

# Chapter 8. Virginia's Northern Cumberland Mountains

## 8.1. Introduction

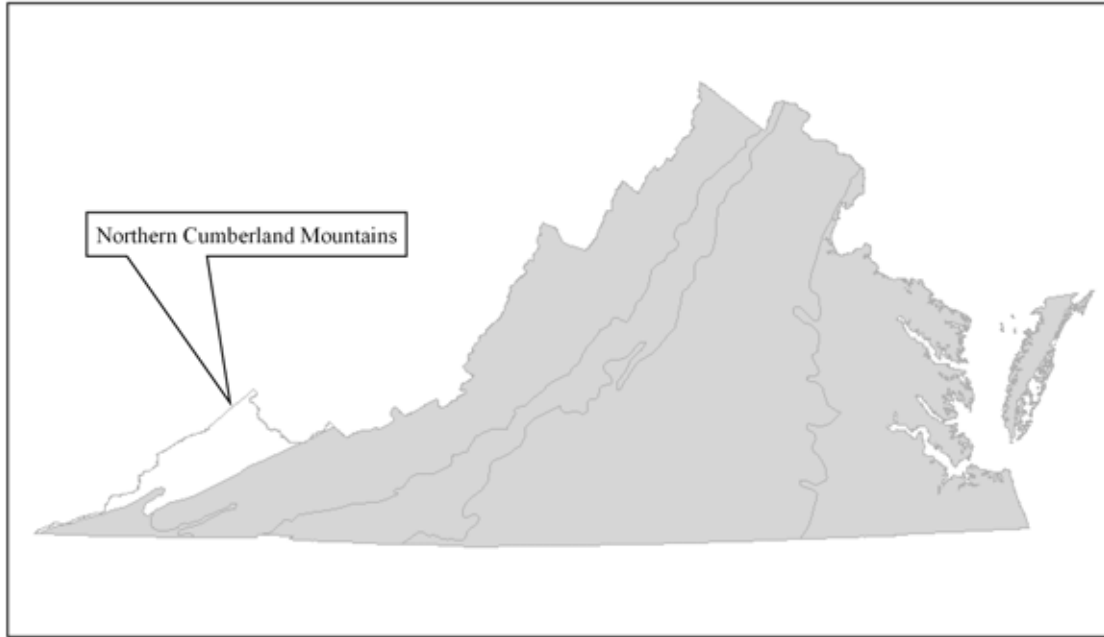


Figure 8.1. The Northern Cumberland Mountains ecoregion.

### 8.1.1. Description

The Northern Cumberland Mountains in Virginia (Northern Cumberlands, Figure 8.1) consist of rough topography with peaks all similar in elevation, approximately 760m (Woodward and Hoffman 1991). In many classification systems, this ecoregion is not recognized on its own but is combined into other sections of the Appalachian Mountains (Table 8.1). The soils are mostly Udults (McNab and Avers 1995). Precipitation in the ecoregion averages between 105-125cm (Woodward and Hoffman 1991). The average temperature is 13°C (McNab and Avers 1995). The growing season generally lasts from 160 to 180 days, dependent on location (Woodward and Hoffman 1991). Forest cover is largely mixed mesophytic, a diverse assemblage of hardwoods and conifers (Woodward and Hoffman 1991). Surface waters are generally small or medium perennial streams, occurring at moderate to high density with moderate flow rates (McNab and Avers 1995). This ecoregion is heavily utilized for coal extraction (Woodward and Hoffman 1991).

Table 8.1. Names for the Northern Cumberland Mountains as used in other ecoregional schemes and planning efforts. The following at least roughly correspond to the same area as Northern Cumberland Mountains as used in this document.

Planning Effort/Regional Scheme	Name of Ecoregion	Reference
NABCI	BCR 28, Appalachian Mountains <sup>1</sup>	NABCI 2000
PIF	Physiographic Area 21, Northern Cumberland Plateau <sup>2</sup>	Anderson et al. 2001
United States Shorebird Conservation	BCR 28, Appalachian Mountains <sup>3</sup>	Brown et al. 2001

<b>Planning Effort/Regional Scheme</b>	<b>Name of Ecoregion</b>	<b>Reference</b>
Waterbird Conservation for the Americas	Southeast U.S. <sup>4</sup>	Kushlan et al. 2002
Freshwater Ecoregions	Ecoregion 34, Teays-Old Ohio and Ecoregion 35, Tennessee-Cumberland <sup>5</sup>	Abell et al. 2000
TNC's Ecoregional Planning Units	Ecoregion 50, Cumberlands and Southern Ridge and Valley <sup>6</sup>	Groves et al. 2000
Omernik's Ecoregions	Ecoregion 69, Central Appalachians	Omernik 1987
Bailey's Ecoregions	M221C, Northern Cumberland Mountains	Bailey 1995

<sup>1</sup> BCR 28 include the Northern and Southern Cumberlands, the Ridge and Valley, and the Blue Ridge.

<sup>2</sup> Partners In Flight has recently adopted BCRs for its planning units.

<sup>3</sup> No regional shorebird plan exists for this BCR.

<sup>4</sup> 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.

<sup>5</sup> Virginia's Northern Cumberlands are split between these two ecoregions.

<sup>6</sup> Virginia's Southern and Northern Cumberlands are both within Ecoregion 50.

### 8.1.2. Land Cover Areas

Over 99% of the Northern Cumberlands is montane, with a small fraction of high elevation and submontane areas. The vast majority of this ecoregion is forested (93%, Figure 8.2). Agriculture/open areas are the second most abundant land cover, covering almost 4% of the ecoregion. Barren (2%) and developed (1%) comprise most of the remaining areas. Water and wetlands together account for less than 0.5% of this ecoregion's surface area. Over 11% of the Northern Cumberlands is protected in a Conservation Land (DCR 2003). Of the protected areas, approximately 98% is forested. Water makes up the majority of remaining Conservation Land at 2%. Water is protected at a higher proportion than it occurs in the overall ecoregion, due to the presence of USACE's Flannagan Reservoir. Agriculture, wetlands, developed, and barren (in order of abundance) each make-up less than 0.5% of the protected lands (DCR 2003).

### 8.1.3. Human Population in the Northern Cumberlands

The Northern Cumberlands, with a 2000 population of over 97,000 people or 1.4% of Virginia's population, has the second lowest number of residents of any ecoregion (USCB 2003). Containing approximately 4% of Virginia's land area, the 2000 average population density is just over 23 people/km<sup>2</sup>, the lowest of any ecoregion. There are very few areas in the Northern Cumberlands with population density over 100 people/km<sup>2</sup> (Figure 8.3). Big Stone Gap, the City of Norton, and the City of Wise are the only areas containing more than 200 people/km<sup>2</sup>. Between 2000 to 2009, the population of the Northern Cumberlands is expected to decrease almost 5% (GeoLytics 2005).

There is only one high impact growth area, covering around 0.6% of the area, within the Northern Cumberlands (Figure 8.4). Between 2000 and 2009, this area in eastern Wise County is expected to grow more than 15% (GeoLytics 2005).

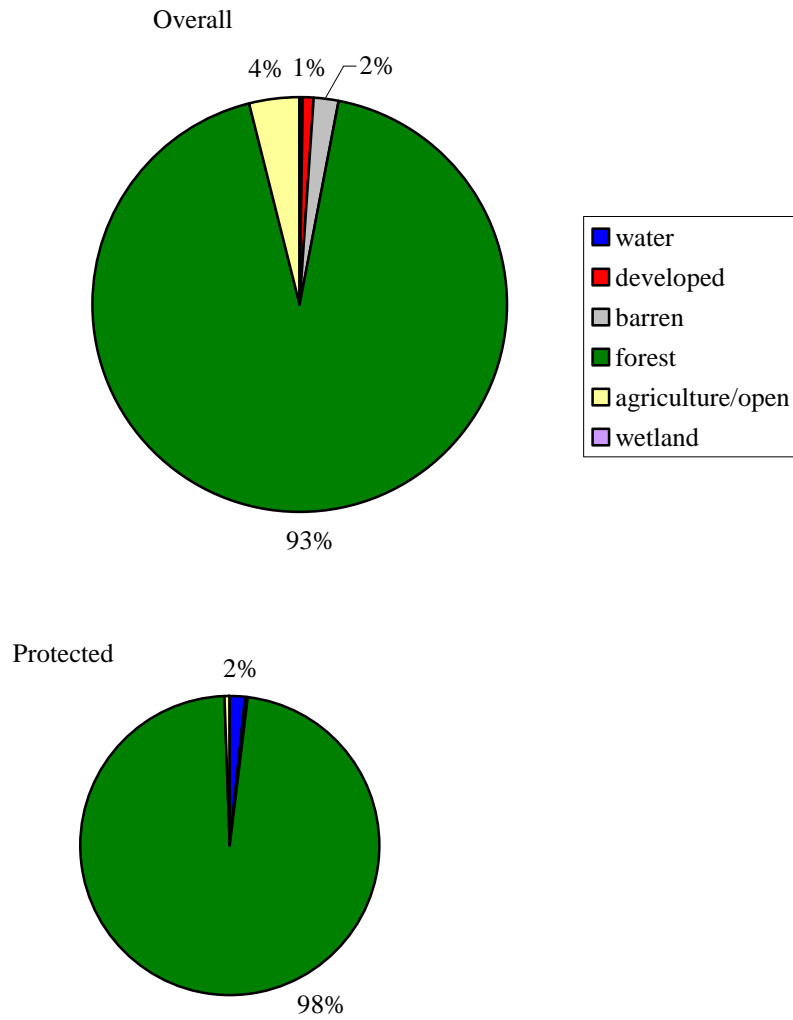


Figure 8.2. Proportional composition of land cover types within the Northern Cumberlands ecoregion compared to the proportion of land cover types within protected areas in the Northern Cumberlands.

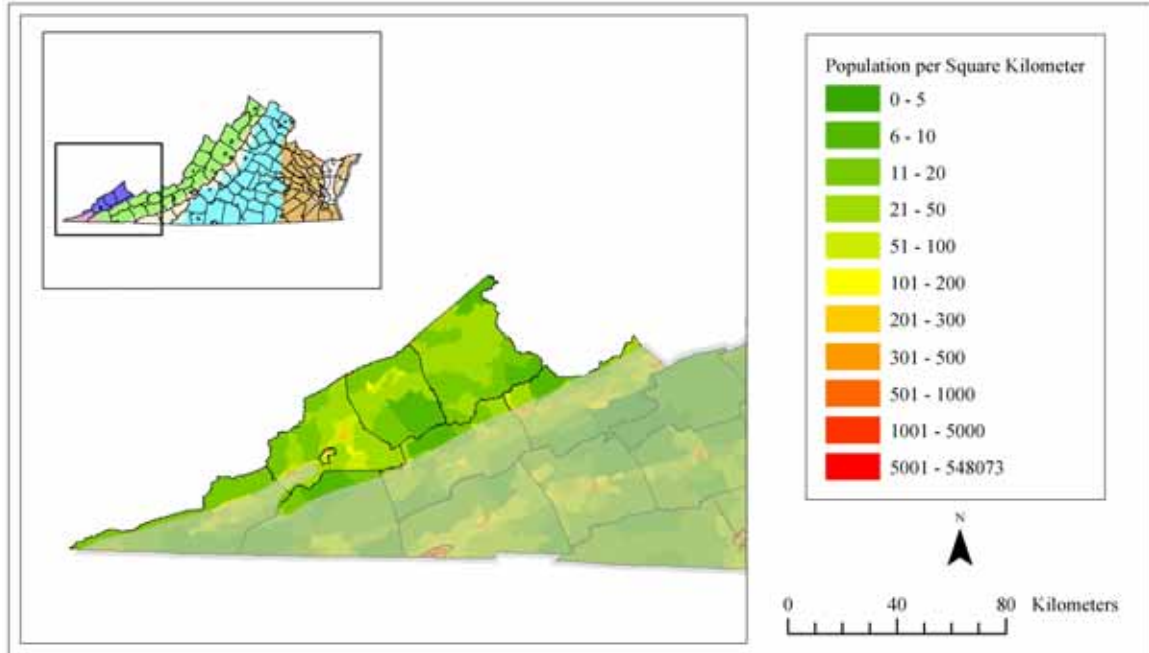


Figure 8.3. Population density from the 2000 census for the Northern Cumberlands ecoregion. The inset map in the upper left shows Virginia's ecoregional boundaries, with the Northern Cumberlands in dark blue.

