Rocky Ridge, Cliff, and Talus

Habitat Distribution Map

Acres in NH: 100863
Percent of NH Area: 2
Acres Protected: 68587
Percent Protected: 68

Habitat Description

This profile covers three related but distinct habitats: rocky ridges, cliffs, and talus slopes. In the 2005 Wildlife Action Plan, rocky ridges and talus slopes were discussed in one habitat profile, while cliffs were addressed in a separate profile. However, these habitats are associated with features that often occur in close proximity to one another on the landscape and are often the result of related geologic processes, and it was considered opportune to lump them together for the purposes of habitat modeling and mapping. Despite this lumping, cliff and talus habitats are still delineated separately from rocky ridges on habitat maps, and these habitats will be discussed separately in this profile where appropriate.

The combination of habitats discussed in this profile corresponds to six natural community system types as described by NHNHB (Sperduto 2011). These systems can be divided into two major groups primarily by elevation and geographic distribution. The first of these groups includes the montane rocky ridge, montane - subalpine cliff, and montane talus slope systems. These are montane systems, generally occurring above 2,200 ft. in elevation, and found primarily in the White Mountains and the highlands of west-central New Hampshire. The second group are temperate (<2,200 ft.) systems found primarily in central and southern New Hampshire. These are the temperate ridge - cliff - talus, rich temperate rocky woods, and rich Appalachian oak rocky woods systems.

Cliffs are steep rocky outcrops greater than 65 degrees in slope and over 3 meters in height. Both

Photo by Dan Sperduto
montane - subalpine and temperate cliffs are exposed to the elements, do not accumulate significant amounts of snow pack, and may be protected from runoff by overhangs. Vegetation is sparse and is usually restricted to cracks and crevices where soil accumulates. Although cliffs are generally dry, seeps do occur and may influence vegetation, pH, and nutrients.

Montane rocky ridges occur on outcrops and shallow-to-bedrock ridges and summits at mid-elevations in New Hampshire. They are dominated by some combination of red spruce (*Picea rubens*), red pine (*Pinus resinosa*), and red oak. Outcrops include cliff slabs, which are steep bedrock exposures of < 65 degree slope. This system includes nearly all the rocky ridges in the White Mountain region and other rocky exposure between 1,300–3,000 ft. in elevation elsewhere in the state. These rocky ridges, summits, and slabs have a woodland to sparse woodland canopy structure (ranging from completely open patches to forest cover < 60%) and extensive open bedrock.

Talus slopes commonly occur below steep mountain slopes and cliffs, usually as a result of mass wasting of the cliff above. The boulders and other component rock material can be stabilized or loose. Montane talus slopes are found at mid to high elevations in the White Mountains and are characterized by spruce, fir, and various other northern species. This system tends to have an open woodland character, with frequent canopy gaps and lichen-dominated talus barren openings. Soil development is variable on these slopes, and moisture conditions range from dry to mesic. Larger examples can have giant talus blocks at their base with late-melting ice that produces a cold, moist microclimate supporting alpine plants well below treeline. This system mostly occurs above 2,200 ft. in elevation, but occasionally down to about 1,500 ft.

In the temperate group, the temperate ridge - cliff - talus system combines the three habitats in a single system, because individual rocky ridge, cliff or talus landscape settings at lower elevations rarely occur at system-level scales that support more than 1 or 2 natural community types. However, system-level complexes of communities are found where ridge, cliff, and talus formations co-occur at single sites (or at least two out of three). In these circumstances, each setting may only contain one or two communities, but collectively form repeating assemblages of 3-6 communities. In the mountains, the montane rocky ridge, montane - subalpine cliff, and montane talus slope systems remain separate, as they tend to occur at larger scales and with a greater diversity of communities, meriting their system status.

The temperate ridge - cliff - talus system is typically expressed as a complex mosaic of rocky woodlands, rock outcrops, cliffs, and talus slopes with an abundance of oaks, pitch or white pines, and other temperate species. Rocky ridge communities usually occupy ridgetops and upper slopes and have a woodland or sparse woodland structure with extensive bedrock exposure. These bedrock outcrops include slabs with less than 65 degree slopes. Slabs with slopes greater than 65 degrees are classified as temperate acidic cliffs. Where fracturing of cliffs and slabs produces accumulations of large boulders, talus communities are formed. These include temperate lichen talus barrens, which are lichen-dominated boulder fields with little vascular plant cover, and wooded talus communities such as red oak - black birch wooded talus, which generally have an open woodland structure. Wooded talus communities have variable and patchy understories of tall shrubs, vines, flowering herbs, and ferns such as rock polypody (*Polypodium virginianum*).

