populations as appropriate.

Mussel TAC (2004) identified conservation actions specific to the threats outlined above (in no particular order):

- Dam removal and/or installation of fish passage for necessary fish host migration and habitat restoration
- Stormwater management
- More efficient use of water
- Education of regional and county planning administrators
- Education of homeowners regarding the use of fertilizers and pesticides (especially molluscicides).
- Work with VDOT to develop possible solutions to salt application and subsequent runoff
- Implementation of appropriate best management practices for agriculture and stormwater management
- Augment population where possible
- Increase hazardous materials response to spills
- Improve enforcement of existing water quality and permitting regulations

Research and Monitoring Needs

The recovery plan for the James spinymussel identified the following research or monitoring needs: determination of essential habitat; threats monitoring; life history and ecology studies to establish the feasibility and methods to re-introduce this species to its historic range; and monitoring of existing and introduced populations (USFWS 1990). Mussel TAC (2004) listed a few other research needs tied to stress reduction. These include: researching and subsequently implementing minimum flow requirements; investigating the amount of sediment reduction needed to see a positive effect on mussel community; researching the impacts of biocide runoff from residents, and investigating the toxicity of creosote contamination from wood bridges and road salts.

5.4.3.1.4. Virginia Piedmont water boatman, *Sigara depressa*

Life History Summary

Very little is known about this species. It is thought to overwinter as an adult. Nymphs have been found in July (Hoffman 1991). The Virginia Piedmont water boatman is legally protected with the status of State endangered. It has also been designated a species of concern by the Virginia Field Office of USFWS.

Location

The map of the Virginia Piedmont water boatman (Figure 5.20) includes a single location in the Piedmont shown as a Stream Conservation Unit (DCR-NH 2005). From what is known, the essential habitat for this species is too specific to be mapped with existing data sets.

Description of Essential Habitat

This species is known from only five locations in Virginia (Fluvanna, Hanover, Caroline, and Prince William counties) (Hobson, et al. 1998; Hoffman 1991). Surveys were conducted by DCR-NH staff in 1997 at 27 sites (Hobson et al. 1998). Only one site contained specimens of *Sigara depressa.* Historical and recent collections were made in fairly deep pools found in streams with a matrix of riffles, runs, and pools. Riparian vegetation included grasses, forbs, and blackberries. This type of habitat is fairly common, and additional localities for this species may be found with intensive sampling.

Relative Condition of Habitat

There is one DCR-NH SCU within this EDU. There are no impaired waters designated within that section (DEQ and DCR 2004).

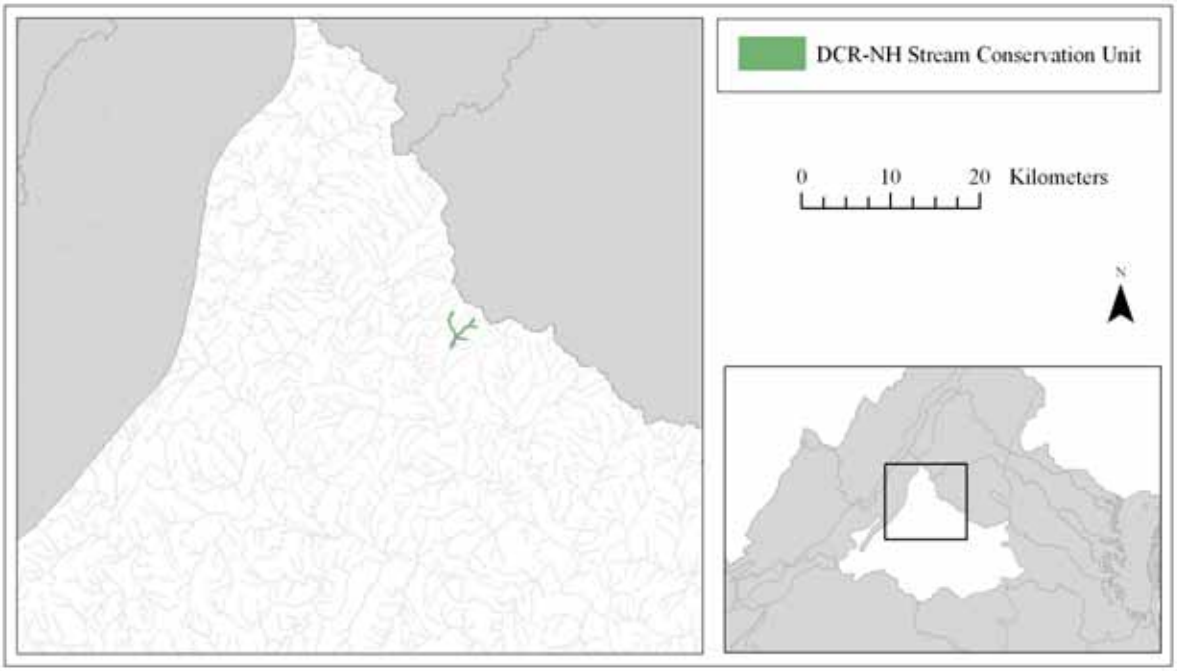

Figure 5.20. Stream Conservation Units (DCR-NH 2005) containing the Virginia Piedmont water boatman in the Piedmont-James EDU.

Specific Threats and Trends

Due to the localized distribution of this species, any significant disturbance to those sites could be catastrophic (Hoffman 1991).

Conservation Actions and Strategies

None are known at this time.

Research and Monitoring Needs

Extensive sampling is necessary to determine the distribution and status of this species, and subsequently to determine possible conservation actions (Hoffman 1991).

5.4.3.2. Aquatic SGCN by Habitat Groups: Piedmont-James EDU

Twenty-four tiered species occur in the Piedmont-James EDU. Of these, nine are fish, 14 are mussels, and one is an insect (Tables 5.34-36). For most species in this EDU (16 species), there were too few collection records to formulate habitat groups (Table 5.36).