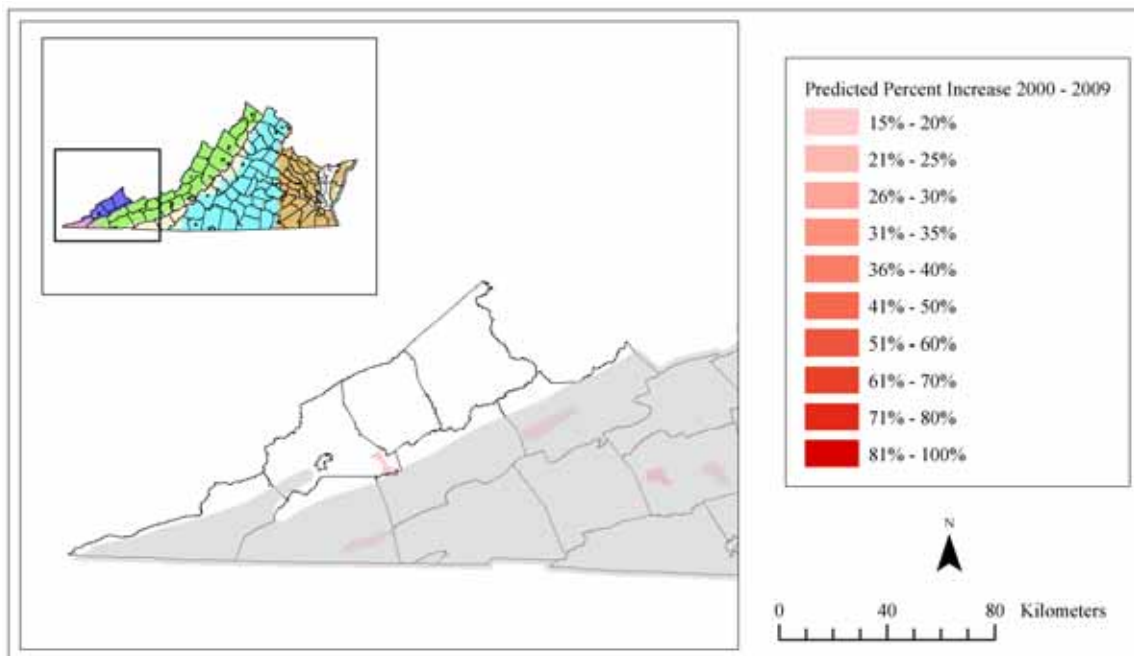


Figure 8.4. High impact growth areas in the Northern Cumberlands ecoregion. This figure contains demographic data from GeoLytics, East Brunswick, New Jersey (GeoLytics 2005).

**8.2. The Species of Greatest Conservation Need: Northern Cumberlands**

Of the 101 species of greatest conservation need that occur in the Northern Cumberlands, six (6%) are in Tier I, 17 (17%) are in Tier II, 12 (12%) are in Tier III, and 66 (65%) are in Tier IV (Table 8.2).

Table 8.2. The species of greatest conservation need in the Northern Cumberlands.

Common Name	Scientific Name
<b>Tier I</b>	
<b>Fishes</b>	
None	
<b>Amphibians</b>	
None	
<b>Reptiles</b>	
None	
<b>Birds</b>	
Peregrine falcon	<i>Falco peregrinus</i>
Loggerhead shrike	<i>Lanius ludovicianus</i>
Appalachian yellow-bellied sapsucker <sup>1</sup>	<i>Sphyrapicus varius appalachiensis</i>
Appalachian Bewick's wren	<i>Thryomanes bewickii</i>
<b>Mammals</b>	
Indiana myotis	<i>Myotis sodalis</i>
<b>Terrestrial Insects</b>	
None	
<b>Other Terrestrial Invertebrates</b>	
Brown supercoil	<i>Paravitrea septadens</i>
<b>Mollusks</b>	
None	
<b>Crustaceans</b>	
Cumberland Gap cave isopod	<i>Bactrurus angulus</i>
<b>Aquatic Insects</b>	
None	
<b>Other Aquatic Invertebrates</b>	
None	
<b>Tier II</b>	
<b>Fishes</b>	
Variagate darter	<i>Etheostoma variatum</i>

VIRGINIA'S COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY  
Chapter 8 — The Northern Cumberland Mountains

Common Name	Scientific Name
Popeye shiner	<i>Notropis ariommus</i>
<b>Amphibians</b>	
Green salamander	<i>Aneides aeneus</i>
Mountain chorus frog	<i>Pseudacris brachyphona</i>
<b>Reptiles</b>	
None	
<b>Birds</b>	
Cerulean warbler	<i>Dendroica cerulea</i>
Swainson's warbler	<i>Limnothlypis swainsonii</i>
<b>Mammals</b>	
None	
<b>Terrestrial Insects</b>	
Little Kennedy Cave beetle	<i>Pseudanophthalmus cordicollis</i>
A cave beetle	<i>Pseudanophthalmus seclusus</i>
<b>Other Terrestrial Invertebrates</b>	
A cave pseudoscorpion	<i>Kleptochthonius binoculatus</i>
Blotchy mantleslug	<i>Megapallifera wetherbyi</i>
Balsam globe	<i>Mesodon andrewsae</i>
Glossy supercoil	<i>Paravitrea placentula</i>
Slender supercoil	<i>Paravitrea subtilis</i>
<b>Mollusks</b>	
Coal elimia	<i>Elimia aterina</i>
<b>Crustaceans</b>	
A crayfish	<i>Cambarus veteranus</i>
Cumberland cave amphipod	<i>Stygobromus cumberlandus</i>
<b>Aquatic Insects</b>	
Lobed roachfly	<i>Tallaperla lobata</i>
<b>Other Aquatic Invertebrates</b>	
None	
<b>Tier III</b>	
<b>Fishes</b>	
Wounded darter	<i>Etheostoma vulneratum</i>
River redhorse	<i>Moxostoma carinatum</i>
<b>Amphibians</b>	
None	

VIRGINIA'S COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY  
Chapter 8 — The Northern Cumberland Mountains

Common Name	Scientific Name
<b>Reptiles</b>	
Eastern box turtle	<i>Terrapene carolina</i>
<b>Birds</b>	
Northern harrier	<i>Circus cyaneus</i>
<b>Mammals</b>	
Eastern small-footed myotis	<i>Myotis leibii</i>
<b>Terrestrial Insects</b>	
A ground beetle	<i>Cyclotrachelus incisus</i>
<b>Other Terrestrial Invertebrates</b>	
Virginia bladetooth	<i>Patera panselenus</i>
Rounded dome	<i>Ventridens lawae</i>
<b>Mollusks</b>	
Brown walker	<i>Pomatiopsis cincinnatiensis</i>
<b>Crustaceans</b>	
Southwestern Virginia cave isopod	<i>Caecidotea recurvata</i>
<b>Aquatic Insects</b>	
Appalachian jewelwing	<i>Calopteryx angustipennis</i>
Shenandoah rhyacophilid caddisfly	<i>Rhyacophila shenandoahensis</i>
<b>Other Aquatic Invertebrates</b>	
None	
<b>Tier IV</b>	
<b>Fishes</b>	
Freshwater drum	<i>Aplodinotus grunniens</i>
Blotched chub	<i>Erimystax insignis</i>
Rainbow darter	<i>Etheostoma caeruleum</i>
Swannanoa darter	<i>Etheostoma swannanoa</i>
Banded darter	<i>Etheostoma zonale</i>
American brook lamprey	<i>Lampetra appendix</i>
Mountain shiner	<i>Lythrurus lirus</i>
Mirror shiner	<i>Notropis spectrunculus</i>
Sand shiner	<i>Notropis stramineus</i>
Stonecat	<i>Noturus flavus</i>
Tangerine darter	<i>Percina aurantiaca</i>
Logperch	<i>Percina caprodes</i>
Blackside darter	<i>Percina maculata</i>
Sharpnose darter	<i>Percina oxyrhynchus</i>
Suckermouth minnow	<i>Phenacobius mirabilis</i>

VIRGINIA'S COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY  
Chapter 8 — The Northern Cumberland Mountains

Common Name	Scientific Name
Bullhead minnow	<i>Pimephales vigilax</i>
Sauger	<i>Stizostedion canadense</i>
<b>Amphibians</b>	
Jefferson salamander	<i>Ambystoma jeffersonianum</i>
Cumberland Plateau salamander	<i>Plethodon kentucki</i>
<b>Reptiles</b>	
Timber rattlesnake	<i>Crotalus horridus</i>
Northern map turtle	<i>Graptemys geographica</i>
Eastern hog-nosed snake	<i>Heterodon platirhinos</i>
Queen snake	<i>Regina septemvittata</i>
<b>Birds</b>	
Grasshopper sparrow	<i>Ammodramus savannarum</i>
Green heron	<i>Butorides striatus</i>
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
Chimney swift	<i>Chaetura pelagica</i>
Yellow-billed cuckoo	<i>Coccyzus americanus</i>
Northern bobwhite	<i>Colinus virginianus</i>
Eastern wood-pewee	<i>Contopus virens</i>
Prairie warbler	<i>Dendroica discolor</i>
Kirtland's warbler (migrant)	<i>Dendroica kirtlandii</i>
Yellow warbler	<i>Dendroica petechia</i>
Gray catbird	<i>Dumetella carolinensis</i>
Willow flycatcher	<i>Empidonax traillii</i>
Rusty blackbird (winter)	<i>Euphagus carolinus</i>
Worm-eating warbler	<i>Helmitheros vermivorus</i>
Wood thrush	<i>Hylocichla mustelina</i>
Yellow-breasted chat	<i>Icteria virens</i>
Black-and-white warbler	<i>Mniotilta varia</i>
Kentucky warbler	<i>Oporornis formosus</i>
Northern parula	<i>Parula americana</i>
Rose-breasted grosbeak	<i>Pheuctitus ludovicianus</i>
Eastern towhee	<i>Pipilo erythrophthalmus</i>
Scarlet tanager	<i>Piranga olivacea</i>
Virginia rail	<i>Rallus limicola</i>
American woodcock	<i>Scolopax minor</i>
Ovenbird	<i>Seiurus aurocapillus</i>
Louisiana waterthrush	<i>Seiurus motacilla</i>
Field sparrow	<i>Spizella pusilla</i>
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>
Eastern meadowlark	<i>Sturnella magna</i>
Brown thrasher	<i>Toxostoma rufum</i>
Eastern kingbird	<i>Tyrannus tyrannus</i>
Yellow-throated vireo	<i>Vireo flavifrons</i>



Common Name	Scientific Name
Canada warbler	<i>Wilsonia canadensis</i>
<b>Mammals</b>	
Appalachian cottontail	<i>Sylvilagus obscurus</i>
<b>Terrestrial Insects</b>	
Diana fritillary	<i>Speyeria diana</i>
<b>Other Terrestrial Invertebrates</b>	
Black Mountain disc	<i>Discus nigrimontanus</i>
Buttressed threetooth	<i>Triodopsis rugosa</i>
<b>Mollusks</b>	
None	
<b>Crustaceans</b>	
Clinch River crayfish	<i>Cambarus angularis</i>
Bunting's crayfish	<i>Cambarus buntingi</i>
A crayfish	<i>Cambarus parvoculus</i>
<b>Aquatic Insects</b>	
Northern pygmy clubtail	<i>Lanthus parvulus</i>
<b>Other Aquatic Invertebrates</b>	
None	

<sup>1</sup> The Appalachian yellow-bellied sapsucker may occur in the Northern Cumberlands, but has not been confirmed (M. D. Wilson, pers. comm.). Please see Chapters 6 and 7 for accounts of this subspecies.

