

National Park Service  
U.S. Department of the Interior

Shenandoah National Park  
Virginia



# **Rock Outcrop Management Plan**

## **Environmental Assessment/Assessment of Effect**



**November 2012**

*Cover photo courtesy of Gary P. Fleming*

**U.S. Department of the Interior  
National Park Service**

**Rock Outcrop Management Plan  
Environmental Assessment / Assessment of Effect**

**Shenandoah National Park  
Luray, Page County, Virginia**

**SUMMARY**

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***Proposed Action:*** Shenandoah National Park has prepared this Environmental Assessment/Assessment of Effect to analyze alternatives related to direct the future management of rock outcrop areas in the Park. The purpose of taking this action is to address the need to protect, restore, and perpetuate rock outcrops and natural resources associated with the outcrops while providing a range of recreational opportunities for visitors to experience. Several feasible alternatives were considered. Alternative B, the NPS preferred alternative, proposed to establish a balance between natural resource protection and visitor use. Actions under this alternative would allow visitor use of selected rock outcrop areas while minimizing impacts to natural resource conditions. Implementing the preferred alternative would have negligible to moderate impacts to geological and soil resources, ecological communities, rare, threatened and endangered plants, rare, threatened or endangered species, wilderness character, cultural landscapes, archeological resources, climbing activities, recreational activities, and visitor experience. This document will be used for compliance with both the National Environmental Policy Act of 1969, as amended, and the National Historic Preservation Act of 1966, as amended.

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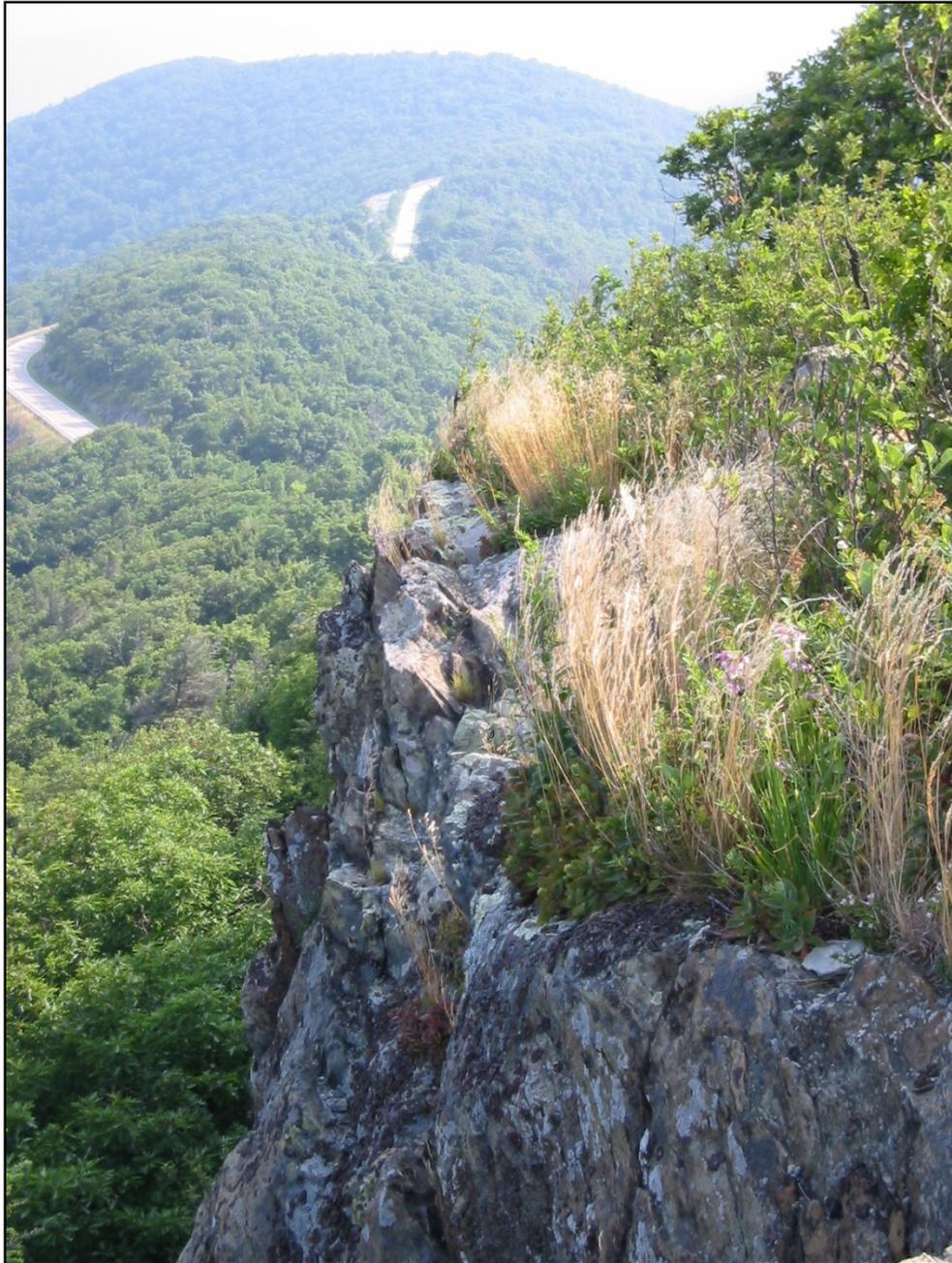
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# CHAPTER 1

## PURPOSE AND NEED FOR ACTION

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*Photo courtesy of Jens Hilke.*

### **Little Stony Man**

## PURPOSE AND NEED FOR ACTION

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The National Park Service (NPS) is preparing this Environmental Assessment/Assessment of Effect (EA/AoE) to analyze alternatives to direct the future management of rock outcrops in Shenandoah National Park (the Park) through a Rock Outcrop Management Plan (ROMP) that incorporates climbing. The Park's rock outcrops are some of the largest in the region and contain a myriad of important vegetation communities and rare plant and animal populations. These rock outcrops are popular destinations in the Park and draw visitors to the views, sweeping vistas and climbing activities they afford.

The Park is proposing to create a ROMP EA/AoE in order to protect, restore, and perpetuate rock outcrops and natural resources associated with the rock outcrops while providing a range of recreational opportunities for visitors to experience.

Rock outcrops at the Park contain globally rare communities and a need exists to protect the biodiversity value associated with the rock outcrops. The proposed action is needed because severe degradation of vegetation and soils at some rock outcrops, including impacts to rare species and communities, has occurred due to intense use of rock outcrops by recreational activities. The ROMP EA/AoE would provide the direction to guide management decisions, protect geologic and biological composition, and minimize visitor use impacts. Given that Park management personnel are mandated to protect rock outcrops while still providing opportunities for visitor enjoyment of these resources, this plan would mitigate impacts of visitor recreation activities, accommodate visitor use, and direct the future management of rock outcrops.

This ROMP EA/AoE analyzes three action alternatives and the No Action Alternative, and their potential impacts on the environment. The ROMP EA/AoE has been prepared in accordance with the National Environmental Policy Act of 1969, as amended (NEPA), the implementing regulations of the Council on Environmental Quality (40 CFR 1500-1508.9) and NPS Director's Order #12: *Conservation Planning, Environmental Impact Analysis and Decision-Making* (DO-12) and accompanying Handbook (2001). This EA/AoE is also intended to fulfill the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), and has been prepared in accordance with the implementing regulations of the Advisory Council for Historic Preservation (36 CFR Part 800) and NPS Director's Order #28: *Cultural Resources Management* (DO-28) and accompanying Handbook.

## BACKGROUND

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### Park Purpose and Significance

The Park was established in 1935 to protect the natural and cultural resources of the northern Blue Ridge, provide scenic and recreational opportunities, and serve as a refuge and "pleasuring ground" for visitors. The mission of the Park dates back to legislation from 1926-1976 and is summarized in the Parks Strategic Management Plan:

Shenandoah National Park restores, where appropriate, and maintains the Park as a functioning ecosystem that is the outstanding representative of the Blue Ridge/Central Appalachian biome. The Park provides present and future generations outstanding opportunities to experience “recreation and re-creation” by driving Skyline Drive, walking the Appalachian Trail and related trails, or experiencing the backcountry wilderness areas. The Park preserves the fabric and tells the stories of the people and the land both before the Park was established and as a result of the establishment of the Park.

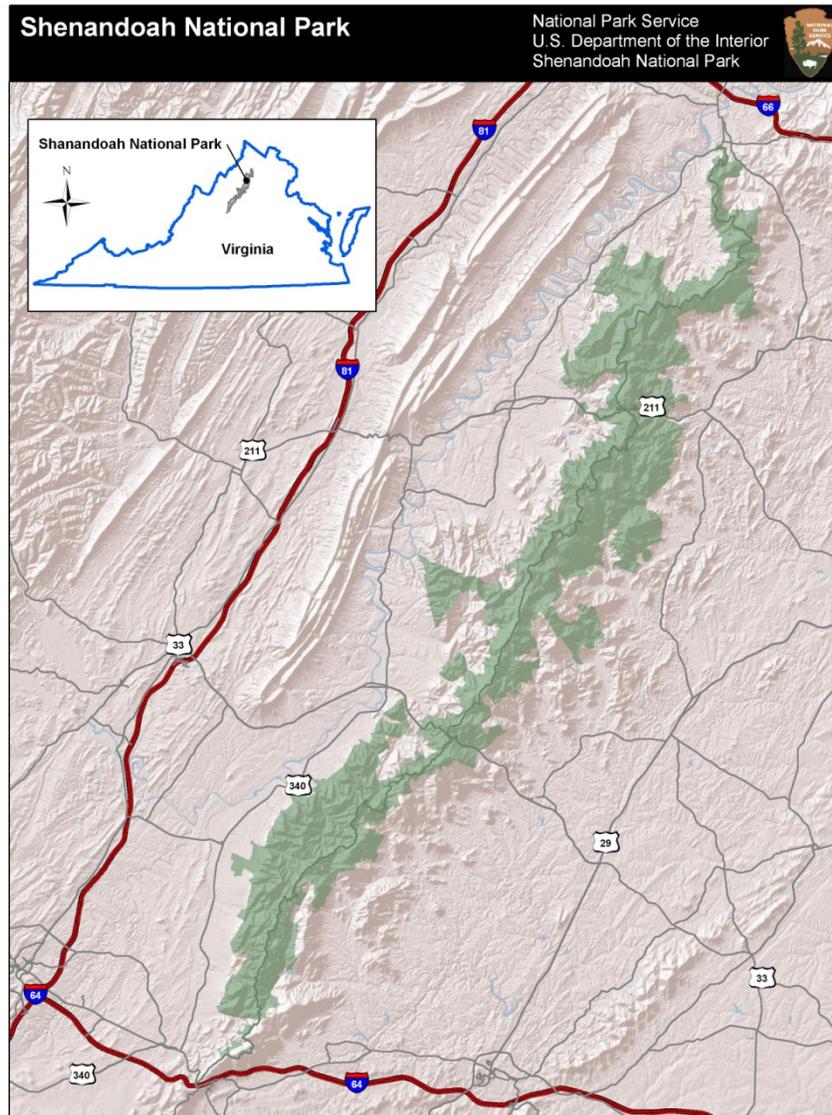
The Park is situated in the mountains of northern Virginia within the Blue Ridge physiographic province. Its length is about 112.0 km (70.0 mi) from Front Royal at the northeastern terminus to Rockfish Gap at the southeastern end, with a maximum width of 21.4 km (13.4 mi) (Gathright 1976). Skyline Drive, a world-famous park tour road, traverses the length of the Park along the crest of the Blue Ridge for 168.6 km (105.4 mi). Numerous trails form circuit hike opportunities off of Skyline Drive as part of the Park’s 804.7km (500 mi) trail system (NPS 1998). Included in this trail system is 162.6 km (101 mi) of the Appalachian Trail (See Figure 1).

The Park straddles habitats of both the northern and southern Appalachians and supports a rich assemblage of approximately 2,100 species of flora and fauna. Rock outcrops punctuate this otherwise forested habitat and compose approximately 2% (1,586 hectare, 3920 acres) of the Park’s 78,400 hectare (197,438 acre) area. Outcrop slopes range from only moderately steep to sheer cliffs, and may be flush with the surrounding topography or rise up dramatically (See Appendix A for photos of rock outcrop types).

Though outcrops represent only a small area of the Park, they are some of the largest outcrops in the region and serve as islands of unusual habitat supporting rare species assemblages. Given the relatively high elevation of many rock outcrops in the Park, these areas provide habitat for unique communities of species that are typically only found in northern regions.

Rock outcrops are also very popular visitor destinations for hiking, rock climbing, camping and vista enjoyment at the Park. The location of Skyline Drive along the ridgeline and the 500 miles of hiking trails provide exceptional access to many outcrops for a large number of the Park’s 1.1 million annual visitors. For example, one of the Park’s most popular hiking and climbing destination, Old Rag Mountain, has a summit area rich in rare species which is visited by an estimated 50,000 people annually. Visitation at one of the Park’s most accessible peaks (Stonyman Mountain) averaged 980 people per week during the summer and fall of 2002 (Hilke 2002). One popular climbing guide identified 27 separate rock climbing areas within the Park, describing each area and the numerous climbing routes in detail (Watson 1998). The availability of trail information and outcrop locations, as well as the ease of accessibility to some of these outcrops makes them highly susceptible to impacts from intense visitor use (See Table 1). Rock outcrops within the Park and the natural resources associated with outcrops was a top management concern in the Park’s Backcountry and Wilderness Management Plan (NPS 1998) because visitor access, recreational use, and associated impacts to outcrop areas were known to be unrestrained and substantial.

**Figure 1: Map of Shenandoah National Park Lands**



Visitor and recreational use of the rock outcrop areas is increasing. According to the observations of long-time Park climbing enthusiasts, the popularity of the Park for rock climbing and bouldering has increased within the last ten years. The Park's rock outcrops are regularly used by near-by universities and outdoor organizations for climbing classes and activities and the Park's concessioner sponsors climbing activities in the Park. With increased use, the visitor experience has also been compromised through overcrowding at popular peaks and climbing areas, waste disposal issues, trail obstruction from climbing activities, and impacts from campers.

In addition to providing a valuable visitor experience, rock outcrops also provide habitat islands and harbor species valuable for state and global conservation. These species are often disjunct from northern populations, making natural re-establishment highly unlikely if populations are lost. The inherent growing conditions found at rock outcrop habitats are tenuous and extreme. Exposed habitats are subjected to desiccation from wind and high levels of solar radiation. They regularly experience low winter temperatures, high winds,

and ice storms. Steep inclinations and the absence of soil inhibit substrate water retention during periods of drought. As a result of these harsh environmental factors, the growth rate of rock outcrop plants and lichens is inhibited (Fleming et al. 2007). Due to the extreme environmental conditions, once these rock outcrop plant communities have been damaged or destroyed, the re-establishment of plant communities, may take generations if possible at all (Fleming et al. 2007).

**Table 1: Images of Pristine Rock Outcrops and Impacted Rock Outcrops**

<b>Pristine Condition</b>	<b>Impacted Condition</b>
Loft Mountain Remote Area	Loft Mountain Summit
	
Marys Rock Southend	Marys Rock Northend
	
Stony Man	Stony Man
	

The vegetative communities that thrive on rock outcrops are very susceptible to human impacts from hiking and climbing activities. Intense visitor use of rock outcrop areas, such as informal social trail development and proliferation, illegal or poorly located campsites, and human waste disposal issues has led to widespread resource impacts. Trampling by hikers and rock climbers stresses rock outcrop plant communities. For

example, individual plants may be crushed underfoot and outcrop soils may be compacted, blown, or washed away once vegetation is removed or destroyed. Additionally, the seed of non-native plant species may be inadvertently brought into outcrop areas by hikers on their boots, where it may thrive in areas disturbed by human impacts (Fleming et al. 2007).

## Relationship of Proposal to Other Planning Projects

The NPS has completed a variety of planning documents to guide the management of the Park. Listed below are several plans and studies that have informed and led to the development of alternatives for the ROMP EA/AoE:

### **General Management Plan**

The 1983 General Management Plan (GMP) provides a "10- to 15-year blueprint of programs and facilities for continuing the mission that started at Shenandoah National Park over half a century ago." The GMP prescribes comprehensive programs for park preservation, interpretation, visitor use, development, and administration. It states that the Park's primary management goal is to continue providing diverse recreational opportunities that are compatible and commensurate with the resources present, so that the use and enjoyment experienced by visitors since establishment of the Park is perpetuated. The Park's GMP makes no specific reference to management of rock outcrops.

### **Backcountry and Wilderness Management Plan**

The Park's 1998 Backcountry and Wilderness Management Plan (BWMP) sets management objectives for backcountry and wilderness conditions to manage recreation carrying capacity. The Park's resource, social and managerial settings, and management zones (recreation opportunity classes) are described. Wilderness is zoned ranging from "primitive wilderness" to "threshold wilderness" and management strategies are designed to manage backcountry and wilderness recreation use and impacts park-wide. Rock outcrops are contained within this range of management zones.

### **Resource Management Plan**

The Resource Management Plan (RMP) is a continually evolving broad action plan developed to provide direction and continuity and to establish priorities for the protection and preservation of park natural and cultural resources. The RMP was last updated in 1998. The RMP addresses numerous natural and cultural resource program areas for strategic planning, including backcountry and wilderness management planning to protect and perpetuate the resources of the Park.

### **Comprehensive Plan for the Appalachian Trail**

The Comprehensive Plan for the Appalachian Trail, prepared in 1981 and abridged in 1987, describes a management system for the Appalachian Trail (AT) called the "Cooperative Management System," which relies on local partnerships among individual trail clubs and agency partners in a decentralized consultation and decision-making process. Management and maintenance of the AT in the Park is a cooperative effort of the Potomac Appalachian Trail Club (PATC), the Appalachian Trail Conservancy (ATC), the Appalachian Trail Park Office (ATPO), and the Park. This plan calls for special concern for retaining the values of lands that are wild and primeval. It also calls for the protection

of wilderness values where the trail passes through designated wilderness. These underlying concepts support the idea that rock outcrops along or near the Appalachian Trail should be managed in a manner that protects their ecological and wildland value.

### **Character and condition of geological resources of interest to the Rock Outcrop Management Project**

This report provides a comprehensive overview of the geology of the Park and in-depth site reports for each of the fifty study sites included within inventory work performed for the Rock Outcrop Management Project. Individual site reports include digital and hand-drawn maps of geological features at each site, and multiple color photographs of each site.

### **Detailed Implementation Plan: identify and assess cliff resources and visitor use, develop and implement cliff management planning**

The Rock Outcrop Management Project Detailed Implementation Plan outlines the project justification and background. The document also includes detailed information on the budget and specific tasks to be completed within each of the project's nine primary task areas. Task 1 – rock outcrop mapping. Task 2 – botanical and zoological surveys of cliff areas. Task 3 – classify plant communities. Task 4 – study geological composition and condition. Task 5 – conduct recreation use survey. Task 6 – conduct social science survey. Task 7 – write cliff management plan and environmental assessment. Task 8 – initiate management activities. Task 9 – interpretive component.

### **A natural heritage inventory of the rock outcrops of Shenandoah National Park**

The natural heritage inventory report is a large comprehensive summary of all plant, animal, and stewardship inventory work completed as part of the Rock Outcrop Management Project. The report includes comprehensive methods for each type of inventory, as well as detailed tables of rare and watch-listed species and communities identified during survey work. The document concludes with detailed site reports for each of the fifty study sites included within the Rock Outcrop Management Project inventory. Each of these summary reports includes: a list of rare species, a site description, descriptions of the rare species and communities, a summary of threats, site management recommendations, and a map showing the location of rare resources.

### **Social science research on recreational use and users of Shenandoah National Park's rock outcrops and cliffs**

The research presented in this report includes a visitor survey administered to rock climbers at Little Stony Man Cliffs and Old Rag Mountain from May to November, 2005 and direct, unobtrusive observations of visitor use on the cliff-top of Little Stony Man Cliffs conducted between May and September, 2005. This report describes the methods used to conduct the visitor survey and observation research, presents results of the survey and observation studies, and summarizes major findings designed to help inform the National Park Service's planning efforts.

### **Mapping outcrops in Shenandoah National Park: Final Report**

This report summarizes the methods used to analyze aerial photography and satellite imagery to determine the location of all rock outcrops within Shenandoah National Park.

2,105 outcrops were mapped. The sizes of outcrops ranged from < 1 ha to 2.4 ha. The average size of outcrops was 0.42 ha.

### **Peregrine Falcon Protection and Restoration**

Since 2000, the Park's Natural Resource Management staff has been engaged in a Peregrine Falcon restoration program undertaken in cooperation with the Center for Conservation Biology at William and Mary and the Virginia Department of Game and Inland Fisheries. The Peregrine falcon is a state threatened species and mountain populations of this raptor are experiencing particularly slow recovery. The recovery program takes young Peregrine falcons from nests on southeastern Virginia bridges and moves them to a safer foster nest site on the cliffs of Hawksbill Mountain. This increases the survival rate of chicks because they no longer prematurely fledge over open water, and boosts peregrine falcon populations in the Central Appalachians. The Peregrine falcon restoration program has released 66 birds from 2000-2007. Sixty of these birds successfully fledged.

The foster nest site for Peregrine falcon on Hawksbill Mountain is protected by a temporary trail closure. This closure impacts about 80 meters of trail that runs along the cliff top. During the closure (April– August) this portion of the cliff vegetation and other natural resources receives less disturbance from human trampling. However, some areas adjacent to the closure receive greater trampling from visitors and park staff as a result of the daily falcon monitoring, and increased visitor interest in the site that results from the presence of the young falcons. The areas of increased impact are relatively small, and take place in an area already heavily impacted by visitor use. Whereas the 80 m trail closure protects a much more pristine cliff-top rare plant habitat. Therefore, overall there is less impact to cliff sites as a result of the Peregrine falcons protection and restoration.

An additional temporary closure for Peregrine Falcons is also used at the summit of Stony Man Mountain. This closure does not affect any hiking trails. It only restricts rock climbers and rock scramblers from using the cliffs below and to the northwest of the summit. The closure is in place to provide naturally nesting Peregrine pairs an adequate buffer from human disturbances. The closure has a positive effect on protecting rare plant populations located within the protected area by reducing trampling impact.

### **Rare Plant Monitoring**

Periodic monitoring is done at all rock outcrop and cliff areas that contain rare plants populations. Most rare plant populations are monitored by Park staff once every five years. However, a subset of the rare plant populations at 18 high-use rock outcrop or cliff areas are monitored by volunteers working within the Adopt-an-Outcrop Program (AOP). AOP field sites are visited three to nine times a year depending on the sensitivity of the site and the threats from human use. Rare plant populations included with the AOP are primarily monitored using photopoints to minimize trampling impact to sensitive areas. AOP monitoring provides greater protection of the area by increasing the presence of uniformed staff and providing visitor education about the sensitivity of rock outcrop natural resources.

### **Exotic Plant Control**

Invasive exotic plants threaten native plants and animals by changing or destroying their habitat. When exotic species invade an area, the biological diversity is decreased and detrimental changes can occur to the stand structure, species interactions, and species composition.

Park staff is engaged in invasive exotic plant control at a variety of sites within the park. At these sites, chemical and mechanical methods are routinely used to reduce the cover of invasive exotic plants. Chemical methods of exotic plant control include the use of herbicides such as Imazapic, Glyphosate, and Triclopyr. Mechanical methods of removal include hand pulling, bypass loppers, and chainsaw.

Invasive exotic plants such as *Poa compressa* (Canada bluegrass), *Alliaria petiolata* (Garlic mustard), *Ailanthus altissima* (Tree of Heaven), *Centaurea biebersteinii* (spotted knapweed), *Microstegium vimineum* (Japanese Stilt Grass), and *Polygonum caespitosum* (Oriental Lady's Thumb); occur near or within some rock outcrop plant communities. At the current time there is no park-wide effort to remove these species from rock outcrop areas. Exotic plant control on rock outcrops and cliffs is limited to very minor manual plant removal work specifically requested by the Park's native plant monitoring staff of the Park's exotic plant management staff. Park staff and Adopt-an-Outcrop Program (AOP) volunteers currently survey for invasive species that occur near or within rare plant populations. Decisions about plant removal are scheduled to be made on a site-by-site basis and will likely include only small scale manual and chemical removal efforts.

### **Gypsy Moth Control**

The European gypsy moth (*Lymantria dispar*) arrived at the Park in 1981. As the insect spread throughout the park, severe defoliation led to oak mortality exceeding 50% of trees in some areas of the Park. Gypsy moth suppression efforts were first initiated in 1986 and took place through 1995. Suppression was done with biological and chemical controls including Bt (*Bacillus thuringiensis*) and Diflubenzurone/Dimilin. The goal of suppression was to preserve trees in areas of Shenandoah Salamander habitat (Hawksbill, Stony Man, and Little Stony Man), a corridor along Skyline drive, and in other developed areas.

The Park gypsy moth population collapsed between 1995 and 1996 as a result of the *Entomophaga maimaiga* fungus. The fungus continued to control the gypsy moths reasonably well until 2002. Since that time, the gypsy moth defoliation of 2000-3000 acres has occurred yearly. In 2008 the Park collaborated with the U.S. Forest Service to aerially spray the fungus Btk (*Bacillus thuringiensis* var. *kurstaki*) on 2500 acres of forest along the Skyline Drive corridor in the North District of the Park. The spray corridor was about 200 meters to either side of Skyline Drive.

