MESIC OAK + DRY-MESIC OAK + DRY OAK ECOZONES
with reference to PINE-OAK/HEATH ECOZONE where appropriate

Information presented in this draft report is considered under development. It may be incomplete and is likely unedited. This may make some sections difficult to follow. An updated version of this report will be posted when it becomes available.

Oak-dominated forest is the most widespread and heterogeneous habitat of the mountain region of North Carolina, and throughout the Southern Blue Ridge ecoregion. Largely because of the production of acorns, hickory nuts, and a variety of soft mast, the value of this habitat to wildlife is immense. When combined with the amount of this habitat available, oak forests become one of the most valuable wildlife habitats in the region, supporting a wide variety of wildlife species.

Range-wide Trends

Despite the relative abundance of montane oak forests within North Carolina, the North Carolina Wildlife Action Plan (NCWAP, NCWRC 2005) broadly identifies stresses on montane oak forest as habitat loss, insects and diseases, and inappropriate management. Specifically, these include the following historic and ongoing problems:

- loss or conversion of habitats (e.g., due to human development, agriculture),
- increased development leading to greater degrees of habitat fragmentation,
- loss of embedded ephemeral pool habitats,
- chestnut blight, oak decline, gypsy moths, and other diseases/pests as they affect the composition and diversity of hardwood stands,
- fire suppression as it affects the composition, structure and diversity of hardwood stands, and
- homogeneity of stand age that has resulted in a lack of understory development.

Individual species associated with oak forest habitats may be experiencing problems other than those listed above. For example, timber rattlesnakes (*Crotalus horridus)* and other snakes are subjected to collection and persecution. Many species (e.g. cerulean warbler (*Setophaga cerulean),* black-capped chickadee (*Poecile atricapilla*), green salamander (*Aneides aeneus*), seepage salamander (*Desmognathus aeneus*), crevice salamander (*Plethodon longicris*), Wehrle's salamander (*Plethodon wehrlei*), and northern pine snake (*Pituophis melanoleucas melanoleucus*)) have such a small range or clumped distribution within North Carolina that they are more susceptible to stochastic or genetic population declines or local extirpations. Many neotropical migrant birds may be experiencing seasonal habitat loss. And finally, since there is such diversity associated with oak forests, the exact habitat or life history requirements that are limiting populations of individual species may not be known.

The high percentage of public lands in the southern Blue Ridge ecoregion (SBR) supporting montane oak forests suggests that large amounts of this habitat will be maintained for the long term, providing habitat for species dependent upon this forest type (Hunter *et al*. 1999). However, while oak forests at higher elevations should provide the habitat needed to sustain populations of forest-dependent bird species, oak forests at low elevations may be more fragmented and thus may not support area-sensitive species (Hunter *et al*. 1999). Impacts on breeding success from forest fragmentation may be prevalent at lower elevations, especially near areas with higher human populations and more agriculture (Robinson *et al.* 1995). It is reasonable to assume that fragmentation effects will become more widespread as people continue to move into the region and develop land. Thus, it is important that landscape context is emphasized for the future management of montane oak forests and the birds associated with them, especially at lower elevations.

The extent of montane oak forest habitat is important for many bird species. Mature cove (mixed mesophytic) hardwood forests can provide important habitat for vulnerable species even in smaller stands as a result of typically having the greatest structural complexity of any southeastern forest type. Whereas, dry-mesic to xeric oak-dominated forests, in contrast, are not as complex and have been shown to support lower bird densities and fewer species (Katz 1997).

Large areas of mid- to late-successional oak forests provide suitable (and often optimal) habitat for almost every species of woodpecker, as well as many species of hawk (Hamel 1992). These areas also support large numbers of wood thrush (*Hylocichla mustelina*) and ovenbird (*Seiurus aurocapilla*) in the understory, black-and-white warblers (*Mniotilta varia*) in the midstory, and scarlet tanager (*Piranga olivacea*) and eastern wood-pewee (*Contopus virens*) in the canopy (Kendeigh and Fawver 1981, Hamel 1992, Stephenson et al. 1993, Bartlett 1995).

Riparian stretches within montane oak forests provide important habitat for Kentucky and hooded warblers (*Geothlypis formosa* and *Setophaga citrina*, respectively), Louisiana waterthrush (*Parkesia motacilla*) and acadian flycatcher (*Empidonax virescens*).

