

Ecosystem Description

Balds are treeless shrub or herb-dominated communities of the high mountains. The treeless areas do not represent a climatic timberline, and often occur near higher peaks that are forested. There are two community types in this ecosystem: Grassy balds and heath balds.

The ecological factors creating balds are not well understood. Harsh climate and shallow soil seem to be a factor in some, particularly Heath Balds, but many examples of both community types are being invaded by trees and, in the case of Grassy Balds, shrubs. Fire may have been a factor, but many bald sites do not appear prone to fire, and are surrounded by vegetation that apparently did not burn.

Grassy balds are open meadows typically dominated by mountain oatgrass and sedges, with a fairly diverse mixture of other species. They usually occur on broad ridgetops. Heath balds are dense thickets of tall shrubs. Catawba rhododendron and mountain laurel are the most common dominants. An unusual variant at Roan Mountain is dominated by green alder, not found elsewhere in North Carolina. Most Heath Balds are on sharp spur ridges, but some occur on rounded peaks or ridgetops.

Some places that superficially resemble balds have been found to have been cleared of forest in historical times, but other balds apparently were open throughout history. The presence of disjunct species which require open habitat suggests that some balds have been open since the Ice Age. Large herbivores, such as Elk and Bison may have kept grassy balds open through grazing. Another possibility is that Native Americans worked to keep grassy balds open for game.

Southern Blue Ridge High Elevation Rock Outcrops, described as a priority habitat in the 2005 Wildlife Action Plan, can be a component of this community type (see Chapter 5A). High elevation rock outcrops obviously occur only in the highest mountain ranges of western North Carolina, notably in the Great Smokies, Plott Balsams, Great Balsams, Black/Craggy Mountains, Grandfather Mountain, Roan Mountain, and in the Amphibolite mountains of Ashe County (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.

The effect of climate change on the species of balds is particularly uncertain. Some species are at their southern range limits and some are northern disjuncts, and these may be directly harmed by warmer temperatures. Some are dependent on seeps or wet areas, and may be harmed by more frequent or more intense drought. 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. Such populations are more vulnerable to extinction by rare events and susceptible to additional stressors such as climate change (DeWan *et al.* 2010).

Many species from this ecosystem face existing threats that are of more immediate concern. For instance, timber rattlesnakes are threatened not only by habitat loss but also by being subject to collection, disturbance of hibernacula/gestation sites, and persecution. There has been considerable effort undertaken in the northeastern United States to determine the impact upon Allegheny woodrat populations from a roundworm parasite that may have impacted populations in that region (McGowan 1993, Stone *et al.* 1993), though no studies have been conducted within North Carolina to assess the level of threat posed to North Carolina woodrat populations.

The decline of peregrine falcons during the last half of the 20th century has been widely attributed to the use of DDT and its concomitant effect on bird reproduction. The use of DDT was banned and peregrine restoration efforts occurred in the late 1980's and 1990's; however, peregrine falcons still face threats due to habitat loss to development and recreation impacts at individual cliff sites. Furthermore, the North Carolina population remains at fairly low density, thereby increasing the threat of stochastic events having significant population impacts. (NCWRC 2005).

Green salamander populations in North Carolina may have experienced dramatic declines during the late 1970's and early 1980's (Wilson 2001). Various theories were promulgated to explain the apparent decline including impacts of air pollution, deforestation, development, disease, successive years of extremely cold winters and/or extreme droughts in summer, and over-collection (see Wilson 2001 for discussion). However, there is no definitive cause for the apparent decline and we do not really know if an overall population decline occurred or whether isolated impacts upon particular sites caused local declines.

Climate Change Compared to Other Threats

Grassy balds and some of the heath balds are already seriously threatened by invasion by native trees and shrubs. This process is a more serious threat than anticipated direct effects of climate change. The current invasion of native trees and shrubs, development, and conversion to agriculture are much more of a concern than impacts from climate change.

Table 5 summarizes the comparison of climate change with other existing threats.

Table 5. Comparison Of Climate Change With Other Threats

Threat	Rank Order	Comments
Woody Succession	1	Trees and shrubs have been invading grassy balds in recent years. The ecological processes that kept them open in the past are not well known, and appear to no longer operate.
Conversion to agriculture/silviculture	2	Conversion to pasture land has historically degraded some grassy balds and continues to be a threat even at otherwise protected sites. Agriculture activities include Christmas tree production.
Development	3	Development (primarily housing) has had an impact upon both the habitat as well as the species utilizing it.
Invasive Species	4	The invasion of native shrubs and trees is a greater concern than exotic species in Grassy Balds. Problems with exotic species invasion in Grassy Balds may increase with warmer temperatures and increased fire, but this is not certain. Pasture grasses, coltsfoot, and Angelica are the most common exotic species likely to invade grassy balds. In addition to these, the Roan Mountain area has been invaded by thistle, yellow spotted knapweed, and garlic mustard. Some of these are currently restricted to the roadsides, but others (thistle in particular) have been found on the balds. Seeds are brought in on vehicles (trucks and tractors) and boots, and spread from roadsides and trails. Invasive exotics may be more of a problem than currently acknowledged.
Climate Change	4	Heath balds are probably less likely to be strongly affected by climate change than grassy balds. Communities and species associated with this ecosystem are likely to be affected by changes in temperature and mild winters associated with climate change.
Fire	5	It is unclear if fire is likely to be harmful or beneficial. If wild fires increase, it could offset the problem of tree and shrub invasion and could allow balds to expand.