The other two systems within the temperate group are the rich temperate rocky woods and rich Appalachian oak rocky woods systems. Structurally, these two systems are quite similar, occurring primarily as closed-canopy forests on slopes with significant amounts of exposed bedrock and/or loose boulders. They both have plant species compositions that reflect enriched soil conditions. The rich Appalachian oak rocky woods system has a more southerly distribution in NH, occurring within 30
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miles of the coast or the Massachusetts border, and is characterized by the dominance of Appalachian species such as white oak (*Quercus alba*), hickories (*Carya* spp.), and flowering dogwood (*Benthamidia florida*). While both of these systems occupy rocky slopes, many occurrences lack the large accumulation of talus boulders that provide habitat structure favored by many wildlife species.

### Justification (Reason for Concern in NH)

#### Talus Slopes And Rocky Ridges:
Talus slope and rocky ridge habitat is uncommon throughout the Northeast, occurring mostly in isolated patches near cliffs and on the tops of low mountains and hills. Due to their scenic views, rocky ridges are recreational destinations, and thus the potential for recreational impacts to the habitat is high. As in alpine habitat, soil depth is shallow and therefore the vegetation is highly susceptible to trampling (D. D. Sperduto, NHNHB, personal communication). Multiple instances of damage and threats to rare plant populations and exemplary natural community occurrences in rocky ridge settings have been documented (NHNHB 2005). Rock outcrops in intensively managed forests have been shown to serve as important biodiversity refugia for some bryophyte species (Pykala 2004), and therefore presumably for related invertebrates and other wildlife species that use this habitat. Rocky ridges may also be targeted for wind energy development. Due to the inaccessible nature of talus slopes, human impacts exist primarily on the rocky ridge portion of this habitat, though some bootleg trails and other impacts are found on talus. For example, rock-climbing activity, in particular, has been found to decrease plant diversity and gastropod species richness, density, and diversity on the talus at the base of cliffs with climbing routes (McMillan and Larson 2002, McMillan et al. 2003). Talus slopes have a distinct habitat compared to cliffs (Kubesova and Chytry 2005) and therefore should be treated separately in conservation plans. Talus slopes and rocky ridges provide crucial habitat for several rare wildlife species in New Hampshire, including timber rattlesnake and bobcat.

#### Cliffs:
Cliffs are primary nesting sites for the state threatened American peregrine falcon (*Falco peregrinus anatum*). Cliffs are used by many other species as well, including the state endangered golden eagle (*Aquila chrysaetos*), common raven (*Corvus corax*), state endangered timber rattlesnake (*Crotalus horridus*), long-tailed shrew (*Sorex dispers*), rock vole (*Microtus chrotorrhinus*), state endangered eastern small-footed bat (*Myotis leibii*), gray fox (*Urocyon cinereoargenteus*), and bobcat (*Lynx rufus*) (DeGraff et al. 2006). The extreme range in chemical and physical factors (e.g., pH, temperature, moisture) found on cliffs may be important to endemic invertebrates and plants. Although often viewed as isolated or inaccessible, the popularity of cliffs and cliff tops as recreational destinations is rapidly increasing.

### Protection and Regulatory Status

Very little of New Hampshire’s rocky ridge, cliff, or talus habitat is protected by laws, rules, or regulations. A notable exception, however, is within the boundaries of the WMNF where many of New Hampshire’s larger examples or groupings of these habitats occur and where several forms of protection apply. In the 2004 revised management plan (draft) for the WMNF, special protection is afforded specifically to “the rarest exemplary natural communities,” including all exemplary cliff and talus slope communities (US Forest Service 2004). The WMNF is part of the National Wilderness Preservation System (16 U.S.C. 1131-1136, 78 Stat. 890). Some of these habitat areas occur within federally owned areas designated by Congress as “Wilderness Areas.” There are currently 4 Wilderness Areas in the WMNF (Great Gulf, Presidential-Dry River, Pemigewasset, and Sandwich) containing talus slope and rocky ridge habitat. Management practices and recreational impacts are tightly restricted in these areas.