Current impacts from Btk spraying to rock outcrops are minimal to negligible. Btk poses no risk to human health. It is considered a biological insecticide and is only effective against lepidopterans (moths and butterflies). The 2008 spraying did not impact any rock outcrop or cliff communities studied as part of the ROMP. However, it did likely have an impact on the lepidopteran populations at small outcrops and cliffs associated with Skyline Drive overlooks within the spray zone.

Future spraying of Btk could impact rare invertebrates known to occur on rock outcrops. Negative impacts can be avoided by assuring that Btk and other pesticides that target lepidopterans are not sprayed at any of the sites mentioned in Fleming et al. Table 17. This includes sites such as Crescent Rocks, South Marshall Cliffs, Blackrock Central District, Blackrock South District, and Gooney Manor Overlook.

### **Recovery Plan for the Shenandoah Salamander**

In 1994, the U.S. Fish and Wildlife Service, in concert with park staff, prepared a Recovery Plan for the Shenandoah Salamander. The recovery plan summarizes what is known about the species, explains why the species is considered endangered, and outlines steps that need to be taken to “recover” the species from this imperiled status. A five year review of the endangered status of the Shenandoah salamander was initiated in January 2008 by FWS.

### **Study to determine Monitoring Procedures**

The National Park Service, in collaboration with scientists from the U.S. Geological Survey and the Virginia Department of Game and Inland Fisheries, is currently engaged in a two year study designed to determine practical monitoring procedures for the Shenandoah salamander. The ultimate goal of the study is to design a long-term monitoring program to detect future change in the remaining three populations of Shenandoah salamander and explore natural and human-related factors that may be responsible for population change.

### **National Park Service Policies and Actions**

Based on discussions with NPS staff and planning team members, implementation of this ROMP EA/AoE should not require any changes to existing legislation or management policies. Appendix E provides a detailed list of the federal and state regulations and guidelines related to this project, as well as applicable NPS guidelines and Director’s Orders.

## **SCOPING, PLANNING ISSUES, AND IMPACT TOPICS**

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Scoping is an early and open process to determine the breadth of environmental issues and alternatives to be addressed in a NEPA document. Scoping is used to identify which issues need to be analyzed in detail and which can be eliminated from in-depth analysis. It also allocates assignments among the participating members and/or other participating agencies; identifies related projects and associated documents; identifies permits, surveys, consultations, and other requirements, and creates a schedule that allows adequate time to prepare and distribute the EA/AoE for public review and comment before a final decision is made. Scoping efforts include any staff, interested agency, or any agency with jurisdiction by law or expertise; including the State Historic Preservation Office, Tribal Historic Preservation Office, or U.S. Fish and Wildlife Service. Scoping may also include interested or affected organizations and individuals.

During scoping, the Park contacted federal and state agencies with jurisdiction and/or special expertise to inform them of the proposed action, to request information, and

identify potential issues with the preferred alternative. The Park has initiated consultation with the U.S. Fish and Wildlife Service (USFWS) and the Virginia State Historic Preservation Office (VA SHPO) by letter and consulted extensively with the Virginia Department of Conservation and Recreation's Division of Natural Heritage (VA-DNH). The Park will continue to consult with these agencies throughout the planning process and, as necessary, through implementation of the project.

## Internal Scoping

Internal scoping about rock outcrop issues in the Park began in 2001 as discussions between NPS and VA-DNH regarding human-caused damage to rare plant populations. In response to these discussions, the Park conducted a summer-long study in 2002 to examine the status of rare plant populations and the intensity of human use and impacts at three rock outcrop sites (Hilke 2002). The results of this study confirmed high levels of human use resulting in damage to rare plant communities and emphasized the complexity of the situation.

As of 2002, the Park had scant information about park-wide cliff (rock outcrop) resource conditions and the visitor recreation activities that were presently, or could potentially affect those conditions with the exception of Little Stony Man Cliffs which had been the subject of recent intensive research. Based on that information, and the knowledge that recreational uses were causing long-term impacts to sensitive vegetative environments at certain rock outcrops, a project to examine park-wide cliff resource conditions and the impacts recreational activities have on those resource conditions was designed and proposed for Natural Resource Preservation Program (NRPP) funding in 2003.

Additional scoping was completed in 2002 and 2003 by an interdisciplinary team of park staff through meetings and a field trip. Issues identified by this team included:

- Protection of natural and cultural resources, including concern for the stability of globally rare plant communities, and state-rare plants and animals from trampling and other human impacts
- Lack of information on the exact number and location of rock outcrops, cliffs, boulderfields, and their associated natural resources
- Protection of unique and exceptional visitor experiences including rock climbing areas and favorite viewpoints
- The existence of permanent climbing bolts/hardware in wilderness and non-wilderness
- Visitor safety, including excessive climbing group size, use of unsafe climbing anchors, rock throwing from cliff tops, and trail obstruction from climbing ropes
- Illegal camping and the associated impacts to native plant communities
- The possibility of designating certain areas as National Historic Landmarks

Based on information gathered from earlier efforts, it became clear that the Park needed a formal planning document to guide management decisions regarding rock outcrops and special recreation activities including climbing.

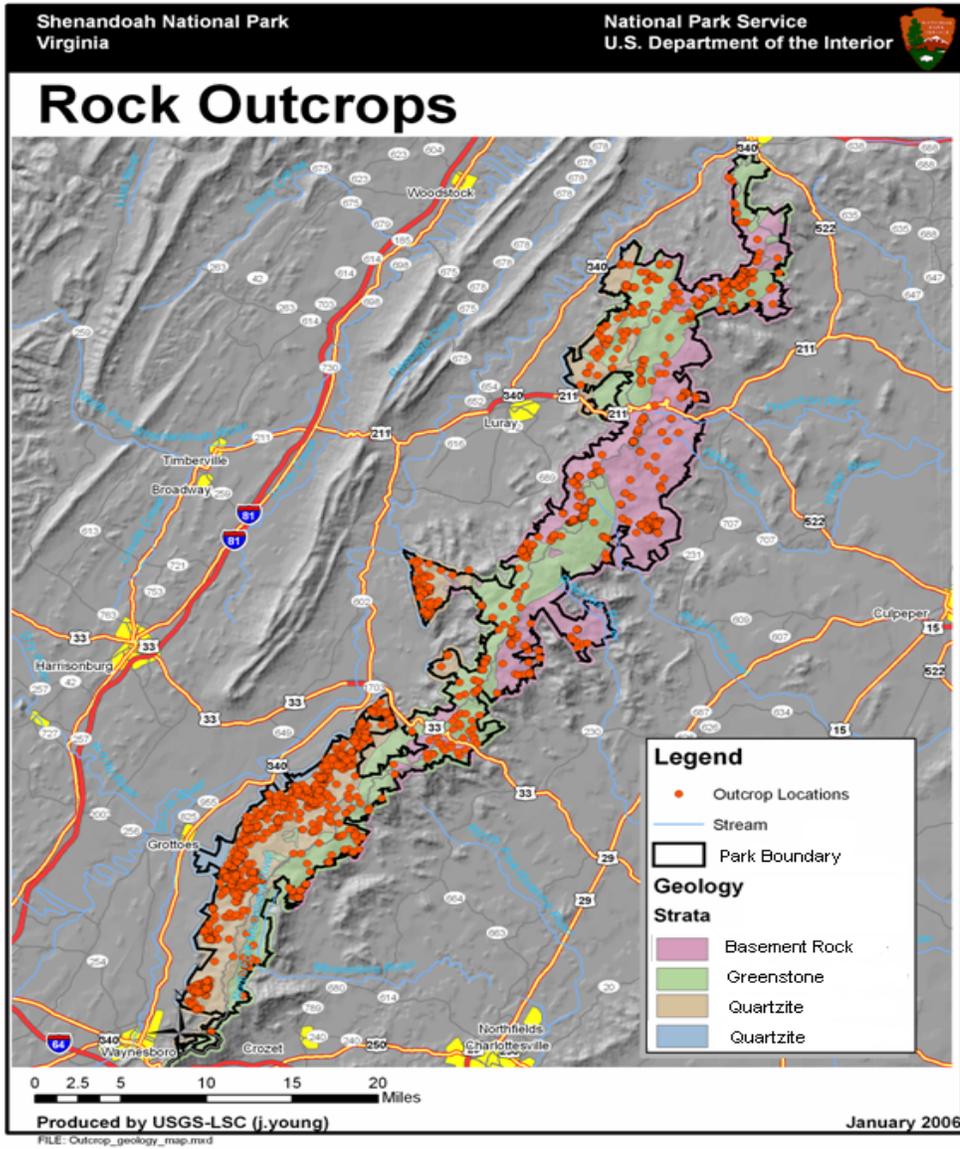
### **Rock Outcrop Management Project**

In 2005 the Park obtained three year National Resource Protection Program funding and the Rock Outcrop Management Project was implemented with the assistance of other agency partners and universities to study the Park's rock outcrops.

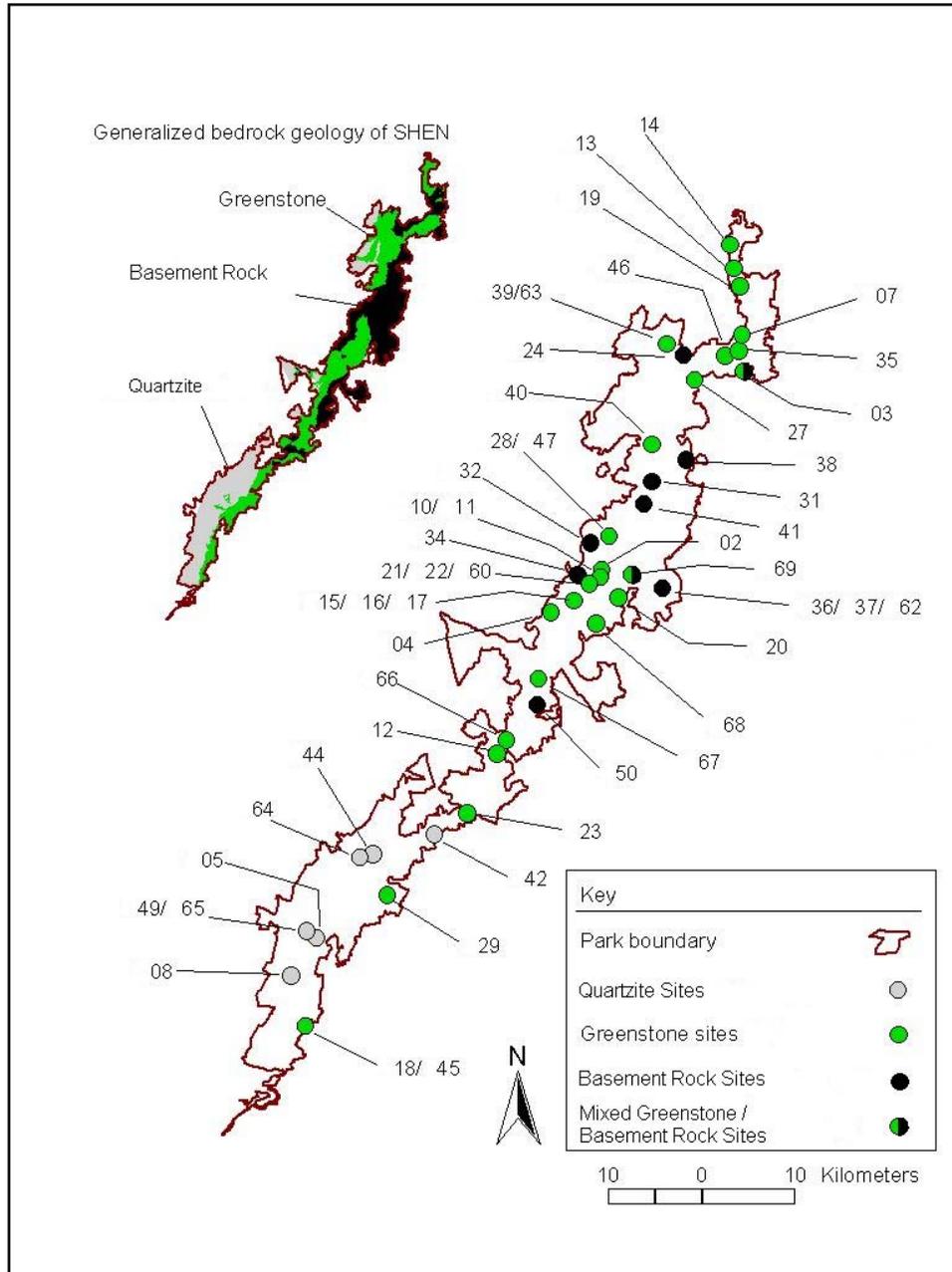
The goal of the Rock Outcrop Management Project was to collect information on rock outcrops including: locations, geology, ecological communities, important biological resources, and threats to those biological resources. Information would also be gathered on visitor recreational uses and their impacts on rock outcrop sites throughout the Park, including climbing. The collected information would be used to create conceptual models of rock outcrop site types on which to base management decisions and monitoring of rock outcrops. A typical rock outcrop "site" is composed of a cluster of rock outcrops, of variable size, some of which are quite small (approximately 10 x 3 feet). A rock outcrop study site is synonymous with a rock outcrop "complex" or group of outcrops.

Part of the Rock Outcrop Management Project entailed completing an inventory of natural heritage resources for the rock outcrops. Of the 2,105 rock outcrops in the Park, 50 were selected to inventory (See Figure 2, Figure 3, and Table 2).

Figure 2: Map of Project Area and All Rock Outcrop Locations



**Figure 3: Map of 50 Rock Outcrop Locations Identified in Rock Outcrop Management Project**



Previous natural heritage inventories in the Park provided a knowledge base for identifying these sites. Using aerial digital imagery a search was conducted to identify new sites not previously inventoried by VA DCR. Using GIS methods, a USGS researcher generated a map of potential sites that was compared to a map of known sites. Three criteria were used to develop a master list from which 50 study sites were selected: 1) Known occurrences of natural heritage resources, 2) Urgent management issues due to intensity of visitor use/popularity, 3) Sites that represented all the major lithographic groups found in the Park (Catoctin Formation metabasalt, Old Rag granite, Chilhowee Group silicilastic rocks, charnockite, layered pyroxene granulite, and the Swift Run Formation).

**Table 2: Rock Outcrop Management Project Study Sites by Park District**

Site ID #	Site Name	Park District
02	Bettys Rock	Central
03	Big Devils Stairs	North
04	Blackrock Central District	Central
05	Blackrock South District	South
07	Browntown Valley Overlook	North
08	Calvary Rocks / Chimney Rock	South
10	Crescent Rock Overlook	Central
11	Crescent Rock South	Central
12	Dean Mountain Ridge	Central
13	Dickey Hill	North
14	Dickey Ridge	North
15	Franklin Cliffs North	Central
16	Franklin Cliffs Overlook	Central
17	Franklin Cliffs South	Central
18	Goat Ridge	South
19	Gooney Manor Overlook	North
20	Halfmile Cliff	Central
21	Hawksbill N Slope Outcrops	Central
22	Hawksbill Summit	Central
23	Hightop	South
24	Hogback Mountain Spur	North
27	Little Devils Stairs	North
28	Little Stony Man	Central
29	Loft Mountain Summit	South
31	Marys Rock	Central
32	Millers Head	Central
34	Nakedtop Upper East Slope	Central
35	North Marshall Summit	North
36	Old Rag Southside	Central
37	Old Rag summit East	Central
38	Oventop	North
39	Overall Run Falls South	North
40	Pass Mountain	North
41	Pinnacles	Central
42	Powell Gap Cliff	South
44	Rocky Mountain	South
45	Sawlog Ridge	South
46	South Marshall Cliff	North
47	Stony Man Summit	Central
49	Trayfoot Saddle boulderfields E	South
50	Upper Devils Ditch	Central
60	Hawksbill North slope talus	Central
62	Old Rag Summit West	Central
63	Overall Run Falls North	North
64	Brown Mountain	South
65	Trayfoot Saddle boulderfields W	South
66	Field Hollow Cliff	Central
67	Bearfence	Central
68	Rose River	Central
69	Whiteoak Canyon	Central

From the new sites identified by this method, several reconnaissance field trips were made, and those sites that showed potential for natural heritage resource occurrences were added to the master list.

A multi-agency study of the 50 selected outcrop sites was conducted in 2005 and 2006. The study assessed recreational use and visitor-caused resource impacts; where conflicts between resource preservation and visitor use are most likely to occur; created a comprehensive inventory of natural heritage resources; developed a classification of the geologic composition and condition of outcrops sites; and surveyed the outcrops rare plants and animals and important natural communities (Butler 2006, Fleming et al. 2007, Wood et al. 2006, Young 2006). A climbing survey was also conducted.

The 50 rock outcrops delineated for the Rock Outcrop Management Project have been divided into seven management categories based on site size, complexity, ecological value, and degree of impact. Each Management Category is designated by a two letter code composed of an Ecological Value Class and an Impact Class: (High (H), Medium (M), or Low (L)) (See Table 3 & Table 4). The seven management categories are listed in Table 5. Two management categories, Little Stony Man Mountain and Old Rag Mountain, consist of single complex sites. The remaining five management categories have been defined according to the ecological value and level of human impact present at rock outcrop sites.

All rock outcrops in the Park can be assigned to a management category. Future rock outcrops can be assigned a management category by assessing the site for ecological value and impacts and assigning an Ecological Value Class and an Impact Class.

**Table 3: Ecological Value Class for Management Categories**

Ecological Value	
H (High)	Sites that contain one or more natural resource classified as endemic to the Park, which is ranked as globally significant (G1 and G2) or is the only known record for a species in the state of Virginia
M (Medium)	Sites that contain one or more natural resource classified as state rare and have global rarity ranks of G3 or greater
L (Low)	Sites that contain no natural resource classified as state or globally rare

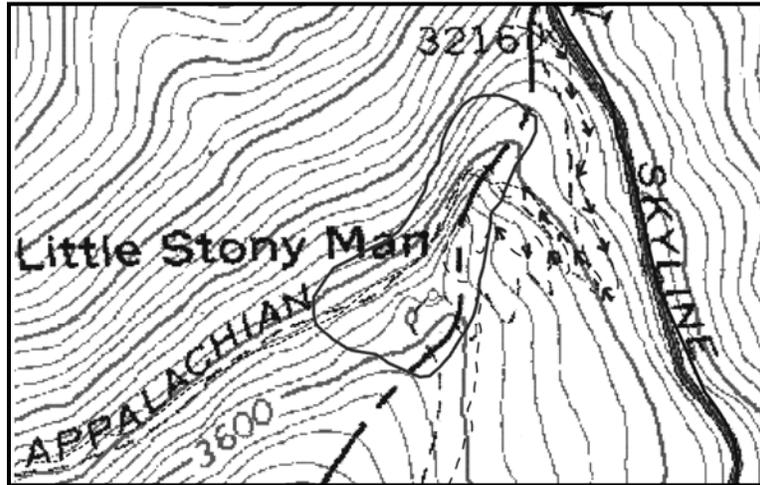
**Table 4: Impact Class for Management Categories**

Impact Class	
H (High)	Sites accessible by formal trails and or the Skyline Drive and the soil and vegetation cover have high levels of human-caused impacts
M (Medium)	Sites with moderate levels of human impact, are poorly accessible but immediately adjacent to a high-use sites; or sites that are easily accessible but are not popular visitor destinations
L (Low)	Sites not accessible by formal trails, or can only be reached by a moderate to long trail hike. The site is not a popular human destination and exhibits little or no signs of human impact.

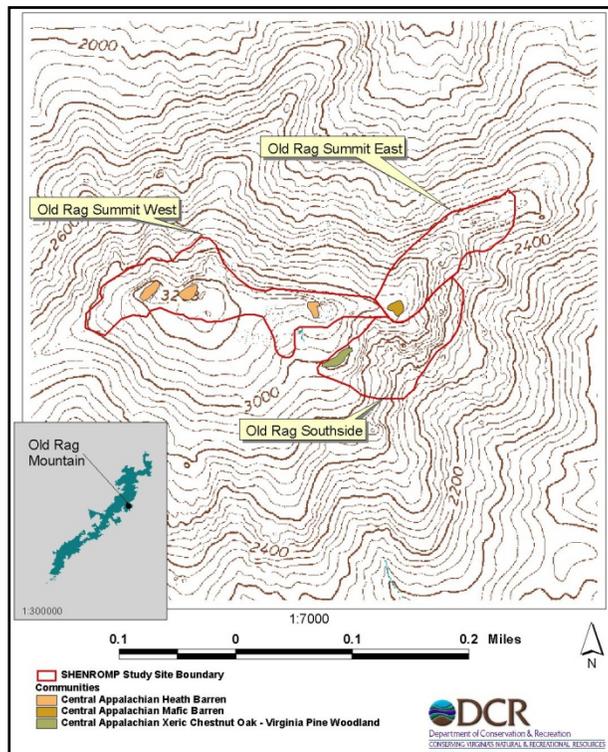
**Table 5: Rock Outcrop Management Categories**

<b>Management Category</b>	
Little Stony Man Mountain	The Little Stony Man group includes all rock outcrop areas within the boundary of Little Stony Man Mountain. See Figure 4. This study site is considered as a unique management category because it is a complex area to manage because it has intense visitor use, strong public interest, and extremely sensitive natural resources.
Old Rag Mountain	All rock outcrop areas within the boundary of Old Rag Mountain. See Figure 5. The Old Rag Mountain group applies to three ROMP sites. The Rock Outcrop Management Project sites at Old Rag Mountain are being considered as a unique management category due to the mountain's heavy visitor use, strong public interest, and sensitive natural resources. <ul style="list-style-type: none"> <li>▪ Old Rag South Side</li> <li>▪ Old Rag Summit East</li> <li>▪ Old Rag Summit West</li> </ul>
Category One (HH)	Areas that support globally rare flora and/or fauna, and that have sustained widespread human impacts. Category One applies to 12 study sites evaluated as part of the Rock Outcrop Management Project. <ul style="list-style-type: none"> <li>• Bettys Rock</li> <li>• Crescent Rock Overlook</li> <li>• Crescent Rock South</li> <li>• Franklin Cliffs Overlook</li> <li>• Franklin Cliffs South</li> <li>• Hawksbill Summit</li> <li>• Loft Mountain summit</li> <li>• North Marshall summit</li> <li>• South Marshall cliff</li> <li>• Stony Man Summit</li> <li>• Overall Run Falls North</li> <li>• Bearfence Mountain</li> </ul>
Category Two (HM)	Areas throughout the Park that support globally rare flora and/or fauna, and that have sustained moderate human impacts. Category Two applies to nine study sites evaluated as part of the Rock Outcrop Management Project. <ul style="list-style-type: none"> <li>• Big Devils Stairs</li> <li>• Blackrock Central District</li> <li>• Blackrock South District</li> <li>• Gooney Manor Overlook</li> <li>• Hawksbill N slope outcrops</li> <li>• Hightop</li> <li>• Marys Rock</li> <li>• Pass Mountain</li> <li>• White Oak Canyon</li> </ul>
Category Three (HL)	Outcrop areas throughout the Park that support globally rare flora and/or fauna, and that have sustained minor human impacts. Category Three applies to 17 study sites evaluated as part of the Rock Outcrop Management Project. <ul style="list-style-type: none"> <li>• Browntown Valley Overlook</li> <li>• Dickey Hill</li> <li>• Dickey Ridge</li> <li>• Franklin Cliffs North</li> <li>• Goat Ridge</li> <li>• Halfmile Cliff</li> <li>• Hogback Mountain spur</li> <li>• Little Devils Stairs</li> <li>• Millers Head</li> <li>• Nakedtop Upper East Slope</li> <li>• Oventop</li> <li>• Overall Run Falls South</li> <li>• Pinnacles</li> <li>• Sawlog Ridge</li> <li>• Hawksbill N slope talus</li> <li>• Field Hollow Cliff</li> <li>• Rose River Cliffs</li> </ul>
Category Four (ML)	Areas throughout the Park that support state rare or watch-listed flora and/or fauna, and that have sustained minor human impacts. Category Four applies to six study sites evaluated as part of the Rock Outcrop Management Project. <ul style="list-style-type: none"> <li>• Calvary Rocks - Chimney Rock</li> <li>• Dean Mountain Ridge</li> <li>• Rocky Mountain</li> <li>• Trayfoot Saddle boulderfields E</li> <li>• Brown Mountain</li> <li>• Trayfoot Saddle boulderfield</li> </ul>
Category Five (LL)	Category Five applies to two study sites evaluated as part of the Rock Outcrop Management Project as well as areas throughout the Park that contain no state or globally rare flora or fauna, and that have human impacts of any level. <ul style="list-style-type: none"> <li>▪ Powell Gap cliff</li> <li>▪ Upper Devils Ditch</li> </ul>

**Figure 4: Map of the Rock Outcrop Management Project Survey Site on Little Stony Man Mountain**



**Figure 5: Map of the Three Rock Outcrop Management Project Survey Sites on Old Rag Mountain, and the Locations of Rare Plant Communities of Concern**



### Identification of Resources and Site Ranking

The 50 study sites identified in the Rock Outcrop Management Project were assigned a Biodiversity Rank which has been used to summarize the overall significance of each site, and help prioritize conservation efforts (Table 6). Natural communities, plants, and animals were ranked based on global and state occurrences of rare natural resources using the Natural Heritage Ranking System. A detailed explanation of the ranking system is provided in Appendix B (Fleming et al. 2007).