Summary and Recommendations

Controlling invasive species and protecting or restoring areas is critical to protect these habitats against these threats.

Recommended Actions

- Surveys
- Obtain baseline data on high elevation bird species of grassy and heath balds.
 - 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
 - Monitor priority reptile population trends and habitat use.
 - Monitor priority small mammal population trends and habitat use.

- Research
 - Investigate the feasibility of using some form of controlled grazing regime to control invasive plants.
 - Study timber rattlesnake movements, use of hibernacula, and reproductive success at gestation sites.

- Management Practices
 - Collaborate with partners to develop a high elevation communities management plan.
 - Maintenance of biologically significant areas, including peregrine falcon nesting areas, reptile den sites and significant salamander occurrences (NCWRC 2005).
 - Management of outcrops to reduce intrusion by alder, rhododendron, and other species, which contributes to the disappearance of some vertebrates (NCWRC 2005).
 - Initiate a prescribed fire regime to control invasive plants and prevent habitat conversion.

- Land Protection
 - Easements and land acquisition to protect from long term impacts such as housing development (NCWRC 2005).
 - Closure of sensitive areas at certain times (*e.g.*, timber rattlesnake emergence or peregrine falcon nesting) or permanently to stop direct (trampling, loss of habitat to recreation developments (trails, vistas, etc.) and indirect human impacts (disturbance) (NCWRC 2005).

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Table 1. Predicted Impacts of Climate Change

Climate Change Factor	Comments
Increased Temperature	As temperatures increase, exotic species in lower elevations may be able to invade these areas more easily.
Drought	Changes in precipitation may not be drastic. However, it is uncertain if fog and cloud cover will change in these high elevation communities, potentially altering moisture from fog deposition. Increased drought or lightening from increased thunderstorms may cause an increase in wildfire, which could actually promote the expansion of grass and heath balds.
Changes in Precipitation	Mild winters may result in reduced winter snow, both in quantity and duration of snow pack. Lack of seasonal snow pack will reduce soil moisture and groundwater recharge. The rainfall on many mountain peaks is as much as double that in the lower basins. Fog moisture input to balds has not been measured, but experience suggests it is significant. Much of the distinctive environment here depends on fog and high elevation cloud cover.
Acreage change	Fire might expand balds and may also alter the vegetation composition. Acreage could decrease due to other causes. For example, in the absence of large herbivores, woody vegetation cover increases and encroaches on the grassy bald. This growth may be more rapid in a warmer climate (depending on availability of moisture).
Structural Change	Warmer temperatures may change the composition of these communities in uncertain ways. Some of the species of Grassy Balds are northern species that presumably would suffer. However, the dominant species occur at lower elevations, and are unlikely to be eliminated by temperature increases. Changing competitive relationships may change composition in uncertain ways.

Table 2. Bird Species Utilizing Grass and Heath Balds

Species	Common Name	Element Rank	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
BIRDS							
<i>Empidonax alnorum</i>	Alder flycatcher						
<i>Eremophila alpestris</i>	Horned lark						Nests in grassy balds, especially around rocks.
<i>Pooecetes gramineus</i>	Vesper sparrow						Nests in grassy or shrub balds.
<i>Scolopax minor</i>	American woodcock						Wet areas of grassy or shrub balds.
<i>Setophaga pensylvanica</i>	Chestnut-sided warbler						Shrub and sapling habitat at high elevations. Often found on edges of balds.
<i>Vermivora chrysoptera</i>	Golden-winged warbler						Found in shrub/sapling areas on slopes and gaps of balds, up to ~5000 feet.

Table 3. Mammal Species Utilizing Grass and Heath Balds

Species	Common Name	Element Rank:	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
MAMMALS							
<i>Microtus chrotorrhinus</i>	Rock Vole					/SC/P	
<i>Sorex dispar</i>	Rock Shrew					/SC/P	

Table 4. Reptile Species Utilizing Grass and Heath Balds

Species	Common Name	Element Rank	Endemic	Major Disjunct	Extinction/Extirpation Prone	US/NC/WAP*	Comments
REPTILES							
<i>Crotalus horridus</i>	Timber Rattlesnake	G4/S3				/SC/P	
<i>Eumeces anthracinus</i>	Coal Skink	G5/S2S3				/SR/P	

*** 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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