Table 5.34. Aquatic species of greatest conservation need in small to large streams with very low gradient connected to similarly sized streams (DGIF classification types 221and 331).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Bridle shiner	*Notropis bifrenatus*	I	67	6
Notched rainbow mussel	*Villosa constricta*	III	60	5
Mud sunfish	*Acantharchus pomotis*	IV	77	2 (9 occurrences)
Triangle mussel	*Alasmidonta undulata*	IV	83	3 (6 occurrences)
Carolina lance	*Elliptio angustata*	IV	60	4

Table 5.35. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 5.36. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
Virginia pigtoe	*Lexingtonia subplana*	I	1 (1 occurrence)
James spinymussel	*Pleurobema collina*	I	10
Virginia Piedmont water boatman	*Sigara depressa*	I	N/A (indeterminate)
Brook floater	*Alasmidonta varicosa*	II	1 (1 occurrence)
Atlantic pigtoe	*Fusconaia masoni*	II	3 (5 occurrences)
Green floater	*Lasmigona subviridis*	II	3 (5 occurrences)
Yellow lance	*Elliptio lanceolata*	III	N/A (indeterminate)
Northern lance mussel	*Elliptio fisheriana*	IV	N/A (indeterminate)

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
Atlantic spike	*Elliptio producta*	IV	3 (4 occurrences)
Banded sunfish	*Enneacanthus obesus*	IV	1 (1 occurrence)
Least brook lamprey	*Lampetra aepyptera*	IV	1 (2 occurrences)
American brook lamprey	*Lampetra appendix*	IV	1 (1 occurrence)
Ridged lioplax	*Lioplax subcarinata*	IV	N/A (indeterminate)
Ironcolor shiner	*Notropis chalybaeus*	IV	N/A (indeterminate)
Sharp sprite	*Promenetus exacuous*	IV	N/A (indeterminate)
Creeper mussel	*Strophitus undulatus*	IV	N/A (indeterminate)

Relative Condition of Habitat

Within the Piedmont-James EDU there are more than 1450km of stream are impaired, representing approximately 14% of riverine habitats in this EDU (DEQ and DCR 2004). The most common impairments are fecal coliform, dissolved oxygen and pH from nonpoint urban or unknown sources. There were also several instances in which "natural conditions" were listed as a source. An assessment of the disturbed land cover within this EDU indicates that about 4% of the area is developed, and 18% is agriculture. Within the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15%.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) Fish TAC (2004) provided this information within habitat groups decided upon at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

5.4.4. Piedmont-York EDU

The York River drainage occurs entirely within Virginia. It drains the Piedmont and Coastal Plain. The mainstem of the York River is formed by the confluence of the Mattaponi and Pamunkey Rivers. The Mattaponi River has been identified by TNC as "the heart of the most pristine freshwater complex on the Atlantic Coast" (American Rivers 1999).

The Piedmont-York EDU (Figure 5.21) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). As its name implies, this ecoregion encompasses all of the drainages of the Chesapeake Bay. This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including the roughhead shiner *Notropis semperasper* found only in the headwaters of the James River. It is also home to several migratory fish including the American shad, alewife, and American eel. Abell et al.(2000) list the Chesapeake Bay freshwater ecoregion as continentally outstanding in terms of biological distinctiveness.

5.4.4.1. Tier I Species in the Piedmont-York EDU

5.4.4.1.1. Bridle shiner, *Notropis bifrenatus*

Life History Summary

The bridle shiner is thought to be a sight predator. Main prey items include invertebrates associated with open water, plants, or benthos (Burkhead and Jenkins 1991). Spawning occurs largely between mid-May and mid-June in pools over submerged aquatic vegetation. The bridle shiner has been designated as State special concern.

Location

The map of the bridle shiner (Figure 5.22) includes confirmed reaches based on Collections (DGIF 2004b). We were not able to determine potential habitat for this species because of few confirmed reaches and the importance of aquatic vegetation, which we cannot identify with existing datasets.

Figure 5.21. Location of the Piedmont-York EDU.

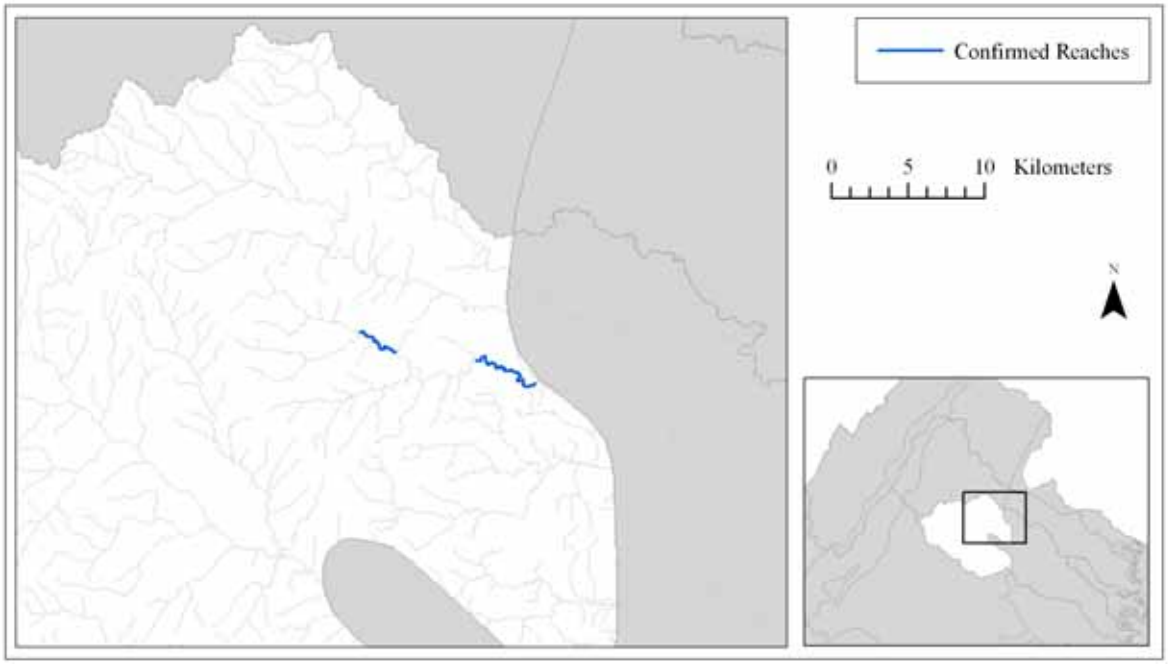

Figure 5.22. Location of confirmed bridle shiner habitat in the Piedmont-York EDU.

