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DRAFT – Low Elevation Cliffs and Rock Outcrops

Ecosystem Description

This broad ecosystem group contains a wide variety, though not all, of the community types that are too steep or rocky to support a closed tree canopy. The vegetation of these communities is generally very patchy, reflecting extreme variability in the depth and composition of soil and of available moisture. Plants include forest species with broad site tolerances, species characteristic of a wide range of open habitats, and species specialized for rock outcrops. Rock outcrops typically are very dry, but seepage zones are often present and may support wetland vegetation.

The nine natural community types are separated based on rock chemistry, topographic location, and geographic region, and the latter is an important factor in determining flora. The community types are: Piedmont/Coastal Plain heath bluffs and acidic cliffs; Piedmont mafic and calcareous cliffs; montane mafic, calcareous, and acidic cliffs; and low elevation granitic domes and rocky summits.

Low elevation rocky summit and low elevation granitic dome communities occur in exposed positions on peaks, ridgetops, and upper slopes in the Mountain ecoregion. Low elevation rocky summits have fractured rock which allows growth of deep-rooted woody plants in places. Soil accumulates in pockets of varying depth and produces heterogeneous vegetation. Many variants potentially occur, but are not well known.

Low elevation granitic domes occur on exfoliated outcrops of granitic rock, where peeling of sheets of rock parallel to the surface produces a dome-shaped outcrop of solid rock. Soil mats that begin as moss clumps gradually thicken over time and follow a characteristic vegetational succession from herbs to shrubs and stunted trees. The unanchored mats are periodically destroyed by falling off or by being pulled up by falling trees, leaving the rock bare and beginning the succession anew.

Cliff communities occur on lower, more sheltered topographic sites. They generally are created by streams undercutting a bluff, but may occur somewhat above a stream. Like rocky summits, the rock is usually fractured and supports very patchy vegetation that includes woody plants rooted in crevices as well as herbs in soil pockets and mosses and lichens on bare rock. The Montane and Piedmont/Coastal Plain types have flora typical of their regions, often combining plants from adjacent communities with typical outcrop plants.

North-facing cliffs have a cooler microclimate than the surrounding areas and sometimes harbor disjunct or regionally rare species characteristic of cooler, moister regions. In some

cases these species are believed to be remnants from more widespread populations that existed in the Ice Ages. In the Mountain ecoregion, south-facing cliffs may support species more typical of the warmer Piedmont or even Coastal Plain.

The acidic, mafic, and calcareous types support different flora that reflect the rock chemistry. Mafic and calcareous cliffs contain calcium-loving species that do not occur on the more common Acidic cliffs. The floristic differences between calcareous and mafic cliffs is more subtle, and reflects differences in balance of basic elements.

Piedmont/Coastal Plain heath bluffs differ somewhat from the other community types in that they have little bare rock. They do, however, lack a closed tree canopy, apparently because of steepness. They are characterized by a dense shrub layer of mountain laurel or Catawba rhododendron, which are otherwise essentially absent in the Piedmont and Coastal Plain. These communities occur on north-facing bluffs, and the cool microclimate is believed to be important to these species.

The 2005 Wildlife Action Plan describes Low Elevation Cliffs/Rock Outcrops in the Southern Blue Ridge Mountains as a priority habitat (see Chapter 5A) (NCWRC 2005). This habitat type is spread throughout the mountains and upper piedmont region of the state (piedmont examples include Sauratown Mountains inclusive of Pilot Mountain, and the Crowders, Uwharries, and South Mountains) (NCWRC 2005).

Table 1 at the end of this report provides of summary of expected climate change impacts to these natural communities.

Predicted Effects to Wildlife Species

Tables 2 through 5 at the end of this report identify the species of conservation concern and priority species that use habitats in this ecosystem.

Many of the wildlife species associated with low elevation cliffs and rock outcrops also occur in association with rock outcrops dispersed throughout other forest or habitat types in patches too small to be considered discreet communities of their own (NCWRC 2005). For animal species associated with cool, sheltered cliffs and steep slopes, on the other hand, any openings in the canopy created by increased droughts and/or fire are likely to have major adverse effects.

No species belonging to these guilds appear to be vulnerable to complete extinction due to the effects of climate change. However, both the Hickory Nut Gorge population of crevice salamander (*Plethodon yonahlossee*) and the Piedmont populations of red back salamander (*P. cinereus*) exist as isolated disjuncts and are likely to be highly vulnerable to the effects of climate change. In both cases, extirpation of these populations would constitute loss of significant ecological as well as genotypic variants of their species.