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**Cliffs:** Areas occupied by state endangered and threatened plants and animals are protected under RSA 217-A and RSA 212-A respectively. Under the 1979 Peregrine Falcon recovery plan, the United States Fish and Wildlife Service (USFWS) protects peregrine falcon nests. Areas within 20 m of peregrine falcon nests are closed to hikers and climbers during the nesting season, typically April to August (United States Forest Service (USFS) 2004). The White Mountain National Forest (WMNF) prohibits rock defacement, including “chipping to create foot and hand holds, gluing to stabilize features, and attaching permanent artificial handholds. Route cleaning is prohibited where federal-listed threatened, endangered, and sensitive species occur. Removing, altering, or manipulating vegetation, soils, or other natural features at the cliff edge, talus slope, or cliff base is prohibited. To protect natural features, the use of mechanical or motorized devices, explosives, or chemicals for cleaning or developing climbing routes is prohibited” (WMNF Proposed Land and Resource Management Plan 2004). The Department of Resources and Economic Development (DRED) has no regulations for rock climbing on state lands, with the exception that hikers must register before climbing any routes on Cannon Cliff (Webster 1996). The USFWS (1979) established a landowner agreement to protect peregrine nesting sites.

**Distribution and Research**

In New Hampshire, rocky ridge, cliff, and talus slope habitat occupies approximately 2% of the state. There is no particular locus of concentration, with isolated polygons and clusters of polygons occurring throughout the state. However, this habitat by definition does occur more frequently in the mountains and regions with steep hilly slopes, such as the White Mountains, hilly ridges in the central and western parts of the state, and discreet mountain areas such as Pawtuckaway State Park and the Ossipee Mountain Range.

CLIFFS: Cliffs occur throughout the mountainous and lowland regions of New Hampshire. Montane acidic cliffs are found in northern areas at elevations of 360 to 1,000 m (1,200 to 3,500 ft). Montane circumneutral cliffs are found in the northern White Mountains at elevations of 275 to 1,000 m (900 to 3,500 ft). Temperate acidic and circumneutral cliffs are found south of the White Mountains below elevations of 300 m (1,000 ft). Calcareous cliffs are restricted to western New Hampshire along the Connecticut River (Sperduto and Nichols 2011). Seeps can occur in any of these cliff types. Research is needed to relate the patterns of plant and animal diversity to the chemical and physical attributes of cliffs. Surveys and long-term monitoring may be needed to determine species composition, trends, and conservation targets. Surveys should be designed to include all taxa, including invertebrates.

**Relative Health of Populations**

There are over 100,000 acres of rocky ridge, cliff, and talus habitats in New Hampshire, and of this, roughly 68% occurs on conservation lands.

**Habitat Condition**

A set of GIS data was used to assess ecological condition of each habitat type. Chapter 3 describes the methodology. The data used for this habitat is described below.

**Biological Condition:**
Species richness of rare animals within polygon
Species richness of rare animals within their dispersal distances from the polygon
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Species richness of rare plants in polygon
Richness of rare and exemplary natural communities in polygon

Landscape Condition:
Contiguous area of adjacent ridge/talus/cliff habitat combined (hectares)
Local Connectedness

Human Condition:
Index of Ecological Integrity scaled to State
Climbed (identified per 2005 WAP Cliffs data, and newer WMNF rock climbing trail areas)
Distance to nearest hiking trail (meters)
Distance to nearest road (meters)

Habitat Management Status:

The 4 Wilderness Areas in the WMNF containing talus slope and rocky ridge habitat (Pemigewasset, Presidential-Dry River, Sandwich Range, and Great Gulf Wilderness Areas) are managed according to the guidelines and standards delineated in the Land and Resource Management Plan for the WMNF, such that natural processes are allowed to continue with minimal impediment, effects and impacts of human use will be minimized, primitive recreation opportunities will be provided, appreciation of the qualities of wilderness landscapes will be fostered, and utilization for educational and scientific purpose will be continued (USFS 2004). National scenic trails bisecting talus slope and rocky ridge habitat will be administered in accordance with the Wilderness Act (1981) and are under the management authority of the Cooperative Management System (1984 MOU between the USFS and the Appalachian Trail Conference), composed of the Appalachian Mountain Club, Dartmouth Outing Club (DOC), NHDES, and WMNF. In addition, an MOU between NHFG, USFWS, and the USFS was established in 1996 delegating authority to develop, maintain, and manage all of the fish, wildlife, and rare plant resources and their habitats within the WMNF to NHFG.

CLIFFS: The 1996 MOU between the NHFG, USFWS, and USFS gives NHFG authority to develop, maintain, and manage all of the fish, wildlife, and rare plant resources within the WMNF. The 1993 memorandum of understanding (MOU) between DRED and NHFG directs land management practices that offer opportunities to combine agency resources for the improvement of wildlife habitat, forest recreation, and forestry operations for public use and benefit. In areas where cliffs occur in the WMNF, habitat improvement is forbidden because habitat should only be a result of natural processes (USFS 2004).

