HABITAT PROFILE

Cliffs

Associated Species: American peregrine falcon (Falco peregrinus anatum), Golden Eagle (Aquila chrysaetos)
Global Rank: Not ranked
State Rank: Montane acidic (S5), Montane circumneutral (S2S3), Lowland acidic (S4), Lowland circumneutral (S2), Cliff seep (S3S4), Calcareous
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Element 1: Distribution and Habitat

1.1 Habitat Description

Cliffs are steep rocky outcrops greater than 65° in slope and 3 m in height. They are more fractured and limited in soil accumulation than other types of rocky outcrops (Sperduto and Nichols 2004). 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 (NatureServe 2004). Although cliffs are generally dry, seeps do occur and may influence vegetation, pH, and nutrients (Sperduto and Nichols 2004).

Vegetation of acidic cliffs commonly includes three-toothed cinquefoil (*Potentilla tridentata*), fragile fern (*Cystopteris fragilis*), mountain cranberry, (*Vaccinium vitis-idaea*), sheep laurel (*Kalmia angustifolia*), and stunted trees such as red oak (*Quercus rubra*) and paper birch (*Betula papyrifera* var. *papyrifera*) (Sperduto and Nichols 2004). Circumneutral cliffs—which are rare in New Hampshire—are often vegetated with the state endangered smooth woodsia (*Woodsia glabella*) and creeping juniper (*Juniperus horizontalis*), state threatened fragrant fern (*Dryopteris fragrans*), and rare bryophytes such as *Distichium capillaceum, Gymnostemum aeruginosum*, and *Tortella tortuosa* (Sperduto and Nichols 2004). Calcareous cliffs are even more rare than circumneutral cliffs and support species such as bulblet bladder fern (*Cystopteris bulbifera*), zig-zag goldenrod (*Solidago flexicaulis*), and small trees and shrubs, such as eastern red cedar (*Juniperus virginiana*) and downy arrow-wood (*Viburnum rafinesquianum*) (Edinger et al. 2002).

1.2 Justification

Cliffs are primary nesting sites for the state endangered 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 dispar*), rock vole (*Microtus chrotorrhinus*), state endangered eastern small-footed bat, (*Myotis leibii*), gray fox (*Urocyon cinereoargenteus*), and bobcat (*Lynx rufus*) (DeGraff and Yamasaki 2001). 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. Cliffs will also likely be targeted for wind energy development.

1.3 Protection and Regulatory Status

There are no laws explicitly protecting cliffs in New Hampshire. 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.

1.4 Population and Habitat Distribution

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). Lowland acidic and lowland 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 2004). Seeps can occur in any of these cliff types.

1.5 Town Distribution Map

See attached.

1.6 Habitat Map

The 10-m Digital Elevation model provided by the Society for the Protection of New Hampshire Forests was analyzed to identify areas greater than 65% slope and was combined with the cliff landforms identified by The Nature Conservancy's (TNC) Ecological Landunit datalayer and the New Hampshire Natural Heritage Bureau's (NHB) exemplary cliff communities. A 200-m buffer was placed around these cliff polygons since research indicates the area within 200 m of a peregrine falcon nest (the primary species using cliff habitats) is the zone of predator defense (Cade 1960, White et al. 2002).

1.7 Sources of Information

Guides to the natural communities of New Hampshire and the NatureServe database were used as sources regarding habitat and distribution of cliffs. Field guides were used to identify species that utilize cliffs. The WMNF management plan was used to gather information regarding climbing rules and regulations. The NHNHB (is this right?) Element Occurrence Database (2004) listed endangered, threatened, or rare animal species associated with cliffs, including known breeding sites of peregrine falcons. In addition, a peregrine falcon assessment produced by the Audubon Society of New Hampshire (ASNH) was used to identify potential breeding sites. Rock climbing guides were used to locate recreational cliffs and assess use levels.

1.8 Extent and Quality of Data

NHB??? field surveys are the only known source of field data for cliff communities. The relative inaccessibility and remoteness of cliff habitats has prevented biologists from fully documenting cliff communities (Farris 1995). Predicted cliff polygons need field verification; however, aerial photographic interpretation may be a viable alternative.

1.9 Distribution Research

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.

Element 2: Species/Habitat Condition

2.1 Scale

Habitat planning units were delineated primarily by mountain ridges, roads, and proximity to other cliffs, which resulted in 51 distinct units.