**Table 6: VA-DNH Biodiversity Ranks for Rock Outcrop Study Site**

VA-DNH Biodiversity ranks for each rock outcrop study site. Lower numbers correspond to sites with greater ecological significance and higher conservation priority.		
Site ID	Study Site Name	Biodiversity Rank*
C02	Bettys Rock	B1
C67	Bearfence Mountain	B2
C03	Big Devils Stairs	B2
C04	Blackrock Central District	B2
C05	Blackrock South District	B3
C64	Brown Mountain	B5
C07	Browntown Valley Overlook	B2
C08	Calvary Rocks-Chimney Rock	B5
C10	Crescent Rock Overlook	B1
C11	Crescent Rock South	B1
C13	Dickey Hill	B2
C14	Dickey Ridge	B2
C66	Field Hollow Cliff	B3
C15	Franklin Cliffs North	B2
C16	Franklin Cliffs Overlook	B2
C17	Franklin Cliffs South	B2
C18	Goat Ridge	B2
C19	Gooney Manor Overlook	B3
C20	Halfmile Cliff	B2
C21	Hawksbill North Slope	B1
C60	Hawksbill North Slope Talus	B1
C22	Hawksbill Summit	B1
C23	Hightop	B2
C28	Little Stony Man	B1
C29	Loft Mountain Summit	B2
C31	Marys Rock	B1
C32	Millers Head	B1
C34	Nakedtop Upper East Slope	B1
C35	North Marshall Summit	B2
C36	Old Rag Southside	B2
C37	Old Rag Summit East	B2
C62	Old Rag Summit West	B2
C38	Oventop	B3
C63	Overall Run Falls North	B2
C40	Pass Mountain	B2
C41	Pinnacles	B1
C42	Powell Gap Cliff	B5
C44	Rocky Mountain	B5
C68	Rose River Cliffs	B2
C45	Sawlog Ridge	B2
C46	South Marshall Cliff	B2
C47	Stony Man Summit	B1
C69	Whiteoak Canyon	B2

Impact assessment data were collected between 2005 and 2006 by three sources: a social science team from Virginia Tech (VT), an independent geology contractor, and a stewardship biologist from the VA-DNH:

As part of the Rock Outcrop Management Project, researchers conducted detailed surveys of human trampling impact evidence at 16 ROMP study sites. Surveys were conducted in high-use areas above and below cliffs, at nearby campsites and on informal trails (Wood et al. 2006) (Table 7).

**Table 7: Evidence of Impacts Caused by Visitor Use**

Site ID Number	Site Name	Number of Cliff top impact sites	Number of Cliff base impact sites	Number of Campsites	Number of Social trails
02	Bettys Rock	1	0	0	3
04	Blackrock Central District	2	0	0	3
08	Calvary Rocks	2	0	1	0
10	Crescent Rock Overlook	2	0	0	1
16	Franklin Cliffs Overlook	2	0	0	1
19	Gooney Manor Overlook	0	0	0	1
22	Hawksbill Summit	5	0	0	4
28	Little Stony Man	5	3	3	6
29	Loft Mountain	2	0	2	1
31	Marys Rock	2	0	1	5
35	North Marshall	8	0	2	10
36	Old Rag Southside	0	3	0	2
46	South Marshall	3	0	0	2
47	Stony Man Summit	3	0	0	4
62	Old Rag Summit W.	5	0	1	17
63	Overall Run Falls N	4	0	0	0

Each of the 50 sites were given a general impact rating based on the overall physical condition of the rock exposures, considering such elements as rock graffiti, garbage, soil stripping, and social trails. Site impacts were rated as Pristine, Mild, Moderate, or Heavy. Impact ratings assigned in this study considered both the worst impact observed and the overall physical condition of the site. The potential for visitor access was rated as Remote, Difficult, Moderate, or Easy (Young 2006). (See Table 8)

The 50 rock outcrop sites were surveyed and ranked on the perceived threat to natural resources. The threat ranking was determined by adding together the invasive plant rank with a human impact rank. The human impact rank was a qualitative assessment of human-caused impact based on observations of trampling and vegetation loss within the site. A detailed explanation of rankings may be found in Appendix B (Table 9).

Together, these surveys found that 31 of the 50 study sites had at least some human impact to the rock outcrop natural resources. Observed human impacts varied widely between and within ROMP sites and included social trails, trampled or absent vegetation,

**Table 8: Site Access and Impact Ratings** (A detailed explanation of access and impact ratings is available in Appendix B.)

Site ID #	Site Name	Access rating	Impact rating
02	Bettys Rock	Easy	Heavy
67	Bearfence	Difficult	Heavy
03	Big Devils Stairs	Difficult	Mild
04	Blackrock Central District	Easy	Heavy
05	Blackrock South District	Easy	Moderate
64	Brown Mountain	Difficult	Mild
07	Browntown Valley	Remote	Pristine
08	Calvary Rocks	Difficult	Mild
10	Crescent Rock Overlook	Easy	Heavy
11	Crescent Rock South	Easy	Moderate
12	Dean Mountain	Remote	Pristine
13	Dickey Hill	Remote	Pristine
14	Dickey Ridge	Remote	Pristine
66	Field Hollow	Remote	Pristine
15	Franklin Cliffs North	Moderate	Mild
16	Franklin Cliffs Overlook	Easy	Heavy
17	Franklin Cliffs South	Moderate	Mild
18	Goat Ridge	Remote	Pristine
19	Gooney Manor Overlook	Easy	Moderate
20	Halfmile Cliff	Remote	Pristine
60	Hawksbill N. Talus	Moderate	Mild
21	Hawksbill North Face	Remote	Mild
22	Hawksbill Summit	Moderate	Heavy
23	Hightop	Moderate	Moderate
24	Hogback Mountain Spur	Remote	Pristine
27	Little Devils Stairs	Difficult	Mild
28	Little Stony Man	Moderate	Heavy
29	Loft Mountain	Easy	Moderate
31	Marys Rock	Moderate	Heavy
32	Millers Head	Moderate	Mild
34	Nakedtop	Remote	Pristine
35	North Marshall	Easy	Moderate
36	Old Rag Southside	Remote	Mild
37	Old Rag Summit East	Difficult	Heavy
62	Old Rag Summit W.	Difficult	Heavy
38	Oventop	Difficult	Mild
63	Overall Run Falls N	Difficult	Heavy
39	Overall Run South	Remote	Pristine
40	Pass Mountain	Moderate	Moderate
41	Pinnacles	Moderate	Mild
42	Powell Gap Cliffs	Moderate	Mild
44	Rocky Mountain	Difficult	Moderate
68	Rose River	Remote	Pristine
45	Sawlog Ridge	Remote	Pristine
46	South Marshall	Moderate	Moderate
47	Stony Man Summit	Moderate	Heavy
65	Trayfoot E.	Difficult	Pristine
49	Trayfoot W.	Difficult	Pristine
50	Upper Devils Ditch	Remote	Pristine
69	Whiteoak Canyon	Moderate	Mild

**Table 9: Site Human Impact and Threat Ranks** (A detailed explanation of rankings may be found in Appendix B.)

Site ID	Study Site Name	Human Impact Rank	Threat Rank
C67	Bearfence Mountain	3	5
C02	Bettys Rock	3	5
C03	Big Devils Stairs	2	4
C04	Blackrock Central District	2	2
C05	Blackrock South District	1	1
C64	Brown Mountain	1	1
C07	Browntown Valley Overlook	0	0
C08	Calvary Rocks-Chimney Rock	1	1
C10	Crescent Rock Overlook	3	5
C11	Crescent Rock South	1	2
C13	Dickey Hill	0	1
C14	Dickey Ridge	0	1
C66	Field Hollow Cliff	0	1
C15	Franklin Cliffs North	1	1
C16	Franklin Cliffs Overlook	3	4
C17	Franklin Cliffs South	3	4
C18	Goat Ridge	0	2
C19	Gooney Manor Overlook	2	2
C20	Halfmile Cliff	0	0
C21	Hawksbill North Slope	0	0
C60	Hawksbill North Slope Talus	1	1
C22	Hawksbill Summit	3	4
C23	Hightop	2	3
C28	Little Stony Man	3	3
C29	Loft Mountain Summit	3	3
C31	Marys Rock	2	2
C32	Millers Head	0	0
C34	Nakedtop Upper East Slope	0	0
C35	North Marshall Summit	2	2
C36	Old Rag Southside	1	1
C37	Old Rag Summit East	3	3
C62	Old Rag Summit West	3	3
C38	Oventop	0	1
C63	Overall Run Falls North	3	5
C40	Pass Mountain	2	2
C41	Pinnacles	1	1
C42	Powell Gap Cliff	1	1
C44	Rocky Mountain	1	1
C68	Rose River Cliffs	0	2
C45	Sawlog Ridge	0	2
C46	South Marshall Cliff	2	3
C47	Stony Man Summit	3	4
C69	Whiteoak Canyon	2	3

compacted or stripped soil, polished or tarnished rock surfaces, lack of lichens, rock graffiti, trash, fire rings, and footprints.

In general, accessible and frequently visited outcrops exhibited loss of vegetation, lichen, and soils, while remote sites or sites with no formal access had well-developed soils and plant and/or lichen communities. Most sites ranked high by Butler (2006) also had moderate to high threat rankings by VA-DNH. High threat rankings were not necessarily based on ease of access. For example, Overall Falls North and Bearfence are difficult to access, but still have a high VA-DNH threat rank. The four sites with the highest threat rank were: Bearfence Mountain, Bettys Rock, Crescent Rock Overlook, and Overall Run Falls North (Table 9). (Butler 2006, Fleming et al. 2007, and Wood et al. 2006)

Information gathered from the Rock Outcrop Management Project was used as a base for the ROMP and associated Climbing Management Guidelines. The 50 rock outcrops identified in the Rock Outcrop Management Project are representative of the 2,105 rock outcrops in the Park. It was determined the 50 sites were a sufficient number to encompass the types of rock outcrops in the Park. The system devised to rank the 50 rock outcrops into Management Categories can be applied to the preservation and maintenance of future rock outcrops that were not included in the rock outcrop sites studied in the Rock Outcrop Management Project.

### External Scoping

External scoping was conducted from April 2006 to September 2007 through a series of public workshops, meetings, and field trips (Table 10). The 50 sample sites and management categories developed through internal scoping were presented to the public. Additional input was received from e-mail communications and phone calls from interested organizations, agencies, and private citizens. Throughout the scoping, meeting announcements and project updates were communicated to the public and interested and affected groups and agencies using an extensive e-mail contact list.

**Table 10: List of External Scoping Meetings**

Date	Purpose	Location	Number of Participants
April 1, 2006	Project Overview / Scoping	Harrisonburg, Virginia	18
April 4, 2006	Project Overview / Scoping	Chantilly, Virginia	9
Aug. 19, 2006	Site Specific Scoping	Little Stony Man Mountain	25
Oct. 20, 2006	Project Overview / Scoping	Bailey's Crossroads, Virginia	3
Nov. 4, 2006	Site Specific Scoping	Old Rag Mountain	33
June 7, 2007	Progress Report / Scoping	Bailey's Crossroads, Virginia	7
June 11, 2007	Progress Report / Scoping	Harrisonburg, Virginia	9
Sept. 13, 2007	Management Plan & Assessment Review	Bailey's Crossroads, Virginia	30
Sept. 19, 2007	Management Plan & Assessment Review	Harrisonburg, Virginia	7

The following issues were raised by the public through external scoping:

- Need for keeping information readily available to the public throughout the process
- Need for hiker and climber education regarding sensitive areas and species
- Concern with implementing climbing permit system rather than using self-regulation
- Concern about closing areas with rare plants to public use
- There is a need to include “human value” in decisions along with “rare resources value”
- What are unacceptable levels of impact to natural resources?
- Consider the possibility of using climbing anchor systems
- Collaboration with climbing community to assess management options and actions
- Continued monitoring of impacts and site changes is important
- There is a need to protect the unique granite climbing experience at Old Rag
- Concern that Little Stony Man Mountain and/or Old Rag Mountain would be closed to rock climbing
- Special consideration must be given to Little Stony Man Mountain and Old Rag Mountain due to the unique resources and intensity of visitor use
- Importance of protecting rare communities
- Clarifying amount of impact caused by different user groups

Upon completion of the Rock Outcrop Management Project in 2007, the Park had identified and inventoried recreational impacts to rock outcrop resource conditions and developed alternatives, with public involvement, to determine strategies and a formal management plan to mitigate site impacts, monitor site conditions, and educate the public about rock outcrops and recreation impacts. The plan also includes the creation of Climbing Management Guidelines.

The issues identified during scoping were used to derive a number of impact topics to focus the environmental analysis presented in this ROMP EA/AoE. Impact topics are resources of concern that could be affected, either beneficially or adversely, by implementing any of the proposed alternatives. Impact topics were identified on the basis of federal laws, regulations, Executive Orders, NPS *Management Policies, 2006*, the NPS Environmental Screening Form (ESF), and NPS knowledge of resources. In completing the ESF the Park reviewed the proposed alternatives, considered the data needed to describe the affected environment, and predicted impacts of the alternatives.

### Impact Topics Retained for Analysis

The impact topics selected for detailed analysis in this EA/AoE include:

#### **Natural Resources**

- Geologic and Soil Resources
- Ecological Communities
- Rare, Threatened, and Endangered Plants
- Rare, Threatened or Endangered Species

## **Wilderness Character**

### **Cultural Resources**

- Cultural Landscapes
- Archeological Resources

### **Visitor Use**

- Climbing Activities
- Recreational Activities
- Visitor Experience

Chapter 3 describes the affected environment for each impact topic analyzed and Chapter 4 presents the potential impacts of implementing any of the alternatives.

## **Impact Topics Dismissed from Detailed Analysis**

During scoping, several impact topics were initially considered and then dismissed from detailed analysis in this ROMP EA/AoE. A brief rationale for the dismissal of each impact topic is provided below.

### **Air Quality**

The 1963 Clean Air Act, as amended (42 United States Code (USC 7401 et seq.), requires that federal land managers have a responsibility to protect air quality-related values from adverse air pollution impacts. Section 118 of the Clean Air Act requires parks to meet all federal, state, and local air pollution standards. Section 176(c) of the Clean Air Act requires all federal activities and projects to conform to state air quality implementation plans to attain and maintain national air quality standards. *NPS Management Policies 2006* addresses the need to analyze potential impacts to air quality during park planning. The Park is a Class I area under the Clean Air Act.

The proposed action would have minimal short-term impacts to air quality when motorized vehicles and equipment would be used to redirect trails and campsites. Hauling material, operating equipment, and construction activities could result in short-term increase of vehicle and equipment exhaust and emission. Overall, there could be a negligible impact to local air quality; however, such impacts would be short-term, lasting only until the end of construction. When completed, the proposed alternatives would have no impact to air quality. Therefore, the impact topic of air quality was dismissed from further analysis.

### **Wetlands**

Executive Order 11990 (“*Protection of Wetlands*”) requires federal agencies to examine the impacts of their actions to wetlands as well as their protection. *NPS Management Policies 2006*, DO-12, and Director’s Order #77-1: *Wetland Protection and accompanying Wetland Procedural Manual*, (2008) (DO-77-1) provide NPS guidelines on developments proposed in wetlands. National Park Service policies require protection of water quality consistent with the Clean Water Act. Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge of dredged or fill material or excavation within U.S. waters. Some rock outcrop areas have spring fed wetland systems. Seeps are usually seasonal, dependent on precipitation levels, are generally intermittent and not limited to any one

classification of outcrops. There are no recommended management activities of the ROMP that would potentially impact the seeps or springs at any outcrops. Therefore, wetlands were dismissed from further analysis.

### **Floodplains**

Executive Order 11988 (“*Floodplain Management*”) requires federal agencies to examine the impacts of their actions to floodplains and the potential risk involved in placing facilities within floodplains. NPS *Management Policies 2006*, DO-12, and *Director’s Order #77-2: Floodplain Management and accompanying Procedural Manual* (2003) (DO-77-2) provide guidelines on developments proposed in floodplains and wetlands. The location of the Park’s rock outcrops on ridges and slopes discounts even the most remote possibility of any outcrop being sited in or near floodplains. Therefore, floodplains were dismissed from further analysis.

### **Water Quality**

NPS *Management Policies 2006*, NPS DO#77: National Resources Management along with the Clean Water Act provides general direction for the protection of surface and ground waters. Some rock outcrop areas in the Park contain wetland systems fed by seeps or springs. Water from these sources is most often seasonal, depends on precipitation levels, and is generally intermittent. The management activities of the ROMP would not potentially impact seeps or springs at the outcrops therefore, water quality was dismissed as an impact topic in this document.

### **Wild and Scenic Rivers**

Nationally designated Wild and Scenic Rivers are rivers that must be free flowing and possess an “outstandingly remarkable” geologic, historic, cultural, natural or recreational resource. There are no wild and scenic rivers in the study area. Therefore, Wild and Scenic Rivers was dismissed from further analysis.

### **Prime and Unique Farmlands**

In August 1980, the Council on Environmental Quality directed that federal agencies assess the effects of their actions on farmland soils classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) as prime or unique (Council on Environmental Quality, 1980). Under the Farmland Protection Policy Act (FPPA) (7 USC 4201), prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion (7 USC 4201(c)(1)(A)). Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, fruits, and vegetables (7 USC 4201(c)(1)(B)).

None of the ROMP sites occur within areas identified as prime or unique farmland. No site is closer than 700 meters to identified prime farmland, as classified in the USDA NRCS Soil Maps. None of the sites occur within farmland of statewide importance, or are closer than 50 m to such soil. Soil classification maps on the USDA NRCS Web Soil Survey were used to make these determinations (Soil Survey Staff, no date).

The land in the study area is not classified as farmland, is not currently used for agricultural purposes, and the alternatives are not going to change the way the land is used; therefore the impact topic of prime and unique farmlands was dismissed from further analysis.

### **Low Income or Minority Populations and Environmental Justice**

Executive Order 12898 (“*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*”) requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities.

According to the Council on Environmental Quality, environmental justice is the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (Council on Environmental Quality, 1997). Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

There are no low income or minority populations in or near the study area or Park. The action alternative would not have disproportionate health or environmental effects on minorities or low-income populations or communities. Therefore, the impact topic of low income or minority populations and environmental justice was dismissed from further analysis.

### **Indian Trust Resources**

Executive Order 13175 requires that any anticipated impacts to Indian Trust Resources from a proposed project or action by Department of Interior agencies be explicitly addressed in environmental documents. There are no Indian Trust Resources identified at the Park; therefore, Indian Trust Resources was dismissed as an impact topic in this document.

### **Sacred Sites**

Executive Order 13007 requires consultation with Indian tribes and religious representatives on the access, use, and protection of sacred sites. No Sacred Sites have been identified in the Park. Therefore, Sacred Sites were dismissed as an impact topic.

### **Ethnography**

Director’s Order # 28, Cultural Resource Management Guideline, 181 defines ethnographic resources as any “site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it”. There are only two possible ethnographic groups found within Shenandoah National Park: Native Americans and mountain residents. Both of these groups predate the creation of the Park and were not in residence after its creation. There is no evidence that Native American groups ever had permanent residence within the current boundaries of the park. In addition, mountain

residents do not represent a defined cohesive ethnographic community (Engle 2007). As a result, there are no ethnographic resources within the park that would be affected by the project; therefore, this impact topic was dismissed from further analysis in this EA.

There are no traditional cultural properties associated with the area of potential effects. In accordance with the Advisory Council on Historic Preservation's (ACHP) regulations implementing Section 106 of the NHPA, the determination of effect is no historic properties affected.

### **Historic Structures**

NPS Director's Order #28: *Cultural Resources Management* defines a historic structure as "a constructed work, usually immovable by nature or design, consciously created to serve some human act." The NPS maintains a List of Classified Structures, which is a database maintained by the Historic Structures Program of the NPS. According to the list of classified structures for the Park, there are historic structures within the Park's boundaries; however, none are located in the area of potential effect. Because there are no structures in the area of potential effect, the impact topic of historic structures was dismissed from further analysis.

There are no historic structures associated with the area of potential effects. In accordance with the Advisory Council on Historic Preservation's (ACHP) regulations implementing Section 106 of the NHPA, the determination of effect is no historic properties affected.

### **Energy Requirements and Conservation Potential**

CEQ guidelines for implementing NEPA require examination of energy requirements and conservation potential as a possible impact topic in environmental documents. The Park strives to incorporate the principles of sustainable design and development into all facilities and park operations. The objectives of sustainability are to design structures to minimize adverse impacts on natural and cultural values; to reflect their environmental setting; to maintain and encourage biodiversity; to construct and retrofit facilities using energy efficient materials and building techniques; to operate and maintain facilities to promote their sustainability; and to illustrate and promote conservation principles and practices through sustainable design and ecologically sensitive use. Essentially, sustainability is living within the environment with the least impact on the environment. The action alternatives presented in this document subscribe to and support the practice of sustainable planning and design in part by addressing and protecting sensitive rock outcrops. The proposed action aims to develop alternatives that meet the purpose and need of the project while maintaining sustainable practices. Consequently, adverse impacts relating to energy use, availability, or conservation would be negligible. Therefore, the impact topic of energy requirements and conservation potential is dismissed.

### **Climate Change**

There is emerging scientific consensus that climate change is occurring due to release of greenhouse gases (mainly carbon dioxide, methane, and nitrous oxide) that are trapping heat in the atmosphere and raising the planet's temperature. According to the UN Intergovernmental Panel on Climate Change (UNIPCC), there is a 90% probability that

climate change is mainly due to human activities. Climate change is projected to accelerate in the future, but the extent depends on our ability to reduce greenhouse gas emissions.

Long-term management of rock outcrops would not result in impacts that contribute to climate change. There may be a negligible contribution to greenhouse gas emissions as a result of relocating trails and campsites, requiring the use of motorized equipment that would emit exhaust gases during construction. These emissions would be short-term, lasting only until the end of construction. Based on the research to date, there is no evidence that climate change effects occur at a local or even regional scale; therefore, any negligible greenhouse gas emissions resulting from trail and campsite relocations would not contribute to climate change in the Park or the Shenandoah region, and would not likely contribute to cumulative impacts on global climate change. Efforts would be made to minimize exhaust emissions by such measures as minimizing the use of motorized equipment and not allowing equipment to idle when not in use. A more likely scenario is the potential for long-term climate changes to impact rock outcrops and how we manage them. The Park will continue to consider the potential effects of future climate change on rock outcrops and will re-evaluate management decisions as more information becomes available. Therefore, the impact topic of climate change was dismissed from further analysis.

## CHAPTER 2 ALTERNATIVES

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*Photo courtesy of Gary P. Fleming*

### **Big Devils Stairs**

## INTRODUCTION

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This chapter describes a range of alternatives that would direct the management of rock outcrop areas at the Park. This EA/AoE explores four alternatives: A No-Action Alternative (Alternative A) and three action alternatives (Alternatives B, C, and D). Following the description of the alternatives, Table 11 provides a comparison of alternatives with an explanation of the degree to which each alternative accomplishes the purpose and need of the project. A comparison of environmental consequences for each of the alternatives is provided in Table 12.

The alternatives in this chapter address how rock outcrops would be managed. Actions presented under the alternatives would apply to all 2,105 rock outcrops in the Park. The management categories defined in Chapter 1 would be applied to all alternatives. As new rock outcrops that need management are identified in the park, they would be assigned a management category.

## ALTERNATIVE A: NO ACTION

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Alternative A, the No Action Alternative, would continue to follow current site management practices and the level of treatment for the resources would remain unchanged.

Under this alternative, current visitor and resource management guidelines such as the Park's BWMP and RMP would continue to be followed. These documents would continue to provide guidance and direction to manage visitor recreation use and impacts in the backcountry and wilderness and to manage natural resource conditions at rock outcrops.

**General Actions:** Campsite and trail management and maintenance would continue as directed by the BWMP. The BWMP establishes specific backcountry and wilderness management objectives including descriptions of several management zones, resource and social indicators and standards, and describes a variety of management actions to address visitor recreation use impacts. A backcountry campsite management program established by the BWMP would continue to be followed. This includes a computerized camping permitting system; campsite inventory and monitoring; campsite rehabilitation and maintenance; designated campsite construction and maintenance; and campsite impact management strategy and education of visitors.

As directed by the BWMP, the trails program includes establishment of trail construction and maintenance standards as described by management objectives for each of the management zones. Leave No Trace information, which is a nationwide program established to promote a code of outdoor ethics, would continue to be made available to park visitors.

Monitoring of rare natural resources would continue by Park staff and would include surveying and documenting rare plant populations and identifying threats such as human trampling and invasive plant infestations. Site management of human impacts to rock

outcrop areas would be in response to site specific impacts, and not guided by a comprehensive plan. All rock outcrop areas would be open to visitor use unless monitoring identifies an immediate threat to resources, then outcrop areas would be closed. However, campsites and social trails would be closed based on professional judgment and BWMP guidelines. Formal trails would continue to be maintained based on professional judgment, established campsite management objectives, and monitoring protocols.

**Climbing Management Actions:** Recreational climbing would be managed by regulations found in 36 CFR. Additional climbing guidelines to manage recreational activity on rock outcrops would not be implemented. Regulations currently exist that deal with commercial use and group sizes. A Commercial Use Authorization (CUA) Permit is required for commercial rock climbing instruction or guiding where a fee is charged for services. Maximum group size for commercial groups is twelve persons, including instructors. All rock outcrop areas are accessible for climbing unless monitoring identifies an immediate threat to resources, then outcrop areas would be closed to visitor use or use may be otherwise restricted in order to prevent further impacts. Climbers are also encouraged to practice the seven principles of Leave No Trace. Park staff and climbers are expected to promote and follow “Clean Climbing” practices. This includes using minimum amounts of chalk and using fixed anchors.