Cliff habitat improvement is not known to be occurring anywhere else in New Hampshire, although some cliff-dwelling species are being managed. Climbing routes that are less than 20 m from known peregrine falcon nesting sites are closed during the breeding and nesting seasons. ASNH posts cliff closure signs to protect peregrine falcons, WMNF has at least one falcon-related display on the Kancamagus Highway, and the Appalachian Trail Conference (ATC) and National Park Service (NPS) created an interpretive sign about cliff ecology that has been installed at Holts Ledge in Lyme, New Hampshire.

Informal agreements exist with Appalachian Mountain Club (AMC), EMS, and IME (1986) regarding posting cliff closure signs (for rare bird nesting) in stores and clubhouses to steer hikers away from Franconia Notch, Willard, and Frankenstein. Under an MOA between Rumney Climbers Association and WMNF, “The Rumney Climber’s Association has the sole responsibility for overseeing fixed
anchors, erosion control, new route activity, trail maintenance, posting peregrine falcon closures, and monitoring the status of rare plants at this popular New Hampshire climbing area.”

**Appendix B: Habitats**

**Threats to this Habitat in NH**

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

<table>
<thead>
<tr>
<th>Disturbance and habitat degradation from hiking and biking trails (Threat Rank: Medium)</th>
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<tbody>
<tr>
<td>Recreational use of rocky ridge habitat is high (much less so for talus slopes). Human disturbance, primarily trampling and off-road vehicle use, is the greatest threat to rocky ridge habitat (USFS 2004, D. D. Sperduto, NHNHB, personal communication). Structures, designated trails, undesignated trails, climbing routes, popular ski areas, and viewpoints co-occur with some of the most sensitive rocky ridge communities, such as those at Mount Cardigan in Orange, Mount Pawtuckaway in Nottingham, and Humphreys Ledge in Bartlett (NHNH 2005). The disturbance incurred at such sites from trampling in summer and snow compaction in winter (both from foot traffic and snowmobiles) may result in vegetative stress, mortality, and erosion, thereby reducing recolonization within these sensitive communities.</td>
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<tr>
<td>Magnitude of response is strongly correlated with trampling intensity (Cole 1995, USFS 2004). Like alpine communities, rocky ridge communities and their soils have been shown to have low tolerances for trampling (Sperduto and Cogbill 1999, D. D. Sperduto, NHNHB, personal communication). Substantial reductions in vegetation cover and height, as well as soil erosion, can result from trampling (Cole 1995, Cole and Monz 2002). Despite varying tolerances of trampling resistance and resiliency among natural communities within this habitat, they all have a threshold beyond which impacts become irreversible (D. D. Sperduto, NHNHB, personal communication).</td>
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<th>Habitat degradation from mining activities (Threat Rank: Medium)</th>
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<tr>
<td>Cliff or rocky ridge habitats could be mined, essentially destroying the habitat.</td>
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<td>Quarrying of dimension stone (RSA 155-e) is permitted by the state through the Department of Resources and Economic Development. In the past 13 years, there has been one permit application for a new stone quarry in New Hampshire (W. Carpenter, pers. comm.). While there are currently some quarries operating without permits, their extent is limited.</td>
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<tr>
<th>Habitat conversion and degradation from wind tower and turbine development or communication towers, potential for ongoing wildlife impacts through direct mortality and disturbance to behavior. (Threat Rank: Medium)</th>
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<tr>
<td>Construction of cell towers or wind turbines could directly impact rocky ridges and indirectly affect cliff faces via increased erosion. There is an increased risk of migratory bird mortality in areas with towers and turbines (Kerlinger 2000).</td>
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<tr>
<td>There were 78 known towers sited in New Hampshire as of 2010 (<a href="http://www.towerkill.com">www.towerkill.com</a>) and 475 towers currently mapped by NHFG. Kerlinger (2000) prepared an extensive literature review for the USFWS</td>
</tr>
</tbody>
</table>
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Office of Migratory Bird Management on avian mortality at towers and turbines. Birds that migrate along ridgelines at night are at greatest risk for tower collision by becoming disoriented when encountering lighted towers (Partners in Flight, unpublished data). Current estimates of the numbers of birds killed annually by communication towers range between 4 and 10 million (www.towerkill.com). Bats are also vulnerable to impacts from wind energy facilities. Based on field data collection in a study of bat mortality at a wind energy facility in West Virginia, Hein et al. (2013) estimated a mortality rate of roughly 100 bats per turbine per year.