Description of Essential Habitat

This is a slackwater shiner found in quiet pools in streams and creeks (Table 5.37). It also occurs in ponds and lakes, where it prefers slow current but not standing water. This species occurs over mud, silt or detritus covered bottoms, usually in association with aquatic vegetation. It will rarely enter tidal fresh and brackish water (Jenkins and Burkhead 1994). Many upland and lowland records are from large marshes or

marsh-fringed shores. In such areas, the bridle shiner's specific affiliation may be with submerged vegetation. It is a freshwater oligohaline fish with a propensity for clear water (Burkhead and Jenkins 1991). It tolerates salinity generally < 2ppt, and is not believed to be acid tolerant, preferring water with pH > 7.0 (Jenkins and Burkhead 1994).

Table 5.37. DGIF aquatic habitat types used by bridle shiner in the Piedmont-York EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small stream connected to another small stream	3

Relative Condition of Habitat

All known habitat for the bridle shiner is affected by impaired waters. The impairment is fecal coliform from unknown sources (DEQ and DCR 2004).

Specific Threats and Trends

Burkhead and Jenkins (1991) list increased turbidity and sedimentation as the primary threats to this species. These stresses affect the sight feeding abilities of this species and reduce populations of submerged aquatic vegetation. Agricultural pollution may also be a threat to this species. Fish TAC (2004) did not identify any specific threats for the bridle shiner; however, stresses and sources of stress were identified for the York River drainage (Appendix H).

Conservation Actions and Strategies

Fish TAC (2004) did not identify any specific conservation strategies for the bridle shiner; however, conservation actions were identified for the James River drainage (Appendix I).

Research and Monitoring Needs

Burkhead and Jenkins (1991) recommend that the existing populations of bridle shiner be monitored and that surveys should be completed to determine the range of the species in Virginia.

5.4.4.1.2. Virginia Piedmont water boatman, *Sigara depressa*

Life History Summary

Very little is known about this species. It is thought to overwinter as an adult. Nymphs have been found in July (Hoffman 1991). The Virginia Piedmont water boatman is legally protected with the status of State endangered. It has also been designated a species of concern by the Virginia Field Office of USFWS.

Location

While it is likely that this species inhabits the Piedmont-York EDU, there are no confirmed locations.

Description of Essential Habitat

This species is known from only five locations in Virginia (Fluvanna, Hanover, Caroline, and Prince William counties) (Hobson et al. 1998; Hoffman 1991). Surveys were conducted by DCR-NH staff in 1997 at 27 sites (Hobson et al. 1998). Only one site contained specimens of *Sigara depressa.* Historical and recent collections were made in fairly deep pools found in streams with a matrix of riffles, runs, and pools. Riparian vegetation included grasses, forbs, and blackberries. This type of habitat is fairly common, and additional localities for this species may be found with intensive sampling.

Specific Threats and Trends

Due to the localized distribution of this species, any significant disturbance to those sites could be catastrophic (Hoffman 1991).

Conservation Actions and Strategies

None are known at this time.

Research and Monitoring Needs

Extensive sampling is necessary to determine its distribution, status, and subsequently to determine possible conservation actions (Hoffman 1991).

5.4.4.2. SGCN by Habitat Group: Piedmont-York EDU

There are very little data available in Collections for the Tier II-IV species except least brook lamprey *Lampetra aepyptera* (Table 5.38) and the anadromous fishes (Table 5.39) (DGIF 2004b). The remaining 16 species have too few occurrences or too little data to determine their DGIF aquatic habitat classification types (Table 5.40).

Table 5.38. Aquatic species of greatest conservation need in small streams with very low gradient connected to other small streams.

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Least brook lamprey	*Lampetra aepyptera*	IV	67	5

Table 5.39. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 5.40. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF aquatic classification)
Bridle shiner	*Notropis bifrenatus*	I	1 (3 occurrences)
Virginia Piedmont water boatman	*Sigara depressa*	I	N/A (indeterminate)
Dwarf wedgemussel	*Alasmidonta heterodon*	II	N/A (indeterminate)
Green floater	*Lasmigona subviridis*	II	1 (1 occurrence)
Yellow lampmussel	*Lampsilis cariosa*	III	N/A (indeterminate)
Mud sunfish	*Acantharcus pomotis*	IV	N/A (indeterminate)
Triangle floater	*Alasmidonta undulata*	IV	N/A (indeterminate)
Alewife floater	*Anodonta implicata*	IV	N/A (indeterminate)
Carolina lance mussel	*Elliptio angustata*	IV	N/A (indeterminate)
Northern lance mussel	*Elliptio fisheriana*	IV	5
Yellow lance	*Elliptio lanceolata*	IV	N/A (indeterminate)
Atlantic spike	*Elliptio producta*	IV	N/A (indeterminate)

Common Name	Scientific Name	Tier	Number of Types Used (DGIF aquatic classification)
Banded sunfish	*Enneacanthus obesus*	IV	N/A (indeterminate)
Least brook lamprey	*Lampetra aepyptera*	IV	N/A (indeterminate)
American brook lamprey	*Lampetra appendix*	IV	N/A (indeterminate)
Panhandle pebblesnail	*Somatogyrus virginicus*	IV	N/A (indeterminate)
Creeper	*Strophitus undulatus*	IV	N/A (indeterminate)

Relative Condition of Habitat

Nearly 400km of river in the Piedmont-York EDU have been listed as impaired by DEQ and DCR (2004). This represents approximately 14% of the riverine habitat in the EDU. The majority of the impairment is fecal coliform from unknown sources. Impairment of pH from unknown or abandoned mining sources is a problem for several waterways. An assessment of the disturbed land cover within this EDU indicates that about 1% of the area is developed, and 23% is agriculture. Within the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15%.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Fish TAC (2004) and Mussel TAC (2004) provided this information within habitat groups decided upon at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

5.4.5. Piedmont-Rappahannock EDU

The Rappahannock River drainage occurs entirely within the state of Virginia. The headwaters of the Rappahannock drain the Blue Ridge ecoregion and flow through the Piedmont and Coastal Plain. The Piedmont-Rappahannock EDU (Figure 5.23) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). As its name implies, this ecoregion encompasses all of the drainages of the Chesapeake Bay. This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including the roughhead shiner *Notropis semperasper* found only in the headwaters of the James River. It is also home to several migratory fish, including the American shad, alewife, and American eel. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness.