**Other Recreational Actions:** Existing campsite and trail management strategies and guidelines of the BWMP would continue to be implemented as stated under general management actions for this alternative.

## ALTERNATIVE B: BALANCE BETWEEN NATURAL RESOURCE PROTECTION AND VISITOR USE (NPS PREFERRED ALTERNATIVE)

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Alternative B would establish a balance between rock outcrop resource protection and visitor use and enjoyment of rock outcrop areas. Actions under this alternative would allow visitor use of selected rock outcrop areas while minimizing impacts to natural resource conditions.

**General Actions:** Visitor access to some rock outcrop areas would be limited in terms of a few closures of sites and unofficial trail segments plus the presence of physical barriers at a few sensitive vegetation sites. Natural resources monitoring and management at rock outcrops would be guided by actions presented in this alternative which would provide prescriptive management objectives for maintaining these special resources.

**Climbing Management Actions:** Recreational climbing management would be implemented through the Climbing Management Guidelines (see Appendix D for full document). Climbing Management Guidelines have been developed to protect the park’s natural and cultural resources and values while providing climbing-related recreational opportunities for park visitors. Rock climbing was addressed briefly by the Park’s 1998 *Backcountry and Wilderness Management Plan* (BWMP) and stated as a future action:

*Develop a Climbing Plan as a subplan to the BWMP with public involvement from organizations such as the PATC Mountaineering Section, The Access Fund, National Outdoor Leadership School and local climbing enthusiasts. SNP needs to better understand and address impacts to resources associated with climbing activity and assure that actions taken are consistent with NPS recreation and wilderness management directives and guidelines.”*

The Climbing Management Guidelines address rock climbing, bouldering, ice climbing, and recreational activities.

The Climbing Management Guidelines addresses several goals which are described in Section 1.2 of the document. Any restrictions to climbing and other recreational uses of rock outcrops requiring new specific site closures and prohibition regulations to be legally enforced will be provided in the Park’s “Superintendent’s Compendium” in accordance with 36 CFR, Chapter 1, Parts 1-7. Specific climbing area closures, restrictions and management actions implemented through the Climbing Management Guidelines are outlined in shaded boxes below. Most rock outcrop management would rely on light-handed management tactics such as educational trailhead bulletin displays, internet and print information, informational and educational programs, and improvement of formal trails and reduced use of informal trails to concentrate recreation use and minimize site impacts. However, a few sites used for climbing activities would require more intensive management where the use of physical barriers and signage would be implemented.

The following “watch” sites would be monitored closely for climbing impacts and may have further restrictions or prohibitions imposed in the future. The rock outcrop “watch” sites would be targeted for at least on-going annual inspection for damage to resources identified as climbing related; i.e., vegetation damage or removal at cliff faces, trampling damage to vegetation at cliff top “staging areas” or climbing routes, rope impacts to tree bark and lichens resulting from use of trees as climbing anchors, placement of climbing hardware (bolts), use of chalk.

- North Marshall Summit
- Marys Rock
- Old Rag West Summit area

**Other Recreational Actions:** Existing campsite and trail management guidelines from the BWMP would be augmented by additional guidelines explained in this alternative. Existing guidance on visitor-created social trails to campsites as provided by the BWMP would be used. Additional actions regarding special issues of recreational impacts to rock outcrops are contained herein to redirect some visitor use and minimize impacts to specific rock outcrop sites that presently are not adequately addressed. Visitor impacts from day use would be eliminated from specific sites or redirected and concentrated to “durable surfaces” by use of signs, physical barriers, improved trails, visitor education, and elimination of damaging visitor-made “social trails.”

Actions proposed within Alternative B organized by the management categories listed in Table 5:

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<b>Little Stony Man Mountain</b>	<ul style="list-style-type: none"><li>• All areas of Little Stonyman mountain located south of an east/west line situated 35 meters north of the informal “chute trail” would be closed to climbing and all other off-trail uses. Also closed to climbing and other off-trail uses would be the area of large boulders on the northernmost end of the Little Stonyman cliffs between the upper and lower cliffs of the AT and Passamaquoddy Trail.</li><li>• Visitors engaged in rock climbing would be prohibited from running anchor ropes and webbing across the AT or other trails.</li><li>• Rare natural resources would be protected from visitor impacts by re-locating the Appalachian Trail from the cliff top down to the current location of the Passamoquoddy trail on the lower cliffs. This action is contingent upon approval for simultaneous relocation of the AT to its original path through the Skyland Resort development on mile south of Little Stony Man Mountain. The “chute” trail would be hardened and rock stairs would be constructed. Barriers and signs would direct day hikers and campers away from informal trails, and from the cliff top area to the large view point at the lower cliffs. The actions associated with relocating the AT are separate from the actions in the ROMP. If and when the park decides to relocate this portion of the AT, the actions will be reviewed under a separate planning process and NEPA document with the AT management office and partners.</li><li>• Actions and activities that would disturb soil, such as camping and fire-line construction would be prohibited within areas designated at Shenandoah salamander habitat.</li><li>• Recommendation to convert day use shelter Byrds Nest #3 in the Pinnacles area south of Marys Rock to an AT hut complex to relieve camping pressure at Little Stony Man Cliff sites.</li><li>• A public education program involving signage, presentations, and literature explaining the need to protect the rare natural resources on Little Stony Man Cliffs would be implemented on-site and/or at the Skyline Drive parking area trailhead.</li><li>• Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done annually.</li><li>• Exotic species would be controlled within rare plant areas as time and funding allows.</li></ul>
<b>Old Rag Mountain</b>	<ul style="list-style-type: none"><li>• Low barriers and signs would be installed on the Eastern Summit, and along informal trails to protect rare plant populations and communities, and to confine visitor use to existing heavily impacted areas. Informal rock climbing trails would be re-routed around <i>Huperzia</i> spp. populations at the base of the north facing summit cliff, and Skyline Wall climbing areas. Visitors would be directed away from the sloping outcrop where the Central Appalachian Mafic</li></ul>

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Barren and the *Populus tremuloides* are located.

- A public education program involving signage, literature, and presentations would be implemented at various Old Rag Mountain trailhead sites to educate park visitors about the sensitive natural resources on Old Rag Mountain.
- The Western summit would be closed to all visitor use using natural barriers (i.e. tree limb debris and rock material), unobtrusive barrier fencing, and signs to protect rare plant populations.
- Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done annually.
- Exotic species would be controlled within rare plant areas as time and funding allows.
- Peregrine falcon nesting sites would be surveyed, monitored, and provided seasonal protection as detailed in the species recovery plan.

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**Category  
One (HH)**

- Barriers would be used to eliminate visitor access to portions of rock outcrop areas that contain rare natural resources.
- Hawksbill Mountain and North Marshall Mountain would be closed to camping.
- Camping at Overall Run Falls –North would be restricted to areas away from rare plant populations.
- Hawksbill Summit and cliff faces would be closed to all climbing activity.
- Rock climbing at North Marshall mountain would be redirected to other areas by working with the climbing community to choose alternative locations. Additional restrictions could be imposed if resources impacts to this site increase.
- Permanently close the Hawksbill summit northwest facing outcrops to off-trail use and climbing, to protect peregrine falcon habitat and to allow recovery of native vegetation. Summit unofficial short-cut trails, including the 80-meter unofficial short-cut trail that runs atop the northwest facing summit cliffs, would be closed to all visitor use.
- The Bettys Rock trail would be abandoned. Information about this trail would be removed from all guides, maps, and signs. Since the site is too small to use barriers, the trail would be abandoned to preserve the integrity of the outcrop's ecological community located where the trail dead-ends.
- The Frazier Discovery Trail at Loft Mountain would have signs and physical barriers installed at the northernmost summit outcrop to protect rare plant communities.
- Designated campsites could be constructed in areas free of the invasive mile-a-minute vine (*Persicaria perfoliata*) at the Hogwallow Flats spring area north of North Marshall Summit to redistribute camping activity.
- Conduct further inventories at Hawksbill Summit to determine the

status of Shenandoah salamander population at this site.

- The public and Park staff would be educated on the sensitivity of the areas in Management Category 1 using kiosks, publications, and outreach and educational programs.
- Aggressive and potentially damaging exotic species would be controlled using herbicide and hand pulling as time and funding allow. Insecticide use would be avoided at sites with rare invertebrates.
- Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done annually.

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**Category  
Two  
(HM)**

- Prohibit camping at Marys Rock. Hiker access may be further restricted in the future as resource conditions are monitored and assessed.
- Recommendation to convert day use shelter Byrds Nest #3 in the Pinnacles area south of Marys Rock to an AT hut complex to relieve camping pressure on the Marys Rock Summit.
- Visitor access to portions of rock outcrop areas that contain rare natural resources would be discouraged using signs, barriers, and trail modifications.
- Off-trail rock scrambling would be discouraged at Blackrock – South District using interpretive signs and barriers to protect the rare lichen community.
- The public and Park staff would be educated on the sensitivity of areas in Management Category 2 using kiosks, publications, and outreach and educational programs.
- Exotic species would be controlled using herbicide and hand pulling to protect rare natural resources as time and funding allow.
- Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done every two to three years, and additional inventories would be completed as time and funding allow.

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**Category  
Three  
(HL)**

- No attempt would be made to modify human access or use of areas containing rare natural resources. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.
- Park staff and cooperators would be educated about the sensitivity of the natural resources within these areas.
- Select exotic species would be controlled with herbicide and hand pulling as time and funding allow.
- Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done every three to five years, and additional inventories would be completed as time and funding allow.

- Category Four (ML)**
- No attempt would be made to modify human access or use of areas containing rare natural resources. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.
  - The use of prescribed fire to simulate the natural fire regimen would be considered and possibly implemented at some areas within three to five years.
  - Monitor campsite conditions and invasive plant status at Compton Peak.
  - Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done every four to eight years as time and funding allow.
- Category Five (LL)**
- No attempt would be made to modify human access or use of outcrop areas in Management Category 5. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.
  - Survey for rare natural resources would be done as time and money allow if an outcrop area would be burned by natural or prescribed fire activity.
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## ALTERNATIVE C: EMPHASIS ON NATURAL RESOURCE PROTECTION

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Alternative C emphasizes protection of natural resources. Under this alternative restrictive visitor management practices would be used to minimize visitor use impacts.

**General Actions:** Visitor use of rock outcrops would be heavily restricted. Natural resources monitoring of rock outcrops would be guided by actions in this alternative that would provide prescriptive management objectives for maintaining these special resources.

**Climbing Management Actions:** Identical to Alternative B, recreational climbing would be managed through the proposed Climbing Management Guidelines (see Appendix D). The same actions associated with the Climbing Management Guidelines for Alternative B would be implemented in Alternative C. See the shaded boxes above for a description of actions related to the proposed climbing management actions. For Alternative C there would be additional site closure restrictions to the climbing activities that are in addition to the Climbing Management Guidelines and are listed below.

Rock outcrops would be managed through minimal management tactics such as off-site educational trailhead bulletin displays, internet and print information, informational and education programs, and improvement of informal trails to concentrate recreation use and minimize site impacts. Physical barriers and signage would be used at sites with heavy climbing activities where more intensive management actions to restore damaged

resources and preserve valuable, sensitive resources from impacts by human recreational activities are needed.

In addition to implementing the Climbing Management Guidelines the following sites would be closed to climbing under Alternative C:

- Little Stony Man Cliffs: The entire cliff area
- Hawksbill Summit: The summit area and cliff faces
- Old Rag Mountain Eastern Summit: The entire climbing area
- Old Rag Mountain Western Summit: The entire climbing area
- Skyline Wall: The entire climbing area
- Reflector Oven: The entire climbing area
- North Marshall Summit: The entire summit area
- Marys Rock: The entire cliff area
- South Marshall: The summit area
- Blackrock, South District: The summit area
- Bearfence: The summit area

The AT would also be relocated, causing changes to the visitor experience:

- Little Stony Man Cliffs: The AT would be relocated to the Passamaquoddy Trail at the lower cliffs and the trail on the upper cliffs would be abandoned or relocated. If this is not feasible, the AT would be re-routed to the east of the upper cliffs rock outcrop viewing area to eliminate access to the outcrops via the AT.
- Marys Rock: The summit area would be closed to camping and climbing activities. Hiker access to outcrops would be heavily restricted by the installation of physical barriers and signage.
- North Marshall: Hiker access to outcrops would be heavily restricted by the installation of physical barriers and signage.
- South Marshall: Hiker access to outcrops would be heavily restricted by the installation of physical barriers and signage.
- Blackrock, South District: Hiker access to outcrops would be heavily restricted by the installation of physical barriers and signage.
- Bearfence: Hiker access to outcrops would be heavily restricted by the installation of physical barriers and signage.
- Pass Mountain: The AT adjacent to the rock outcrop viewing area north of Beahms Gap on the north slope of Pass Mountain would be relocated to the east to eliminate hiker access to the site.

**Other Recreation Actions:** Existing campsite and trail management guidelines from the BWMP would be supplemented by guidelines from this alternative. Additional actions would be provided to redirect some visitor use and minimize impacts to specific rock outcrop sites that presently are not adequately addressed. The Climbing Management Guidelines would manage various climbing activities to minimize impacts of that type of recreation; visitor impacts from day use would be eliminated from specific sites or redirected and concentrated to “durable surfaces” by use of signs, physical barriers, improved trails, visitor education, and elimination of damaging visitor-made “social trails”.

Actions proposed within Alternative C by management category:

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Little Stony Man Mountain	<ul style="list-style-type: none"><li>• The Appalachian Trail would be relocated from the cliff top to the current Passamaquoddy trail on the lower cliffs.</li><li>• The current location of the Appalachian Trail along the cliff top would be closed to all visitor access. The informal “chute” trail would be closed with barriers at top and bottom.</li><li>• Actions and activities that would disturb soil such as camping and fire-line construction would be prohibited within areas designated as Shenandoah Salamander habitat.</li><li>• Exotic plants would be aggressively controlled throughout the site.</li><li>• Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done annually.</li><li>• Rare natural resources would be protected from visitor impacts by relocating the Appalachian Trail from the cliff top down to the current location of the Passamaquoddy trail on the lower cliffs. This action is contingent upon approval for simultaneous relocation of the AT to its original path through the Skyland Resort development one mile south of Little Stonyman Mountain. Barriers and signs would direct day hikers and campers away from informal trails and from the cliff top area to the large view point at the lower cliffs.</li></ul>
Old Rag Mountain	<ul style="list-style-type: none"><li>• The Main and Western Summits of Old Rag Mountain would be closed to all visitor access using barriers and signage.</li><li>• The Summit Wall, Skyline Wall, and Reflector Oven climbing sites would be closed to climbers using barriers and signage.</li><li>• Barriers and signs would be used to direct visitors away from the sloping outcrop area along the Ridge Trail near rare plant populations.</li><li>• Peregrine falcons would be surveyed for, monitored, and provided with seasonal nesting site protection as detailed in the species recovery plan.</li><li>• Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done annually.</li><li>• Exotic plants would be aggressively controlled throughout the sites.</li></ul>
Category One (HH)	<ul style="list-style-type: none"><li>• Human access to areas containing rare and sensitive natural resources would be eliminated using regulations, signs, barriers, and trail re-routes.</li><li>• Exotic species on or near rock outcrops would be controlled using herbicide and hand pulling. Insecticide use would be avoided at sites with rare invertebrates.</li><li>• Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done annually.</li></ul>

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|---------------------------|--|
| Category<br>Two<br>(HM)   | <ul style="list-style-type: none"><li>• Human access and use of areas containing sensitive natural resources would be substantially restricted or eliminated using regulations, signs, and barriers.</li><li>• Exotic species on or near rock outcrops would be controlled using herbicide and hand pulling. Insecticide use would be avoided at sites with rare invertebrates.</li><li>• Rare natural resources, exotic species extent, and visitor impacts would be monitored every one to two years.</li></ul>  |
| Category<br>Three<br>(HL) | <ul style="list-style-type: none"><li>• Human access and use of areas containing sensitive natural resources would be discouraged using regulations and signs.</li><li>• Most exotic species on or near rock outcrop areas would be controlled using herbicide and hand pulling. Insecticide use would be avoided at sites with rare invertebrates.</li><li>• Rare natural resource status, exotic species extent, and visitor use impacts would be monitored every three to five years.</li></ul>   |
| Category<br>Four<br>(ML)  | <ul style="list-style-type: none"><li>• No attempt would be made to modify human access or use of areas containing rare natural resources. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.</li><li>• Prescribed fire would be used to simulate the natural fire regimen.</li><li>• Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done annually.</li><li>• Insecticide use would be avoided at sites with rare invertebrates.</li></ul> |
| Category<br>Five (LL)     | <ul style="list-style-type: none"><li>• No attempt would be made to alter human access or use of these outcrop areas. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.</li><li>• Sites would be surveyed for rare natural resource occurrences as time and funding allow or following major disturbance events such as fire.</li></ul>   |
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## ALTERNATIVE D: EMPHASIS ON VISITOR USE

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Alternative D emphasizes the preservation and enhancement of visitor access and opportunities for the enjoyment of rock outcrops.

**General Actions:** Visitor use of rock outcrop areas would be encouraged by providing improved trail access, viewing platforms and railings, interpretive and directional signage and informational publications directing visitors to sites. The only exceptions would be in the event that monitoring identifies an immediate threat to a rare, threatened or endangered species, at which time that individual outcrop may be closed to visitor use or use may be otherwise restricted in order to prevent further impacts that would likely lead to the loss of the species.

Monitoring of rare natural resources would continue by Park staff and would include surveying and documenting rare plant populations and identifying threats such as human trampling and invasive plant infestations. Site management of human impacts to rock outcrop areas would be in response to site specific impacts and not guided by a comprehensive plan.

**Climbing Management Actions:** Climbing activity would be regulated under current management practices. The proposed Climbing Management Guidelines would not be implemented. Extensive unmanaged recreational climbing would be allowed. The only exceptions would be in the event that monitoring identifies an immediate threat to a rare, threatened or endangered species, at which time that individual outcrop may be closed to visitor use or use may be otherwise restricted in order to prevent further impacts that would likely lead to the loss of the species. Protection of rock outcrops would be directed by minimal management tactics, as approved in the BWMP, such as off-site educational trailhead bulletin displays, internet and print information, informational and education programs, and improved informal trails to concentrate recreation use and minimize site impacts. Increasingly, intensive management tactics may include use of physical barriers and signage at sites heavily impacted by recreational use.

**Other Recreational Activities:** Existing campsite and trail management guidelines from the BWMP would be supplemented by guidelines from the ROMP. Additional actions are contained herein to redirect some visitor use and minimize impacts to specific rock outcrop sites that presently are not adequately addressed. Fewer actions would be taken that might restrict visitor use of rock outcrops than Alternative C.

Summary of actions proposed within Alternative D by management category:

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Little Stony Man Mountain	<ul style="list-style-type: none"><li>• Additional signage and literature would be produced that direct people to the Little Stony Man cliffs. The “chute” trail would be hardened and stairs installed to improve rock climber access.</li><li>• Several permanent anchors would be installed at the top of the cliffs, and additional campsites would be established within the vicinity of the cliffs.</li><li>• An education program would be undertaken that explains the natural resources of interest and great recreational opportunities offered by the cliffs.</li><li>• Monitoring of visitor use and impacts, rare natural resources, and exotic species would be done annually. Exotic species would be controlled within areas with rare, threatened and endangered species.</li></ul>
Old Rag Mountain	<ul style="list-style-type: none"><li>• Implement an education program using signage, literature, and presentations that informs people about the recreational opportunities and natural resources on Old Rag Mountain.</li><li>• Facilitate visitor use by constructing a summit viewing platform, formalizing additional trail spurs to cliff edges, and performing trail enhancements to facilitate access to both summits.</li></ul>

- Allow camping at all elevations.
  - Monitoring of visitor use and impacts, sensitive natural resources, and exotic species would be done annually. Exotic species would be controlled within areas with rare, threatened, and endangered species.
- Category One (HH)
- No restrictions would be placed on human access to areas with known sensitive natural resources. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.
  - The environment would be modified to support and enhance high visitor use including addition of modifications such as viewing platforms, additional access trails, and handrails.
  - Select exotic species would be controlled using herbicide.
  - Monitoring of visitor use and impacts, sensitive natural resources, and exotic species would be done annually.
- Category Two (HM)
- No restrictions would be placed on human access to areas with known sensitive natural resources. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.
  - The environment would be modified to encourage and support visitor use including addition of modifications such as viewing platforms, additional access trails, and promotional literature.
  - Exotic species would be controlled using herbicide and hand pulling to protect sensitive natural resources as time and funding allow.
  - Monitoring of visitor use and impacts, sensitive natural resources, and exotic species would be done every two to three years, and additional inventories would be completed as time and funding allow.
- Category Three (HL)
- No restrictions would be placed on human access to areas with known sensitive natural resources. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.
  - The environment would be modified to encourage visitor use including additional access trails, new signage, and promotional literature.
  - Select exotic species would be controlled with herbicide and hand pulling as time allows.
  - Monitoring of visitor use and impacts, sensitive natural resources, and exotic species would be done every three to five years and additional inventories would be completed as time and funding allow.
- Category Four (ML)
- No restrictions would be placed on human access to areas with known sensitive natural resources. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.
  - Visitor use of areas in Management Category 4 would be encouraged

through additional signage and literature.

- Monitoring of visitor use and impacts, sensitive natural resources, and exotic species would be done every four to eight years as time and funding allow.

Category  
Five (LL)

- No restrictions would be placed on human access to areas with known sensitive natural resources. The only exception would be if monitoring identifies an immediate threat to a sensitive resource, an individual site may be closed to prevent further impacts.
- Surveying for sensitive natural resources would be done as time and money allow or if an outcrop area is to be burned by natural or prescribed fire activity.

## ENVIRONMENTALLY PREFERABLE ALTERNATIVE

In accordance with the DO-12 Handbook, the NPS identifies the environmentally preferable alternative in its NEPA documents for public review and comment [Sect. 4.5 E(9)]. The environmentally preferable alternative is the alternative that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative (43 CFR 46.30).

Alternative C best protects the natural and cultural resources of the Park by providing a plan that would offer the greatest protection, restoration, and perpetuation of rock outcrops and natural resources associated with the outcrops. Based on the analysis of environmental consequences of each alternative in Chapter 4, Alternative C is the Environmentally Preferable Alternative.

### Summary Comparison of Alternatives

Table 11 provides a summary of the three alternatives presented above and analyzes the degree to which each alternative meets the purpose and need identified in Chapter 1.

TABLE 11: SUMMARY COMPARISON OF ALTERNATIVES

	<b>Alternative A: No Action Alternative</b>	<b>Alternative B: Balance Between Natural Resource Protection and Visitor Use (NPS Preferred)</b>	<b>Alternative C: Emphasis on Natural Resource Protection</b>	<b>Alternative D: Emphasis on Visitor Use</b>

		<b>Alternative)</b>		
<b>Protect, restore, and perpetuate rock outcrops and natural resources</b>	Would provide minimum protection to resources based on site-specific response to threats as they are identified.	Would restore rock outcrops and natural resources by directing visitor access and use to selected areas.	Would restore rock outcrops and natural resources to an extent greater than Alt. B.	Would provide minimum protection to resources based on site-specific response to threats as they are identified.
<b>Provide a range of recreational opportunities for visitors</b>	Would provide a range of recreational opportunities: rock climbing, ice climbing, bouldering, day hiking/viewing, backcountry camping and hang gliding/paragliding.	Would provide recreational opportunities while balancing natural resource protection.	Would provide a limited range of recreational opportunities, but less than what is currently offered under the No Action Alternative.	Would provide a wide range of recreational opportunities: rock climbing, ice climbing, bouldering, day hiking/viewing, backcountry camping and hang gliding/paragliding. Would offer more recreational opportunities than Alternative A, B or C.
<b>Meet Purpose and Need</b>	No. This alternative does not provide protection for natural resources.	Yes. This alternative meets the project's objectives by protecting natural resources while providing recreational opportunities.	Yes. Although this alternative meets the project's objectives, it falls short of fully meeting the planning issues to the same extent as Alternative B because more emphasis is placed on resource protection while the numbers of recreational opportunities are reduced.	Yes. Although this alternative meets the project's objectives, it falls short of protecting natural resources to the extent that Alternative B or C does.

**Summary of Environmental Consequences**

Table 12 provides a comparison of the environmental consequences of the proposed alternatives. See Chapter 4 for a detailed impact analysis.