Habitat conversion due to development (Threat Rank: Medium)

Rocky ridges may be impacted by the construction of vacation homes. Clifftop development could impact cliffs through erosion.

There is little evidence to suggest that rocky ridges, cliffs and talus slopes are experiencing significant development pressure.

List of Lower Ranking Threats:

Habitat degradation and disturbance from climbers
Habitat degradation and conversion due to clifftop development
Habitat degradation from drought stress and associated mortality of vegetation
Habitat impacts from drought stress and associated mortality of vegetation
Habitat degradation from energy development, including direct impact to clifftop and indirect impact to cliff face
Mortality and habitat impacts (fragmentation) from roads
Disturbance to cliff-nesting species from timber harvesting occurring near cliffs
Habitat degradation and conversion due to clifftop development Mortality from the commercial collection of individuals from the wild Habitat degradation and species impacts from mercury deposition Disurbance to nesting species from motorized recreation near cliff face Habitat degradation from snow compaction related to recreational activity Habitat degradation from fire suppression that causes vegetation changes Habitat degradation from fire suppression that causes vegetation changes Habitat degradation and species impacts from acid deposition Habitat degradation from acid deposition
Mortality and disturbance related to intentional or unintentional shooting and trapping
### Actions to benefit this Habitat in NH

**Advise trail managers on mitigation for habitat impacts, regulation, and policy**

**Primary Threat Addressed:** Disturbance and habitat degradation from hiking and biking trails

**Specific Threat (IUCN Threat Levels):** Human intrusions & disturbance

**Objective:**
Reduce impacts of recreation on rare plant populations and exemplary occurrences of rare natural community types associated with rocky ridge habitats.

**General Strategy:**
NHFG will delineate sensitive areas and provide trail advisories to all managing agencies to mitigate trail impacts to wildlife and wildlife habitats. NHFG will become a recognized participant of the Appalachian Trail Conference (ATC) Cooperative Management System. Participants include AMC, DOC, NHDES, and WMNF formalized through a series of cooperative agreements at both the state-level and trail section-by-trail section level (New Hampshire is one of the only states that do not have a wildlife agency as a partner). The NHFG will be involved in the development, review, and approval of the Appalachian Trail Local Management Plan. The NHFG will enter a Memorandum of Agreement with the Department of Resources and Economic Development to maintain and manage trails in accordance with the health of wildlife and wildlife habitats. The NHFG will review the 1996 Memorandum of Understanding between the Department, USFWS, and the USFS.

**Political Location:**

**Watershed Location:**

### Conduct research on impacts of recreational climbing on cliff habitats and rare plant and animal species.

**Primary Threat Addressed:** Habitat degradation and disturbance from climbers

**Specific Threat (IUCN Threat Levels):** Human intrusions & disturbance

**Objective:**
The objective is to identify where recreational climbing is having an impact on cliff vegetation and rare plant species.

**General Strategy:**
Site-specific information on the impacts of climbers in NH is generally lacking, and is necessary if management of recreational activities is going to be successful. WMNF is currently in the midst of a study on the impacts of recreational climbing, but follow-up visits have not been conducted, and these results may have to be supplemented by further research.

**Political Location:**
Statewide

**Watershed Location:**

### Advise Site Evaluation Committee on wind energy facilities

**Primary Threat Addressed:** Habitat conversion and degradation from wind tower and turbine development or communication towers, potential for ongoing wildlife impacts through direct mortality and disturbance to behavior.
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Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:
To minimize impacts on rocky ridge habitats.

General Strategy:
Examining potential long and short-term implications of wind farm development and maintenance will aid in making decisions and recommendations dealing with wind farm proposals at local, state, regional and a national level.

Political Location: Watershed Location:
Statewide

References and Authors

2015 Authors:
Peter Bowman, NHNHB

2005 Authors:
Alina J. Pyzikiewicz, NHFG; Steven G. Fuller, NHFG; Benjamin D. Kimball, NHNHB.

Literature:

Belcher, C.F. 1980. Logging Railroads of the White Mountains. Appalachian Mountain Club, Boston, Massachusetts, USA.


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Nichols, W.F. 2002. Rare plant and exemplary natural community inventory of Mt. Monadnock State Park, Gay State Forest, and adjacent Town of Jaffrey Lands. New Hampshire Natural Heritage Bureau, Concord, New Hampshire, USA.


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