### **8.3. Terrestrial and Wetland Species in the Northern Cumberlands**

#### **8.3.1. Tier I Species in the Northern Cumberlands**

##### **8.3.1.1. Peregrine falcon, *Falco peregrinus***

###### *Life History Summary*

The peregrine falcon occurs most frequently in the Coastal Plain, but it is regularly observed statewide. In the Northern Cumberlands, its main nesting habitat is (or will be) cliff faces. They occur year-round in Virginia (Watts 1999). This falcon eats mainly birds, ranging in size from hummingbirds to sandhill cranes (White et al. 2002), but focusing on prey 100-500g (Johnsgard 1990). Young falcons are removed from nests in the Coastal Plain and “hacked,” or transplanted, to areas in the mountains, with the hope that these birds will return to their historic mountain range. Peregrine falcon is legally protected, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 20% of its statewide predicted potential habitat is protected.

###### *Location*

The map of peregrine falcon habitat (Figure 8.5) includes cliffs mapped during DGIF aerial surveys (Reynolds 2003).

*Description of Habitat Requirements*

Nest sites for this species are typically located on ledges or shelves on cliff faces (J. L. Cooper, DGIF, pers. comm.). Analysis of 15 historic Virginia eyries revealed that all nests were located on sedimentary rock facing southwest or northeast, averaging 402m from flowing water (Gabler 1983).

*Relative Condition of Habitat*

There are three potential nest cliffs within the Northern Cumberlands ecoregion (17 statewide), one of which is a historic next site (DGIF 2004b). These potential nest sites are all at least partially protected within Conservation Lands, including USFS and NPS lands (DCR 2003).

*Specific Threats and Trends*

The peregrine falcon is recovering range-wide since the use of the pesticide DDT was banned in the U.S. (Johnsgard 1990; Rich et al. 2004). Within Virginia, the breeding population is very small but undergoing active management.

*Conservation Actions and Strategies*

Bird TAC (2004) reported a goal of population maintenance in the Coastal Plain while increasing the population in the mountains (including the Northern Cumberlands) of Virginia. Reduction of organochlorine pesticide contamination is important in continuing the peregrine's recovery (White et al. 2002). Protection of nesting areas from disturbance and destruction is also important (White et al. 2002). A thorough treatment of needed conservation actions is given in USFWS (1987).

Little is known of nesting populations and success in the mountain population (R. J. Reynolds, DGIF, pers. comm.). An aerial mountain survey of 23 nests found no nesting pairs, but identified key sites that are in need of additional surveys and could be potential hack sites (Reynolds 2003). Specific sublethal effects of



Figure 8.5. Distribution of the peregrine falcon in the Northern Cumberlands.

*Reeseearch and Monitoring Needs*

toxins on peregrines are poorly known (Bird TAC 2004). Monitoring of the recovery of all populations and the dynamics of these recovering populations should be continued (White et al. 2002).

8.3.1.2. Loggerhead shrike, *Lanius ludovicianus*

*Life History Summary*

The loggerhead shrike occurs most frequently in Virginia in the Blue Ridge Mountains and Ridge and Valley, but also occurs rarely in the Northern Cumberlands (Fraser 1991). It occurs year-round in Virginia (Yosef 1996). It 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 (DGIF 2004a), 14% of its statewide predicted potential habitat is protected.

*Location*

Loggerhead shrike habitat in this part of the state is ephemeral and cannot be accurately mapped, so the map (Figure 8.6) includes only confirmed locations from the breeding season (DGIF 2004b).

*Description of Habitat Requirements*

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

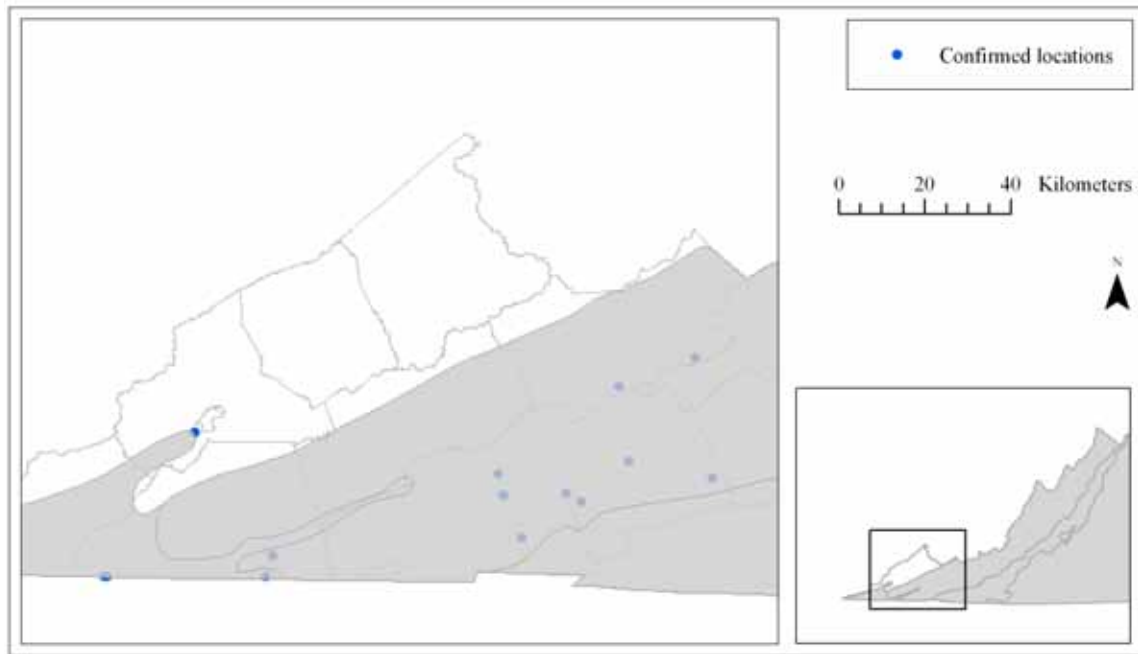


Figure 8.6. Distribution of the loggerhead shrike in the Northern Cumberland Mountains.

### *Relative Condition of Habitat*

There are only two Collection locations, within 20m of each other, for loggerhead shrike in the Northern Cumberlands (145 statewide, DGIF 2004b). These locations, representing a single site, are outside of a Conservation Land (DCR 2003).

### *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 decline of 87% in the northeast (which includes Virginia) is reported by NESWDTC (2004). Bird TAC (2004) reports that the population levels of this species are unknown in Virginia, but could be as low as < 100 individuals.

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 (1996) reports 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 monitoring the success of every individual nest (NESWDTC 2004). Other conservation actions are habitat-related. These can be found in Appendix I and generally involve grassland management. 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.

### *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 causes for the species' decline, both in Virginia and throughout its range, are unclear and need further research (Yosef 1996; Bird TAC 2004). Certainly, the role of pesticides in the decline of this species needs to be better understood.

#### 8.3.1.3. Appalachian Bewick's wren, *Thryomanes bewickii*

##### *Life History Summary*

The Appalachian Bewick's wren has become a very rare bird in the mountains of Virginia; in fact, it may be extirpated (Rosenberg 2003). It was fairly common in the era between deforestation and reforestation, peaking around the 1930s. Its habitat in Virginia is brushy, high-altitude areas, where it was common around farmsteads, utilizing fencerows, brushpiles, and snags, while nesting in and among outbuildings (Adkisson 1991). It builds its nest in a cavity or on a ledge. Like all wrens, its primary foods are arthropods (Kennedy and White 1997). Important threats are unclear, though reversion of landcover to forest has undoubtedly played a part in this species' decline (Adkisson 1991). In addition, range expansion by the house wren *Troglodytes aedon* may have contributed to the decline (Kennedy and White 1997), though Bewick's wren has been observed nesting near both house and Carolina wrens *Thryothorus ludovicianus* without apparent interspecific aggression (Adkisson 1991). Competition with the exotic house sparrow *Passer domesticus* and European starling *Sturnus vulgaris* may also have contributed to the decline of Bewick's wren in the east (Adkisson 1991; Kennedy and White 1997). The Appalachian Bewick's wren is

legally protected under MBTA and with the status of State endangered. According to VA-GAP (DGIF 2004a), 2% of its statewide predicted potential habitat is protected.

*Location*

Because the habitat requirements for this species are ephemeral and cannot be mapped accurately, the map (Figure 8.7) includes confirmed locations from the breeding season (DGIF 2004b).

*Description of Habitat Requirements*

This species only occurs at high elevations in Virginia, in farmyards or overgrown fields with tree cavities or abandoned buildings (NatureServe 2004).

*Relative Condition of Habitat*

There is only one location in the Northern Cumberlands (six statewide) for the Appalachian Bewick's wren in Collections (DGIF 2004b). This location is not protected by a Conservation Land (DCR 2003).

*Specific Threats and Trends*

As mentioned earlier, causes for the decline of Bewick's wren in Virginia are unclear. It has exhibited a strong negative trend in the region (Rosenberg 2003). While there exist no known species-specific stresses for this species, it shares stresses with other members of the "Bird: Early Successional" habitat group (Bird TAC 2004; Appendix H). However, due to it only occurring at high elevations, some of these threats may not be as severe to this species as those that occur at lower elevations. It seems likely that natural succession of habitat and competition with the house wren have negative impacts on Bewick's wren (Adkisson 1991; Kennedy and White 1997).

*Conservation Actions and Strategies*

Effective conservation actions for this species are not clear, though those associated with its early successional habitat seem likely to be helpful (Bird TAC 2004; Appendix I). Bird TAC (2004) indicates

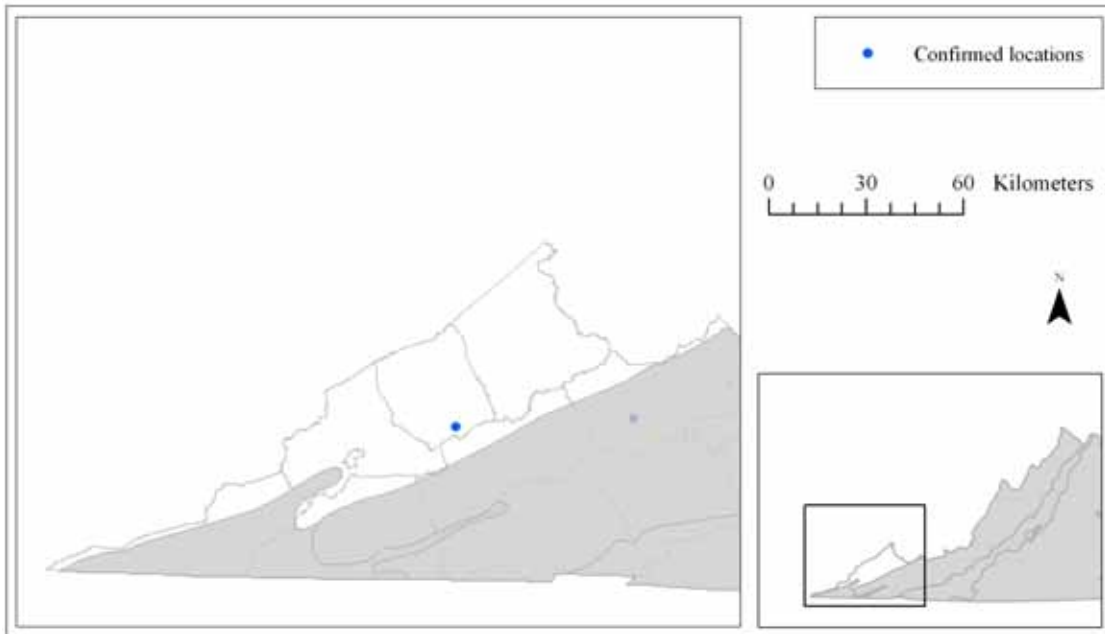


Figure 8.7. Distribution of Appalachian Bewick's wren in the Northern Cumberlands.

that Bewick's wren in Virginia numbers fewer than 20 individuals, and that the population needs to be increased while being more closely inventoried. Rosenberg (2003) gives a population goal of 100 pairs throughout the PIF Mid-Atlantic Ridge and Valley, which includes portions of Virginia and neighboring states. Anderson et al. (2000) give a goal of 12,000ha of scrub-shrub habitat in the PIF Northern Cumberland Plateau, but steps this down to 4,000ha each in West Virginia, Tennessee, and Kentucky, without an allotment to Virginia. Nest boxes in areas without house wrens may be helpful; removal of nest boxes in areas with house wrens may also be helpful to reduce that competitor's numbers in the area.