In addition, grass/forb and seedling/sapling stages of montane oak forests have been shown to provide quality habitat (nesting and foraging) for many early successional bird species including, golden-winged, prairie and chestnut-sided warblers (*Setophaga chrysoptera, S. discolor,* and *S. pensylvanica*, respectively), northern bobwhite (*Colinus virginianus*), field sparrow (*Spizella pusilla*), yellow-breasted chat (*Icteria virens*) and indigo bunting (*Passerina cyanea*).

To provide habitat necessary to support the myriad of species that rely upon the extent, condition and variation of Appalachian oak forests, the current proportions of early and late successional stands within the southern Blue Ridge ecoregion should be maintained and, whenever possible, augmented with appropriate disturbances reintroduced into the system (Hunter *et al*. 1999).

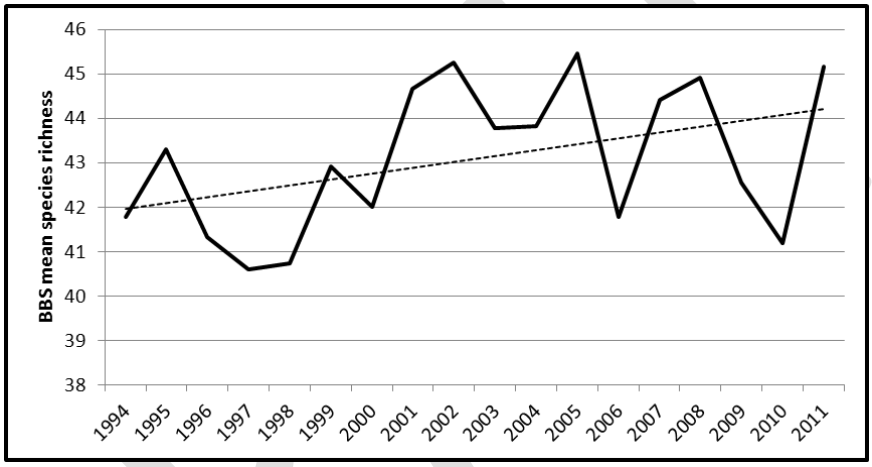
Maintaining and improving healthy game bird populations is also an important issue for montane oak forests and should be considered when plans are developed for the conservation of early successional habitat for nongame species (NCWAP 2005). Management of habitat conditions for ruffed grouse (*Bonasa umbellus*), for example, can be addressed with that of golden-winged warbler, since there is a high degree of overlap in habitat requirements and both species have

persistently low numbers. In fact, persistence of golden-winged warbler is in question in many of the same areas ruffed grouse populations are also declining (AMJV 2012).

Forest-Level Trends

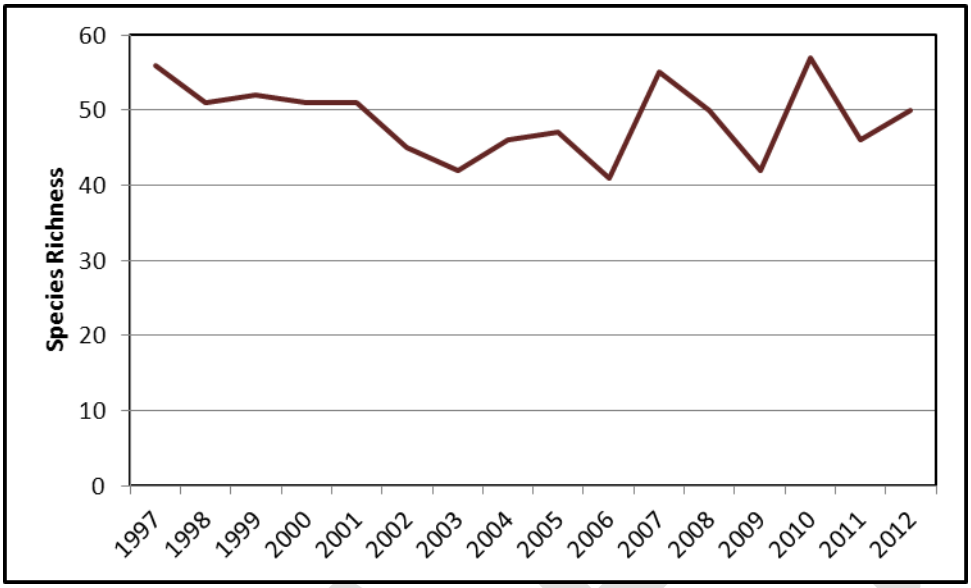
Across the Nantahala and Pisgah National Forests, Breeding Bird Survey (BBS) data shows mean species richness to be stable to slightly increasing. There are seventeen established routes on or across the Forests, of which thirteen have consistent data (Figure XXX). Most of these routes traverse montane oak and mixed pine-oak forests. This positive trend does not necessarily correlate to positive trends for individual species (see below).