2.2 Relative Health of Populations

According to New Hampshire Fish and Game (NHFG), the Crawford Notch (828 ac), Carter-Wildcat (551 ac), Presidential (524 ac), Franconia-Whaleback (512 ac), and Carrigain (467 ac) units contain the greatest amounts of cliff habitat. Patterns of decline or loss are unknown.

2.3 Population Management Status

N/A

2.4 Relative Quality of Habitat Patches

Of the 316 cliffs mapped by NHFG, 68 (26% of total cliff areal extent) contain known climbing routes. Of 74 (27% of total cliff areal extent) current or historic peregrine falcon nesting sites, 46 (84% of occupied areal extent) contain known climbing routes. Thirty-three percent of the total areal extent of cliffs has potential for commercial wind turbine development, and 35% has potential for small turbines.

2.5 Habitat Patch Protection Status

Of the mapped cliff polygons, 66% are federally owned (USFS, WMNF), 23% are state owned (DRED), 1% are owned by private organizations, and less than 1% are town or county owned. Nine percent are protected.

2.6 Habitat Management Status

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 fewer 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 PEFA-related display on the Kancamaugus 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."

2.7 Sources of Information

Information on management and regulations was obtained from the WMNF Protection Plan. GIS datalayers were used to identify key habitat areas and determine the quality of habitat patches.

2.8 Extent and Quality of Data

Peregrine falcon breeding and nesting is well documented by the ASNH peregrine falcon monitoring program, but is lacking for other bird species. Little is known about habitat use by other taxa, especially invertebrates.

2.9 Condition Assessment Research

- Establish baseline data regarding habitat quality
- Identify indicator species of high quality habitat, and survey for the existence of these species in potential habitat
- Determine the climbability of different cliffs, the impact of climbing at critical habitat areas, and the presence and location of rare species on cliffs used for recreational activity
- Assess the intensity of recreational use including infrastructure on cliff tops

Element 3: Species and Habitat Threat Assessment

3.1.1 Recreation

(A) Exposure Pathway
Cliffs, especially in the White Mountains, are often heavily used for hiking and rock climbing. Rare plants, soil, and sensitive communities may be trampled or removed to create new routes, or displaced by non-native species. Climbers and sight-seeing tours that repeatedly get too close to nesting birds can frighten birds off nesting sites, potentially causing nest abandonment.

(B) Evidence
New Hampshire has a long climbing history, dating back to 1910 (Webster 1996). In a 1969 rock climbing guidebook, 18 climbing routes were described for Cathedral Ledge, an area where peregrine falcons have nested for the past 10 years (ASNH unpublished data). By 1996, 222 new routes were established (Webster 1996). Statewide, New Hampshire has 106 cliffs with over 2,000 established climbing routes (Webster 1996, Smith 2001, Sykes 2001).

A common result of increased climbing activity is the establishment of informal trails (Pyke 2001). Climbers hiking to climbing routes and assembling at cliff plateaus cause minimal damage to vegetation (McMillan and Larson 2002), although seed viability and productivity may be reduced (Maschinski et al. 1997). On the face of the Niagara Escarpment in Canada, the density and composition of vascular plants, bryophytes, and lichens were lower in climbed areas than in unclimbed areas (McMillan and Larson 2002). The removal of vegetation to create new climbing routes can cause wind and rain to wash away soil, slowing the establishment of new plants (Camp and Knight 1998). Rock climbing can introduce non-native species through seeds transported on climbing equipment, shoes, and clothing (McMillian and Larson 2002).

The presence of low flying aircraft can frighten cliff-nesting birds from their nests, inadvertently knocking eggs or chicks from the nest (White et al. 2002). Nest disturbance can expose eggs and chicks to unfavorable environmental conditions that may result in mortality, or complete nest abandonment (White et al. 2002).

3.1.2 Energy and Communication Infrastructure

(A) Exposure Pathway
Construction of cell towers or wind turbines could directly impact the cliff top and indirectly affect the cliff face via increased erosion. There is an increased risk of migratory bird mortality in areas with towers and turbines (Kerlinger 2000).

(B) Evidence
There were 60 known towers sited in New Hampshire as of 1998 (www.towerkill.com) and 475 towers currently mapped by NHFG. Kerlinger (2000) prepared an extensive literature review for the USFWS 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 disorientated 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).

3.2 Sources of Information

Expert review and consultation provided input on identifying and ranking threats. Rock climbing guides provided information on recreational cliffs. Peer-reviewed journal articles provided evidence for threats.