TABLE 12: SUMMARY OF ENVIRONMENTAL CONSEQUENCES

	<b>Alternative A: No Action Alternative</b>	<b>Alternative B: Balance Between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)</b>	<b>Alternative C: Emphasis on Natural Resource Protection</b>	<b>Alternative D: Emphasis on Visitor Use</b>
<b>Natural Resources</b>				
<b>Geologic and Soil Resources</b>	Alternative A would have adverse, site-specific, negligible to moderate long-term impacts to geologic and soil resources. There would be no cumulative impacts.	Alternative B would have adverse, site-specific, short-term impacts from construction activities and adverse, site-specific, negligible to minor long-term impacts to geologic and soil resources. Restriction of use to some rock outcrops and trails would result in positive impacts. There would be no cumulative impacts.	Alternative C would have adverse, site-specific, short-term impacts from construction activities and adverse, site-specific, negligible long-term impacts. This alternative would have beneficial impacts. There would be no cumulative impacts.	Alternative D would have adverse, site-specific, moderate, short-term impacts from construction activities and adverse, site-specific, moderate, long-term impacts to geologic and soil resources. There would be no cumulative impacts.
<b>Ecological Communities</b>	Alternative A would have adverse, site-specific, negligible to moderate long-term impacts to ecological communities. There would be no cumulative impacts.	Alternative B would have adverse, site-specific, minor, short-term impacts from construction-related activities and adverse, site-specific, negligible to minor long-term impacts to ecological communities. This alternative would have beneficial impacts but no cumulative impacts.	Alternative C would have adverse, site-specific, minor, short-term impacts from construction-related activities and adverse, site-specific, negligible, long-term impacts to ecological communities. Alternative C may increase protection to ecological communities, resulting in increased	Alternative D would have adverse, site-specific, minor, short-term impacts from construction-related activities and adverse, site-specific, negligible to moderate, long-term impacts to ecological communities. There would be no cumulative impacts.

			growth. There would be no cumulative impacts.	
<b>Rare, Threatened and Endangered Plants</b>	Alternative A would have adverse, site-specific, negligible to moderate long-term impacts to rare, threatened and endangered plants. There would be no cumulative impacts.	Alternative B would have adverse, site-specific, negligible, short-term impacts from construction-related activities and adverse, site-specific, negligible to minor long-term impacts to rare, threatened and endangered plants. Alternative B may provide beneficial results to certain sites containing rare plant populations. There would be no cumulative impacts.	Alternative C would have adverse, site-specific, negligible, short-term impacts from construction-related activities and adverse, site-specific, negligible long-term impacts to rare, threatened and endangered plants. Alternative C may be beneficial and restore botanical populations by restricting visitor use. There would be no cumulative impacts.	Alternative D would have adverse, site-specific, negligible, short-term impacts from construction-related activities and adverse, site-specific, negligible to moderate long-term impacts to rare plant populations. There would be no cumulative impacts.
<b>Rare, Threatened and Endangered Species</b>	Alternative A would have adverse, site-specific, negligible to minor long-term impacts to rare, threatened and endangered species. There would be no cumulative impacts.	Alternative B would have adverse, site-specific, negligible, long-term impacts to rare, threatened and endangered species. Most of the actions would have beneficial results. There would be no cumulative impacts.	Alternative C rare, threatened and endangered species would benefit from actions taken under this alternative through restored habitat and less human-induced stress on wildlife. There would be no cumulative impacts.	Alternative D would have adverse, site-specific, negligible, short-term impacts from construction related activities and adverse, site-specific, minor, long-term impacts to rare, threatened and endangered species. There would be no cumulative impacts.
<b><i>Wilderness Character</i></b>				
<b>Wilderness Character</b>	Alternative A would have adverse, site-specific, negligible to moderate, long-	Alternative B would have adverse, site-specific, minor, short-term impacts from	Alternative C would have adverse, site-specific, minor, short-term impacts from	Alternative D would have adverse, site-specific, minor, short-term impacts from

	term impacts on the Wilderness character. There would be no cumulative impacts.	construction related activities and adverse, site-specific, minor, long-term impacts on the Wilderness character. There would be no cumulative impacts.	construction related activities and adverse, site-specific, negligible to moderate, long-term impacts on the Wilderness character. There would be no cumulative impacts.	construction related activities and adverse, site-specific, minor to moderate, long-term impacts on the Wilderness character. There would be no cumulative impacts.
<b>Cultural Resources</b>				
<b>Cultural Landscapes</b>	Alternative A would have no cumulative impacts on cultural landscapes. For purposes of Section 106 consultation, a determination of no historic properties affected is anticipated.	Alternative B would have long-term beneficial impacts to the cultural landscape. For purposes of Section 106 consultation, a determination of no adverse effect is anticipated.	Alternative C would have long-term beneficial impacts to the cultural landscape and no cumulative impacts. For purposes of Section 106 consultation, a determination of no adverse effect is anticipated.	Alternative D would have no cumulative impacts on cultural landscapes. For purposes of Section 106 consultation, a determination of adverse effect is possible.
<b>Archeological Resources</b>	Alternative A would have no cumulative impacts on archeological resources. For purposes of Section 106 consultation, a determination of no historic properties affected is anticipated.	Alternative B would have no cumulative impacts on archeological resources. A determination of effect for the purposes of 106 can not be determined at this time.	Alternative C would have no cumulative impacts on archeological resources. For purposes of Section 106 consultation, a determination of no historic properties affected is anticipated.	Alternative D would have long-term moderate impacts to the archeological resources. For purposes of Section 106 consultation, a determination of adverse effect is possible.
<b>Visitor Use</b>				
<b>Climbing Activities</b>	Alternative A would have beneficial impacts to climbing activities by allowing unrestricted climbing to occur in the Park. There would be no cumulative	Alternative B would have adverse, site-specific, minor, short-term impacts from construction related activities and adverse, site-specific, negligible to	Alternative C would have adverse, site-specific, minor, short-term impacts from construction related activities and adverse, site-specific, minor to	Actions under Alternative D would have adverse, site-specific, minor, short-term impacts from construction related activities. Alternative D would most likely

	impacts.	minor, long-term impacts on climbing activities. There would be beneficial impacts at Little Stony Man Mountain. There would be no cumulative impacts.	moderate, long-term impacts on climbing activities. There would be no cumulative impacts.	positively benefit climbing activities in the Park. There would be no cumulative impacts.
<b>Recreational Activities</b>	Alternative A would have no impacts on recreational activities. There would be no cumulative impacts.	Alternative B would have adverse, site-specific minor, short-term impacts from construction related activities and adverse, site-specific, negligible to minor long-term impacts on recreational activities. There would be no cumulative impacts.	Alternative C would have adverse, site-specific, minor, short-term impacts from construction related activities and adverse, site-specific, negligible to moderate, long-term impacts. There would be adverse cumulative impacts.	Alternative D would have adverse, site-specific, minor, short-term impacts from construction related activities and long-term beneficial impacts on recreational activities. There would be beneficial cumulative impacts.
<b>Visitor Experience</b>	Alternative A would have adverse, site-specific, minor, long-term impacts on visitor experiences and beneficial impacts. There would be beneficial cumulative impacts.	Alternative B would have adverse, site-specific, short-term impacts from construction-related activities to visitor experience. There would be long-term beneficial and negative adverse, site-specific, moderate, long-term impacts to the overall visitor experience. There would be beneficial cumulative impacts.	Alternative C would have adverse, site-specific, negligible to moderate long-term impacts and some beneficial impacts. There would be adverse cumulative impacts.	Actions under Alternative D would enhance visitor experience by increasing hiking and climbing access. There would be adverse, site-specific, minor short-term impacts from construction related activities and adverse, site-specific, minor, long-term adverse impacts to visitor experience. There would be beneficial cumulative impacts.

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## CHAPTER 3 AFFECTED ENVIRONMENT

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*Photo courtesy of NPS.*

### **Hawksbill North Slope**

## INTRODUCTION

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This chapter describes the existing environmental conditions for rock outcrops in the Park. Organized by impact topic, this chapter describes the resources that could be impacted by the proposed action. Natural resources examined in detail include geologic and soil resources, ecological communities, rare, threatened and endangered plants, rare, threatened and endangered species. Cultural resources include cultural landscapes and archeological resources. Visitor use resources are climbing activities, recreational activities, and visitor experience. Wilderness character is also examined. Resources dismissed from further consideration were discussed in “Chapter One: Purpose and Need for Action” and include air quality, wetlands, floodplains, water quality, wild and scenic rivers, prime and unique farmlands, low income or minority populations and environmental justice, Indian trust resources, sacred sites, historic structures, ethnography, museum collections, energy requirements and conservation potential, and climate change.

## NATURAL RESOURCES

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Although the Park’s rock outcrops represent only a small area of the Park, they are some of the largest outcrops in the region and serve as islands of unusual habitat supporting rare species assemblages, including those valuable for state and global conservation.<sup>1</sup> To identify the Park’s resources, VA-DNH inventoried the fifty sites identified in the Rock Outcrop Management Project to determine the presence of rare animals and plants; and conducted an ecological inventory of each study site to determine the U.S. National Vegetation Classification (USNVC) association in 2005 and 2006. Information gathered from these studies is a representative sample of resources in the park and can be applied to the 2,105 rock outcrops.

Rock composition is highly influential to the characteristics, location, shape, chemistry, vegetation, and animal life associated with rock outcrops. Because rock type plays a large role in the composition of the outcrop, many sections of this chapter are organized by rock type.

### Geologic and Soil Resources

As stated in NPS policy, “The Park Service will preserve and protect geologic resources as integral components of park natural systems. *NPS Management Policies 2006*, and *NPS DO #77: Natural Resources Management* provides general direction for the protection of geology and soils along with NPS Management.

Geologic formations in the Park are composed of three major bedrock units of different age and composition: basement rock (otherwise known as igneous/metamorphic rock), greenstone, and quartzite (otherwise known as metasedimentary rock) (Gathright, 1976) (Table 13). As part of the Rock Outcrop Management Project, a detailed geologic study titled, *Character and Condition of Geological Resources of Interest to the Rock Outcrop*

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<sup>1</sup> Explanation of ranking system used by VA-DNH is in Appendix B.

*Management Project Final Report* (Butler 2006), was completed in 2006. The information below was obtained from this study.

Three major rock types occur within discrete areas and elevations of the Park, producing unique outcrop patterns and generating physically and chemically distinct landforms and habitats. The bedrock geology of the Park has distinct chemical and physical properties that directly influence the location, physical character, and soil characteristics of rock exposures within the Park, and thus the vegetation communities and animal populations that rely upon these exposures.

### **Basement Rock Outcrops**

The oldest rocks found within the Park are a diverse set of igneous and metamorphic rocks, known as basement rocks, which form the base of the Blue Ridge. These occur in the central and eastern flanks of the Park. These rocks form the well known outcrops of the Old Rag Mountain area. The basement rocks of the Park are generally light gray to white (Old Rag Formation) or green to blue-gray (Pedlar Formation) and erode into large spheroidal boulders and rounded blocks (Gathright 1976). Soil developed on basement rock outcrops is nutrient poor, has high levels of aluminum and iron, and low levels of calcium. In many cases, there is no mineral soil development and the vegetation is growing only atop a thin mat of organic matter.

### **Greenstone Rock Outcrops**

Greenstone overlies basement rocks and constitutes the Catoctin Formation, a near-continuous unit of volcanic rock that can be traced from southern Virginia into southern Pennsylvania (Badger and Sinha 2004). A greenstone rock formation is a dark, dense, and fine grained rock and because it is more resistant to erosion than other rocks in the Park, it outcrops as lines of cliffs and ledges. The most common formation is a “staircase” pattern of cliffs and ledges, but boulder fields, isolated outcrops, and angled slopes of greenstone bedrock are all present within the Park (Gathright 1976, Morgan et al. 2004, Bulter 2006). Greenstone rock outcrops are confined to high-elevations (900m - 1,200m) on southwest to west facing cliff sites and gentle eastern slopes with deep canyons. They tend to create more open ledges than other rock types (Butler 2006).

Greenstone bedrock is rich in magnesium, manganese, and calcium, soils of low elevation greenstone outcrops exhibit a high pH and high concentration of these nutrients. Soils of high elevation greenstone outcrops are acidic and contain low nutrient concentrations. Despite this difference, outcrops at both elevations support assemblages of plants different from those found on nutrient poor bedrock substrates such as basement rock or quartzite. (Fleming, Pers. Com. 2007).

### **Quartzite Rock Outcrops**

Overlying the greenstone is quartzite. Quartzite formations form flatiron and hogback ridges, and erode into block and talus fields, and thin acidic soils supporting sparse vegetation (Morgan et al. 2004). Quartzite contains very hard, strong rock, and is difficult to erode. The combination of hard, resistant quartzite layers and easily eroded silty layers results in a very rugged landscape with steep slopes and deep ravines that erode into other rocks. Soil development is non-existent to minimal at most quartzite rock outcrops. When found, mineral soil is extremely low in calcium, magnesium, and manganese, and very

high in iron and aluminum. Boulderfields in the Park typically have no soil capable of supporting vascular plants, but are rich in lichen diversity.

**Table 13: ROMP Study Sites**

Site ID #	Site Name	Park District	Site Bedrock Group
31	Marys Rock	Central	Basement rock
32	Millers Head	Central	Basement rock
34	Nakedtop Upper East Slope	Central	Basement rock
36	Old Rag Southside	Central	Basement rock
37	Old Rag summit East	Central	Basement rock
41	Pinnacles	Central	Basement rock
50	Upper Devils Ditch	Central	Basement rock
62	Old Rag Summit West	Central	Basement rock
69	Whiteoak Canyon	Central	Basement rock
24	Hogback Mountain Spur	North	Basement rock
38	Oventop	North	Basement rock
02	Bettys Rock	Central	Greenstone
04	Blackrock Central District	Central	Greenstone
10	Crescent Rock Overlook	Central	Greenstone
11	Crescent Rock South	Central	Greenstone
12	Dean Mountain Ridge	Central	Greenstone
15	Franklin Cliffs North	Central	Greenstone
16	Franklin Cliffs Overlook	Central	Greenstone
17	Franklin Cliffs South	Central	Greenstone
20	Halfmile Cliff	Central	Greenstone
21	Hawksbill N Slope Outcrops	Central	Greenstone
22	Hawksbill Summit	Central	Greenstone
28	Little Stony Man	Central	Greenstone
47	Stony Man Summit	Central	Greenstone
60	Hawksbill North slope talus	Central	Greenstone
66	Field Hollow Cliff	Central	Greenstone
67	Bearfence	Central	Greenstone
68	Rose River	Central	Greenstone
03	Big Devils Stairs	North	Greenstone
07	Browntown Valley Overlook	North	Greenstone
13	Dickey Hill	North	Greenstone
14	Dickey Ridge	North	Greenstone
19	Gooney Manor Overlook	North	Greenstone
27	Little Devils Stairs	North	Greenstone
35	North Marshall Summit	North	Greenstone
39	Overall Run Falls South	North	Greenstone
40	Pass Mountain	North	Greenstone
46	South Marshall Cliff	North	Greenstone
63	Overall Run Falls North	North	Greenstone
18	Goat Ridge	South	Greenstone
23	Hightop	South	Greenstone
29	Loft Mountain Summit	South	Greenstone
45	Sawlog Ridge	South	Greenstone
05	Blackrock South District	South	Quartzite
08	Calvary Rocks / Chimney Rock	South	Quartzite
42	Powell Gap Cliff	South	Quartzite
44	Rocky Mountain	South	Quartzite
49	Trayfoot Saddle boulderfields E	South	Quartzite

64	Brown Mountain	South	Quartzite
65	Trayfoot Saddle boulderfields W	South	Quartzite

Quartzite rock outcrop soil development is slow, highly localized, and heavily dependent on environmental conditions and bedrock composition. Outcrop soils lack a classic profile and consist of weathered rock fragments and humus material composed of decomposed invertebrates and plant material. Soil typically accumulates on ledges, rock crevices, and shallow bedrock depressions and can vary in depth from less than a centimeter near the outcrop edge to 30 or more centimeters depth a few meters away near the adjacent forest.

High-elevation outcrops are typically located on summits and ridge crests, and have extremely slow mineral soil development through the weathering in place of bedrock. Middle to low-elevation rock outcrops are more often located on mid-slopes, and have their soil development supplemented by the deposition of coluvium (unconsolidated weathered material) moving in from surrounding areas. In some cases rock outcrop areas have no mineral soil development and consist only of a thin mat of organic matter held in place by a dense mat of low-growing herbaceous vegetation.

### Ecological Communities

NPS policy is to protect the natural abundance and diversity of naturally occurring communities. The NPS *Management Policies 2006*, NPS DO #77: *Natural Resources Management* and other NPS and Park policies provide general direction for the protection of ecological communities. In 2005 and 2006 VA-DNH surveyed the 50 rock outcrops selected in the Rock Outcrop Management Project to identify ecological community types growing at the sites that are representative of the rock outcrops found in the Park.

Ecological community classification represents an important “coarse-filter” approach to biological conservation that ensures the protection of intact ecological systems containing diverse organisms. Identifying excellent examples of rock outcrop natural community types ensures that the majority of native plant and animal species, including many cryptic and poorly known ones that occupy or use these sites, can be protected. (Fleming et al. 2007.)

The physical, chemical, and environmental conditions of rock outcrops combine in such a way that the resulting habitat supports rare ecological communities. For example, the thin soil, abundance or lack of certain ions, and high winds together create an environment that is well suited to supporting certain plant species, which when occurring together are key components of an ecological community. In many cases the rare plants found within rock outcrop ecological communities are “relictual” or “left over” from when the climate was cooler and larger portions of the landscape were covered with a more northern-adapted forest. At this point in time, the climate has warmed and the forests have changed, and rock outcrops provide the last place where conditions are still appropriate to support these natural plant communities.

Project ecologists identified 54 occurrences of 11 ecological community types at the outcrops. Of the 11 ecological community types, nine are globally rare and two are

entirely endemic<sup>2</sup> to the Park (Table 14). The two communities endemic to the park are the High-Elevation Greenstone Barren, (documented at 12 sites) and Central Appalachian Mafic Boulderfield, (documented at five sites). Of the 11 known occurrences of the High-Elevation Outcrop Barren community in the world, six are found at rock outcrops in the Park.

Many new and previously undocumented ecological communities were discovered during the study. Twenty-six of the 54 occurrences were not previously documented. Classification work for this project resulted in modifications to two community types in the National Vegetation Classification (Fleming et al. 2007). Table 14 below lists important ecological communities located at the Park's outcrops.

### **Ecological communities at Basement Rock Outcrops**

The ecological communities recorded at basement rock outcrop sites are globally rare (G1 and G2-ranked) and rare across the Commonwealth of Virginia (S1 and S2-ranked). See Appendix B for a description of global and state ranking systems. Basement rock outcrops support five different types of ecological communities. Central Appalachian Heath Barren is found exclusively on basement rock sites.

### **Ecological communities at Greenstone Rock Outcrops**

Ecological communities recorded at Greenstone rock outcrop sites are globally rare (G1 and G2-ranked) and rare across the Commonwealth of Virginia (S1 and S2-ranked). Greenstone rock outcrops support eight ecological communities. Four of these communities were found exclusively on greenstone outcrops:

- High-Elevation Greenstone Barren (entirely endemic to the Park)
- Central Appalachian Mafic Boulderfield (entirely endemic to the Park)
- Central Appalachian Circumneutral Barren
- High-Elevation Outcrop Barren

This project resulted in the discovery of three new occurrences of globally rare High-Elevation Greenstone Barren. The High-Elevation Greenstone Barren is endemic to a small area in the Central District of Shenandoah National Park (Fleming et al. 2001). This community occurs at a total of 30 rock outcrops, which for the purposes of the study are grouped into five named rock outcrop sites based on the proximity of the rock outcrops to one another (Franklin Cliffs, Hawksbill, Crescent Rocks, Stony Man Mountain, Mount Marshall). The total coverage of all known occurrences is less than four hectares (10 acres). The long-term viability of this vegetation type depends entirely on future events in the Park (Fleming et al. 2007).

### **Ecological communities at Quartzite Rock Outcrops**

Ecological communities recorded at Quartzite rock outcrop sites are globally rare (G3: uncommon and G4: common ranked) and rare across the Commonwealth of Virginia (S3: uncommon and S4: common ranked). The Central Appalachian Acidic Boulderfield and the Sweet Birch – Chestnut Oak Talus Woodland communities were found exclusively at outcrops composed of quartzite bedrock. Sites with these communities include the Blackrock South District, Trayfoot Saddle Boulderfields East, and Trayfoot Saddle

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<sup>2</sup> An endemic community is one that is confined to a particular geographic region, in this case the rock outcrops within Shenandoah National Park. Other definitions included in Appendix C.

Boulderfields West. The Sweet Birch – Chestnut Oak Talus Woodland community located at the Trayfoot Saddle Boulderfields East is a new location for the Park.

**Table 14: Important Ecological Communities Located at the Park’s Rock Outcrop Study Sites**

Common Name	Scientific Name	Global Rank State Rank	Number of ROMP Study Sites Where Found
Central Appalachian Basic Woodland	<i>Fraxinus americana</i> - <i>Carya glabra</i> / <i>Muhlenbergia sobolifera</i> - <i>Helianthus divaricatus</i> - <i>Solidago ulmifolia</i> Woodland	G2 / S2	Basement Rock Outcrops: 2 Greenstone Rock Outcrops: 7
Central Appalachian Heath Barren	<i>Kalmia latifolia</i> - <i>Gaylussacia baccata</i> - <i>Vaccinium (angustifolium, pallidum)</i> - <i>Menziesia pilosa</i> Shrubland	G2 / S1	Basement Rock Outcrops: 3
Central Appalachian Acidic Boulderfield	<i>Lasallia (papulosa, pensylvanica)</i> - <i>Dimelaena oreina</i> - ( <i>Melanelia culbersonii</i> ) Nonvascular Vegetation	G4 / S4	Quartzite Rock Outcrops: 3
Central Appalachian Mafic Boulderfield	<i>Lasallia papulosa</i> - <i>Stereocaulon glaucescens</i> - <i>Chrysothryx chlorina</i> Nonvascular Vegetation	G2 / S2	Greenstone Rock Outcrops: 5
Central Appalachian Circumneutral Barren	<i>Juniperus virginiana</i> - <i>Fraxinus americana</i> / <i>Carex pensylvanica</i> - <i>Cheilanthes lanosa</i> Wooded Herbaceous Vegetation	G2 / S2	Greenstone Rock Outcrops: 5
Sweet Birch - Chestnut Oak Talus Woodland	<i>Betula lenta</i> - <i>Quercus prinus</i> / <i>Parthenocissus quinquefolia</i> Woodland	G3G4 / S3S4	Quartzite Rock Outcrops: 3
Central Appalachian High-Elevation Boulderfield Forest	<i>Betula alleghaniensis</i> / <i>Sorbus americana</i> - <i>Acer spicatum</i> / <i>Polypodium appalachianum</i> Forest	G2 / S2	Basement Rock Outcrops: 1 Greenstone Rock Outcrops: 7
High-Elevation Outcrop Barren (Chokeberry Igneous / Metamorphic Type)	<i>Photinia melanocarpa</i> - <i>Gaylussacia baccata</i> / <i>Carex pensylvanica</i> Shrubland	G1 / S1	Greenstone Rock Outcrops: 6
Central Appalachian Mafic Barren (Ninebark / Pennsylvania Sedge Type)	<i>Fraxinus americana</i> / <i>Physocarpus opulifolius</i> / <i>Carex pensylvanica</i> - <i>Allium cernuum</i> - ( <i>Phacelia dubia</i> ) Wooded Herbaceous Vegetation	G2 / S2	Basement Rock Outcrops: 3 Greenstone Rock Outcrops: 4
High Elevation Greenstone Barren	<i>Diervilla lonicera</i> - <i>Solidago randii</i> - <i>Deschampsia flexuosa</i> - <i>Hylotelephium telephioides</i> - <i>Saxifraga michauxii</i> Herbaceous	G1 / S1	Greenstone Rock Outcrops: 12
Central Appalachian Xeric Chestnut Oak - Virginia Pine Woodland	<i>Quercus prinus</i> - <i>Pinus virginiana</i> - ( <i>Pinus pungens</i> ) / <i>Schizachyrium scoparium</i> - <i>Dichanthelium depauperatum</i> Woodland	G2 / S2	Basement Rock Outcrops: 4 Greenstone Rock Outcrops: 1

## Rare, Threatened and Endangered Plants

Guidance for the protection of rare, threatened and endangered plants and lichens and the control of invasive exotic plants is directed by the NPS *Management Policies 2006*, NPS DO #77: *Natural Resources Management*, and other NPS and Park policies. Section 7 of the Endangered Species Act (16 USC 1531 et seq.), as amended (ESA), requires an examination of impacts on all federally-listed threatened or endangered species. NPS policy also requires examination of the impacts on federal candidate species, as well as state listed threatened, endangered, candidate, rare, declining, and sensitive species (NPS, 2006)

Rare, threatened and endangered plants, lichens, and invasive species are located in the Park's rock outcrops. In 2005 VA-DNH surveyed the 50 selected rock outcrops identified in the Rock Outcrop Management Project to identify these communities at the Park. Detailed results of the survey and a full listing of rare plants, watch list species, exotic plants and lichens can be found in Table A, Table B and Table C in Appendix G.

Previously unknown rare plants, lichen, invasive exotic plants were identified at many of the rock outcrop sites, while six rare plant populations that were known to have existed could not be located.

### **Rare, Threatened, and Endangered Plants**

Project botanists located 76 rare plant populations comprising 21 species at 31 sites. Nine of the populations representing seven species were previously unknown in the Park:

- bristly sarsaparilla (*Aralia hispida*)
- purple clematis (*Clematis occidentalis* var. *occidentali*)
- hazel dodder (*Cuscuta coryli*)
- Appalachian fir-clubmoss (*Huperzia appalachiana*)
- marsh muhly (*Muhlenbergia glomerata*)
- red raspberry (*Rubus idaeus* spp. *strigosus*)
- three-toothed cinquefoil (*Sibbaldiopsis tridentata*)

Colonies of Appalachian fir-clubmoss at several ROMP sites could not be relocated, had declined in population size from earlier reports, and/or appeared unhealthy.

Forty-two populations of uncommon (watchlist) plants were located, comprising 12 species. One of these uncommon species, the northern prickly-ash (*Zanthoxylum americanum*), is new to the Park (Fleming et al. 2007).