5.4.5.1.1. Bridle shiner, *Notropis bifrenatus*

Life History Summary

The bridle shiner is thought to be a sight predator. Main prey items include invertebrates associated with open water, plants, or benthos (Burkhead and Jenkins 1991). Spawning occurs largely between mid-May and mid-June in pools over submerged aquatic vegetation. The bridle shiner has the status of State special concern.

Location

The map of the bridle shiner (Figure 5.24) includes confirmed reaches based on Collections (DGIF 2004b). We were not able to determine potential habitat for this species because of few confirmed reaches and the importance of aquatic vegetation, which we cannot identify with existing datasets.

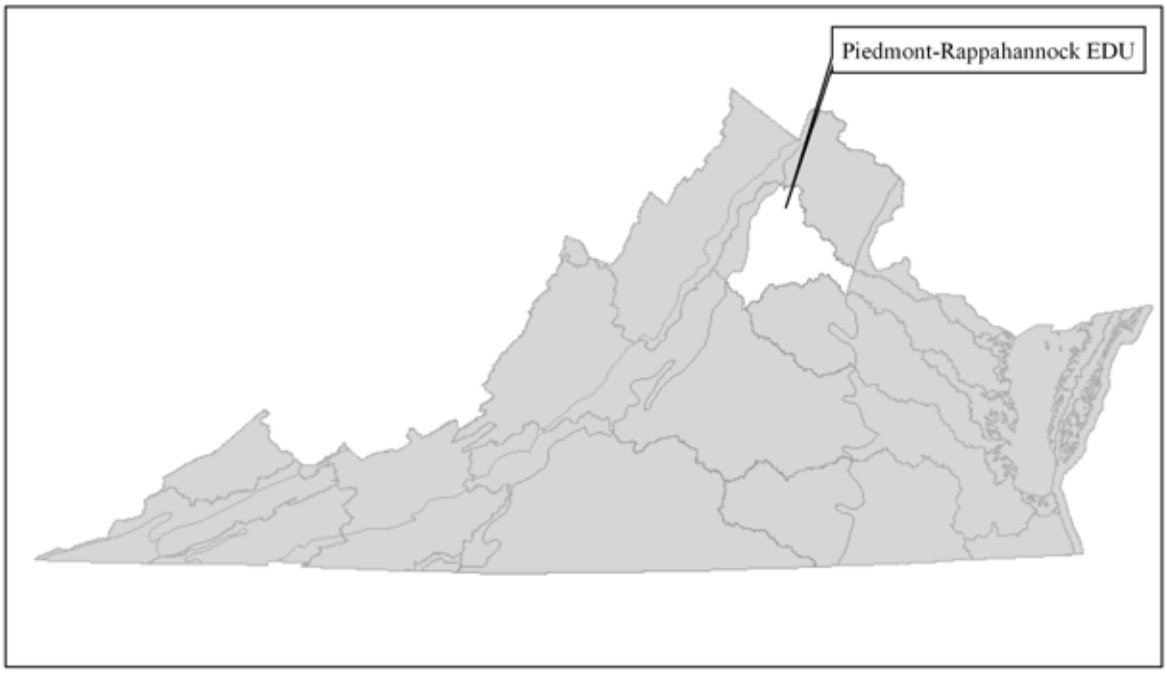

Figure 5.23. Location of the Piedmont-Rapphannock EDU.

5.4.5.1. Tier I Species in the Piedmont-Rappahannock EDU

Description of Essential Habitat

This is a slackwater shiner, found in quiet pools in streams and creeks. It is also found in ponds and lakes, where it prefers slow current, but not standing water. This species occurs over mud, silt or detritus covered bottoms usually in association with aquatic vegetation. It will rarely enter tidal fresh and brackish water (Jenkins and Burkhead 1994). Many upland and lowland records are from large marshes or marsh-fringed shores. In such areas the bridle shiner's specific affiliation may be with submerged vegetation. It is a freshwater oligohaline fish with a propensity for clear water (Burkhead and Jenkins 1991). It tolerates salinity generally < 2ppt, and is not believed to be acid tolerant, preferring water with pH > 7.0 (Jenkins and Burkhead 1994). The DGIF aquatic habitat classification was used to assess patterns in habitat use and distribution (Table 5.41). The bridle shiner was documented in only two stream reaches in the Rappahannock drainage.

Table 5.41. DGIF aquatic habitat types used by bridle shiner in the Piedmont-Rappahannock EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient headwater stream connected to another headwater stream	1
Very low gradient small river connected to another small river	1

Relative Condition of Habitat

There are no impaired waters in the known habitat of the bridle shiner in this EDU (DEQ and DCR 2004).

Specific Threats and Trends

Burkhead and Jenkins (1991) list increased turbidity and sedimentation as the primary threats to this species. These stresses affect the sight feeding abilities of this species and reduce populations of submerged

Figure 5.24. Location of confirmed bridle shiner habitat in the Piedmont-Rappanannock EDU.

aquatic vegetation. Agricultural pollution may also be a threat to this species. Fish TAC (2004) did not identify any specific threats for the bridle shiner; however, stresses and sources of stress were identified for the Rappahannock River drainage (Appendix H).

Conservation Actions and Strategies

Fish TAC did not identify any specific conservation strategies for the bridle shiner; however, conservation actions were identified for the Rappahannock River drainage (Appendix I).

Research and Monitoring Needs

Burkhead and Jenkins (1991) recommend that the existing populations of bridle shiner be monitored and that surveys should be completed to determine the range of the species in Virginia.