#### *Research and Monitoring Needs*

Knowledge of this species would benefit from an effort to gather historical data regarding its distribution and abundance in Virginia (Bird TAC 2004). In addition, targeted surveys for this species should be performed to determine whether this species is still extant in Virginia, and if so, where (Bird TAC 2004). The extent and nature of interspecific competition with house wrens needs to be fully investigated to determine its effect on the decline of Bewick's wren (Kennedy and White 1997). Overall, a better understanding of the nature and causes of its rapid decline in the Appalachians is needed (Rosenberg 2003).

#### 8.3.1.4. Indiana myotis, *Myotis sodalis*

##### *Life History Summary*

The Indiana myotis is a small brown bat that occurs throughout much of the eastern U.S. It spends summer in small maternity colonies in a complex of snags exposed to sunlight (Whitaker and Hamilton 1998). This species is migratory, and the majority of individuals winter in only 15 caves, nine of which are in the eastern U.S. (with the remainder in Missouri, Whitaker and Hamilton 1998). The concentrated nature of its winter range is part of the reason for its Federal status, as such a concentration renders a larger proportion of the population susceptible to negative effects at each winter site (USFWS 1983a; Pierson 1998). Its main foods are small moths, beetles, and dipterans (Whitaker and Hamilton 1998). Major threats to this species include human disturbance of hibernacula and destruction of the riparian forest necessary for maternity colonies and foraging. The Indiana myotis is protected with the status of Federal and State endangered. According to VA-GAP (DGIF 2004a), 26% of its statewide predicted potential habitat is protected.

##### *Location*

The map of habitat for the Indiana myotis (Figure 8.8) includes confirmed locations from Collections (DGIF 2004b) and cave Conservation Sites (DCR-NH 2004).

##### *Description of Habitat Requirements*

This species requires caves with cool stable temperatures (Whitaker and Hamilton, 1998). More specifically, R. J. Reynolds (DGIF, pers. comm.) states that essential habitat includes caves with high humidity and stable temperatures (3-10°C), and that the Indiana myotis is often associated with old saltpeter mines.

##### *Relative Condition of Habitat*

There are 15 Collections locations for the Indiana myotis in the Northern Cumberlands (DGIF 2004b). All but one of these locations is within a Conservation Land, either National Forest land or Cumberland National Historical Park (DCR 2003). There are three DCR-NH Conservation Sites that contain Indiana myotis populations (DCR-NH 2005). All of these sites contain Collections locations and are at least partially within a Conservation Land (DCR 2003; DGIF 2004b).

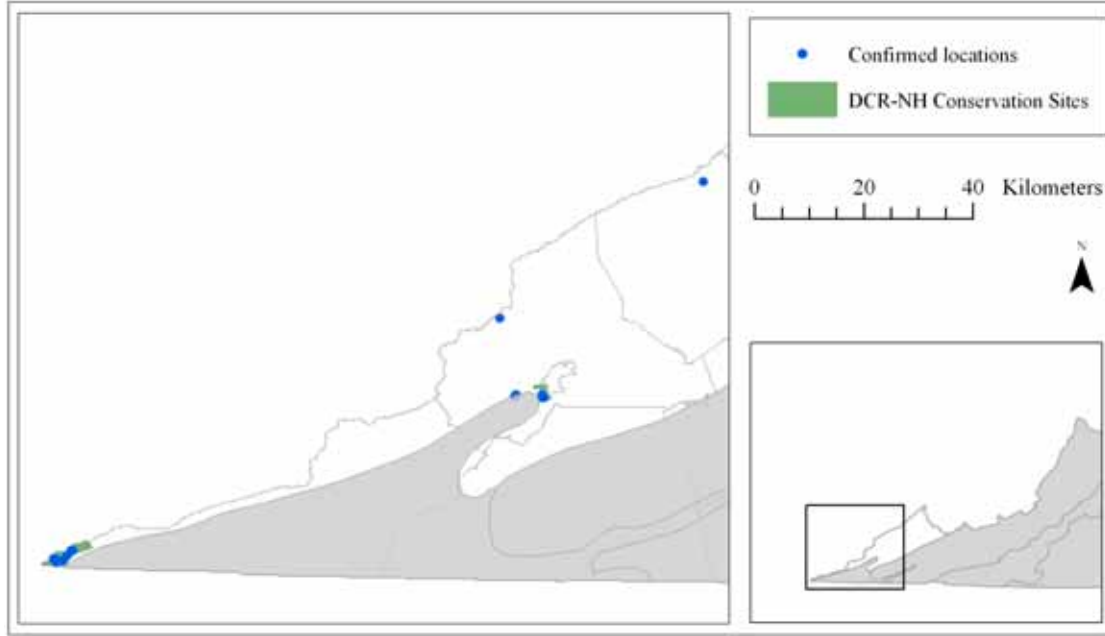


Figure 8.8. Distribution of the Indiana myotis in the Northern Cumberland Mountains.

*Specific Threats and Trends*

Mammal TAC (2004) identified two stresses on this species in Virginia (Table 8.3). Additional stresses were identified by USFWS (1983a), including collapse of hibernacula, destruction of riparian areas, and (possibly) pesticide poisoning. Thomson (1982) listed alteration of hibernaculum microclimate as a threat.

Table 8.3. Species-specific stresses on the Indiana myotis (Mammal TAC 2004).

Stress	Source of Stress	Scope	Severity	Comments
Human disturbance	Recreational use of habitat	3	3	Disturbance of hibernacula
Unintentional kills	Power generation	U	U	Wind turbine effects unknown

*Conservation Actions and Strategies*

No conservation actions were identified by Mammal TAC (2004). USFWS (1983a) identify several in the recovery plan. These include preventing disturbance to hibernacula; protecting, and restoring foraging and nursery areas; and a public information campaign. For detailed conservation actions, see USFWS (1983a).

*Research and Monitoring Needs*

No research or monitoring needs were identified by Mammal TAC (2004). USFWS (1983a) identify several in the recovery plan. These include monitoring of summer and hibernacula population trends; monitoring levels of toxins and researching their effects; and research on summer habitat requirements. For a full list and further details, see USFWS (1983a).

8.3.1.5. Brown supercoil, *Paravitrea septadens*

*Life History Summary*

The brown supercoil is endemic to Dickenson and Buchanan counties in Virginia. It inhabits deep leaf litter in valleys and on hillsides. Nothing is known of its life history (Batie 1991). This species is protected by its

status of State threatened. It has also been designated a species of concern by the Virginia Field Office of USFWS.

*Location*

The map of habitat for the brown supercoil (Figure 8.9) includes only confirmed locations from Collections (DGIF 2004b), since the habitat requirements are more specific than we are able to spatially depict.

*Description of Habitat Requirements*

The only habitat information on this species is provided by Batie (1991), who reports that habitat includes deep leaf litter in ravines and at the bases of hills.

*Relative Condition of Habitat*

There are seven known locations within Dickenson and Buchanan Counties of the brown supercoil from Collections (DGIF 2004b). Only one of these locations is protected by a Conservation Land (Breaks Interstate Park, DCR 2003).

*Specific Threats and Trends*

Invertebrate TAC did not provide any specific threats to or trends in this species. Batie (1991) mentions only that reduction of leaf litter in areas in which this snail occurs would detrimentally affect this species. However, no potential causes of such disruption are listed.

*Conservation Actions and Strategies*

Invertebrate TAC did not list any specific conservation actions for this species.

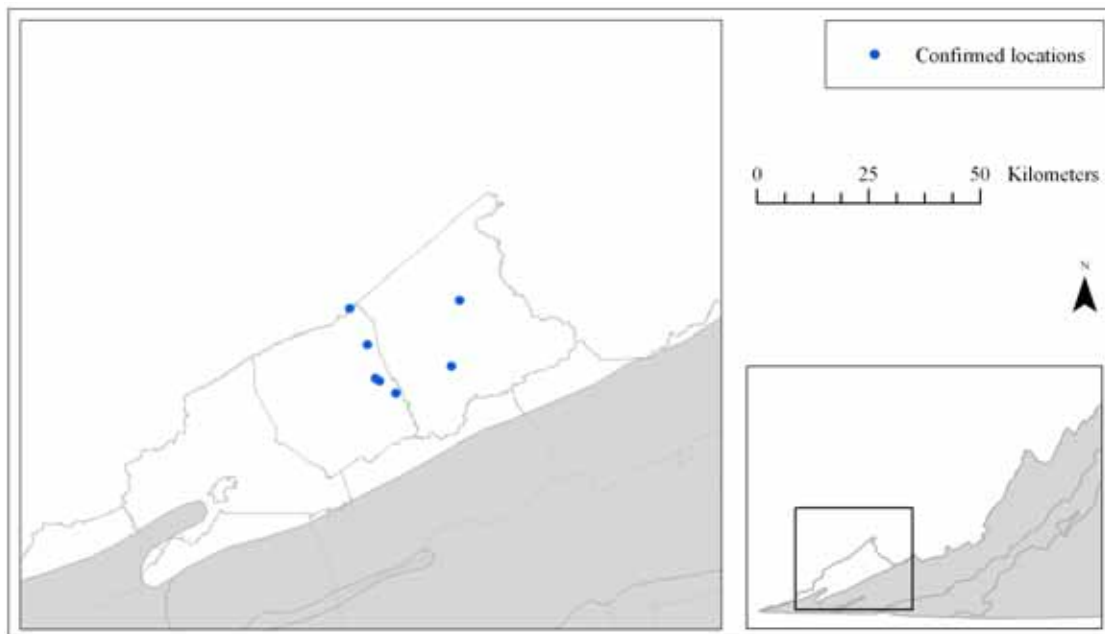


Figure 8.9. Distribution of the brown supercoil in the Northern Cumberlands.



*Research and Monitoring Needs*

Invertebrate TAC did not list any specific research or monitoring needs for this species. Batie (1991) recommends surveys for additional populations in the vicinity of known occurrences. Research into the life history of this species would be useful, since nothing is currently known about it.

**8.3.2. Forest Species of Greatest Conservation Need in the Northern Cumberlands**

8.3.2.1. Species of Greatest Conservation Need by Forest Type

Of the 39 tiered species that occur in forest in the Southern Cumberlands, 19 are generalists that occur in all forest types (Table 8.4). Of the remaining 19 species, 19 occur in deciduous forest (Table 8.5), two occur in coniferous forest (Table 8.6), and 12 occur in mixed forest (Table 8.7).

*Table 8.4.* Forest generalist species of greatest conservation need in the Northern Cumberlands. “Open woods,” throughout Tables 8.4-8.7, unless otherwise indicated, indicates mature, closed canopy, open understory forest, and not open canopy, shrubby understory forests, such as shelterwood cuts.

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Peregrine falcon	<i>Falco peregrinus</i>	I	Cliffs for nesting, often near water
Indiana myotis	<i>Myotis sodalis</i>	I	Snags in sunlight (breeding)
Eastern box turtle	<i>Terrapene carolina</i>	III	Forest generalist
Green heron	<i>Butorides striatus</i>	IV	Near streams or wetlands
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	IV	Open woods
Northern bobwhite	<i>Colinus virginianus</i>	IV	Open woods
Eastern wood-pewee	<i>Contopus virens</i>	IV	Open second-growth to mature woods
Prairie warbler	<i>Dendroica discolor</i>	IV	Open woods
Worm-eating warbler	<i>Helmitheros vermivorus</i>	IV	Thick understory near water
Eastern hog-nosed snake	<i>Heterodon platirhinos</i>	IV	Forest ecotones with sandy soils
Yellow-breasted chat	<i>Icteria virens</i>	IV	Open shrubby woods
Black-and-white warbler	<i>Mniotilta varia</i>	IV	Forest generalist
Kentucky warbler	<i>Oporornis formosus</i>	IV	Thick understory, closed canopy near water
Northern parula	<i>Parula americana</i>	IV	Damp or wet woods near water
Eastern towhee	<i>Pipilo erythrophthalmus</i>	IV	Shrubby openings and edges
Ovenbird	<i>Seiurus aurocapillus</i>	IV	Open mature woods
Appalachian cottontail	<i>Sylvilagus obscurus</i>	IV	Thickets within mixed forest
Brown thrasher	<i>Toxostoma rufum</i>	IV	Shrubby clearcuts
Canada warbler	<i>Wilsonia canadensis</i>	IV	Thick understory near water

*Table 8.5.* Deciduous forest species of greatest conservation need in the Northern Cumberlands.