### **Rare Plants at Basement Rock Outcrops**

Five populations of rare plants were located at basement rock outcrops. Species represented include bristly sarsaparilla, bearberry (*Arctostaphylos uva-ursi*), Appalachian fir clubmoss, mountain sandwort (*Minuartia groenlandica*), and quaking aspen (*Populus tremuloides*). The two populations of bristly sarsaparilla were previously unknown to the Park. In addition, a population of bristly sarsaparilla was relocated on Old Rag Mountain which had not been documented from that site since it was first discovered there in 1938. Wildfires have recently occurred in all of the areas where bristly sarsaparilla was found during the course of this study. The rare plant is believed to be unable to compete with

other species in the absence of periodic wildfire or a management regime that mimics the effects of wildfire (Fleming et al. 2007).

One rare plant population known to occur at a basement rock site prior to this study, but not identified during the survey was Rand's goldenrod (*Solidago randii*) at Marys Rock. Colonies of Appalachian fir-clubmoss at several ROMP sites could not be relocated, had declined in population size from earlier reports, and/or appeared unhealthy.

There were four watchlist plants located at six basement rock outcrops. These include the roundleaf serviceberry (*Amelanchier sanguinea* var. *sanguinea*), hawthorn (*Crataegus pruinosa*), mountain pimpernel (*Taenidia montana*), and hairy goldenrod (*Solidago hispida* var. *hispida*) (Fleming et al. 2007).

### **Rare Plants at Greenstone Rock Outcrops**

Botanists located 16 rare plant species at greenstone outcrops. Six of these are new species locations for purple clematis (*Clematis occidentalis* var. *occidentalis*), hazel dodder, Appalachian fir-clubmoss, marsh muhly, red raspberry, and three-toothed cinquefoil.

Colonies of Appalachian fir-clubmoss at greenstone sites could not be relocated, had declined in population size from earlier reports, and/or appeared unhealthy. The latter was manifest by the presence of dead, stunted, and/or chlorotic plants. Greenstone outcrop sites with apparent problems include Stony Man Summit and Hawksbill Summit.

Ten populations of watchlist species were located at greenstone outcrops (Table B in Appendix G). One of these species, *Zanthoxylum americanum* (northern prickly-ash), is new to the Park. (Fleming et al. 2007).

### **Rare Plants at Quartzite Rock Outcrops**

Vegetation overlying quartzite formations is somewhat sparser, but supports more evergreen communities (Young 2006). Mountain paper birch (*Betula cordifolia*) and Bradley's spleenwort (*Asplenium bradleyi*) were found exclusively at three quartzite outcrops site. One new population of bristly sarsaparilla was also found.

No clubmoss or watchlist species were identified for Quartzite Rock Outcrops.

Based on correspondence with the USFWS and Virginia Department of Game and Inland Fisheries (VDGIF), of the species listed in the letter, habitat exists at other rock outcrop areas in the Park for the *Paxistima canbyi*, a species of concern at the Overall Run Falls site.

### **Invasive Exotic Plants**

Eighteen rock outcrop sites were identified as requiring invasive species management. Stewardship biologists identified 13 invasive plant species at rock outcrop study sites. Eleven of the invasive species were herbaceous, with Canada bluegrass (*Poa compressa*) and Sheep sorrel (*Rumex acetosella*) occurring most frequently at rock outcrop sites. Two woody species, Tree-of-Heaven (*Ailanthus altissima*) and coralberry (*Symphoricarpos orbiculatus*) also occurred at a small number of sites. Most invasive plants were recorded

at greenstone outcrops, there were also some found at basement rock outcrops (Fleming et al. 2007). See Table 15 for invasive plant ranks and Table 16 for a list of invasive exotic species requiring management action.

**Table 15: VA-DNH Invasive Plant Ranks** (Rank values range from 0 to 3. Higher values correspond to greater invasive plant threats.)

Site ID	Study Site Name	Invasive Plant Rank
C02	Bettys Rock	2
C67	Bearfence Mountain	2
C03	Big Devils Stairs	2
C04	Blackrock Central District	0
C05	Blackrock South District	0
C64	Brown Mountain	0
C07	Browntown Valley Overlook	0
C08	Calvary Rocks-Chimney Rock	0
C10	Crescent Rock Overlook	2
C11	Crescent Rock South	1
C13	Dickey Hill	1
C14	Dickey Ridge	1
C66	Field Hollow Cliff	1
C15	Franklin Cliffs North	0
C16	Franklin Cliffs Overlook	1
C17	Franklin Cliffs South	1
C18	Goat Ridge	2
C19	Gooney Manor Overlook	0
C20	Halfmile Cliff	0
C21	Hawksbill North Slope	0
C60	Hawksbill North Slope Talus	0
C22	Hawksbill Summit	1
C23	Hightop	1
C28	Little Stony Man	0
C29	Loft Mountain Summit	0
C31	Marys Rock	0
C32	Millers Head	0
C34	Nakedtop Upper East Slope	0
C35	North Marshall Summit	0
C36	Old Rag Southside	0
C37	Old Rag Summit East	0
C62	Old Rag Summit West	0
C38	Oventop	1
C63	Overall Run Falls North	2
C40	Pass Mountain	0
C41	Pinnacles	0
C42	Powell Gap Cliff	0
C44	Rocky Mountain	0
C68	Rose River Cliffs	2
C45	Sawlog Ridge	2

C46	South Marshall Cliff	1
C47	Stony Man Summit	1
C69	Whiteoak Canyon	1

**Table 16: Invasive Exotic Plant Species Requiring Management Action**

Scientific Name	Common Name	ROMP Sites
<i>Ailanthus altissima</i>	Tree-of-Heaven	Big Devils Stairs, Overall Run Falls North, Millers Head, Bettys Rock
<i>Alliaria petiolata</i>	Garlic mustard	Dickey Ridge, Field Hollow Cliff
<i>Bromus tectorum</i>	Junegrass	Millers Head
<i>Centaurea biebersteinii</i>	Spotted knapweed	Bettys Rock, Hawksbill Summit
<i>Commelina communis</i>	Asiatic day flower	Big Devils Stairs, Whiteoak Canyon, Rose River Cliffs
<i>Dactylis glomerata</i>	Orchard grass	Millers Head
<i>Digitaria sanguinalis</i>	Crab grass	Bearfence Mountain
<i>Microstegium vimineum</i>	Japanese stiltgrass	Dickey Ridge
<i>Poa compressa</i>	Canada bluegrass	Stony Man, Crescent Rock Overlook, Crescent Rock South, Hawksbill Summit, Franklin Cliffs Overlook, Field Hollow Cliff, Hightop, Loft Mountain Summit
<i>Poa pratensis</i>	Kentucky bluegrass	Millers Head
<i>Polygonum caespitosum</i> var. <i>longisetum</i>	Oriental lady's thumb	Loft Mountain Summit
<i>Rumex acetosella</i>	Sheep sorrel	Crescent Rock Overlook, Crescent Rock South, Hawksbill Summit, Franklin Cliffs Overlook, Field Hollow Cliff, Loft Mountain Summit
<i>Symphoricarpus orbiculatus</i>	Coralberry	Dickey Ridge, Goat Ridge

### **Invasive Exotic Plants at Basement Rock Outcrops**

Five invasive exotic species were found within two basement rock outcrop sites. Millers Head was found to support populations of Tree-of-Heaven, Junegrass (*Bromus tectorum*), Orchard grass (*Dactylis glomerata*), and Kentucky bluegrass (*Poa pratensis*). Whiteoak Canyon was found to support Asiatic day flower (*Commelina communis*).

### **Invasive Exotic Plants at Greenstone Rock Outcrops**

Eleven invasive exotic species were found within 15 greenstone rock outcrop sites. Canada bluegrass and Sheep sorrel were the most widespread invasive species among Greenstone rock outcrop sites. Tree-of-Heaven was present at three sites, and the highly invasive Japanese stilt grass (*Microstegium vimineum*) has begun invading the Dickey Ridge site.

## **Invasive Exotic Plants at Quartzite Rock Outcrops**

No invasive exotic plants were identified on quartzite rock outcrops during the survey.

### **Lichens**

Lichen collection at five sites<sup>3</sup> representative of the three major rock outcrop types in the Park resulted in the identification of approximately 90 taxa, 38 of which were new to the Park's lichen list.

Of the 90 total taxa identified, six taxa were potentially new to science:

- *Chrysothrix* sp.
- *Fuscidea* sp.
- *Lecanora* sp.
- *Lepraria* sp.
- *Opegrapha* sp. (possibly *O. gyrocarpa*, which has only recently been recorded from northern North America)
- An unknown yellow crust.

Of the taxa potential new to science two occurred on greenstone, two on basement rock, and three on quartzite.

Seven lichen species were evidently not previously documented in Virginia:

- *Arctoparmelia centrifuga*
- *Buellia stellulata*
- *Cladonia coccifera*
- *Microcalicium arenarium*
- *Porpidia lowiana*
- *Porpidia tuberculosa*
- *Stereocaulon glaucescens*

*Buellia stellulata* was previously unknown in the eastern United States. Of the species not previously documented in Virginia, one occurred on basement rock, six occurred on greenstone, and four on quartzite.

Twelve species were significantly disjunct in Virginia from their main geographic range; the majority of these are northern-boreal species:

- *Arctoparmelia centrifuga*
- *Buellia stellulata*
- *Cladonia coccifera*
- *Melanelia stygia*
- *Microcalicium arenarium*
- *Parmelia omphalodes*
- *Porpidia lowiana*
- *Porpidia tuberculosa*
- *Punctelia graminicola*
- *Rhizocarpon geographicum*

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<sup>3</sup> Collection sites include Blackrock South District, Crescent Rock South, Hawksbill North Slope Talus, Old Rag, and North Marshall Summit.

- *Stereocaulon glaucescen*
- *Umbilicaria caroliniana*

Of these twelve geographically disjunct species, ten occurred on greenstone, three on basement rock, and six on quartzite.

In addition, the identification of these collections and other lichen data collected during the project enabled VA-DNH ecologists to define the range of two, new Non-Vascular vegetation, lichen-dominated communities.

A number of other lichen taxa present in the Park may merit a ranking of state rare, but information about their ranges and abundance is currently too ambiguous to support a firm rank (Fleming et al.2007).

### Rare, Threatened and Endangered Species

NPS policy is to protect the natural abundance and diversity of all naturally occurring communities. The *NPS Management Policies 2006*, NPS DO#77: *Natural Resources Management* and Section 7 of the ESA as amended provide general direction for the protection of wildlife and wildlife habitat.

Because rock outcrops are highly specialized habitat utilized by special animals, this review focuses on specific rare, threatened and endangered species. Use by other types of wildlife in the park is transient.

Rock outcrops provide habitat for various snakes, salamanders, a rare bat, and insects, including several species of rare invertebrates. VA-DNH Zoologists completed inventories at 50 ROMP sites in 2006. A total of 763 invertebrate species were identified in the field or from field collections. Table D and Table E in Appendix G provide a full list of watchlist and rare animals found in the Park.

In the study, thirty-two uncommon (watchlist) animals were collected or observed. One of these is the smooth green snake (*Liochlorophis vernalis*); the others are invertebrates (Fleming et al. 2007). Six rare species tracked by VA-DNH were identified from fauna samples collected and observed at ROMP sites. These include four moths (*Itame ribearia*, *Catocala herodias gerhardi*, *Hadena ectypa*, and *Properigea costa*), one caddisfly (*Wormaldia thyria*), and one bat (*Myotis leibii*). One Virginia special status species, the winter wren (*Troglodytes troglodytes*), was identified.

In addition, one state threatened species was observed by VA-DNH zoologists, the Peregrine falcon (*Falco peregrinus*, G4S1B/S2N), and one federally endangered species, the Shenandoah salamander (*Plethodon Shenandoah*, G1S1), which is endemic to the park (Fleming et al. 2007). The peregrine falcon was found at Hawksbill Summit, Stony Man Mountain, and Old Rag Mountain.

The endangered Shenandoah salamander has been found at five sites in the park; Hawksbill, Little Stony Man Cliffs, Pinnacles, and Stony Man, and presently occurs on three mountains including Hawksbill, Stony Man, and The Pinnacle.

The Shenandoah salamander is endemic to the Park and exists entirely in the higher peaks of the Park at elevations above 3000 feet. This species is confined to deep pockets of soil within the talus on the north and northwestern faces of these mountain ranges in mixed-conifer forest. The Shenandoah salamander was listed as Federally Endangered in 1989. Due to its restricted range, limitations on range expansion and potential threats within defined population areas. Although its range falls entirely within a National Park where protection might be assumed, there are many threats to this species.

Based on correspondence with USFWS and Virginia Department of Game and Inland Fisheries (VDGIF), of the species listed in the letter, habitat exists in rock outcrop areas in the Park for the federally listed Shenandoah salamander at moist talus slopes adjacent to the rock outcrops at the Little Stony Man and Hawksbill sites.

### **Rare, Threatened and Endangered Species at Basement Rock Outcrops**

Two rare species tracked by VA-DNH were identified from fauna samples collected and observed at two igneous / metamorphic outcrop sites. These include one bat, the Eastern small-footed myotis (*Myotis leibii*) and one moth (*Properigea costa*). In addition, eight watchlist species were identified at igneous / metamorphic rock outcrops (Fleming et al. 2007).

### **Rare, Threatened and Endangered Species at Greenstone Rock Outcrops**

Four species of rare invertebrate animals previously unknown to occur in the Park were collected: two noctuid moths (*Hadena ectypa*, and *Properigea costa*), a currant spanworm moth (*Itame ribearia*), and a philopotamid caddisfly (*Wormalia thyrta*) (Fleming et al. 2007). In addition, 27 watchlist species were identified by VA-DNH at greenstone rock outcrops (Fleming et al. 2007).

### **Rare, Threatened and Endangered Species at Quartzite Rock Outcrops**

One species, *Catocala herodias gerhardi*, a moth tracked by VA-DNH was identified from fauna samples collected and observed at a quartzite ROMP sites. In addition, four watchlist species were identified at four quartzite outcrop sites (Fleming et al. 2007).

## **WILDERNESS CHARACTER**

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### Wilderness Character

The Park's BWMP, NPS *Management Policies, 2006*, NPS DO #77: *Natural Resources Management and the Wilderness Act* provides guidance for the protection of wilderness areas. The purpose of the Wilderness Act is to provide "an enduring resource of wilderness for present and future generations of Americans." Areas designated in the National Wilderness Preservation System are to be kept as wild and natural as possible. Congress intended areas of wilderness to be places where natural processes are the primary influences and the imprint of human use largely unnoticeable.

The Park contains 32,205 hectares (79,579 acres) of wilderness, approximately 42% of the Park's backcountry land area. The Shenandoah Wilderness (Wilderness) exists in three general areas of the Park divided into eleven separate, non-contiguous parcels with irregular boundaries. Wilderness is generally surrounded by non-wilderness backcountry

with a similar use within the Park. Wilderness along the Park's east and west boundaries touches some private lands that have non-compatible uses. Approximately 40% of the Park's trail system traverses wilderness areas.

Half of the rock outcrops studied in the rock outcrop management project are located in federally designated wilderness. Nearly all park-wide rock outcrops are located within and in close proximity to the AT and Skyline Drive Historic District and are located outside of wilderness. However, most rock outcrop sites located outside of the Appalachian Trail and Skyline Drive are very likely to be contained in wilderness.

Any rock outcrops in wilderness would be located within the various recreation opportunity classes, or "management zones", established for wilderness management by the 1998 BWMP. These zones include "all" rock outcrops in the Park's wilderness, number unknown. The wilderness opportunity classes include management for the range of recreational low use to high use from Primitive Wilderness (low use) to Semi-Primitive Wilderness to Threshold Wilderness (high use) and Appalachian Trail Wilderness.

## CULTURAL RESOURCES

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### History of the Area

The history of the Park reveals a continuous interaction between land and people for over 9000 years. Archeological evidence indicates that as early as 8000 B.C., Paleo-Indians were using the Blue Ridge Mountains. These people were hunters and gatherers who lived in seasonal camps in the mountains. By 1000 A.D., agricultural communities had developed in the surrounding valleys, and use of the mountains was limited to short hunting trips.

The first European to record any exploration of this part of the Blue Ridge was Dr. John Lederer. In 1669, Lederer climbed to the crest of the mountain and described a wild forest teeming with game and a large open area at the present site of Big Meadows. In 1716, the Colonial Governor of Virginia, Alexander Spotswood, led a celebrated expedition across the mountain to encourage settlement of the surrounding valleys. During the 18th century, people moved into the Piedmont from the Tidewater region and into the Shenandoah Valley from Pennsylvania. By 1800, settlement of the valleys was fairly complete. During this period, the Native Americans living in the area moved elsewhere.

During the 19th century, settlement progressed into the mountain hollows as land in the lowlands became scarce. In time, the mountain farmers developed a culture and life style distinct from their valley relatives, due to their isolation and the harshness of conditions. Steep, rocky slopes, thin soil, and severe climate kept mountain farming to bare subsistence level. As the population increased, the land supporting it depreciated. Game was hunted out, pastures overgrazed, soil depleted, and timber logged out. At the turn of the century, small industries near the base of the mountain began to fail or move away. The population reached its peak about 1900. It began to decline until the 400-500 families living in the hollows in 1930 were estimated to be half of what were there 30 years before.

The Park was authorized by Act of Congress in 1926. It provided for establishment of a park with no expenditure of Federal funds for land purchase. Over a period of ten years, private donations and a major expenditure by the Commonwealth of Virginia secured the land necessary to officially establish the national park in 1935. In the meantime, the now-famous Skyline Drive was funded as a drought relief measure to spur employment, with construction beginning in 1931. Beginning in 1933, the Civilian Conservation Corps established ten camps in the park and constructed most of the facilities necessary for visitor services. Of the people still living on the mountain, many sold their land to the Commonwealth and moved out on their own, while the remainder were placed in resettlement camps outside the park.

The prevailing philosophy at the time the park was established was that any evidence of human occupation in the "natural area" was a blight on the landscape. As a result, many of the buildings in the park were demolished and practically all of those that remained have been allowed to disappear into the landscape. Today, very little of the material remains of the mountain culture or border industries.

### Cultural Landscapes

A cultural landscape is a reflection of human adaptation and use of natural resources. It is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and types of structures that are built. The character of a cultural landscape is defined by physical materials such as roads, buildings, and vegetation and by use reflecting cultural values and traditions. Shaped through time by historical land use and management practices, cultural landscapes provide a visual record of an area's past. The dynamic nature of modern human life, however, contributes to the continual reshaping of cultural landscapes. They are a good source of information about specific times and places, but at the same time, their long-term preservation is a challenge.

There are 17 identified cultural landscapes in the Park. The majority of these are the developed areas in the park, such as Skyland and Lewis Mountain. The only Cultural Landscape in the area of potential effect is the AT. Access to many of these rock outcrops would be in part via the AT and other trails in the park.

### Archeological Resources

Although there has not been a comprehensive archeological survey at Shenandoah National Park, the park has identified archeological resources through compliance oriented surveys of targeted areas. There are 507 known archeological sites in the Park listed in the Archeological Sites Management Information System database (ASMIS) representing both historic and prehistoric use of the park. Of those 507 sites, only three archeological resources may potentially be affected by this plan.

There are two sites in the vicinity of the Rock Spring Cabin (ROMP #34). One is considered a seasonal base camp while the other is a temporary hunting/gathering camp. The third site is a lithic scatter in the Hogwallow Flats area (ROMP #07). After reviewing the report "A Phase 1 Cultural Resources Survey of Seven Locations Associated with Appalachian Trail Campsite Improvements in Shenandoah National

Park, Luray, VA.” (Nash 2001) and the exact locations of the sites it was determined that the sites are not in the Area of Potential Effect (APE).

## VISITOR USE AND EXPERIENCE

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### Climbing Activities

Virginia Tech outdoor recreation researchers surveyed park users at the park’s two most popular climbing areas between May and September 2005 as part of the Rock Outcrop Management Project. Details of the survey can be found in the Lawson et al. (2006). Climbing activities include ice climbing, bouldering, and rock climbing. The surveys found that rock climbing is the most popular and widespread climbing activity in the Park. It is likely that the Park has less than 500 climber use-days per year, based on the number of climbers surveyed during climber surveys. Because climbing is a popular recreational use activity specific to rock outcrops, climbing activities are presented in greater detail than other recreational activities the Park supports. The types of climbing offered in the park are described below.

#### **Ice Climbing**

Ice climbing activity is very specialized and most frequently used locations include Hawksbill Summit and Whiteoak Canyon along with other remote locations in backcountry and wilderness. This activity is infrequent in the Park, due to the seasonal requirements and required specific conditions.

#### **Bouldering**

Bouldering requires a substantial boulder or set of boulders and does not necessarily require rock outcrops. According to the observations of the Park’s long-time climbing enthusiasts and Virginia Tech researchers, bouldering has experienced some recent increase and it is likely that bouldering may increase in the Park in the future. Bouldering activity is infrequent at the Park.

#### **Rock Climbing**

Rock climbing opportunities are limited at the Park due to inaccessibility of many satisfactory park rock outcrop sites for this activity. Most climbing activity occurs in close proximity to the easily accessible Skyline Drive at overlook rock outcrop vista clearings and at rock outcrop sites along or near the Appalachian Trail, which parallels Skyline Drive on the ridge top, Little Stony Man Cliffs, and Old Rag Mountain.

The Park has no officially designated routes for rock climbing. Although rock climbing activity is known to have increased in the Park somewhat over the past 20 years, according to the observations of the Park’s long-time climbing enthusiasts, climbing activity levels appear to have remained at a stable level in recent years.

### Recreational Activities

The Park’s rock outcrops are very popular visitor destinations and are used for a variety of recreational activities and vista enjoyment. The location of Skyline Drive along the ridgeline and the 500 miles of hiking trails provide exceptional access to many rock

outcrops. The availability of trail information and outcrop locations, along with ease of accessibility makes these outcrops highly susceptible to intense visitor use.

### **Day Hiking/Viewing**

Day hiking to obtain unobstructed views from rock outcrops is by far the most common recreational activity on rock outcrops. Many outcrops are highly accessible at overlooks on the Skyline Drive and several sites are very popular, including Crescent Rock (South Crescent Rock and Bettys Rock), Franklin Cliffs, and Gooney Manor Overlooks. Other outcrops used for viewing are generally easily accessible and proximal to backcountry ridge top trails, especially the Appalachian Trail. The rock outcrop scrambles of Old Rag Mountain summit is one of the least accessible outcrops as it requires a strenuous 7-mile hike (for a circuit hike). However, it is the most popular day hike in the Park and one of the most popular hikes in the Mid-Atlantic region.

### **Backcountry Camping**

Backcountry camping infrequently occurs at rock outcrops due to the undesirability of terrain and topography making campsite selection difficult. Presently, camping at rock outcrops is currently regulated by the general backcountry camping regulations described in the Park's BWMP and the *Exploring the Backcountry* brochure. Activities associated with camping include sanitation, campfires, littering, and other impacting activities which are also addressed by the BWMP.

### **Hang Gliding/Paragliding**

Hang gliding and paragliding are permitted at three ridge top launch sites (Millers Head, Hogback, and Dickey Ridge) in the Park, as identified and regulated at Title 36 of the CFR. Only one of the three sites, Millers Head, is described as a rock outcrop.

## Visitor Experience

*NPS Management Policies 2006* state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for people to enjoy the parks. Part of the purpose of the Park is to protect the natural and cultural resources of the Northern Blue Ridge and to provide scenery, serving as a refuge and pleasuring ground. The GMP reaffirmed the importance and significance of visitor use and established provisions for diverse recreation experiences.

The Park offers many recreational activities as well as its natural beauty. In addition to Skyline Drive and viewing the overlooks, the park offers various outdoor activities including hiking, camping, rock climbing, and hang gliding. The Park's attraction lies in sweeping vistas, wilderness areas, recreational opportunities, and natural habitats that visitors travel to experience.

## CHAPTER 4

# ENVIRONMENTAL CONSEQUENCES

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*Photo courtesy of Gary P. Fleming*

### **Blackrock South**

## INTRODUCTION

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This chapter describes the environmental consequences associated with the no-action and action alternatives presented in Chapter 2. The overall methodology for assessing impacts is presented below. It is organized by impact topic, and provides a standardized comparison between alternatives based on the most relevant impact topics described in Chapter 1. In accordance with the National Environmental Policy Act, impacts are described in terms of context, intensity, duration, and cumulative impacts. Because this document is intended to comply with Section 106 of the NHPA, the analysis of impacts to cultural resources contains an assessment of effect. Mitigating measures for adverse impacts are also described.

## METHODOLOGY

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The following impact analysis is based on the results of the studies on the 50 rock outcrops identified in the Rock Outcrop Management Project. Potential impacts described here are representative examples of all outcrops that will be designated into the Management Categories.

As required by NEPA, potential impacts are described in terms of type, context, duration, and level of intensity. These terms are defined below. Overall, these impact analyses and conclusions were based on the review of the existing literature and Park studies, information provided by on-site experts and other agencies, professional judgment and park staff knowledge and insight.