3.3 Extent and Quality of Data

Extensive information is available regarding rock climbing and its impacts on cliff vegetation. Little is known about rock climbing impacts on animal species other than peregrine falcons. There is no documentation on avian mortality or habitat degradation resulting from wind turbine or telecommunications tower collisions/construction in New Hampshire.

3.4 Threat Assessment Research

Plant harvest, climate change, forestry operations, acid deposition, development, succession/revegetation, and mining operations were identified as low ranking threats to cliff habitat. More research is needed to determine whether these could become more significant in the future.

Element 4: Conservation Actions

4.1.1 Cultivate Recreational User Stewardship, Education and Outreach

(see also Strategies, Education and Outreach)

(A) Human disturbance

(B) Justification
Existing education and outreach programs have engaged recreational enthusiasts, especially rock-climbers, to support conservation and management designed to protect cliffs from recreational impacts. Stewardship activities will target high-use areas and specific audiences. Adverse human-wildlife interactions are expected to increase as the human population and recreational use of cliffs increases. Thus, stewardship programs need to be cultivated immediately. Stewardship programs can be modified to target new areas, audiences, and user groups.

(C) Conservation Performance Objectives
Eliminate the co-occurrence of adverse recreational impacts in delineated S1-ranked natural communities and rare cliff habitats.

(D) Performance Monitoring
Performance will be evaluated based on implementation of management and stewardship agreements and subsequent decreases in recreational impacts. Stewardship agreements will include recommendations for monitoring.

(E) Ecological Response Objective
Restore S1-ranked natural communities and rare wildlife to delineated cliff habitat areas. Increased native vegetation and wildlife use will indicate a beneficial response.

(F) Response Monitoring
Monitor cliffs for changes in vegetation and wildlife. Stewardship agreements will include recommendations for monitoring.

(G) Implementation
NHFG will delineate high-risk cliffs and cultivate user stewardship or support existing approaches. ASNH has successfully implemented stewardship programs. NHFG will review existing agreements with other agencies and planning entities, including WMNF, USFWS, DRED, SCORP, and ATC, and modify them or provide input to support stewardship. Recommended activities include the following:

- Install signs regarding cliff ecology along access routes and in New Hampshire and Massachusetts climbing shops
- Produce and distribute educational and outreach materials to delineated areas and target audiences
- Recruit stewards and volunteer outreach personnel
- Contribute material to guidebooks
- Develop and train volunteer group to assist with habitat mapping
- Develop a website on climbing and cliffs that is linked to existing rock-climbing websites

(H) Feasibility
Given that implementation will build on current ASNH methods and existing agreements, it is reasonable to expect these objectives can be accomplished.

4.1.2 Advise Land Managers on Mitigation of Recreational Impacts, Regulation and Policy

(see also Strategies, Inter-Agency Regulation and Policy)

(A) Human disturbance

(B) Justification
Restricting use, placement, and width of trails, rock-climbing routes, or other modes of access to sensitive areas will reduce disturbance. Cliff species benefit from efforts to restrict access to sensitive areas. Advisories will be designated for sensitive areas immediately upon entry into management agreements and may be modified based on habitat response indicators.

(C) Conservation Performance Objective
Eliminate recreational impacts on rare cliffs and wildlife. Performance will be assessed based on management agreements, modification of recreational management practices, and adoption of trail advisories.

(D) Performance Monitoring
Advisories will include reporting protocols to docu-

ment the modification of recreational management practices.

(E) Ecological Response Objective
Restore rare natural communities and cliff species to delineated areas. Advisories will include restoration and monitoring recommendations.

(F) Response Monitoring
Vegetative cover, soils, and presence of rare species will be measured prior to the implementation of advisories and in subsequent years. Responses will be used to revise advisories.

(G) Implementation
NHFG will delineate sensitive areas and provide advisories to all managing agencies and organizations to mitigate recreational impacts on cliffs and associated wildlife. Recreational users will be engaged to develop or provide input on advisories. NHFG will participate in the ATC Cooperative Management System. NHFG will help develop, review, and approve the Appalachian Trail Local Management Plan (see Alpine habitat profile for detail). NHFG will review existing agreements with other agencies and planning entities, including WMNF, USFWS, DRED, SCORP, and ATC, and modify them or provide input in accordance with the health of wildlife and wildlife habitats. In particular, NHFG will review or revise its 996 MOU with USFWS and the USFS, and the 1993 MOU with DRED.