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Brown supercoil	<i>Paravitrea septadens</i>	I	Deep leaf litter in ravines and on hillsides
Green salamander	<i>Aneides aeneus</i>	II	Damp crevasses in mesophytic hardwoods
Cerulean warbler	<i>Dendroica cerulea</i>	II	Mature forest with complex canopy structure
Swainson's warbler	<i>Limnothlypis swainsonii</i>	II	Non-flooding bottomland hardwoods
Mountain chorus frog	<i>Pseudacris brachyphona</i>	II	Wooded hillsides near wet areas
Jefferson salamander	<i>Ambystoma jeffersonianum</i>	IV	Shallow ponds within woodlands
Whip-poor-will	<i>Caprimulgus vociferous</i>	IV	Open woods near large fields
Chimney swift	<i>Chaetura pelagica</i>	IV	Large snags or houses with chimneys

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	IV	Tall forest with partially open canopy
Timber rattlesnake	<i>Crotalus horridus</i>	IV	South-facing ledges and talus slopes
Gray catbird	<i>Dumetella carolinensis</i>	IV	Dense thickets in forest openings or edges
Willow flycatcher	<i>Empidonax traillii</i>	IV	Willow thickets near water
Wood thrush	<i>Hylocichla mustelina</i>	IV	Mature upland forest with undergrowth
Rose-breasted grosbeak	<i>Pheuctitus ludovicianus</i>	IV	Second-growth mesic forest
Scarlet tanager	<i>Piranga olivacea</i>	IV	Mature forest, min size 10-12ha
Cumberland Plateau salamander	<i>Plethodon kentucki</i>	IV	Beneath logs or other debris
American woodcock	<i>Scolopax minor</i>	IV	Moist or wet woods near wetlands
Louisiana waterthrush	<i>Seiurus motacilla</i>	IV	Near water
Yellow-throated vireo	<i>Vireo flavifrons</i>	IV	Tall forest with partially open canopy

*Table 8.6. Coniferous forest species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Green salamander	<i>Aneides aeneus</i>	II	Damp crevasses in moist shaded areas
Yellow-throated vireo	<i>Vireo flavifrons</i>	IV	Tall forest with partially open canopy

*Table 8.7. Mixed forest species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Mountain chorus frog	<i>Pseudacris brachyphona</i>	II	Wooded hills with wet areas or pools
Jefferson salamander	<i>Ambystoma jeffersonianum</i>	IV	Shallow ponds within woodlands
Whip-poor-will	<i>Caprimulgus vociferus</i>	IV	Open woods near large fields
Chimney swift	<i>Chaetura pelagica</i>	IV	Large snags or houses with chimneys
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	IV	Open woods with dense understory
Timber rattlesnake	<i>Crotalus horridus</i>	IV	South-facing ledges and talus slopes
Gray catbird	<i>Dumetella carolinensis</i>	IV	Dense thickets in forest openings or edges
Wood thrush	<i>Hylocichla mustelina</i>	IV	Mature upland forest with undergrowth
Rose-breasted grosbeak	<i>Pheuctitus ludovicianus</i>	IV	Second-growth mesic forest
Scarlet tanager	<i>Piranga olivacea</i>	IV	Mature forest, min size 10-12ha
American woodcock	<i>Scolopax minor</i>	IV	Moist or wet woods near wetlands
Louisiana waterthrush	<i>Seiurus motacilla</i>	IV	Near water

#### 8.3.2.2. Status of Forested Habitats

The 2001 Forest Inventory Analysis (FIA) reported 40,000 acres (16,200ha) of coniferous forest, 0.81 million acres (0.33 million ha) of deciduous forest, 6,000 acres (2,400ha) of mixed forest, and 160,000 acres (64,800ha) of non-forested land in the Blue Ridge (USFS 2001).

#### 8.3.2.3. Trends in Forested Habitats

As mentioned in Section 2.5.5, NRCS combined the Northern and Southern Cumberlands for this analysis. According to USDA (2000), non-federal forestland in the Northern and Southern Cumberlands increased by > 40,000 acres (> 16,000ha) during the period between 1982 and 1997. These totals do not include a total of 126,000 acres (51,000ha) of federal land in these ecoregions. 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.

### 8.3.3. Open Vegetated Habitat Species of Greatest Conservation Need in the Northern Cumberlands

#### 8.3.3.1. Species of Greatest Conservation Need by Open Vegetated Habitat Type

Of the 29 tiered species that occur in open habitats in the Northern Cumberlands, 14 are generalists that occur in all open vegetated habitat types (Table 8.8). Of the remaining 15 species, eight occur in herbaceous open habitats (Table 8.9) and six occur in scrub-shrub (Table 8.10).

*Table 8.8. Open vegetated habitat generalist species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Loggerhead shrike	<i>Lanius ludovicianus</i>	I	Scattered perches over short vegetation
Appalachian Bewick's wren	<i>Thryomanes bewickii</i>	I	High-elevation brushy areas, old fields
Northern harrier	<i>Circus cyaneus</i>	III	Damp to wet fields with few trees/shrubs
Eastern box turtle	<i>Terrapene carolina</i>	III	Dense groundcover, some shrubs
Whip-poor-will	<i>Caprimulgus vociferous</i>	IV	Forages over open fields
Northern bobwhite	<i>Colinus virginianus</i>	IV	Grassy fields with shrubby cover, also agricultural fields (active and fallow)
Prairie warbler	<i>Dendroica discolor</i>	IV	Open habitat with some trees or shrubs
Eastern hog-nosed snake	<i>Heterodon platirhinos</i>	IV	Ecotonal areas with sandy soils
Yellow-breasted chat	<i>Icteria virens</i>	IV	Dense tall vegetation
Eastern towhee	<i>Pipilo erythrophthalmus</i>	IV	Dense tall vegetation
American woodcock	<i>Scolopax minor</i>	IV	Fields for foraging and in winter
Field sparrow	<i>Spizella pusilla</i>	IV	Weedy fields with scattered shrubs
Brown thrasher	<i>Toxostoma rufum</i>	IV	Dense tall vegetation
Eastern kingbird	<i>Tyrannus tyrannus</i>	IV	Scattered perches (shrubs, trees, fences)

*Table 8.9. Herbaceous habitat species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Indiana myotis	<i>Myotis sodalis</i>	I	Uses solitary sunlit snags in summer
Mountain chorus frog	<i>Pseudacris brachyphona</i>	II	Breeds in wet fields adjacent to woodlands
Grasshopper sparrow	<i>Ammodramus savannarum</i>	IV	Grassy fields with few to no shrubs
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	IV	Near pine forest (forages over fields)
Rusty blackbird (winter)	<i>Euphagus carolinus</i>	IV	Croplands in winter
Queen snake	<i>Regina septemvittata</i>	IV	Open riparian areas
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	IV	Stream banks in open areas
Eastern meadowlark	<i>Sturnella magna</i>	IV	Grassy fields (pastures, etc.)

*Table 8.10. Scrub-shrub species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	IV	Dense shrubby thickets
Kirtland's warbler (migrant)	<i>Dendroica kirtlandii</i>	IV	Pine scrub (migration only)
Gray catbird	<i>Dumetella carolinensis</i>	IV	Ecotonal thickets and shrubby clearings
Willow flycatcher	<i>Empidonax traillii</i>	IV	Willow thickets near water
Wood thrush	<i>Hylocichla mustelina</i>	IV	Shrubby clearings within deciduous forest
Black-and-white warbler	<i>Mniotilta varia</i>	IV	Sapling stage of forest clearings

**8.3.3.2. Status of Open Vegetated Habitats**

The 1997 NRI reports no cultivated cropland and 70,400 acres (28,490ha) of noncultivated cropland and pasture in the Southern Cumberlands (USDA 2000). These totals do not include a total of 118,300 acres (47,875ha) of federal land in this ecoregion (USDA 2000).

**8.3.3.3. Trends in Open Vegetated Habitats**

As mentioned in Section 2.5.5, NRCS lumped the Northern and Southern Cumberlands together for this analysis. According to USDA (2000), during the period from 1982 through 1997, cultivated cropland decreased by > 10,000 acres (> 4,000ha) and pastureland, CRP, and non-cultivated cropland increased by > 10,000 acres (> 4,000ha). These totals do not include a total of 126,000 acres (51,000ha) of federal land in these ecoregions. Please see Section 3.2.3.2 for statewide status and trends in open habitats for Virginia.

**8.3.4. Barren Habitat Species of Greatest Conservation Need in the Northern Cumberlands**

**8.3.4.1. Species of Greatest Conservation Need by Barren Habitat Type**

Of the 11 tiered species that occur in barren or developed habitats in the Northern Cumberlands, nine occur primarily in developed residential areas (Table 8.11) and four occur in other barren areas (Table 8.12).

*Table 8.11. Developed habitat species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Appalachian Bewick's wren	<i>Thryomanes bewickii</i>	I	Residential neighborhoods
Eastern box turtle	<i>Terrapene carolina</i>	III	Residential neighborhoods
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	IV	Residential neighborhoods
Chimney swift	<i>Chaetura pelagica</i>	IV	Residential neighborhoods (chimneys)
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	IV	Residential neighborhoods
Eastern wood-pewee	<i>Contopus virens</i>	IV	Residential neighborhoods
Gray catbird	<i>Dumetella carolinensis</i>	IV	Residential neighborhoods
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	IV	Bridges
Brown thrasher	<i>Toxostoma rufum</i>	IV	Residential neighborhoods

*Table 8.12. Other barren habitat species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Appalachian Bewick's wren	<i>Thryomanes bewickii</i>	I	Rocky outcroppings
Eastern small-footed myotis	<i>Myotis leibii</i>	III	Sometimes roosts under rocks on the ground or in quarries
Timber rattlesnake	<i>Crotalus horridus</i>	IV	Rock ledges, rockslides
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	IV	Sand pits

*Balds species of greatest conservation need in the Northern Cumberlands*

No tiered species have been documented on balds in the Cumberland Mountains of Virginia.

*Beach species of greatest conservation need in the Northern Cumberlands*

Appropriate beaches do not occur in the Cumberland Mountains of Virginia.

**8.3.4.2. Status of Barren Habitats**

The 1997 NRI reports 35,000 acres (14,160ha) of urban and built-up land and 15,400 acres (6,230ha) of rural transportation infrastructure in the Northern Cumberlands (USDA 2000). This does not include a total of 118,300 acres (47,875ha) of federal lands in this ecoregion (USDA 2000).

**8.3.4.3. Trends in Barren Habitats**

Trends for most barren areas are not available at any scale. However, the NRI (USDA 2000) does track developed areas. As mentioned in Section 2.5.5, NRCS lumped the Northern and Southern Cumberlands together for this analysis. Developed areas in the Cumberlands increased by > 15,000 acres (> 6,000ha) during the period 1982-1997. Please see Section 3.2.3.3 for statewide status and trends of barren and developed areas in Virginia.

**8.3.5. Wetland Species of Greatest Conservation Need in the Northern Cumberlands**

**8.3.5.1. Species of Greatest Conservation Need by Wetland Type**

Of the 26 tiered species that occur in wetlands of the Northern Cumberlands, three are generalists that may occur in either wetland type (Table 8.13). Of the remaining 23 species, three occur in emergent wetlands (Table 8.14), and 20 occur in wooded wetlands (Table 8.15).