Figure XXX. Mean bird species richness from BBS routes on or across the Nantahala and Pisgah National Forests, 1994 through 2011 (BBS 2012).



Eighty-eight bird species have been documented from montane oak forests in the Nantahala and Pisgah National Forest between 1997 and 2012 (Appendix XXX, R8Bird 2013). Within this same monitoring period, species richness within montane oak forests has decreased slightly, although annual variability is evident (Figure XXX).

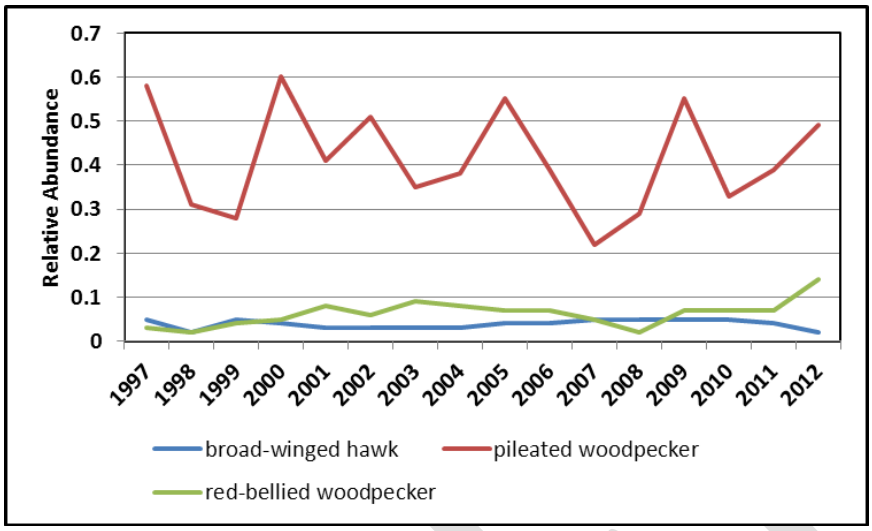
Figure XXX. Landbird species richness within montane oak forests on the Nantahala and Pisgah National Forests, 1997-2012 (R8Bird 2013).



Long-term monitoring data (R8Bird 2013) includes three priority bird species identified in the Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Hunter *et al*. 1999) associated with montane oak forests that depend on snags and other characteristics associated with mid- to late-successional forests. These species include pileated woodpecker (*Dryocopus pileatus*), red-bellied woodpecker (*Melanerpes carolinus*) and broad-winged hawk (*Buteo platypterus*).

Populations of red-bellied woodpecker and broad-winged hawk, while at low densities, are stable to slightly increasing within montane oak forest. Populations of pileated woodpecker are decreasing slightly within montane oak forests and exhibit high annual variability (Figure XXX).

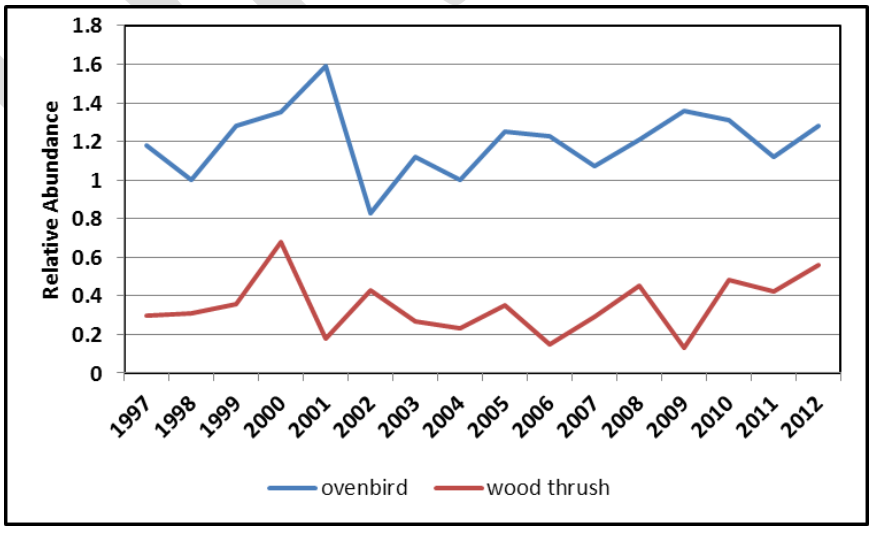
Figure XXX. Relative abundance of bird species associated with mid- to late successional characteristics (e.g. snags) of montane oak forests, 1997 through 2012 (R8Bird 2013).