(H) Feasibility
Given that implementation will build on current methods and existing agreements (see above), it is reasonable to expect these objectives can be accomplished. Limiting factors may include personnel to enforce climbing regulations and resistance of user groups to new regulations.

4.1.3 Engage in Inter-Agency Risk Assessment for Recreation and Wind Energy Development, Regulation and Policy
(see Strategies, Inter-Agency Regulation and Policy)

4.1.4 Identify High Risk Areas for Recreation and Wind Energy Development, Conservation Planning
(see Strategies, Conservation Planning)

4.1.5 Restrict Access to High Risk Areas, Regulation and Policy
(see Strategies, Inter-Agency Regulation and Policy)

4.1.7 Advise Wind Energy Developers on Best Management Practices for Construction, Regulation and Policy
(see Strategies, Inter-Agency Regulation and Policy)

4.1.8 Prioritize Cliffs for Protection, Land Protection
(see Strategies, Conservation Planning)

4.1.9 Protect Unfragmented Blocks, Land Protection
(see Strategies, Land Protection)

4.2 Conservation Action Research

Develop methods to monitor the response of cliff wildlife and natural communities to recreational pressures.

Element 5: References

5.1 Literature

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5.2 Data Sources

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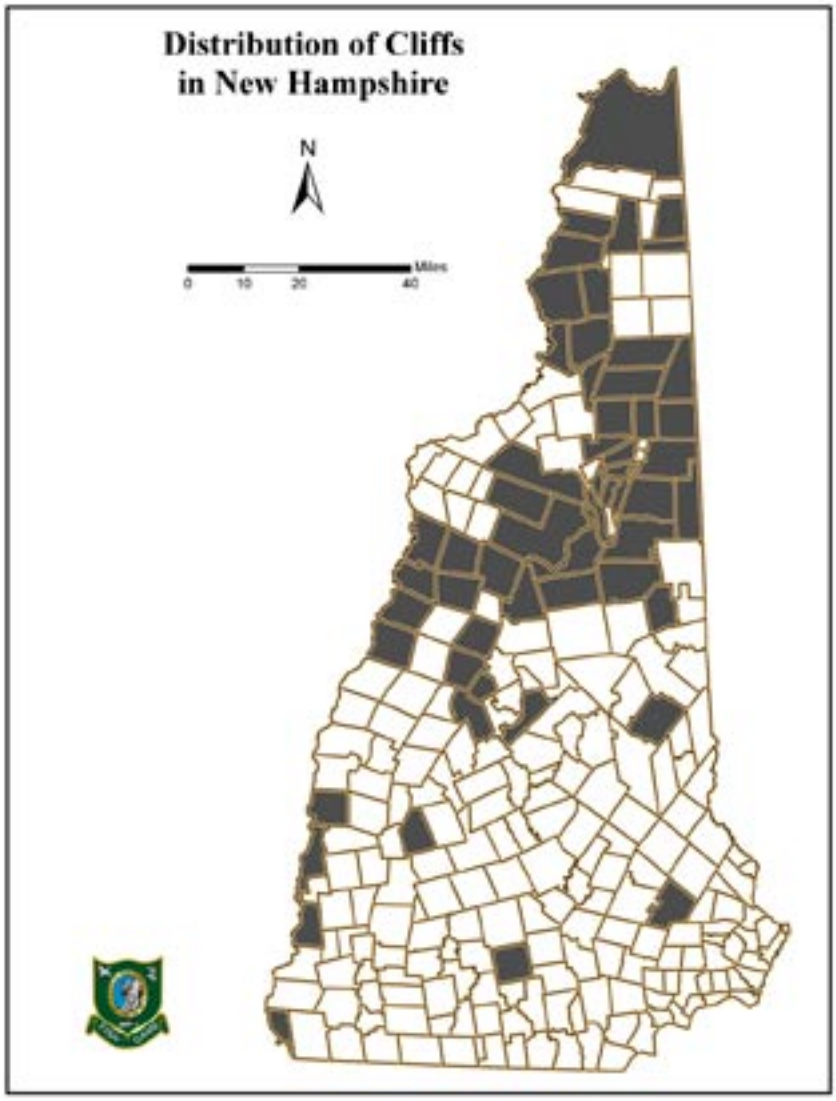
Distribution of Cliffs
in New Hampshire
N
0
10
20
40
Miles