5.4.5.2. Aquatic SGCN by Habitat Groups: Piedmont-Rappahannock EDU

The Piedmont-Rappahannock EDU contains 16 tiered species. Of these, seven are fishes, eight are mussels, and one is a snail. These species were distributed between two habitat groups and one generalist or unknown category (Tables 5.42-44).

Table 5.42. Aquatic species of greatest conservation need in small to large streams with very low or low gradient connected to small or large streams (DGIF classification types 221, 231, 222, and 331).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Yellow lance	*Elliptio lanceolata*	III	73	7
Triangle floater	*Alasmidonta undulata*	IV	79	6
American brook lamprey	*Lampetra appendix*	IV	64	10
Creeper	*Strophitus undulatus*	IV	78	5 (9 occurrences)

Table 5.43. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 5.44. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
Bridle shiner	*Notropis bifrenatus*	I	2 (2 occurrences)
Dwarf wedgemussel	*Alasmidonta heterodon*	II	2 (2 occurrences)
Green floater	*Lasmigona subviridis*	II	3 (4 occurrences)
Mud sunfish	*Acantharcus pomotis*	IV	N/A (indeterminate)
Carolina lance mussel	*Elliptio angustata*	IV	7
Northern lance mussel	*Elliptio fisheriana*	IV	5
Atlantic spike	*Elliptio producta*	IV	2 (2 occurrences)
Least brook lamprey	*Lampetra aepyptera*	IV	N/A (indeterminate)
Panhandle pebblesnail	*Somatogyrus virginicus*	IV	N/A (indeterminate)

Relative Condition of Habitat

Approximately 270km, or 8%, of riverine habitat in this EDU are impaired (DEQ and DCR 2004). All are impaired by fecal coliform, from largely unknown sources. An assessment of the disturbed land cover within this EDU indicates that about 3% of the area is developed, and 40% is agriculture. Within the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15%.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups decided upon at the workshops. The level of detail within these groups does not correspond to that used in the DGIF aquatic habitat classification.

5.4.6. Piedmont-Potomac EDU

The Potomac River drainage covers a large area encompassing parts of Pennsylvania, Maryland, Virginia, and West Virginia. The watershed drains the Ridge and Valley, Blue Ridge, Piedmont, and the Coastal Plain. Several tributaries of the middle Potomac drain the eastern front of the Blue Ridge. The fall line, which occurs at the break between the Piedmont and Coastal Plain, is a natural barrier to most migratory fish. The Piedmont-Potomac EDU (Figure 5.25) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). As its name implies, this ecoregion encompasses all of the drainages of the Chesapeake Bay. This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including the roughhead shiner *Notropis semperasper*, found only in the headwaters of the James River. It is also home to several migratory fish including the American shad, alewife, and American eel. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness.

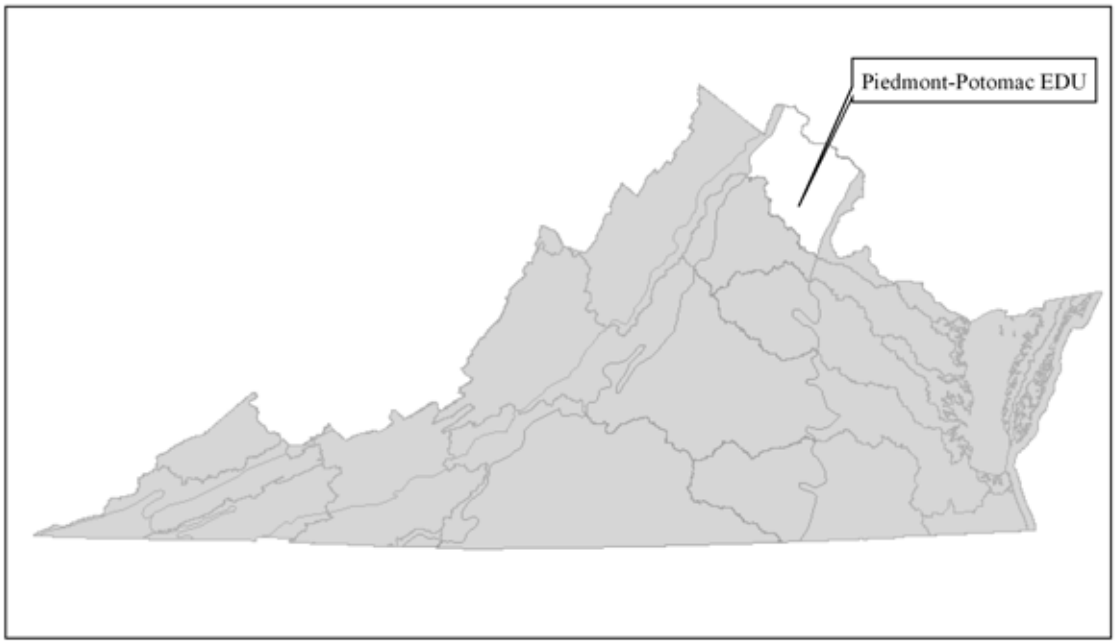

Figure 5.25. Location of the Piedmont-Potomac EDU.

5.4.6.1. Tier I Species in the Piedmont-Potomac EDU

5.4.6.1.1. Bridle shiner, *Notropis bifrenatus*

Life History Summary

The bridle shiner is thought to be a sight predator. Main prey items include invertebrates associated with open water, plants, or benthos (Burkhead and Jenkins 1991). Spawning occurs largely between mid-May and mid-June in pools over submerged aquatic vegetation. The bridle shiner has the status of State special concern.

Location

The map of bridle shiner habitat (Figure 5.26) includes confirmed reaches based on Collections (DGIF 2004b). We were not able to determine potential habitat for this species because of few confirmed reaches and the importance of aquatic vegetation, which we cannot identify with existing datasets.

Description of Essential Habitat

This is a slackwater shiner, found in quiet pools in streams and creeks. It is also found in ponds and lakes, where it prefers slow current but not standing water. This species occurs over mud, silt or detritus covered bottoms, usually in association with aquatic vegetation. It will rarely enter tidal fresh and brackish water (Jenkins and Burkhead 1994). Many upland and lowland records are from large marshes or marsh-fringed shores. In such areas, the bridle shiner's specific affiliation may be with submerged vegetation. It is a freshwater oligohaline fish with a propensity for clear water (Burkhead and Jenkins 1991). It tolerates salinity generally >2 ppt, and is not believed to be acid tolerant, preferring water with pH > 7.0 (Jenkins and Burkhead 1994). The DGIF aquatic habitat classification was used to examine patterns in habitat use and distribution. In the Piedmont-Potomac EDU, this species occurred in only two habitat types (Table 5.45).