Long-term monitoring data (R8Bird 2013) includes two priority bird species identified in the Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Hunter *et al*. 1999) associated with montane oak forests that depend on understory vegetation. These species include wood thrush and ovenbird. Additionally, wood thrush is identified as a priority species associated with montane oak forest in the NCWAP (NCWRC 2005).

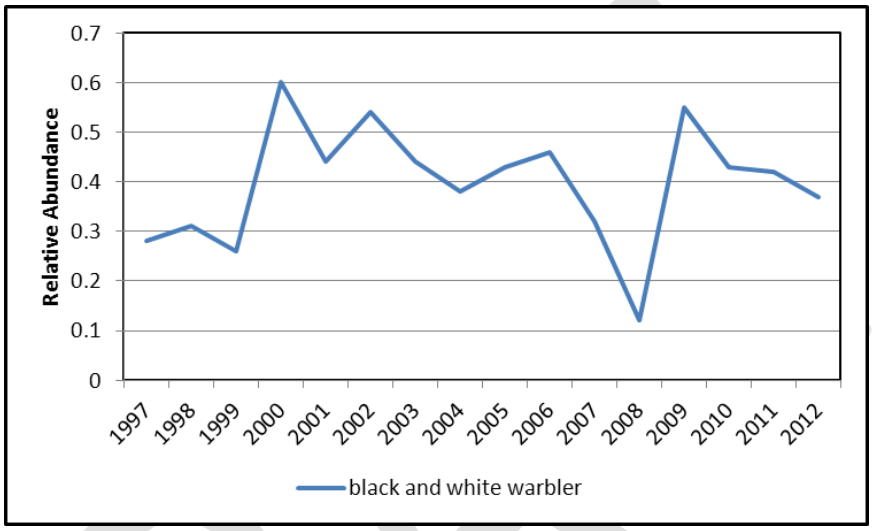
Population trends of these species are stable to slightly increasing within montane oak forests (Figure XXX).

Figure XXX. Relative abundance of bird species associated with understory vegetation within montane oak forests, 1997 through 2012 (R8Bird 2013).



Long-term monitoring data (R8Bird 2013) includes one priority bird species identified in the Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Hunter *et al*. 1999) associated with montane oak forests that depends on midstory vegetation, black and white warbler. Populations of this species have steadily increased, despite high annual variability, within montane oak forests (Figure XXX) over the sixteen-year monitoring period (Figure XXX).

Figure XXX. Relative abundance of bird species associated with midstory vegetation within montane oak forests, 1997 through 2012 (R8Bird 2013).

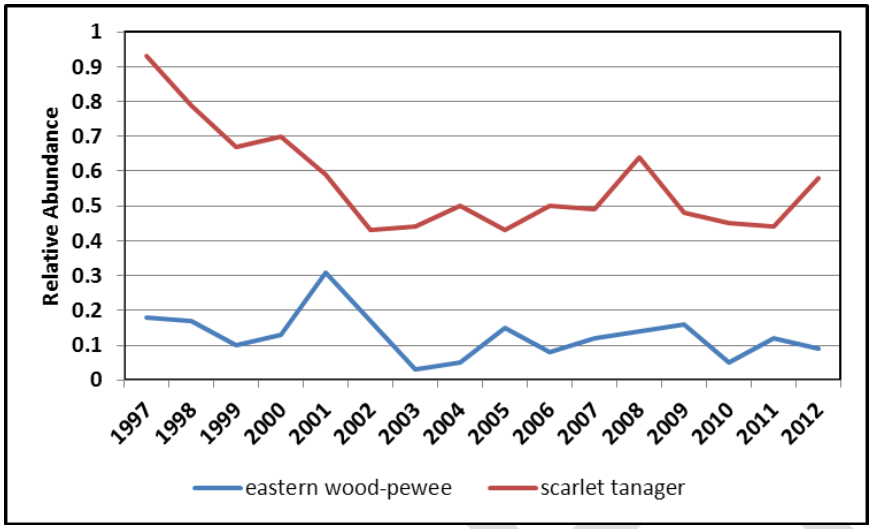


Long-term monitoring data (R8Bird 2013) includes two priority bird species identified in the Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Hunter *et al*. 1999) associated with montane oak forests that depend on intact canopy vegetation. These species include scarlet tanager and eastern wood-pewee. The NCWAP (NCWRC 2005) identifies the eastern wood-pewee and cerulean warbler (*Setophaga cerulea*) as priority species associated with intact canopy conditions within montane oak forest.