- **Type of Impact:** Impacts can be beneficial or adverse. Beneficial impacts would improve resource conditions while adverse impacts would deplete or negatively alter resources.
- **Context:** Context is the setting within which an impact occurs and can be site specific, local, parkwide, or regionwide. Site-specific impacts would occur at the location of the action, local impacts would occur within the general vicinity of the project area, parkwide impacts would affect a greater portion of the Park and regionwide impacts would extend beyond Park boundaries.
- **Intensity:** Impact intensity is the degree to which a resource would be adversely affected. Because level of intensity definitions (negligible, minor, moderate, major) varies by resource, separate definitions are provided for each impact topic analyzed. The criteria that were used to rate the intensity of the impacts for each impact topic is presented below under “impact thresholds”. Beneficial impacts are described in terms of the relative benefit or improvement of the resource but are not given intensity definitions.
- **Duration:** Impacts can be either short term or long term. A short-term impact would be temporary in duration or with construction and would be associated with recreational use of rock outcrops. Depending on the resource, impacts would last as long as construction or use was taking place, for a single year or growing season, or longer. Long-term impacts last beyond the construction or visitor use period, and the resources may not

resume their pre-construction conditions for a longer period of time following construction. Impact duration for each resource is unique to that resource and is presented for each impact topic.

### Direct and Indirect Impacts

DO-12 requires that direct and indirect impacts be considered, but not specifically identified. A direct impact is caused by an action and occurs at the same time and place. An indirect impact is caused by an action that may occur later in time or is farther removed in distance, but is still reasonably foreseeable.

### Cumulative Impacts

The Council on Environmental Quality regulations, which implement NEPA, requires assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all alternatives included in this EA/AoE.

Cumulative impacts were determined by combining the impacts of the alternatives with the impacts of other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at the Park and, if applicable, the surrounding region.

One project was identified as contributing to cumulative impacts on the resources addressed by this EA/AoE: the proposed construction of a new Old Rag parking lot at the Nethers park boundary public access. The primary objectives for making improvements at Old Rag are: (1) to ensure a long-term and environmentally responsible solution to parking issues in the Nethers area; (2) to reduce park visitor impacts to the Nethers neighborhood, including obstruction of traffic flow caused by roadside parking along the narrow State Route 600, trespassing, littering, and inappropriate disposal of human waste; (3) to improve visitor experiences which are impaired by the lack of parking and/or poor trailhead access; and (4) to resolve visitor safety concerns caused by high numbers of vehicles and pedestrians sharing the same roadway. An EA was prepared for the new parking lot at Old Rag Mountain and distributed for public review in April and May of 2008. A final decision is still pending.

### Impacts to Cultural Resources and Section 106 of the National Historic Preservation Act

Impacts to cultural resources are described in terms of type, context, duration, and intensity, which is consistent with the Council on Environmental Quality regulations for implementing the National Environmental Policy Act. However, the impact analysis is also intended to comply with the requirements of Section 106 of the NHPA, as amended

(16 USC 470 et seq.). In accordance with the Advisory Council for Historic Preservation's regulations implementing Section 106 (36 CFR 800), impacts to cultural landscapes and archaeological resources were identified and evaluated by (1) determining the area of potential effects; (2) identifying cultural resources present in the area of potential effects that were either listed on or eligible for listing on the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed on or eligible for listing on the national register; and (4) considering ways to avoid, minimize or mitigate adverse effects.

Under the regulations of the Advisory Council for Historic Preservation a determination of either *adverse effect* or *no adverse effect* must also be made for affected National Register eligible cultural resources. An *adverse effect* occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion on the National Register (e.g., diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the action alternatives that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5, Assessment of Adverse Effects). A determination of *no adverse effect* means there is an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion on the National Register. If there are no impacts to cultural resources, the determination is *no effect* on cultural resources.

Council on Environmental Quality regulations and NPS DO-12 also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g. reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation only under the National Environmental Policy Act. It does not suggest that the level of effect as defined by Section 106 would be similarly reduced. Although adverse effects under Section 106 could be mitigated, the effect would remain adverse.

An assessment of effect for purposes of Section 106 of NHPA is included in the Section 106 Summary for cultural landscapes and archeological resources, and an overall Section 106 summary for each alternative is included at the end of Chapter 4. The overall summary is an assessment of the effect of the undertaking on cultural resources, based on the criteria of adverse effect found in the Advisory Council for Historic Preservation's regulations.

The cultural resource management policies of the National Park Service are derived from several historic preservation and other laws, proclamations, Executive Orders, and regulations. Two primary mandates include the NHPA and NPS DO-28. Taken collectively, they provide the NPS with the authority and responsibility for managing cultural resources within units of the NPS so that those resources will be preserved unimpaired for future generations. Cultural resource management for this project will be carried out in a manner consistent with legislative and regulatory provisions, and with implementing policies and procedures.

**National Historic Preservation Act of 1966, as amended, Section 106:**

Section 106 of NHPA requires federal agencies to consider the impacts of their proposals on historic properties, and to provide state and tribal historic preservation officers and, as appropriate, Advisory Council for Historic Preservation and the public reasonable opportunity to review and comment on these actions.

The park maintains an active relationship with the VA SHPO regarding cultural resource issues and has notified the VA SHPO regarding the initiation of this EA/AoE and the intention of using this document for compliance with Section 106.

**NPS Director’s Order #28: Cultural Resource Management:**

NPS DO-28 requires the NPS to protect and manage cultural resources in its custody through a comprehensive program of research, planning, and stewardship and in accordance with the policies and principles contained within the *NPS Management Policies, 2006*. The Order also requires the NPS to comply with the requirements described in the Secretary of the Interior’s Standards and Guidelines for Archeology and Historic Preservation and with the 1995 Servicewide Programmatic Agreement with the Advisory Council for Historic Preservation and the National Conference of State Historic Preservation Officers.

The park manages its cultural resources by conducting research to identify, evaluate, document and register basic information about its cultural resources, and sets priorities for stewardship to ensure resources are protected, preserved, maintained and made available for public understanding and enjoyment. The park consults and coordinates with outside entities where appropriate regarding cultural resource management.

**IMPACTS TO NATURAL RESOURCES**

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**GEOLOGIC AND SOIL RESOURCES**

Methodology and Impact Thresholds

Information compiled from available park documents and park staff was used to analyze the impacts. The definitions for identifying intensity level of an adverse impact are defined as follows:

Impact Intensity	Intensity Level Definition
Negligible	A reduction in the composition, amount, or compaction of geologic and soil resources may occur, but any change would be so small that it would not be measurable.
Minor	A reduction in the composition, amount, or compaction of geologic and soil resources would occur and would be measurable but would be limited and of little consequence to the viability of bedrock or soil.
Moderate	Some reduction in the composition, amount, or compaction of geologic and soil resources would occur, and it would be measurable but would result in a small-scale consequence to the viability of bedrock or soil.
Major	A noticeable reduction in the composition, amount, or compaction of geologic and soil resources would occur. The change would be measurable and of widespread consequence to the viability of bedrock or soil.

Beneficial impacts are described but not assigned intensity levels.

### Impacts of Alternative A: No Action

**Impact Analysis:** Under this alternative, current management practices and level of treatment for the resources would continue. Campsite and trail management and maintenance would continue as directed by the BWMP. Overall, impacts to geologic resources and soils would continue to be slight in many areas but more severe in high-use locations. Bedrock exposures would be largely unaffected; however impacts to rock such as polishing in areas of high human traffic, scratches and gouges left by crampons, and holes drilled for rock climbing fixed anchor installation would still occur. Soil would continue to be compacted and worn away in high to moderate-use areas leading to adverse impacts.

At Little Stony Man Mountain the greenstone bedrock would continue to sustain minor polishing of rock in high-use, high-traffic areas. The soil of high-use areas would continue to be lost from the site. The granite bedrock exposed on Old Rag Mountain would continue to sustain impacts, such as minor polishing in high-use areas, scratches and gouges left by crampons, and holes drilled for bolt installation, preservation of natural features. Human trampling would continue to have impacts as soil is compacted and lost from high-use areas within the site. Social trail creation and use would also continue to further degrade the amount and condition of the soil in high-use areas. The bedrock exposures present for sites in Management Categories 1-5 would continue to sustain impacts such as minor polishing in areas frequented by humans. Soil impacts would continue as a result of human trampling and social trail creation and use.

At Little Stony Man Mountain, the soil and bedrock at high use areas would sustain minor and moderate impacts respectively. At Old Rag Mountain the soil and bedrock of high-use areas would have moderate and minor impacts. Impacts to bedrock for Management Category 1 and Management Category 2 sites would be negligible and soil impact would be moderate. Soil impacts to Management Category 3 sites would be minor and bedrock would sustain negligible impacts. There would be no impacts to geologic and soil resources to Management Category 4 or Management Category 5 sites.

Overall impacts to geologic and soil resources from Alternative A would be negligible to moderate due to soil erosion caused by rock polishing and gouging from human traffic. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive resource, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** There are no present or future actions that would result in any impacts to the geologic resources within or adjacent to the rock outcrop sites. Soil types at the rock outcrops are specific to rock outcrop sites and different than soils found at the Old Rag parking lot site. There are no geological impacts associated with the Old Rag parking lot project. As a result, Implementation of Alternative A would result in no beneficial or adverse cumulative impacts to the existing geologic and soil resources of the rock outcrop sites.

**Conclusion:** Action taken under Alternative A would result in adverse, site-specific, negligible to moderate long-term impacts to geologic and soil resources. There would be no adverse or beneficial cumulative impacts from past, present and reasonably foreseeable future actions associated with this alternative.

### Impacts of Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Alternative B would allow visitor use of selected rock outcrop sites while minimizing impacts to natural resource conditions. Under this alternative, access to some areas would be limited through trail closures and reduced access to rock outcrops and resource monitoring and management would occur. The Climbing Management Guidelines would be implemented. This includes educational displays and programs, installing physical barriers and signage at selected sites and annual inspection of “watch” sites.

At Little Stony Man Mountain the greenstone bedrock would continue to sustain minor impacts from rock climbing anchor installation in areas open to rock climbing and hiking. The soil of high use areas open to recreational activities would sustain additional impacts. The soil within areas closed to recreational uses would sustain positive benefits from the decreased trampling. Signs would be installed in certain areas with minimal impacts to soil.

The granite bedrock exposed on Old Rag Mountain would continue to sustain impacts such as minor polishing in high-use areas and scratches and gouges left by crampons. Impacts from human trampling would be concentrated in previously damaged areas and most additional soil impacts would be prevented. Signs would be installed in certain areas with minimal impacts to soil. Social trail creation would be curtailed further reducing soil impacts and allowing damaged areas to recover.

For Management Category 1 the bedrock exposures present on these sites would sustain few impacts. Soil impacts would reduce as visitor use is concentrated in previously disturbed areas, and social trail creation is curtailed. Minimal impacts to soil would occur through sign installation and barrier construction.

For Management Category 2 the bedrock exposures present on these sites would continue to sustain impacts. Signs would be installed in certain areas with minimal impacts to soil. Soil impacts would reduce as areas are protected from human-use. Impacts to soils would continue in isolated areas of high human trampling and social trail creation and use.

In Management Category 3 the bedrock exposures present on these sites would continue to sustain impacts such as minor polishing caused by footsteps being placed on the same rocks over time in areas frequented by humans. Isolated soil impacts would continue as a result of human trampling and social trail creation and use.

There would be negligible impacts to the geological and soil resources within Management Category 4 and 5 sites as no restrictions would be put on access to rock outcrops. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive resource, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

At Little Stony Man Mountain the bedrock and soil would sustain negligible and minor impacts respectively. Bedrock at Old Rag Mountain would have minor impacts from polishing and marks from crampons. Soil loss would cause negligible impacts. Soil would benefit from reducing the number of social trails. Sites in Management Categories 1 through 5 would have negligible impacts to bedrock and soil. Some sites in Management Categories 1 and 2 would have beneficial impacts where visitor use is concentrated in appropriate areas and reducing social trails.

Overall, impacts to geologic and soil resources would be negligible to minor due to trampling and crampon use. Geologic and soil resources would benefit and recover as a result of redirecting visitor use and reducing social trails.

**Cumulative Impacts:** There are no present or future actions that would result in any impacts to the geologic resources within or adjacent to the rock outcrop sites. Soil types at the rock outcrops are specific to rock outcrop sites and different than soils found at the Old Rag parking lot site. There are no geological impacts associated with the Old Rag parking lot project. As a result, Implementation of Alternative B would result in no beneficial or adverse cumulative impacts to the existing geologic and soil resources of the rock outcrop sites.

**Conclusion:** Actions taken under Alternative B would result in adverse, site-specific, short-term impacts from construction activities from sign and barrier installation to geologic and soil resources. Impacts to geology and soil resources from actions in Alternative B would be adverse, site-specific, negligible to minor long-term impacts. Restriction of use to some rock outcrops and trails would result in positive impacts to geologic and soil resources. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Under Alternative C, impacts caused by visitor use would be restricted in favor of protecting geologic and soil resources. Implementation of this alternative would result in positive impacts to geology and soils of rock outcrops as human use would decrease or be restricted in some areas and soil erosion and imprints left from climbing would decrease. Small areas of bedrock may continue to sustain areas of polishing in high-use areas and areas not closed to the public. Soil compaction and erosion may decrease within closed areas but increase in areas adjacent to summit closures as visitors seek new viewpoints. Minimal impacts would occur as signage and barriers are installed.

At Little Stony Man Mountain the greenstone bedrock would see reduced human use in areas previously open to rock climbing and hiking resulting in beneficial impacts. Positive impacts would also occur to the soil as soil loss would be reduced in areas closed to human-use as trampling and erosion decrease. Soil depths would slowly increase over time.

At Old Rag Mountain, the exposed granite bedrock would continue to sustain impacts, such as polishing in high-use areas and scratches and gouges left by crampons. Soil would be impacted from human trampling in non-summit areas as visitors seek new viewpoints to replace the closed summit areas. Soil within the summit area would be positively impacted as trampling and trail creation would be dramatically reduced, allowing soil depth to increase and damaged areas to recover.

For rock outcrop sites in Management Category 1, the bedrock would sustain positive impacts. Soil compaction caused by human trampling would decrease in areas protected from human use.

At Management Category 2 sites, bedrock exposures present would continue to sustain impacts. Positive soil impacts would occur within areas protected from human-use.

At Management Category 3 sites, bedrock exposures present would continue to be impacted. Bedrock exposures present would continue to sustain impacts. Areas protected from human use would result in positive soil impacts.

At Management Categories 4 and 5 sites, there would be negative impacts to the geological resources and beneficial impacts to soil resources. Bedrock exposures present would continue to sustain impacts. Positive soil impacts would occur within areas protected from human-use.

At Little Stony Man Mountain bedrock and soils would sustain positive impacts in areas that were previously open to hiking and climbing. At Old Rag Mountain the granite would sustain negligible impacts from crampons, and impacts to soil from human trampling at non-summit areas. Soil at the summit area would benefit from closure to visitors. For Management Category 1-5 sites, impacts to bedrock would be negligible. Soils would benefit from areas closed to visitor use.

Overall impacts in Alternative C from human trampling and traffic to bedrock would be negligible. Impacts to soil would be positive.

**Cumulative Impacts:** There are no present or future actions that would result in any impacts to the geologic resources within or adjacent to the rock outcrop sites. Soil types at the rock outcrops are specific to rock outcrop sites and different than soils found at the Old Rag parking lot site. There are no geological impacts associated with the Old Rag parking lot project. As a result, Implementation of Alternative C would result in no beneficial or adverse cumulative impacts to the existing geologic and soil resources of the rock outcrop sites.

**Conclusion:** Action taken under Alternative C would result in adverse, site-specific, short-term impacts from construction activities from sign and barrier installation to geologic and soil resources. Impacts to geology and soil resources from actions in Alternative C would result in adverse, site-specific, negligible long-term impacts. This alternative would be beneficial to many areas by restricting visitor use to summit and outlook areas. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

### Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Under Alternative D actions would be taken that would maximize visitor use and enjoyment. Implementation of this alternative would result in adverse impacts to geology and soils. The increased use of certain sites is likely to lead to highly localized impacts to bedrock, such as the installation of permanent rock climbing anchors and bolts and platforms and handrails for viewing areas. Soils in high-use areas would sustain negative impacts through increased erosion resulting from greater compaction and vegetation loss.

At Little Stony Man Mountain, bedrock would be modified in small areas through the installation of permanent climbing anchors at the top of the cliff. The disturbance area would be small, but the change would be long-term. Impacts to soil would continue throughout the site through severe soil compaction and loss, with high impact occurring in the highest-use areas.

At Old Rag Mountain additional visitation would cause moderate negative impacts to bedrock through polishing and the installation of climbing anchors and bolts. Negative impacts may occur to soil as the number of social trails increases and visitors establish new viewpoints. Severe soil compaction and loss would occur within high use areas. Unrestricted rock climbing may result in additional permanent anchors being installed into the rock.

For Management Category 1 sites bedrock exposures would sustain negative impacts as the result of likely increases in rock polish and vandalism. Severe soil compaction and loss would occur throughout rock outcrop sites, with greater impacts in extremely high-use areas subjected to the highest number of social trails and the greatest amount of visitor trampling.

At Management Category 2 sites bedrock exposures would sustain negative impacts as the result of likely increases in rock polish and vandalism. Negative soil impacts would occur throughout rock outcrop sites, with impacts becoming more intense in higher-use areas.

At Management Category 3 sites the bedrock exposures would sustain negative impacts as the result of increased visitation. Soil impacts would occur throughout rock outcrop sites, with concentrated impacts only in the most frequently visited areas.

At Management Category 4 sites the bedrock exposures on these sites would sustain negative impacts to bedrock and soil as the result of increased visitation.

At Management Category 5 sites the bedrock exposures on these sites would sustain negative impacts to bedrock and soil as the result of increased visitation.

Moderate soil compaction and loss would occur within high use areas at Little Stony Man Mountain and Old Rag Mountain. At Management Category 1 sites bedrock exposures would sustain negligible impacts, while moderate soil compaction and loss would occur within high use areas. At Management Category 2 sites bedrock and soil would sustain minor negative impacts in most areas, with high-use areas sustaining moderate soil compaction and loss. Bedrock and soil exposures would sustain negligible impacts at Management Category 3 sites becoming minor in high use areas. Increased human traffic would cause negligible impacts at Management Category 4 and 5 sites.

Overall, impacts to geology and soils from Alternative D would be moderate due to continued and in some cases increased access to rock outcrop sites. Construction would be planned and implemented in accordance with all NPS laws, mandates and policies. This means the Park will use all required measures to avoid and minimize impacts to protected resources. If immediate threats are identified that jeopardize the continued existence or viability of a rare, threatened or endangered species, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** There are no present or future actions that would result in any impacts to the geologic resources within or adjacent to the rock outcrop sites. Soil types at the rock outcrops are specific to rock outcrop sites and different than soils found at the Old Rag parking lot site. There are no geological impacts associated with the Old Rag parking lot project. As a result, Implementation of Alternative D would result in no beneficial or adverse cumulative impacts to the existing geologic and soil resources of the rock outcrop sites.

**Conclusion:** There would be adverse, site-specific, moderate, short-term impacts from construction related activities. Actions taken under Alternative D would result in adverse, site-specific, moderate, long-term impacts to geologic and soil resources. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## ECOLOGICAL COMMUNITIES

### Methodology and Impact Thresholds

Information compiled from available park documents and park staff was used to analyze the impacts. The definitions for identifying intensity level of an adverse impact are defined as follows:

Impact Intensity	Intensity Level Definition
Negligible	A reduction in the abundance and diversity of the ecological community may occur, but any change would be so small that it would not be measurable.
Minor	A reduction in the abundance and diversity of the ecological community would occur and would be measurable but would be limited and of little

	consequence to the viability of the community.
Moderate	Some reduction in the abundance and diversity of the ecological community would occur, and it would be measurable but would result in a small-scale consequence to the viability of the community.
Major	A noticeable reduction in the abundance and diversity of the ecological community would occur. The change would be measurable and of widespread consequence to the viability of the community.

Beneficial impacts are described but not assigned intensity levels.

### Impacts of Alternative A: No Action

**Impact Analysis:** Under Alternative A, current management practices for ecological communities would continue. This constitutes surveying and documenting plant populations and identifying impacts caused by external threats such as human trampling and invasive plant infestations. In the absence of any action, listed ecological communities would continue to degrade, and substantial portions of these communities would be damaged. Two of these ecological communities are endemic to the Park and their global existence would continue to be threatened. Other non-listed ecological communities would also sustain impacts resulting from visitor-use activities, but the wide-spread distribution and large acreages of these communities would result in less damage than communities with highly restricted distributions.

At Little Stony Man Mountain two globally rare community types occur on the site, the High-Elevation Greenstone Barren, and the Central Appalachian High-elevation Boulderfield Forest. The integrity of the High-Elevation Greenstone Barren would continue to degrade as thin mats of soil and vegetation would be compacted and worn away; leading to the decreased abundance and potential loss of diagnostic species. Camp sites and outcrops near the southern end of Little Stony Man Mountain would continue to be barricaded to discourage visitor use and associated impacts. The Northern Red Oak forest and Hemlock-Northern Hardwood Forest that surround the exposed outcrop and boulderfield communities would continue to sustain isolated impacts from illegal camping, and hikers and climbers seeking shaded rest areas.

At Old Rag Mountain, three globally rare ecological community types, the Central Appalachian Xeric Chestnut Oak – Virginia Pine Woodland, the Central Appalachian Heath Barren, and the Central Appalachian Mafic Barren are found on the summit area. Of these three, the Heath Barren would continue to sustain a large amount of damage from visitor impacts. The other two communities would continue to sustain impacts from the development and use of informal trails.

At Management Category 1 sites, five globally rare ecological communities (High Elevation Greenstone Barren, Central Appalachian High-Elevation Boulderfield Forest, Central Appalachian Mafic Boulderfield, High Elevation Outcrop Barren, and the Central Appalachian Xeric Chestnut Oak – Virginia Pine Woodland) have been identified at outcrops included within Management Category 1. These communities would continue to be degraded by high levels of human use. Two of the communities (High Elevation Greenstone Barren, and the High Elevation Outcrop Barren) are endemic to the rock outcrops of the Park and their global existence would continue to be threatened.

At Management Category 2 sites, seven globally rare ecological communities (High Elevation Outcrop Barren, High Elevation Greenstone Barren, Central Appalachian Heath Barren, Central Appalachian Basic Woodland, Central Appalachian High Elevation Boulderfield Forest, Central Appalachian Circumneutral Barren, Central Appalachian Xeric Chestnut Oak – Virginia Pine Woodland), and two state watch-listed ecological communities (Sweet Birch – Chestnut Oak Talus Woodland, Central Appalachian Acidic Boulderfield) have been identified at outcrops included within this category. These communities include two that are endemic to the park. All would continue to be degraded by human use.

Eight globally rare ecological communities occur on outcrops included within Management Category 3. These communities (High Elevation Greenstone Barren, Central Appalachian Heath Barren, Central Appalachian Mafic Barren, Central Appalachian Basic Woodland, Central Appalachian Circumneutral Barren, Central Appalachian Mafic Boulderfield, Central Appalachian Xeric Chestnut Oak – Virginia Pine Woodland, Central Appalachian High Elevation Boulderfield Forest) include one endemic to the park, and all would continue to sustain impacts caused by human use.

One state watch-listed ecological community, the Sweet Birch – Chestnut Oak Talus Woodland, occurs on outcrops in some Management Category 4 sites and would sustain impacts from human use.

No ecological communities exist at sites in Management Category 5.

At Little Stony Man Mountain two globally rare ecological communities would continue to degrade, resulting in moderate impacts. Three globally rare ecological communities would continue to sustain moderate impacts from visitor use and other communities would sustain minor impacts from informal trails at Old Rag Mountain. Five globally rare ecological communities at Management Category 1 sites, two of which are endemic to the Park would receive negligible to minor impacts. In Management Category 2, seven globally rare ecological communities, two which are endemic to the Park, would receive minor impacts. In Category 3 eight globally rare ecological communities, one which is endemic to the park would continue to experience negligible to minor impacts due to human use. In Category 4 the ecological communities would have negligible impacts from human use.

Overall impacts to ecological communities from Alternative A would be negligible to moderate due to trampling from human traffic. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive, rare, threatened or endangered species, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact ecological communities associated with the rock outcrops nor are there any actions associated with the project that would impact other ecological communities in the Park. Therefore, it would not contribute to cumulative impacts to ecological communities; there are no cumulative impacts.

**Conclusion:** Actions taken under Alternative A would result in adverse, site-specific, negligible to moderate long-term impacts to ecological communities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

### Impacts of Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Alternative B focuses on reaching a balance between visitor use and resource protection. Under this alternative, rock outcrop sites supporting ecological communities that are pristine to slightly impacted would be protected with barriers and signs to facilitate re-vegetation. Portions of rare ecological communities that are impacted by human activity would continue to sustain impacts from visitor use. Other non-listed ecological communities adjacent to areas of limited visitor-use may sustain impacts, but the wide-spread distribution and large acreages of these communities would mean that the collective damage is less than that sustained by communities with highly restricted distributions.

At Little Stony Man Mountain, ecological communities that support pristine and partially degraded examples of the High-Elevation Greenstone Barren ecological community on the southern section of the cliffs, and boulders at the extreme northern end of the cliffs would be protected from visitor use impacts. The Northern Red Oak forest and Hemlock-Northern Hardwood Forest that surround the exposed outcrop and boulderfield communities would continue to sustain isolated impacts from camping, hikers, and climbers seeking shaded rest areas.

At Old Rag Mountain, the most pristine example of the Central Appalachian Heath Barren would be protected from human trampling. The Central Appalachian Heath Barren on the Main Summit would be partially protected from trampling, but some of the community would be lost. The Central Appalachian Xeric Chestnut Oak – Virginia Pine Woodland and Central Appalachian Mafic Barren would continue to sustain impacts from development and use of informal trails.

At Management Category 1 sites, trampling impacts would be reduced within portions of all occurrences of the park-endemic High Elevation Outcrop Barren and High Elevation Greenstone Barren ecological communities.