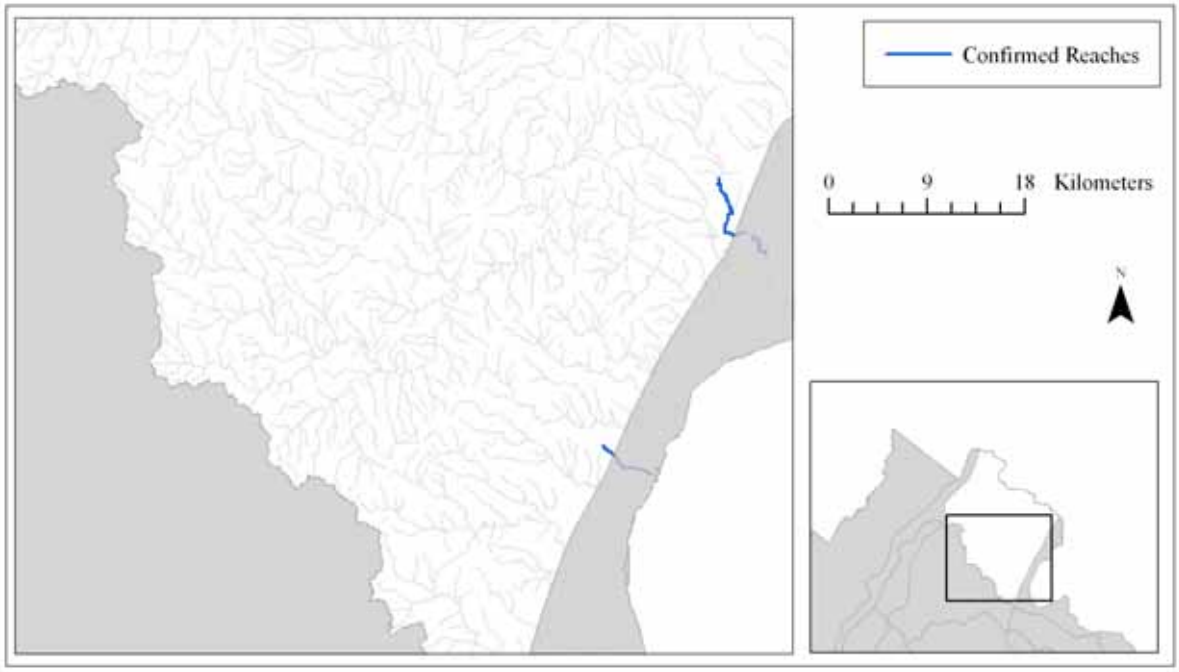

Figure 5.26. Location of confirmed bridle shiner habitat in the Piedmont-Potomac EDU.

Table 5.45. DGIF aquatic habitat types used by bridle shiner in the Piedmont-Potomac EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small stream connected to another small stream	2
Low gradient headwater stream connected to another headwater stream	1

Relative Condition of Habitat

The only known habitat of this species is impaired by general standard (benthics) and fecal coliform from unknown sources (DEQ and DCR 2004).

Specific Threats and Trends

Burkhead and Jenkins (1991) list increased turbidity and sedimentation as the primary threats to this species. These stresses affect the sight feeding abilities of this species and reduce populations of submerged aquatic vegetation. Agricultural pollution may also be a threat to this species. Fish TAC (2004) did not identify any specific threats for the bridle shiner; however, stresses and sources of stress were identified for the Potomac River drainage (Appendix H).

Conservation Actions and Strategies

Fish TAC (2004) did not identify any specific conservation strategies for the bridle shiner; however, conservation actions were identified for the Potomac River drainage (Appendix I).

Research and Monitoring Needs

Burkhead and Jenkins (1991) recommend the existing populations of bridle shiner be monitored, and that surveys should be completed to determine the range of the species in Virginia.

5.4.6.2. Aquatic SGCN by Habitat Group: Piedmont-Potomac EDU

Twenty-four tiered species occur in the Piedmont-Potomac EDU. These include 13 mussels, 10 fishes, and one insect. Two habitat groups and one generalist/unknown group were idenitified (Table 5.46-48).

Table 5.46. Aquatic species of greatest conservation need in small to large streams with very low gradient connected to small or large streams (DGIF classification types 221 and 331).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Dwarf wedgemussel	*Alasmidonta heterodon*	II	100	1 (3 occurrences)
Yellow lance	*Elliptio lanceolata*	III	80	3
Triangle floater	*Alasmidonta undulata*	IV	60	8
Northern lance	*Elliptio fisheriana*	IV	75	4 (8 occurrences)
American brook lamprey	*Lampetra appendix*	IV	64	10
Creeper	*Strophitus undulatus*	IV	67	9

Table 5.47. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 5.48. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
Manassas stonefly	*Acroneuria flinti*	I	N/A (indeterminate)
Bridle shiner	*Notropis bifrenatus*	I	5
Brook floater	*Alasmidonta varicose*	II	1 (1 occurrence)
Green floater	*Lasmigona subviridis*	II	N/A (indeterminate)
Yellow lampmussel	*Lampsilis cariosa*	III	1 (1 occurrence)
Alewife floater	*Anodonta implicate*	IV	1 (1 occurrence)
Carolina lance mussel	*Elliptio angustata*	IV	9
Atlantic spike	*Elliptio producta*	IV	4 (6 occurrences)
Rainbow darter	*Etheostoma caeruleum*	IV	1 (1 occurrence)
Oblong ancylid	*Ferrissia parallelus*	IV	N/A (indeterminate)
Least brook lamprey	*Lampetra aepyptera*	IV	3 (7 occurrences)
Ridged lioplax	*Lioplax subcarinata*	IV	N/A (indeterminate)
Ironcolor shiner	*Notropis chalybaeus*	IV	N/A (indeterminate)
Logperch	*Percina caprodes semifasciata*	IV	N/A (indeterminate)
Trout-perch	*Percopsis omiscomaycus*	IV	N/A (indeterminate)

Relative Condition of Habitat

Nearly 400km of river in this EDU are impaired, representing approximately 11% of available riverine habitat (DEQ and DCR 2004). The main impairment was fecal coliform from unknown sources. There were also segments impaired by pH, *Escherichia coli*, fish tissue contamination, and general standard

(benthics). An assessment of the disturbed land cover within this EDU indicates that about 14% of the area is developed, and 35% is agriculture. Within the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15%.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups decided upon at the workshops. The level of detail within these groups does not correspond to that used in the DGIF aquatic habitat classification.