DeWan *et al*. (2010) suggests that habitat specialists and species with restricted ranges will likely be some of the greatest affected by the combined effects of habitat loss and climate change. They also note such populations are more vulnerable to extinction by rare events and susceptible to additional stressors such as climate change.

Climate Change Compared to Other Threats

As with high elevation rock outcrops, two major problems most associated with the low elevation rock outcrops include development and recreational impacts. For animals associated with cool, moist slopes or cliffs, particularly in relict situations, climate change represents the most significant threat, particularly in the Piedmont where their populations are typically small and highly isolated. For the plants associated with this theme, climate change is not expected to be a major threat. Development and changes caused by fire suppression are the most severe threats. In some areas, excessive deer browse is also a major threat.

Table 6 compares climate change with other existing threats.

Table 6. Comparison Of Climate Change With Other Threats

Threat	Rank Order	Comments
Development	1	Development can have both direct and indirect impacts that severely threaten many unprotected examples. Improved access may increase recreational use that leads to trampling and poaching of rare plants.
Invasive Species	2	Cliffs and rock outcrops have some problems with invasive plants, which can invade edge zones and more favorable soil pockets. Cogon grass (*Imperata cylindrica*) may not already be present but is likely to increase with climate change. If climate change increases disturbance of adjacent forests, it may allow invasive plant seed sources to develop closer to rock outcrops that are now remote from them. It is possible that some of the invasive species, such as Japanese honeysuckle (*Lonicera japonica*) and wineberry (*Rubus phoenicolasius*), will be harmed by drought more than the native species of rock outcrops.
Climate Change	2	Some particular outcrops in this theme are more likely to suffer from the effects of climate change than others.
Fire	3	It is unclear how much climate change will change fire frequency in the fragmented landscapes of the Piedmont and lower Mountains. Fire suppression has been a major factor degrading some of these communities. Fire may allow dry rock outcrops to expand while mesic cliff and heath bluff communities could be harmed by intense fires. Fires during severe drought may be too intense and may cause damage to the characteristic plants and the shallow soils as well.
Logging/Exploitation	4	Land ownership patterns, proximity to markets, accessibility, and other factors influence short term habitat alterations like forestry operations.

Summary and Recommendations

Low Elevation Cliffs and Rock Outcrops are a diverse group that are expected to have a variety of responses to climate change. While some are dependent on moisture and may be harmed, others may actually benefit from increased drought and fire. This benefit will only be realized if sites are protected from other forms of destruction, and for most, if fire is restored to them through prescribed burning. These communities are naturally rare in North Carolina, due to limited availability of suitable habitat. Examples need to be protected and managed appropriately.

Recommended Actions

Surveys

- Mapping of these sites in a GIS format would facilitate tracking changes over time in both the habitat, as well as the associated species and facilitate landscape scale management of this rare habitat (NCWRC 2005).
- Obtain baseline data on amphibian communities and habitat use.
- Obtain baseline data on reptile communities and habitat use (*e.g.*, identify timber rattlesnake den sites).
- Obtain baseline data on small mammal communities and habitat use.

Monitoring

- Continue monitoring peregrine falcon population.
- Monitor priority species population trends and habitat use.

Research

- Study the impact of various management scenarios on the habitat and associated species (NCWRC 2005).
- Study timber rattlesnake movements, use of hibernacula, and reproductive success at gestation sites.

Management Practices

- Burning around open, dry outcrops that naturally burned will restore more natural structure around the margins, and will favor species that will tolerate drought and wild fire better.
- Initiate genetic and morphological studies to clarify taxonomic status of plethodontid salamanders.
- Study habitat use of rock outcrop salamander communities, including movements in and among rock outcrop habitats (*e.g.,* green salamander metapopulations).
- Maintenance of biologically significant areas, including peregrine falcon nesting areas, reptile den sites, and significant salamander occurrences, is critical (NCWRC 2005).

Land Protection

- Protect remaining examples and surrounding forests.
- Given the relative rarity of low elevation rock outcrops across the state,

measures need to be taken to conserve as much of this habitat as possible. This includes preservation measures, as well as conservation/management measures to ensure that species which rely upon these outcrops continue to be afforded the variety of habitat conditions desired into the future (NCWRC 2005).

- Assign appropriate management schemes to rock outcrops upon conservation lands to minimize negative impacts from human activities, including recreational use and development.