Cerulean warblers occur in such low numbers within montane oak forests on the Nantahala and Pisgah National Forests that population trends cannot be accurately displayed. This may be, at least in part, an artifact of the sampling design for R8Bird. R8Bird is a regional database, and there may not be enough sites within habitats suitable for cerulean warblers within North Carolina (i.e. these sites were randomly chosen from suitable habitats within other National Forests). Largely because they occur at naturally-low densities (i.e. are "rare"), cerulean warblers may be identified as a Species of Conservation Concern (SCC) during this plan revision process and are discussed further in Section XXX of this document.

Populations of eastern wood-pewee and scarlet tanager have declined within montane oak habitats (Figure XXX) over the sixteen-year monitoring period. At least part of this decline may be attributable to sampling bias. R8bird is designed to monitor the effects of vegetation management on landbird populations. As such, a majority of the permanent monitoring sites are within managed areas where intact canopy conditions may not be the objective.

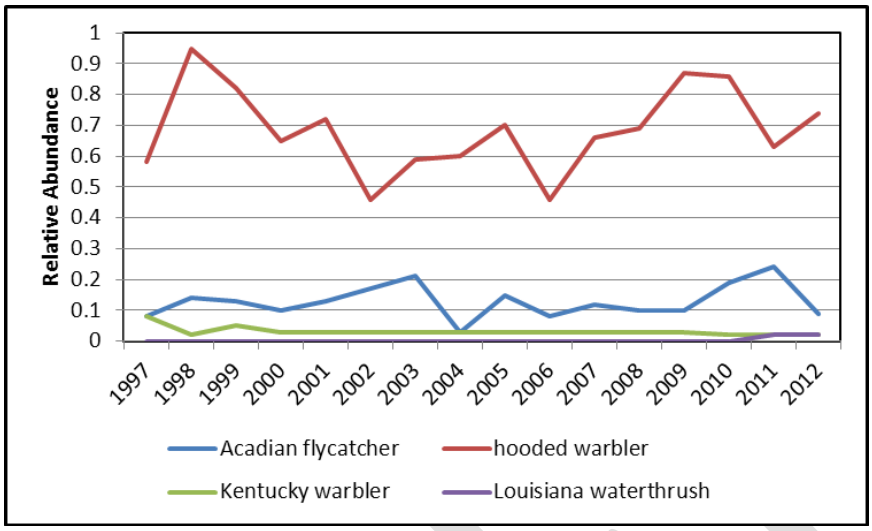
Figure XXX. Relative abundance of bird species associated with intact canopy conditions within montane oak forests, 1997 through 2012 (R8Bird 2013).



Long-term monitoring data (R8Bird 2013) includes four priority bird species identified in the Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Hunter *et al*. 1999) associated with riparian conditions within montane oak forests. These species include hooded warbler, Kentucky warbler, Acadian flycatcher, and Louisiana waterthrush. Additionally, hooded warbler and Kentucky warbler are identified as a priority species associated with riparian characteristics within montane oak forest in the NCWAP (NCWRC 2005).

Population trends of riparian-dependent bird species appear to be stable to slightly increasing over the long-term with montane oak forests. Hooded warbler populations, occurring at much higher densities than the other riparian species in this report, exhibited higher variability during the sixteen-year monitoring period. Louisiana waterthrush was not detected during the monitoring period until 2006 and has increased slightly since then, despite occurring at extremely low densities (Figure XXX).