5.4.7. Piedmont-Pee Dee EDU

A very small portion of the Pee Dee drainage is located in Virginia (Figure 5.27). The remainder flows through North Carolina and South Carolina. The drainage crosses the Blue Ridge and upper Piedmont. The streams in Virginia are actually part of the Ararat River, which flows into the Yadkin. There are four species and two subspecies of fish that are found only in the Pee Dee drainage in Virginia (Jenkins and Burkhead 1994). Three of them have been identified as SGCN: highback chub (*Hybopsis hypsinotus*), thicklip chub (*Cyprinella labrosa*), and the Piedmont darter (*Percina crassa*).

The Pee Dee joins the Roanoke and Chowan drainages to form the South Atlantic freshwater ecoregion, which is considered "globally outstanding" in terms of biological distinctiveness (Abell et al. 2000). The South Atlantic freshwater ecoregion is home to 48 endemic aquatic species (fish, mussels, and amphibians).

5.4.7.1. Tier I Species in the Piedmont-Pee Dee EDU

There are no Tier I species in the Piedmont-Pee Dee EDU.

5.4.7.2. Aquatic SGCN by Habitat Group: Piedmont-Pee Dee EDU

Eight tiered fish occur in the Piedmont-Pee Dee EDU. Only one habitat group was identified for the tiered species in this EDU (Tables 5.49-50). There is some taxonomic uncertainty within the jumprock group (*Moxostoma* and *Scartomyzon*) (Jenkins and Burkhead 1994:491).

Table 5.49. Aquatic species of greatest conservation need in small streams with low gradient connected to small streams (DGIF classification types 221).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Highback chub	*Hybopsis (=Notropis) hysinotus*	IV	67	4
Smallfin redhorse	*Moxostoma robustum*	IV	83	2 (6 occurrences)
Redlip shiner	*Notropis chiliticus*	IV	77	4
Piedmont darter	*Percina crassa*	IV	67	3 (6 occurrences)

Table 5.50. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
American eel	*Anguilla rostrata*	IV	N/A (indeterminate)
Thicklip chub	*Cyprinella labrosa*	IV	N/A (indeterminate)
Lined topminnow	*Fundulus lineolatus*	IV	N/A (indeterminate)
Smallfin redhorse	*Moxostoma robustum*	IV	N/A (indeterminate)

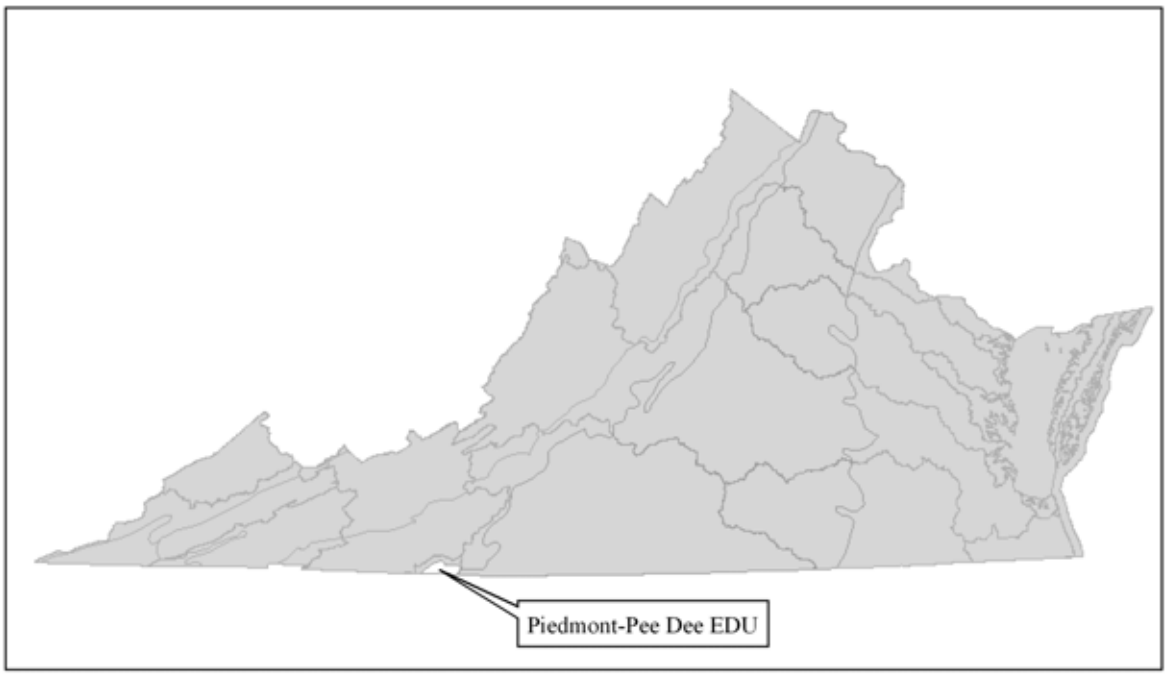

Figure 5.27. Location of the Piedmont-Pee Dee EDU.

Relative Condition of Habitat

Of the limited portion of the Pee Dee drainage in the Piedmont-Pee Dee EDU, only about 3km of Lovill's Creek are impaired (DEQ and DCR 2004). This represents less than 2% of available riverine habitat in this EDU. This impairment is from temperature violations from an unknown source. An assessment of the disturbed land cover within this EDU indicates that about 2% of the area is developed, and 24% is agriculture. Within the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15%.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups decided upon at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

5.5. Subterranean Species in the Piedmont

5.5.1. Tier I Species in the Piedmont

There are no Tier I subterranean species in the Piedmont.