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Table 1. Predicted Impacts of Climate Change	
Climate Change Factor	**Comments**
Wind Damage	There is an expectation of increased hurricane activity. Wind damage could create and maintain openings around outcrops.
Drought	Some climate change models predict that rainfall will be concentrated during the fall, and there will be increased droughts in the spring and summer. Droughts could favor herbaceous species and grasses in open, dry outcrops, which tend to be more rare than the woody species associated with outcrops.
Fire	Low intensity fires could expand the open area and benefit some of the rare plants of outcrops. More mesic outcrops such as heath bluff communities are more likely to be harmed by fire. Landscape fragmentation and fire suppression practices likely will continue to prevent most fires from spreading very far.
Increased Temperature	Increased temperatures could increase demand for water, a limited resource in these sites. Phenological shifts (earlier bloom periods, emergence from hibernation, nesting and breeding) in seasons may occur in a warmer climate.
Exotic species invasion	Exotic plants readily invade favorable microsites on many outcrops. Increased disruption of adjacent forests may bring seed sources closer to many outcrops.
Structural Change	Dense woody vegetation around edges may become more open. Increased drought or fire might produce beneficial structural changes.
Compositional Change	Some outcrops have been altered by fire suppression and these changes may help return to more natural composition. Others will lose characteristic mesophytic species. The effect may be severe in a small number of outcrops.
Acreage Change	Some dry outcrops may expand into adjacent forests, while heath bluffs may shrink.

Table 2. Bird Species Utilizing Low Elevation Cliffs and Rock Outcrops							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
BIRDS							
Falco peregrinus	Peregrine Falcon	G4/ S1B,S2N				/E/P	

Table 3. Mammal Species Utilizing Low Elevation Cliffs and Rock Outcrops							
Species	**Common Name**	**Element Rank:**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
MAMMALS							
Myotis leibii	Small-footed Bat					/SC/P	
Myotis septentrionalis	Northern Long-eared Bat					/SC/P	
Neotoma floridana haematoreia	Eastern woodrat, Southern Appalachian pop.	G5T4Q/ S3				FSC/W 2/P	
Spilogale putorius	Eastern Spotted Skunk					//P	

Table 4. Reptile Species Utilizing Low Elevation Cliffs and Rock Outcrops							
Species	**Common Name**	**Element Rank**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
REPTILES							
Crotalus horridus	Timber Rattlesnake	G4/S3				/SC/P	
Eumeces anthracinus	Coal Skink	G5/S2S3				/SR/P	

Table 5. Amphibian Species Utilizing Low Elevation Cliffs and Rock Outcrops							
Species	**Common Name**	**Element Rank:**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
AMPHIBIANS							
Aneides aeneus	Green Salamander	G3G4/S2		YES		FSC/E/ P	Populations located in the Southern Blue Ridge Escarpment of NC and SC are isolated from populations in the major portion of this species' range, located farther to the west and north.
Eurycea longicauda	Longtail Salamander						Associated with rock outcrops and road-cut rock faces in riparian zones.
Plethodon amplus	Blue Ridge Gray-cheeked Salamander						Found in the Hickory Nut Gorge
Plethodon cinereus	Red Back Salamander						Isolated disjuncts in Piedmont.
Plethodon longicrus (= yonahlossee pop. 1)	Crevice Salamander	G4T1Q/ S1	YES		YES	/SC/P	The taxonomic status needs further clarification. Whether a separate subspecies or just a distinctive form of the Yohnalossee Salamander, however, the disjunct population located in the vicinity of Hickory Nut Gorge is highly associated with cool rock outcrops and is especially vulnerable to extinction/

Table 5. Amphibian Species Utilizing Low Elevation Cliffs and Rock Outcrops							
Species	**Common Name**	**Element Rank:**	**Endemic**	**Major Disjunct**	**Extinction/ Extirpation Prone**	**US/ NC/ WAP***	**Comments**
AMPHIBIANS							
							extirpation.
Plethodon meridianus	South Mountain Gray-cheeked Salamander						Range is apparently restricted
Plethodon ventralis	Southern Zigzag Salamander					/SC/P	
Plethodon wehrlei	Wehrle's Salamander						NC is on the southern edge of this species' range

*** US/ NC/ WAP Abbreviations (species are subject to reclassification by USFWS, NHP, or WRC).**

E	Endangered	SC	Special Concern	P	WAP Priority Species
T	Threatened	SR	Significantly Rare		
FSC	Federal Species of Concern	W	Watch Category		
T(S/A)	Threatened due to Similarity of Appearance				

NatureServe Element Rank: http://www.natureserve.org/explorer/ranking.htm

USFWS Endangered Species Listing Status: http://www.fws.gov/raleigh/es_tes.html

NC Natural Heritage Program Status:
http://www.ncnhp.org/Images/2010%20Rare%20Animal%20List.pdf

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