*Table 8.13. Wetland generalist species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Mountain chorus frog	<i>Pseudacris brachyphona</i>	II	Wooded hills including or adjacent to wet areas
Green heron	<i>Butorides striatus</i>	IV	Nests in wooded wetlands, forages in any but avoids open water
Willow flycatcher	<i>Empidonax traillii</i>	IV	Willow thickets near water

*Table 8.14. Emergent wetland species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Northern harrier	<i>Circus cyaneus</i>	III	Fresh marshes
Yellow warbler	<i>Dendroica petechia</i>	IV	Willow thickets near water
Virginia rail	<i>Rallus limicola</i>	IV	Shallow water, dense emergent cover

*Table 8.15. Wooded wetland species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Swainson's warbler	<i>Limnothlypis swainsonii</i>	II	Dense river swamp
Eastern box turtle	<i>Terrapene carolina</i>	III	Forest generalist
Jefferson salamander	<i>Ambystoma jeffersonianum</i>	IV	Shallow ponds in deciduous/mixed forest
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	IV	Dense thickets in deciduous bottomland
Eastern wood-pewee	<i>Contopus virens</i>	IV	Seasonally-flooded bottomland forest
Gray catbird	<i>Dumetella carolinensis</i>	IV	Dense shrubs near water
Rusty blackbird (winter)	<i>Euphagus carolinus</i>	IV	Trees near marshes or wooded swamps
Worm-eating warbler	<i>Helmitheros vermivorus</i>	IV	Thick understory near water
Wood thrush	<i>Hylocichla mustelina</i>	IV	Mature forest
Black-and-white warbler	<i>Mniotilta varia</i>	IV	Hardwood swamps and bottomlands
Kentucky warbler	<i>Oporornis formosus</i>	IV	Dark, wooded swamps

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
Northern parula	<i>Parula americana</i>	IV	Wooded swamps with tree moss present
Rose-breasted grosbeak	<i>Pheuctitus ludovicianus</i>	IV	Deciduous wooded swamps
Scarlet tanager	<i>Piranga olivacea</i>	IV	Mature bottomland forest
Queen snake	<i>Regina septemvittata</i>	IV	Water with overhanging branches
American woodcock	<i>Scolopax minor</i>	IV	Moist or wet woods near wetlands
Louisiana waterthrush	<i>Seiurus motacilla</i>	IV	Wooded streams or wooded swamps
Diana fritillary	<i>Speyeria diana</i>	IV	Streamside forests with <i>Viola</i> spp.
Yellow-throated vireo	<i>Vireo flavifrons</i>	IV	Wooded swamps

#### 8.3.5.2. Status and Trends in Wetlands

Wetlands are rare in the Northern Cumberlands. According to the 1992 NLCD (USGS 1992), the Northern Cumberlands contains 211ha of wooded and shrubby wetlands and 72ha of emergent wetlands.

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.

## **8.4. Aquatic Species in the Northern Cumberlands**

### **8.4.1. Northern Cumberlands-Clinch EDU**

The Northern Cumberland-Clinch River EDU (Figure 8.10) is part of the Tennessee-Cumberland freshwater ecoregion, which is considered “globally outstanding” in terms of biological distinctiveness (Abell et al. 2000). Abell et al. (2000) also considered this freshwater ecoregion “Endangered.” The Tennessee drainage contains the most diverse fish assemblage in North America (Jenkins and Burkhead 1994). There is a high level of endemism in this freshwater ecoregion, with 29% of the fish, 16% of the mussels, and 62% of the crayfish considered endemic (Abell et al. 2000).

The Clinch River flows 251km in Virginia before entering Tennessee (Jenkins and Burkhead 1994). Shortly after entering Tennessee, it joins the Powell River and is impounded into the Norris Reservoir. In Virginia, the Clinch largely drains the Ridge and Valley, with some tributaries flowing off the Cumberland Mountains, and approximately the last half of the mainstem flowing through the Southern Cumberlands. Small portions of the mainstem and many of the headwaters of the Clinch and Powell rivers drain the Northern Cumberlands ecoregion.

#### **8.4.1.1. Tier I Species in the Northern Cumberlands-Clinch EDU**

##### **8.4.1.1.1 Shiny pigtoe, *Fusconaia cor***

###### *Life History Summary*

The shiny pigtoe is very rare in Virginia and rare throughout its range (Neves 1991b). Its decline is believed to be due to habitat degradation. Adult size ranges from 60-80mm and the shell is typically

subtriangular in shape (Neves 1991b; Parmalee and Bogan 1998). This mussel is tachytictic (Kitchel 1985). Kitchel (1985) listed the telescope shiner *Notropis telescopus*, warpaint shiner *Luxilus coccogenis*, and common shiner *L. cornutus* as hosts. The shiny pigtoe is legally protected with the status of State and Federal endangered.

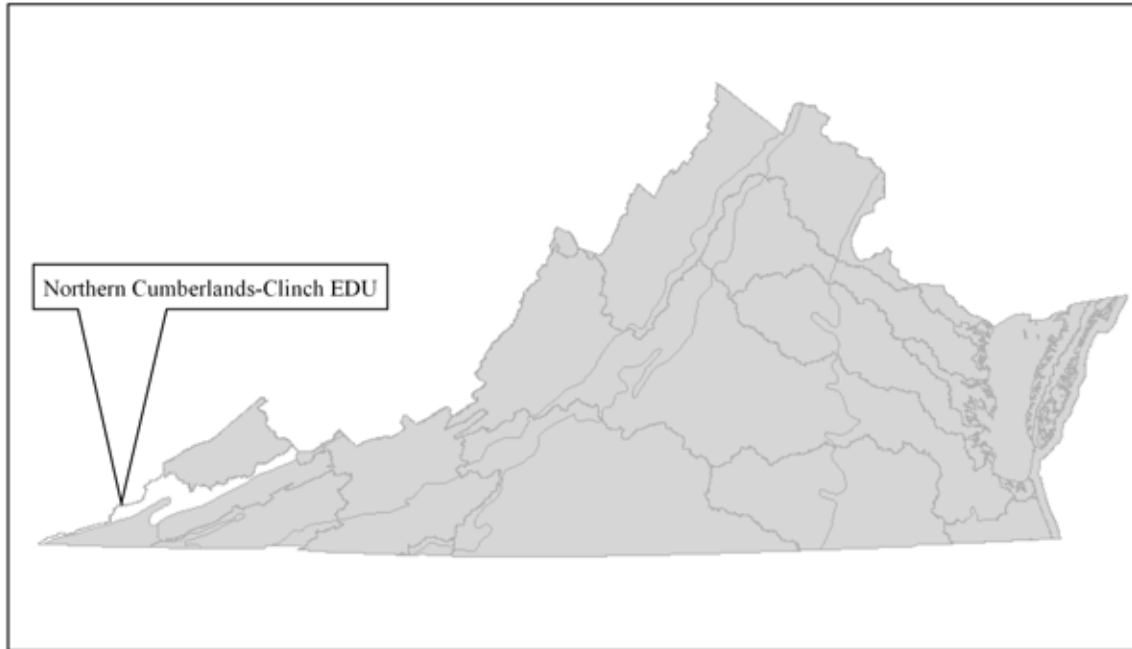


Figure 8.10. Location of the Northern Cumberlands-Clinch EDU.

*Location*

The map of shiny pigtoe habitat (Figure 8.11) includes confirmed reaches from Collections (DGIF 2004b) and potential reaches. Potential habitat was selected using attributes (link magnitude and link magnitude of downstream reaches, as well as gradient) within DGIF's aquatic habitat classification. See Appendix D for more details.

*Description of Essential Habitat*

The shiny pigtoe occurs in fords, shoals, and other shallow riverine habitats with moderate to swift current (Bogan and Parmalee 1983). It can be found in stable substrates of anything from sand to cobbles. In the Northern Cumberlands-Clinch EDU, the shiny pigtoe has been confirmed in one habitat type (Table 8.16).

Table 8.16. DGIF aquatic habitat types used by the shiny pigtoe in the Clinch-Powell River watershed.

<b>Aquatic Habitat Type</b>	<b>Number of Reaches</b>
Very low gradient small river connected to another small river	5

*Relative Condition of Habitat*

The recovery plan for the shiny pigtoe provides some information on past and recent habitat quality issues (USFWS 1983b). The known habitat of the shiny pigtoe is immediately downstream of impaired stream reaches (DEQ and DCR 2004). The impairments include general standard benthic, total fecal coliform, and *Escherichia coli* from non-point sources (urban and septic disposal).

*Specific Threats and Trends*

The recovery plan for the shiny pigtoe identifies impoundments, siltation, and general water pollution as contributing factors in the decline of this species (USFWS 1983b). Current threats include water quality and sedimentation effects of mining activities, general water quality degradation (especially fecal coliform

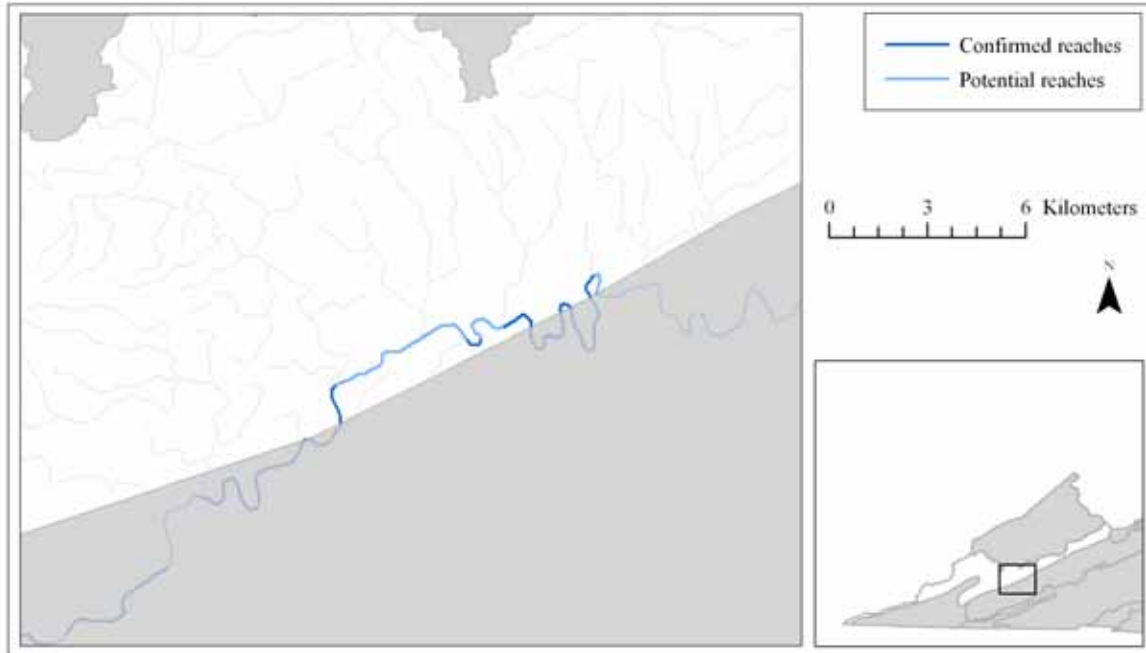


Figure 8.11. Location of confirmed and potential shiny pigtoe habitat in the Northern Cumberland Mountains-Clinch EDU (DGIF 2004b).

levels), and catastrophic toxic spills (Neves 1991b). Mussel TAC (2004) did not identify any specific threats to the shiny pigtoe. However, they identified several threats to the Clinch-Powell River drainages (Appendix H).

#### *Conservation Actions and Strategies*

Neves (1991b) recommends strict enforcement of existing water quality regulations to improve water and habitat quality. The recovery plan for the shiny pigtoe recommends two high priority conservation actions: protection of existing populations and habitats and mitigation or elimination of current threats (USFWS 1983b). Mussel TAC (2004) identified a suite of conservation actions for the Clinch-Powell River drainages (Appendix I), but nothing specific to this species.

#### *Research and Monitoring Needs*

The recovery plan (USFWS 1983b) recommends that life history studies be completed. Mussel TAC (2004) identified several research or monitoring needs for the Holston River drainage (Appendix J), but nothing specific to the shiny pigtoe.

#### 8.4.1.1.2. Fine-rayed pigtoe, *Fusconaia cuneolus*

##### *Life History Summary*

The fine-rayed pigtoe is very rare in Virginia and throughout its range (Neves 1991a). It is subtriangular in shape and may reach 80mm (Parmalee and Bogan 1998). Fine-rayed pigtoe is tachytictic. Laboratory research has indicated that the river chub *Nocomis micropogon*, white shiner *Luxilus albeolus*, telescope shiner *Notropis telescopus*, Tennessee shiner *N. leuciodus*, central stoneroller *Campostoma anomalum*, fathead minnow *Pimephales promelas*, and mottled sculpin *Cottus bairdi* could serve as hosts for glochidia of this species (Bruenderman 1989). This species is believed to live up to 35 years. The fine-rayed pigtoe is protected with the status of State and Federal endangered.