5.5.2. Subterranean Species of Greatest Conservation Need in Virginia's Piedmont

5.5.2.1. Species of Greatest Conservation Need by Subterranean Habitat Type

Of the four species of greatest conservation need in subterranean habitats in the Piedmont, one occurs in caves (Table 5.51) and four occur in groundwater (Table 5.52).

Table 5.51. Cave species of greatest conservation need in Virginia's Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Pizzini's amphipod	*Stygobromus pizzinii*	II	Seeps and springs, possibly caves

Table 5.52. Groundwater species of greatest conservation need in Virginia's Piedmont.

Common Name	Scientific Name	Tier	Special Habitat Needs
Holsinger's groundwater planarian	*Sphalloplana holsingeri*	II	Groundwater; otherwise unknown
Bigger's groundwater planarian	*Sphalloplana subtilis*	II	Groundwater; otherwise unknown
Pittsylvania well amphipod	*Stygobromus obrutus*	II	One well near Danville, VA
Pizzini's amphipod	*Stygobromus pizzinii*	II	Seeps and springs, possibly caves

5.5.2.2. Status and Trends of Subterranean Habitats

The status of these habitats is very difficult to ascertain, and so is not available at an ecoregional scale. For statewide status and trends of subterranean habitats, see Section 4.2.5.

5.6 Overview of Tier I Species Habitat in the Piedmont

In order to highlight geographic areas that are likely important for one or more Tier I species, the potential and confirmed habitats for Tier I terrestrial (Section 5.3.1) and aquatic (Sections 5.4.1-5.4.7) species were overlaid in one map (Figure 5.28). Please note that potential habitat for many Tier I species could not be mapped, and that areas containing habitat for only one or a few Tier 1 species are important for conservation. However, areas with a higher density of Tier I species habitat may represent extraordinary conservation opportunities.

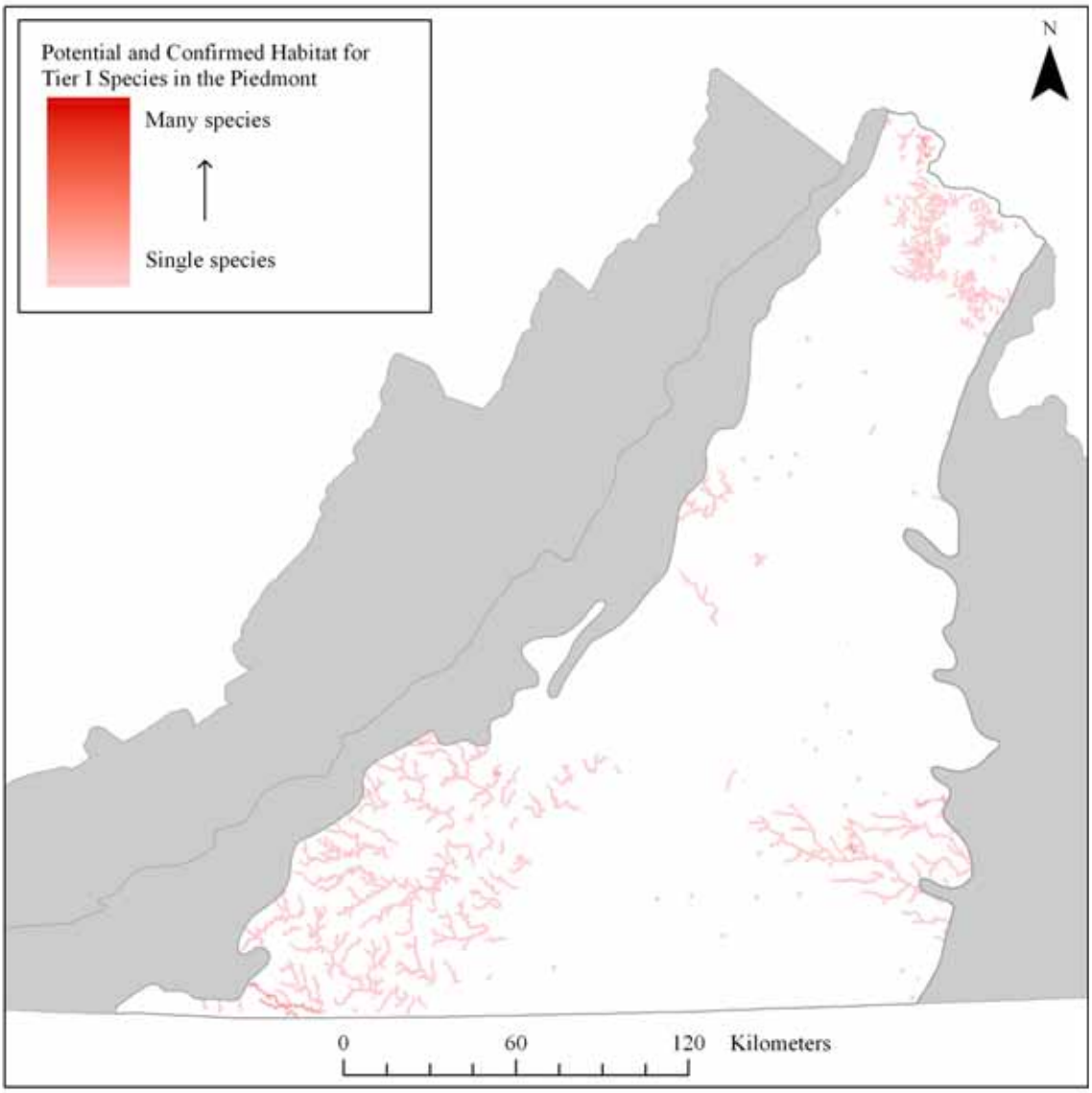

Figure 5.28. Potential and confirmed habitat for Tier I species in the Piedmont. Darker shades represent areas with a higher co-occurrence of these habitats.

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