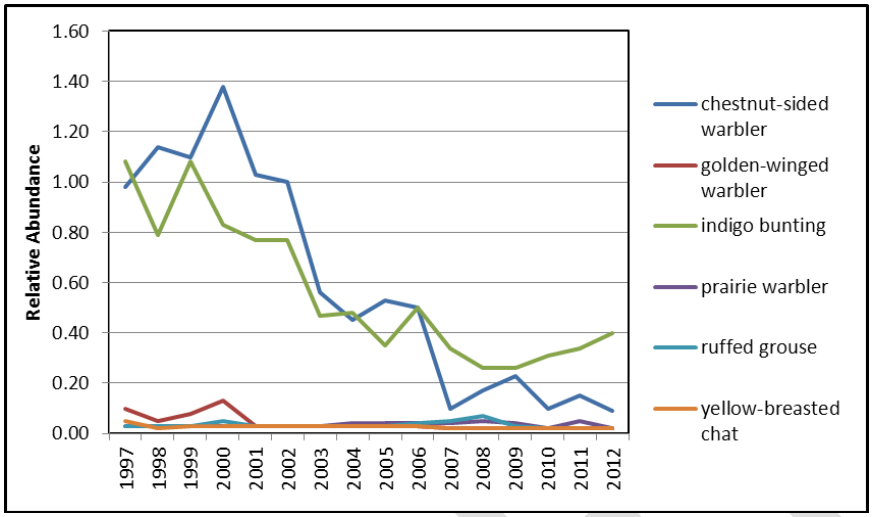
Figure XXX. Relative abundance of bird species associated with riparian conditions within montane oak forests, 1997 through 2012 (R8Bird 2013).



Long-term monitoring data (R8Bird 2013) includes eight priority bird species identified in the Partners in Flight Bird Conservation Plan for the Southern Blue Ridge (Hunter *et al*. 1999) associated with montane oak forests that depend on early successional and young forest conditions. These species include the chestnut-sided warbler, golden-winged warbler, northern bobwhite, yellow-breasted chat, field sparrow, indigo bunting, prairie warbler, and ruffed grouse. The golden-winged warbler is identified as a priority species associated with early successional and young forest characteristics within montane oak forest in the NCWAP (NCWRC 2005). Additionally, ruffed grouse are of conservation interest since the species is managed as a game species by the NCWRC. Field sparrows and northern bobwhite do not occur in high enough numbers across the Nantahala and Pisgah National forests to be included in Figure XXX. Largely because they occur at low densities (i.e. are "rare") or have experienced dramatic population declines, golden-winged warblers and ruffed grouse may be identified as Species of Conservation Concern (SCC) during this plan revision process and are discussed further in Section XXX of this document

Golden-winged warblers, ruffed grouse, and yellow-breasted chat occur at low densities, but have been relatively stable within montane oak habitats, whereas populations of chestnut-sided warblers and indigo buntings have declined dramatically over the sixteen-year monitoring period (Figure XXX).

Figure XXX. Relative abundance of bird species associated with early successional and young forest characteristics of montane oak forests, 1997 through 2012 (R8Bird 2013).



Generally-speaking, bird populations within montane oak forests are stable to slightly increasing, except for species associated with early successional and young forest conditions and intact canopy conditions, where almost all species are declining, some significantly (see above).

As discussed earlier, montane oak forests provide essential habitat for many animal species. Of note is the fact that the NCWAP identifies a relatively large suite of amphibians, mostly salamanders, as priority species associated with montane oak forests (NCWRC 2005) (Table XXX).

Table XXX. Amphibian species identified as priority species in the NCWAP associated with montane oak forests.

Scientific Name	Common Name
Ambystoma maculatum	spotted salamander
Ambystoma opacum	marbled salamander
Aneides aeneus	green salamander
Desmognathus aeneus	seepage salamander
Hemidactylium scutatum	four-toed salamander
Plethodon aureoles	Tellico salamander
Plethodon chattahoochee	Chattahoochee slimy salamander
Plethodon glutinosus sensustricto	northern slimy salamander
Plethodon longicris	crevice salamander
Plethodon richmondi	southern ravine salamander
Plethodon ventralis	southern zigzag salamander
Plethodon wehrlei	Wehrle's salamander
Pseudacris brachyphona	mountain chorus frog

Some of these species may be identified as Species of Conservation Concern (SCC) (highlighted in Table XXX) during this plan revision process, largely because or rarity, and are discussed further in Section XXX of this report.

Effects of habitat change on plethodontid salamanders and green salamanders are well documented (Petranka et al. Semlistch et al, etc.). Such effects are less-documented on other amphibians. While no long-term monitoring data exists for most amphibians, NCWRC inventories have recently expanded the known range of many amphibian species.