*Location*

The map of fine-rayed pigtoe habitat (Figure 8.12) includes confirmed reaches based on Collections (DGIF 2004b) and potential reaches. Potential habitat was selected using attributes (link magnitude and link magnitude of downstream reaches, as well as gradient) within DGIF's aquatic habitat classification. See Appendix D for more details.

*Description of Essential Habitat*

Neves (1991a) indicates that the fine-rayed pigtoe is a lotic, riffle-dwelling species that is typically found in shallow fords and shoals with moderate gradient. The DGIF aquatic habitat classification was used to examine patterns in habitat use and distribution. In the Northern Cumberlands-Clinch EDU, this species was found in one habitat type (Table 8.17).

*Table 8.17. DGIF habitat types used by the fine-rayed pigtoe in the Northern Cumberlands-Clinch EDU.*

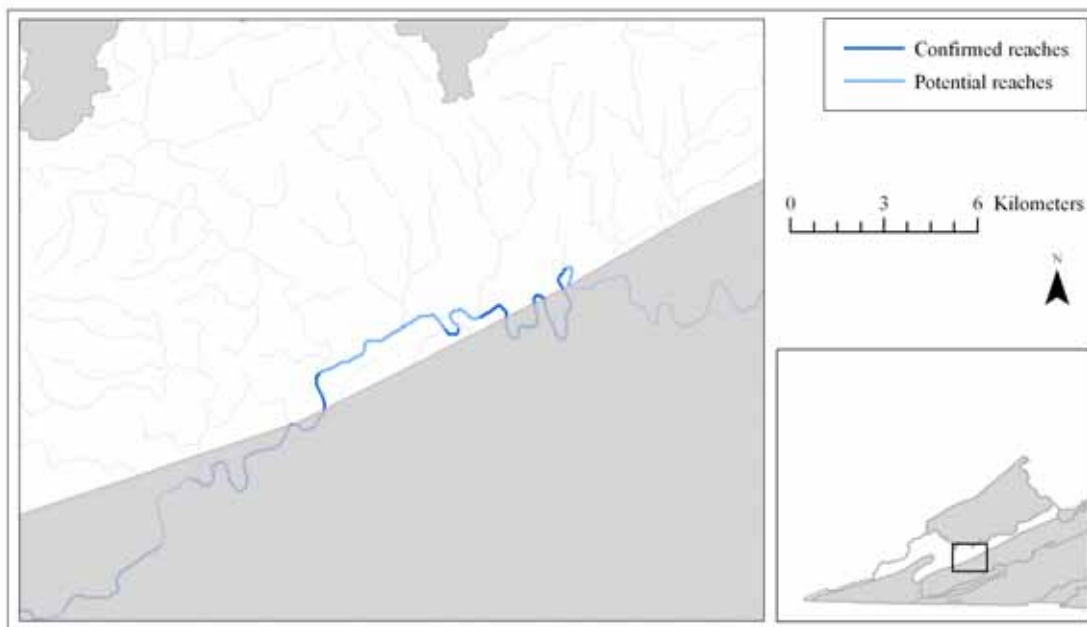
<b>Aquatic Habitat Type</b>	<b>Number of Reaches</b>
Very low gradient small river connected to another small river	4

*Relative Condition of Habitat*

The recovery plan for the fine-rayed pigtoe describes some issues related to past and current conditions of its habitat (USFWS 1984). The known habitat of the fine-rayed pigtoe is immediately downstream of impaired stream reaches (DEQ and DCR 2004). The impairments include general standard benthic, total fecal coliform, and *Escherichia coli* from non-point sources (urban and septic disposal).

*Specific Threats and Trends*

Industrial development and agriculture have likely caused the declines in the fine-rayed pigtoe (USFWS 1984). This development was the source of impoundments, mining wastes, herbicides, pesticides, siltation,



*Figure 8.12. Location of confirmed and potential fine-rayed pigtoe habitat in the Northern Cumberlands-Clinch EDU (DGIF 2004b).*

and channelization. Existing populations are threatened by oil and gas drilling, impacts of coal mining, fecal coliform pollution, and siltation (Neves 1991a).

Mussel TAC (2004) did not identify any specific threats to the fine-rayed pigtoe. However, they identified several threats to the Clinch River drainage (Appendix H).

*Conservation Actions and Strategies*

Neves (1991a) suggests that recolonizing the section of the Clinch River between Carbo and St. Paul would help to ensure the viability of the population in Virginia. In general, improvements in water quality would help populations in both the Clinch and Powell rivers. Specifically, the following actions would increase the viability of this species: upgrades to sewage treatment plants, expedition of reclamation of mined lands, elimination of coal waste dumping into the river, and strict enforcement of permitted discharges (Neves 1991a).

The recovery plan for the fine-rayed pigtoe lists three high priority recovery actions: mitigating or eliminating current and future foreseeable threats, enforcing existing state and federal laws and regulations, and protecting known habitats and populations (USFWS 1984). Details are available in USFWS (1984).

Mussel TAC (2004) identified a suite of conservation actions for the Clinch and Powell River drainages (Appendix I), but nothing specific to the fine-rayed pigtoe.

*Research and Monitoring Needs*

The recovery plan for the fine-rayed pigtoe recommends that threats (current and future) be identified (USFWS 1984). Mussel TAC (2004) identified several research or monitoring needs for the Clinch and Powell River drainages (Appendix J), but nothing specific to the fine-rayed pigtoe.

**8.4.1.2. Aquatic SGCN by Habitat Group: Northern Cumberlands-Clinch EDU**

The Northern Cumberlands-Clinch EDU has 22 tiered aquatic species. This includes 15 fish, two mussels, two snails, and three crayfish. These species are distributed among two habitat groups and one group of species with generalist or indeterminate habitat preferences (Tables 8.18-8.20).

*Table 8.18.* Aquatic species of greatest conservation need in very low and low gradient small streams (DGIF Classification types 221, 222, and 232).

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Percent Occurrences in Habitat Group</b>	<b>Number of Types Used (DGIF Aquatic Classification)</b>
Popeye shiner Clinch River	<i>Notropis ariommmus</i>	II	75	4 (4 occurrences)
crayfish	<i>Cambarus angularis</i>	IV	83	3 (6 occurrences)
A crayfish	<i>Cambarus parvoculus</i>	IV	100	2 (2 occurrences)
Swannanoa darter	<i>Etheostoma swannanoa</i>	IV	100	2 (2 occurrences)
Mountain shiner	<i>Lythrurus lirus</i>	IV	75	4 (4 occurrences)

*Table 8.19.* Aquatic species of greatest conservation need in very low gradient small rivers connected to other small rivers (DGIF Classification types 441 and 442).

Common Name	Scientific Name	Tier	Percent Occurrences in Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Shiny pigtoe	<i>Fusconaia cor</i>	I	100	1 (5 occurrences)
Fine-rayed pigtoe	<i>Fusconaia cuneolus</i>	I	100	1 (4 occurrences)
River redhorse	<i>Moxostoma carinatum</i>	III	100	2 (2 occurrences)
Freshwater drum	<i>Aplodinotus grunniens</i>	IV	100	2 (2 occurrences)
Sauger	<i>Stizostedion canadense</i>	IV	100	2 (2 occurrences)

*Table 8.20.* 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)
Coal elimia	<i>Elimia aterina</i>	II	NA
Wounded darter	<i>Etheostoma vulneratum</i>	III	1 (1 occurrence)
Brown walker	<i>Pomatiopsis cincinnatiensis</i>	III	NA
Bunting's crayfish	<i>Cambarus buntingi</i>	IV	NA
Rainbow darter	<i>Etheostoma caeruleum</i>	IV	1 (1 occurrence)
Blotched chub	<i>Erimystax insignis</i>	IV	2 (2 occurrences)
Banded darter	<i>Etheostoma zonale</i>	IV	4 (5 occurrences)
Mirror shiner	<i>Notropis spectrunculus</i>	IV	3 (3 occurrences)
Stonecat	<i>Noturus flavus</i>	IV	NA
Tangerine darter	<i>Percina aurantiaca</i>	IV	2 (2 occurrences)
Logperch	<i>Percina caprodes</i>	IV	2 (2 occurrences)
Bullhead minnow	<i>Pimephales vigilax</i>	IV	1 (1 occurrence)

#### Relative Condition of Habitat

Approximately 19% of the riverine habitat in the Northern Cumberlands-Clinch EDU is impaired (DEQ and DCR 2004). Impairments include general standard benthics, total fecal coliform, and *Escherichia coli* from resource extraction, non-point urban sources, and acid mine drainage. A portion of the water in this EDU has a fish tissue impairment for PCBs, mercury, and arsenic. The source of this impairment is unknown. These water quality issues affect not only the species in this EDU but others downstream. There are many tiered species in downstream portions of this drainage. The impairments in the headwater portions could significantly impact these critical resources.

Within the Northern Cumberlands-Clinch EDU, 3.2% of the land use is agriculture and 1.3% is developed (USGS 1992). Across the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.2 to 15%.

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

#### **8.4.2. Northern Cumberlands-Big Sandy EDU**

The Northern Cumberland-Big Sandy EDU (Figure 8.13) is part of the Teays-Old Ohio freshwater ecoregion (Abell et al. 2000). The Teays-Old Ohio is considered “globally outstanding” because of the large number of species found here, second only to the Tennessee-Cumberland freshwater ecoregion. The



Figure 8.13. Location of the Northern Cumberlands-Big Sandy EDU.

level of endemism is considered moderately high, with 12% of fish, 14% of mussels, and 47% of crayfish found nowhere else. Abell et al. (2000) consider this region to have a conservation status of “Vulnerable.”

Most of the Big Sandy drainage in Virginia is within the Northern Cumberlands ecoregion (Figure 8.13). The remainder drains the Northern Ridge and Valley ecoregion. The Big Sandy flows north and west to the Ohio River.

**8.4.2.1. Tier I Species in the Northern Cumberlands-Big Sandy EDU**

There are no documented occurrences of tier I species in the Northern Cumberlands-Big Sandy EDU.

**8.4.2.2. Aquatic SGCN by Habitat Group: Northern Cumberlands-Big Sandy EDU**

The Northern Cumberlands-Big Sandy EDU contains nine tiered aquatic species. This includes eight fish and one crayfish. These species are distributed among two habitat groups and one group of species with generalist or indeterminate habitat preferences (Tables 8.21-8.23).

Table 8.21. Aquatic species of greatest conservation need in very low gradient large streams and small rivers (DGIF Classification types 331, 441, 442, and 443).

Common Name	Scientific Name	Tier	Percent Occurrences in Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Sharpnose darter	<i>Percina oxyrhynchus</i>	IV	70	8

*Table 8.22.* Aquatic species of greatest conservation need in very low or low gradient small to large streams (DGIF Classification types 221, 222, 223, 231, 232, and 331).

Common Name	Scientific Name	Tier	Percent Occurrences in Habitat Group	Number of Types Used (DGIF Aquatic Classification)
Variagate darter	<i>Etheostoma variatum</i>	II	83	3 (6 occurrences)
Rainbow darter	<i>Etheostoma caeruleum</i>	IV	84	9
Banded darter	<i>Etheostoma zonale</i>	IV	79	5
Sand shiner	<i>Notropis stramineus</i>	IV	92	7

*Table 8.23.* 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)
A crayfish	<i>Cambarus veteranus</i>	II	NA
Blackside darter	<i>Percina maculata</i>	IV	NA (2 occurrences, pre-1937)
Suckermouth minnow	<i>Phenacobius mirabilis</i>	IV	2 (2 occurrences)

#### Relative Condition of Habitat

Approximately 12.4% of the riverine habitat in the Northern Cumberlands-Big Sandy EDU is impaired (DEQ and DCR 2004). The impairments include general standard (benthics), total fecal coliform, and *Escherichia coli*. The sources of these impairments include resource extraction, non-point source (urban), and habitat alteration. A section of stream in this EDU is impaired for fish tissue (PCBs). The source of this impairment is unknown.

Within the Northern Cumberlands-Big Sandy EDU, 2.4% of the land use is agriculture and 0.3% is developed (USGS 1992). Across the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.2 to 15%.

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

#### **8.4.3. Northern Cumberlands-New EDU**

The Northern Cumberland-New River EDU is part of the Teays-Old Ohio freshwater ecoregion (Abell et al. 2000) (Figure 8.14). The Teays-Old Ohio is considered “globally outstanding” because of the large number of species found here, second only to the Tennessee-Cumberland freshwater ecoregion. The level of endemism is considered moderately high, with 12% of fish, 14% of mussels, and 47% of crayfish found nowhere else. Abell et al. (2000) consider this region to have a conservation status of “Vulnerable.”

The headwaters of the New River are in North Carolina. The river then cuts north across Virginia and enters West Virginia (Jenkins and Burkhead 1994). Approximately 245km flow through Virginia. Most of the drainage is located in the Ridge and Valley or Blue Ridge ecoregions. Only a very small portion of the New River drainage is located within the Northern Cumberlands ecoregion (Figure 8.14).

##### **8.4.3.1. Tier I Species in the Northern Cumberlands-New EDU**

There are no documented tier I species in this EDU.

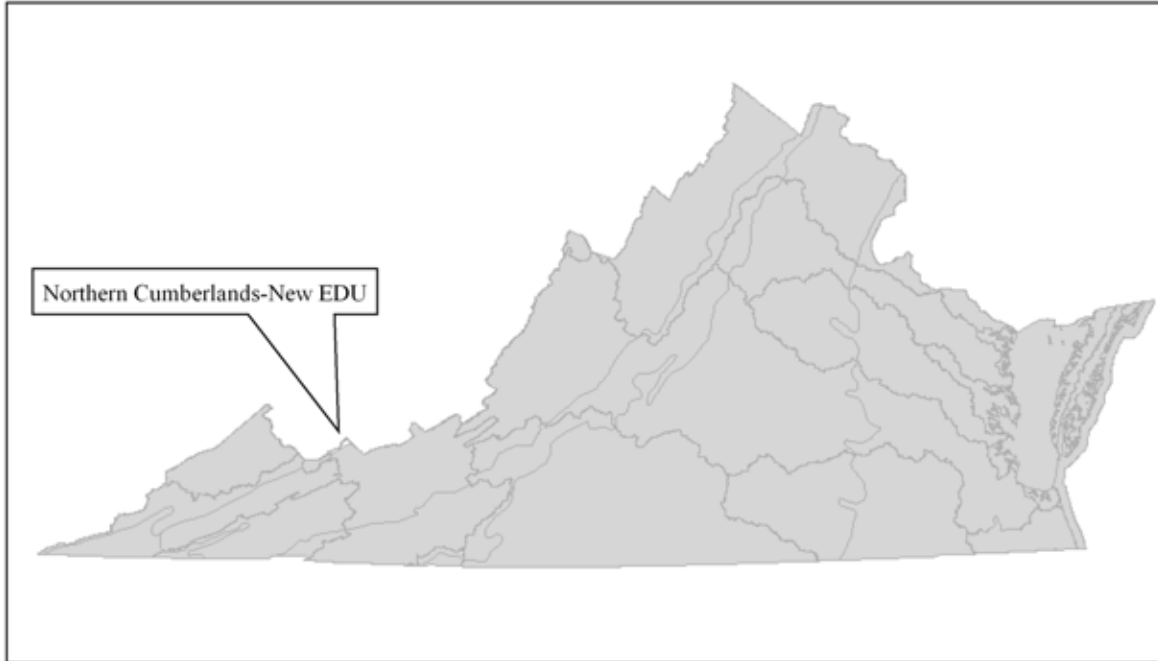


Figure 8.14. Location of the Northern Cumberlands-New EDU.

**8.4.3.2. Aquatic SGCN by Habitat Group: Northern Cumberlands-New EDU**

The Northern Cumberlands-New EDU potentially contains five tiered aquatic species. However, we have no confirmed records from Collections for any of these species (Table 8.24, DGIF 2004b).

Table 8.24. 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)
A crayfish	<i>Cambarus veteranus</i>	II	NA
Sand shiner	<i>Notropis stramineus</i>	IV	NA
Rainbow darter	<i>Etheostoma caeruleum</i>	IV	NA
Logperch	<i>Percina caprodes</i>	IV	NA
Sharpnose darter	<i>Percina oxyrhynchus</i>	IV	NA

Relative Condition of Habitat

Approximately 13.4% of the riverine habitat in the Northern Cumberlands-New EDU is impaired (DEQ and DCR 2004). The impairments include dissolved oxygen, general standard (benthics), and total fecal coliform. The source for all of these impairments is listed as non-point source (urban).

Within the Northern Cumberlands-New EDU, 3.7% of the land use is agriculture and 1.0% is developed (USGS 1992). Across the state, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.2 to 15%.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are given in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information

within habitat groups selected at the workshops. The level of detail within these groups does not correspond to that used in the DGIF aquatic habitat classification.

## **8.5. Subterranean Species in the Northern Cumberlands**

### **8.5.1. Tier I Subterranean Species in the Northern Cumberlands**

#### **8.5.1.1. Cumberland Gap cave isopod, *Bactrurus angulus***

##### *Life History Summary*

A seep-fed pool in Cumberland Gap Saltpetre Cave is the only known collection site for this species in Virginia (C. S. Hobson, pers. comm.). It was not described until 2001 (Koenemann and Holsinger 2001), and very little is known about it. This species has been designated a species of concern by the Virginia Field Office of USFWS.

##### *Location*

The map of habitat for the Cumberland Gap cave isopod (Figure 8.15) includes a cave Conservation Site (DCR-NH 2004).

##### *Description of Habitat Requirements*

There is limited knowledge about this species, which is known only from a seep-fed pool in Cumberland Gap Saltpetre Cave (J. R. Holsinger, ODU, pers. comm.).

##### *Relative Condition of Habitat*

There is one Conservation Site for the Cumberland Gap cave isopod (DCR-NH 2005). This site is mostly protected by the Cumberland Gap National Historical Park, owned by NPS.



Figure 8.15. Distribution of the Cumberland Gap cave isopod in the Northern Cumberlands.

*Specific Threats and Trends*

No specific threats to this species are known. However, as with any aquatic organism, water quality could be an issue. C. S. Hobson (DCR-NH, pers. comm.) reports that there is no known trend for this species.

*Conservation Actions and Strategies*

No specific conservation actions were identified by Invertebrate TAC. Its recent description indicates that little work has been done with this species.

*Research and Monitoring Needs*

No specific research or monitoring needs were identified by Invertebrate TAC. Basic life history and distribution research are needed.

**8.5.2. Subterranean Species of Greatest Conservation Need in the Northern Cumberlands**

8.5.2.1. Species of Greatest Conservation Need by Subterranean Habitat Type

All five subterranean species occurring in the Northern Cumberlands occur in caves (Table 8.25). None occur only in groundwater.

*Table 8.25. Cave species of greatest conservation need in the Northern Cumberlands.*

<b>Common Name</b>	<b>Scientific Name</b>	<b>Tier</b>	<b>Special Habitat Needs</b>
A cave pseudoscorpion	<i>Kleptochthonius binoculatus</i>	II	Unknown
Little Kennedy Cave beetle	<i>Pseudanophthalmus cordicollis</i>	II	Under rocks or debris near streams
A cave beetle	<i>Pseudanophthalmus seclusus</i>	II	Under rocks or debris near streams
Cumberland cave amphipod	<i>Stygobromus cumberlandus</i>	II	Drip pools
Southwestern Virginia cave isopod	<i>Caecidotea recurvata</i>	III	Drip pools or small gravel streams

8.5.2.2. 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 3.2.5.

**8.6 Overview of Tier I Species Habitat in the Northern Cumberlands**

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 8.3.1), aquatic (Sections 8.4.1-8.4.3), and subterranean (Section 8.5.1) species were overlaid in one map (see Figure 8.16). 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 I species are important for conservation. However, areas with a higher density of Tier I species habitat may represent extraordinary conservation opportunities.



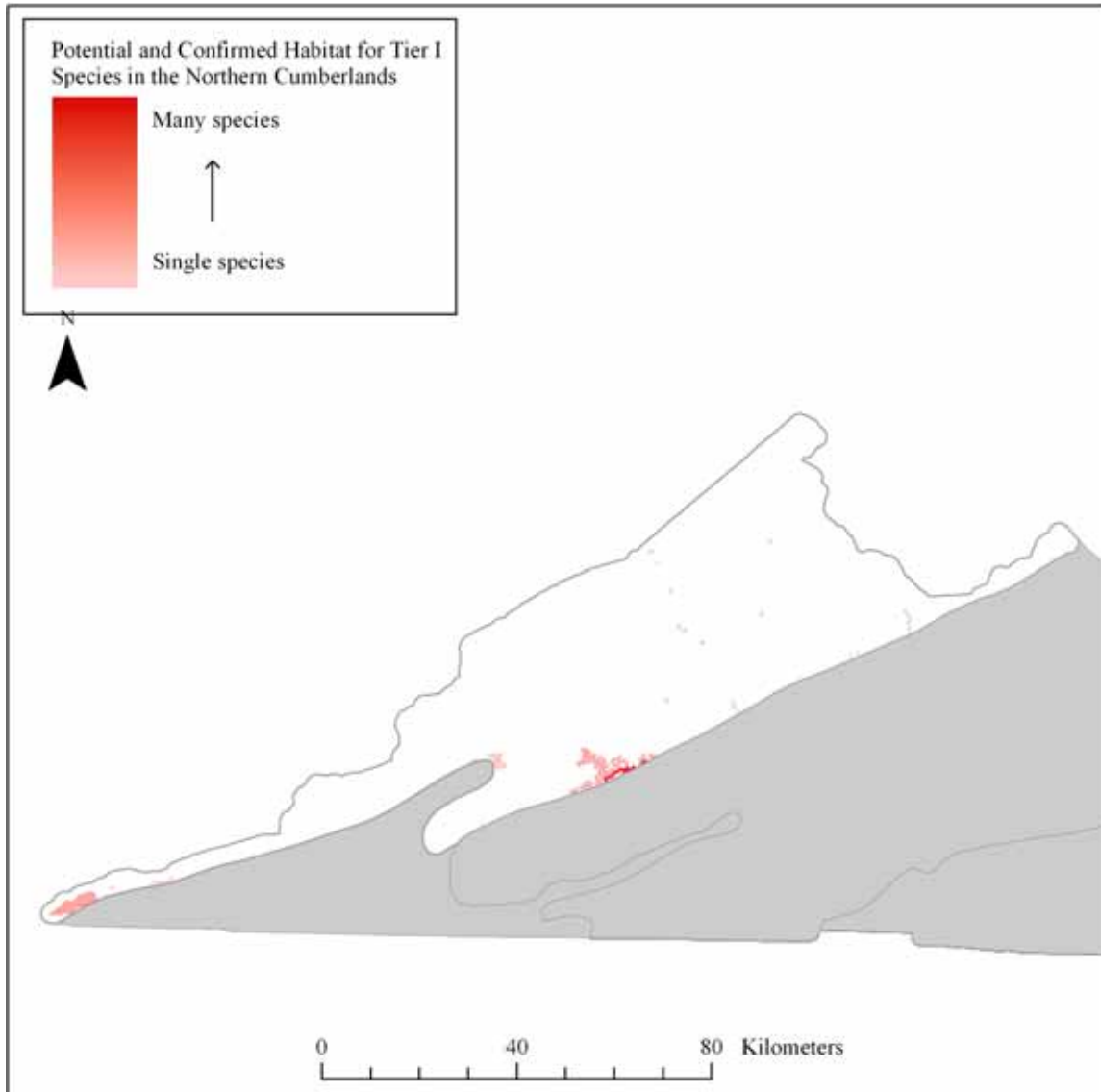


Figure 8.16. Potential and confirmed habitat for Tier I species in the Northern Cumberlands. Darker shades represent areas with a higher co-occurrence of these habitats.

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VIRGINIA'S COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY  
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