At Management Category 2 sites, impacts to the endemic High elevation Greenstone Barren and High Elevation Outcrop Barren would be reduced. Impacts would be reduced at other rare ecological communities, but mild trampling impacts are still likely.

At Management Category 3 sites, eight globally rare ecological communities, including one endemic to the park, would continue to sustain low levels of human-caused impacts.

There would be no impacts on ecological communities at sites in Management Category 4 or 5.

At Little Stony Man Mountain certain ecological communities would benefit from re-directing visitation to the site while other communities would sustain negligible impacts from camping, hikers, and climbers. Some ecological communities at Old Rag Mountain would receive benefits from protection while others would sustain minor impacts from visitor use. Ecological communities in Management Category 1 would benefit along with some ecological communities in Management Category 2. Other Management Category 2 and Management Category 3 sites would receive negligible impacts from trampling. There are no impacts expected at Management Category 4 and 5 sites. The installation of signs and barriers would have negligible impacts on ecological communities.

Overall impacts to ecological communities from Alternative B would be negligible to minor due to trampling from human traffic. Alternative B would be beneficial to some communities.

**Cumulative Impacts:** The Old Rag parking lot project would not impact ecological communities associated with the rock outcrops nor are there any actions associated with the project that would impact other ecological communities in the Park. Therefore, it would not contribute to cumulative impacts to ecological communities; there are no cumulative impacts.

**Conclusion:** Actions taken in Alternative B, ecological communities would receive adverse, site-specific, minor, short-term impacts from the installation of signs and barriers. Actions would result in adverse, site-specific, negligible to minor long-term impacts to ecological communities. Alternative B may result in beneficial impacts to sites with ecological communities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

### Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Under Alternative C, protection of natural resources would be emphasized. Implementation of this alternative would result in benefits to ecological communities. Trampling would greatly decrease within all existing rare plant community acreage. Rare plant community vigor would increase, and degraded areas may recover their full complement of characteristic species over time. Other non-listed plant communities adjacent to areas of limited visitor-use may sustain impacts, but the widespread distribution and large acreages of these communities would mean that the collective damage is less than that sustained by communities with highly restricted distributions.

Little Stony Man Mountain restrictions to the entire cliff area would greatly reduce trampling within all remaining acreage of the High-Elevation Greenstone Barren, and within the adjacent boulderfield and hardwood forests. Native vegetation in the communities would slowly recover in areas that were degraded. Areas currently stripped of all vegetation would likely not recover.

Closing the climbing areas at the eastern and western summits of Old Rag Mountain would protect the globally rare Central Appalachian Heath Barren ecological community from trampling and would allow the community to recover with vigor. Trampling impacts to the other two rare ecological communities would be reduced near the Skyline Wall and Summit Wall climbing sites, but may increase in areas along the trail as visitors seek viewpoints to replace the summit.

Reducing access to ecological communities at Management Category 1 sites would protect at least five globally rare ecological communities from human impact, adding security to these communities' global existence. Rare ecological community vigor would increase, and degraded areas may recover their full complement of characteristic species over time.

Restricting access to sensitive areas at Management Category 2 sites would protect at least seven globally-rare ecological communities from most human impacts, adding security to these communities' global existence. Rare ecological community vigor would increase, and degraded areas may recover their full complement of characteristic species over time.

Discouraging access to Management Category 3 sites through signage would decrease human-use impacts within at least eight globally-rare ecological communities. Minor gains in community vigor may occur. Some impacts may still occur. Minimal protection activities at Management Category 4 sites would possibly reduce human-use impact to at least one state watch-listed ecological community.

There are no affected ecological communities at Management Category 5 sites.

At Little Stony Man Mountain, trampling would be reduced, benefiting the plant communities. At Old Rag Mountain, trampling would also be reduced and result in beneficial impacts. Any impacts to ecological communities from trampling at Old Rag Mountain, and Management Category 1, 2, and 3 sites would be negligible. Reducing trampling at Management Category 1, 2, and 3 sites would result in positive benefits and impacts from residual trampling would be negligible. Efforts at Management Category 4 sites would result in negligible impacts. There are no affected rare or watch listed ecological communities at Management Category 5 sites, therefore no impacts. The installation of signs and barriers would have negligible impacts on ecological communities.

Overall, impacts to ecological communities from Alternative C would be negligible. Plant communities would benefit from actions taken under this alternative.

**Cumulative Impacts:** The Old Rag parking lot project would not impact ecological communities associated with the rock outcrops nor are there any actions associated with the project that would impact other ecological communities in the Park. Therefore, it would not contribute to cumulative impacts to ecological communities; there are no cumulative impacts.

**Conclusion:** Under Alternative C ecological communities would receive adverse, site-specific, minor, short-term impacts from the installation of signs and barriers to ecological communities. Alternative C may increase protection to ecological communities, resulting in protection and increased growth. In cases where visitors encroached on protected areas, impacts would result in adverse, site-specific, negligible, long-term impacts to ecological communities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

### Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Actions proposed under Alternative D provide an enhanced visitor experience while preserving ecological communities to a lesser extent than other alternatives. Implementation of Alternative D would result in negative impacts to ecological communities. Large portions of all occurrences of the Park's two endemic globally rare plant communities would be degraded by human trampling. Most if not all examples of these communities would be heavily degraded over time and may lose characteristic species. Negative impacts associated with human-use would increase within at least eight globally rare plant communities. The area covered and vigor of the communities would be decreased. Other plant communities would also sustain localized impacts resulting from the likely increase in the size of areas used by visitors in support of recreational activities.

At Little Stony Man Mountain all occurrences of the globally rare High-Elevation Greenstone Barren Ecological community on the site would be degraded by human trampling and may be completely destroyed over time. The Northern Red Oak forest and Hemlock-Northern Hardwood Forest that surround the exposed outcrop and boulderfield communities would sustain impacts from camping and day users seeking shaded rest areas.

At Old Rag Mountain all occurrences of the globally rare Central Appalachian Heath Barren community would be heavily degraded by human trampling impacts, and may lose their ecological significance. The other two globally rare ecological communities occurring on the summit area would be degraded by trampling and may lose cover of diagnostic species.

At Management Category 1 sites, human-use impacts would increase within at least eight globally rare ecological communities. The area covered and vigor of the communities may decrease. Certain management actions such as creating holes to install signage or fencing may remove portions of rare ecological communities.

At Management Category 2 sites, human-use impacts may increase within at least eight globally rare ecological communities. The area covered and vigor of the communities may decrease. Certain management actions such as creating holes to install signage or fencing may remove portions of rare ecological communities.

At Management Category 3 sites, human-use impacts would probably increase within at least eight globally rare ecological communities. The area covered and vigor of the communities may be decreased.

At Management Category 4 sites, human-use impacts to at least one state watch-listed ecological community would continue to be negligible.

There are no affected ecological communities at Management Category 5 sites.

Little Stony Man Mountain ecological communities would continue to degrade, likely causing moderate impacts. At Old Rag Mountain, ecological communities would also continue to degrade resulting in moderate impacts. At Management Category 1 and 2 sites, certain communities would continue to degrade and likely have moderate impacts. Actions at Management Category 3 sites would result in moderate impacts. Human-use impacts at Management Category 4 sites would have negligible impacts. The installation of signs and barriers would have negligible impacts on ecological communities.

Overall, human-use impacts to ecological communities from Alternative D would be negligible to moderate. Construction would be planned and implemented in accordance with all NPS laws, mandates and policies. This means the Park will use all required measures to avoid and minimize impacts to protected resources. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive, rare, threatened or endangered species, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact ecological communities associated with the rock outcrops nor are there any actions associated with the project that would impact other ecological communities in the Park. Therefore, it would not contribute to cumulative impacts to ecological communities; there are no cumulative impacts.

**Conclusion:** Under Alternative D ecological communities would receive adverse, site-specific, minor, short-term impacts from construction related activities. Actions taken under Alternative D would result in adverse, site-specific, negligible to moderate, long-term impacts to ecological communities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## RARE, THREATENED, AND ENDANGERED PLANTS

### Methodology and Impact Thresholds

Information compiled from available park documents and park staff was used to analyze the impacts. The definitions for identifying intensity level of an adverse impact are defined as follows:

Impact Intensity	Intensity Level Definition
Negligible	Impacts would result in no measurable or perceptible changes to a population or individuals of a species or its habitat.
Minor	Impacts would result in measurable or perceptible changes to individuals of a species, a population, or its habitat, but would be localized within a relatively small area. The overall viability of the species would not be affected. Mitigation measures, if needed to offset adverse impacts, would

	be simple and successful.
Moderate	Impacts would result in measurable and or consequential changes to individuals of a species, a population, or its habitat; however, the impact would remain relatively localized. The viability of the species could be affected, but the species would not be permanently lost. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.
Major	Impacts would result in measurable and/or consequential changes to a large number of individuals of a species or a population or a large area of its habitat. These changes would be substantial, highly noticeable, and permanent, occurring over a widespread geographic area, resulting in a loss of species viability and potential extirpation from the park. Extensive mitigation measures would be needed to offset any adverse impacts, and their success would not be guaranteed.

Beneficial impacts are described but not assigned intensity levels.

### Impacts of Alternative A: No Action

**Impact Analysis:** Under Alternative A, current management actions would continue. Monitoring of rare natural resources would continue by park staff. Monitoring would include surveying and documenting rare plant populations in the Park and identifying threats like invasive species and human use. State-rare plants, lichens, threatened and endangered species and native plants in accessible and high-use areas of popular rock outcrop destinations would continue to be heavily degraded. Invasive species would continue to spread within rock outcrop sites colonizing areas once occupied by rare and native plants and resources would be degraded by trampling by visitors.

At Little Stony Man Mountain, populations of four state-rare plant species would continue to be trampled by hikers and climbers. The continued trampling impacts would cause populations to decrease in size. The aggressive native path rush (*Juncus tenuis*) would continue to displace rare plants in areas of trampled vegetation. Two circumboreal disjunct lichen species, *Rhizocarpon geographicum* and *Melanellia stygia*, which survive in the park only on high elevation rock outcrops, would continue to be lost from rock surfaces due to trampling and climbing activities. Rare plant populations would continue to be protected by barriers at the southern cliffs.

Populations of four state-rare plant species (one tree, three herbs) occur on Old Rag Mountain. Trampling would continue to decrease the cover of two of the rare species, probably ultimately resulting in the loss of some populations. The remaining two species would continue unaffected.

Twelve state-rare vascular plant species and three state-rare lichens are currently known from outcrops included within Management Category 1. Six of the vascular plant species are herbs and would continue to be damaged by human trampling. Aggressive invasive plants such as tree-of-heaven, spotted knapweed and oriental lady's thumb would continue to degrade native plant habitat.

Nine state-rare vascular plant species and three lichens are currently known from outcrops included within Management Category 2. Four of the vascular plant species are herbs and would continue to sustain moderate damage caused by human-use activities. Invasive plants such as tree-of-heaven, Asiatic day flower, and Canada bluegrass would continue to degrade native plant habitat.

Nine state-rare vascular plant species and four state-rare lichens are currently known from outcrops included within Management Category 3. Five of the rare vascular plant species would continue to be vulnerable to minor human-use impacts. Invasive plants such as Asiatic day flower, coralberry, Japanese stilt grass, Garlic mustard, Canada bluegrass, tree-of-heaven, sheep sorrel, and Kentucky bluegrass would continue to degrade native plant habitat.

Four state-rare vascular plant species are currently known from outcrops included within Management Category Four. Human impacts to these species are expected to remain negligible if no action is taken.

No rare, threatened or endangered plants exist in Management Category 5.

At Little Stony Man Mountain and Old Rag Mountain outcrops, four state-rare plant populations would be trampled by visitors resulting in moderate impacts. At Management Category 1 rock outcrops, aggressive invasive plants would continue to degrade native plant habitat and twelve state-rare vascular plant species and three state-rare lichens resulting in moderate impacts. Along with invasive plant species, nine state-rare plants and three lichen species would sustain moderate damage caused by human-use activities for outcrops in Management Category 2. Invasive plants would continue to degrade native plant habitat and five state-rare plant species and four state-rare lichens would receive minor impacts from human use. In Management Category 4, rare, threatened or endangered plants would have negligible impacts from human use.

Overall impacts to rare, threatened and endangered plants from Alternative A would be negligible to moderate due to the impacts to native plant habitat from invasive plants and trampling from human traffic. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive, rare, threatened or endangered species, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact rare, threatened and endangered plants associated with the rock outcrops nor are there any actions associated with the project that would impact other rare, threatened and endangered plants in the Park. Therefore, it would not contribute to cumulative impacts to rare, threatened and endangered plants; there are no cumulative impacts.

**Conclusion:** Actions taken under Alternative A would result in adverse, site-specific, negligible to moderate long-term impacts to rare, threatened and endangered plants. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## Impacts of Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Alternative B strives to find a balance between protecting natural resources and access to visitors. Implementation of Alternative B would reduce most human use-impacts and help restore populations of rare, threatened and endangered plants by installing barriers and educational signs. A few state rare plant and lichen populations would continue to be vulnerable to damage and loss from human-use activity. Invasive species would continue to grow unimpeded within heavily trampled areas, but selective removal would occur within the protected areas of rare plant populations. Non-listed rare, threatened and endangered plants adjacent to rock outcrops may sustain localized impacts in places where rock outcrop management activities divert high visitation to these less sensitive areas.

On the northern section of Little Stony Man Mountain, two state-rare herbs would continue to be trampled and some populations may be lost. The remaining populations of these two species plus one additional species occurring on the southern portion of the cliff, “chute” trail, and boulders at the extreme northern end of the cliff would be protected from most visitor impacts. The aggressive native path rush (*Juncus tenuis*) would continue to displace rare plants on the northern section of the cliffs in areas of trampled vegetation. Two circumboreal disjunct lichen species, *Rhizocarpon geographicum* and *Melanellia stygia*, would continue to be lost from rock surfaces on the Northern section of the cliff, but would be preserved on the Southern section of the cliff. Invasive plants would be controlled in rare plant populations and communities.

At Old Rag Mountain, human trampling of two state-rare herb species and lichen species would decrease in protected areas of the Eastern summit, the entire Western summit, and along closed informal trails. Some populations of one rare plant on the Main summit would be lost to trampling, but others would be protected. All rare plant populations on the Western summit would be protected from trampling damage. Trampling damage of one rare plant growing along informal trails would be decreased and plants may increase in vigor. The remaining two rare plant species would continue unaffected. Invasive plants would be controlled in rare plant populations and communities.

Impacts in populations of six state-rare vascular plant species and three state-rare lichen species for Management Category 1 would be reduced by decreasing trampling by visitors. Invasive vegetation occurring near or within rare plant populations would be removed by chemical or manual treatment. Invasive plants would continue to degrade portions of the rare plant communities not immediately adjacent to rare plant populations.

Impacts to a selection of rare plant populations of four herb species and three lichen species would be reduced in Management Category 2 sites. Impacts to rare lichens would be reduced. Invasive vegetation occurring near or within rare plant populations would be removed by chemical or manual treatment. Invasive plants would continue to degrade some portions of native plant habitats.

In Management Category 3, five state-rare plant species and four state-rare lichen species would be protected from park or cooperators caused impacts, but would continue to be vulnerable to mild visitor-use impacts. Invasive plant species would be selectively controlled in areas where they directly threaten rare plant populations.

Four state-rare plant species would remain largely unaffected by human activities in Management Category 4 sites. Periodic prescribed burns may be used to stimulate reproduction of one state-rare herb. Invasive species found adjacent to rare plant populations would be removed by manual or chemical means.

No impacts are expected to rare, threatened or endangered plants in Management Category 5.

At Little Stony Man Mountain, Old Rag Mountain and Category 1 and 2 sites, some areas would benefit from the actions while other areas would receive minor impacts. Some rare, threatened and endangered plants at sites in Management Category 3 would have mostly beneficial results from the actions, but some negligible impacts may occur. Sites in Management Category 4 would most likely have beneficial results. The installation of signs and barriers would have negligible impacts on rare, threatened and endangered plants.

Overall impacts to rare, threatened and endangered plants from Alternative B would be negligible to minor due to the growth of invasive species and trampling. Alternative B would be beneficial to some communities.

**Cumulative Impacts:** The Old Rag parking lot project would not impact rare, threatened and endangered plants associated with the rock outcrops nor are there any actions associated with the project that would impact other rare, threatened and endangered plants in the Park. Therefore, it would not contribute to cumulative impacts to rare, threatened and endangered plants; there are no cumulative impacts.

**Conclusion:** Under Alternative B rare, threatened and endangered plants would receive adverse, site-specific, negligible, short-term impacts from the installation of signs and barriers. Actions taken under Alternative B would result in adverse, site-specific, negligible to minor long-term impacts to rare, threatened and endangered plants. Alternative B may provide beneficial results to certain sites containing plant communities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Under Alternative C, the preservation of rare, threatened and endangered plants would be emphasized. Implementation of this alternative would result in positive benefits to the rare, threatened and endangered plants as areas were closed to visitor use. Trampling and other human-caused impacts would decrease at all rare plant and lichen populations, allowing some populations to slowly recover. Invasive plants on

or near rock outcrops would be removed by various control methods. Non-listed rare, threatened and endangered plants adjacent to rock outcrop sites would sustain impacts in places where rock outcrop management activities divert high visitation to less sensitive areas.

At Little Stony Man Mountain, trampling would greatly decrease at all populations of four state-rare plant species. The remaining populations of two state rare lichens would be protected from further damage. All invasive plants would be controlled within the site, and displacement of native plants would be greatly reduced. The rare native plants and lichens may increase and recover due to the control measures taken. Most invasive plants would be controlled with herbicide. Displacement of native species would be reduced.

At Old Rag Mountain, trampling would greatly decrease at populations of one state rare plant on the Main and Western Summits. Sandwort populations would increase in vigor and slowly expand. Trampling would greatly decrease at all populations of another rare plant found at the base of the cliffs. Plants may increase in vigor and population size over time if environmental conditions (global warming, acid rain) permit. Invasive plants would be controlled in rare plant populations and communities.

At Management Category 1 sites, at least six state-rare vascular plant species and three rare lichen species would be protected from human impacts. Invasive exotic species at rock outcrops would be controlled. Rare plant vigor and population size would increase as human impact and invasive species pressures are removed. Invasive plants would be controlled in rare plant populations and communities.

At Management Category 2 sites at least four state-rare vascular plant species and three rare lichen species would be protected from most human-use impacts. Invasive exotic species near or on rock outcrops would be controlled. The vigor and population size of some rare plants may increase as human impact and invasive species pressures are removed.

At Management Category 3 sites, human-use impacts would decrease within populations of at least five state-rare vascular plant species and four state-rare lichen species as human-use activities are limited. Invasive exotic species on or near rock outcrops would be controlled selectively. Minor gains in population vigor may occur.

At Management Category 4 sites, human-use impacts to four state-rare plant species would remain negligible. Prescribed fire may be used to selectively increase the vigor of certain rare plant populations. Invasive species that would be adjacent to any rare plant sites would be removed manually or chemically.

There are no affected rare, threatened and endangered plants at Management Category 5 sites.

At Little Stony Man Mountain, Old Rag Mountain, and Categories 1, 2, 3, and 4, trampling would decrease, protecting rare plant and lichen species and invasive species would be removed, resulting in beneficial results. Negligible impacts would occur in areas that were accessed by visitors who did not adhere to closed sites. The installation of

signs and barriers would have negligible impacts on rare, threatened and endangered plants.

Overall impacts to rare, threatened and endangered plants from actions taken under Alternative C would be positive in nature and benefit the populations by allowing them to recover and repopulate native habitat. Any impacts from visitors not heeding closed areas and trampling rare, threatened and endangered plants would be negligible.

**Cumulative Impacts:** The Old Rag parking lot project would not impact rare, threatened and endangered plants associated with the rock outcrops nor are there any actions associated with the project that would impact other rare, threatened and endangered plants in the Park. Therefore, it would not contribute to cumulative impacts to rare, threatened and endangered plants; there are no cumulative impacts.

**Conclusion:** Under Alternative C rare, threatened and endangered plants would receive adverse, site-specific, negligible, short-term impacts from the installation of signs and barriers. Actions taken under Alternative C may be beneficial and restore botanical populations by heavily restricting visitor use. Impacts from visitors using trails that were closed would result in adverse, site-specific, negligible long-term impacts. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

#### Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Actions taken under Alternative D would result in decreased protection for rare, threatened and endangered plants as more emphasis would be placed on visitor enjoyment and access. Habitat for at least twelve state-rare vascular plant species and four state-rare lichen species may experience impacts caused by human-use. Invasive exotic species would continue to spread throughout outcrops encouraged by the establishment of new trails and increased visitation. The vigor and size of rare plant populations may reduce over time, and some populations may be lost. Other rare, threatened and endangered plants would also sustain impacts through trampling depending on the location.

At Little Stony Man Mountain most populations of three state-rare herb species would be trampled, and large portions of the populations may be damaged. The aggressive native path rush (*Juncus tenuis*) would continue to displace rare plants throughout the site. Two circumboreal disjunct lichen species, *Rhizocarpon geographicum* and *Melanellia stygia*, would continue to be lost from rock surfaces throughout the site and would likely only survive on small areas of overhanging rock surface. Invasive plants would be controlled in rare plant populations and communities.

At Old Rag Mountain most if not all populations of two state-rare plant species would be heavily impacted and possibly destroyed by trampling. One state-rare species would likely be eradicated from the mountain over time. The remaining two rare plant species would sustain some trampling impacts. Invasive plants would be controlled in rare plant populations and communities.

Human use at Management Category 1 sites may reduce habitat vitality at no less than nine state-rare vascular plant species and three lichen species. Invasive exotic species would continue to spread along informal trails around outcrops as well as by the establishment of new trails and increased visitation. The vigor and size of rare plant populations would likely be reduced over time, and some populations would be lost. Invasive plants would be removed from rare plant populations via chemical or manual treatments.

Human use at Management Category 2 sites may reduce habitat health at no less than nine state-rare vascular plant species and three lichen species. Invasive exotic species would continue to spread throughout outcrops within this category encouraged by the establishment of new trails and increased visitation. The vigor and size of rare plant populations would likely be reduced over time, and some populations may be lost. Invasive plants would continue to degrade some portions of native plant habitat, but would be treated in others.

Human use at Management Category 3 sites may reduce habitat health at no less than nine state-rare vascular plant species and four state-rare lichen species. Invasive exotic species would continue to spread throughout outcrops within this category encouraged by the establishment of new trails and increased visitation. The vigor and size of rare plant populations would likely be reduced, and over time some populations would be lost.

At Management Category 4 sites human-use impacts to four state-rare plant species would sustain negative impacts. Invasive species adjacent to rare plant sites would be removed manually or chemically.

There would be no affected rare, threatened and endangered plants at Management Category 5 sites.

The impacts of human use at Little Stony Man Mountain would result in moderate impacts. Old Rag Mountain would sustain mild to moderate impacts from trampling. Management Category 1, 2 and 3 would sustain moderate impacts from increased visitor use. Impacts at Management Category 4 sites would be negligible.

Overall, impacts to plant communities from Alternative D would be negligible to moderate due to increased visitor use. Construction would be planned and implemented in accordance with all NPS laws, mandates and policies. This means the Park will use all required measures to avoid and minimize impacts to protected resources. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive, rare, threatened or endangered species, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact rare, threatened and endangered plants associated with the rock outcrops nor are there any actions associated with the project that would impact other rare, threatened and endangered plants in the Park. Therefore, it would not contribute to cumulative impacts to rare, threatened and endangered plants; there are no cumulative impacts.

**Conclusion:** Under Alternative D rare, threatened and endangered plants would receive adverse, site-specific, negligible, short-term impacts from construction related activities. Actions taken under Alternative D would result in adverse, site-specific, negligible to moderate long-term impacts to plant communities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## RARE, THREATENED, AND ENDANGERED SPECIES

### Methodology and Impact Thresholds

Information compiled from available Park documents and Park staff was used to analyze the impacts. The definitions for identifying intensity level of an adverse impact are defined as follows:

Impact Intensity	Intensity Level Definition
Negligible	There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be of short duration and well within natural fluctuations.
Minor	Impacts would be detectable, but would not be outside the natural range of variability. Small changes to population numbers, population structure, genetic variability, and other demographic factors might occur. Occasional responses to disturbance by some individuals could be expected, but without interference to factors affecting population levels. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside critical reproduction periods for sensitive native species. Mitigation measures, if needed to offset adverse impacts, would be simple and successful.
Moderate	Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Changes to population numbers, population structure, genetic variability, and other demographic factors would occur, but species would remain stable and viable. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to factors affecting population levels. Sufficient habitat would remain functional to maintain the viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.
Major	Impacts to native species, their habitats, or the natural processes sustaining them would be detectable, would be expected to be outside the natural range of variability, and would be extensive. Population numbers, population structure, genetic variability, and other demographic factors might experience large declines. Frequent responses to disturbance by some individuals would be expected, with negative impacts to factors resulting in a decrease in population levels. Loss of habitat might affect the viability of at least some native species. Extensive mitigation measures would be needed to offset any adverse impacts, and their success would not be guaranteed.

Beneficial impacts are described but not assigned intensity levels.

Because rock outcrops are highly specialized habitat utilized by special animals, this review focuses on specific rare, threatened and endangered species. Use by other types of wildlife in the park is transient.

### Impacts of Alternative A: No Action

**Impact Analysis:** For Alternative A, existing management practices to protect rare, threatened and endangered species would be followed. In addition to the standard laws and NPS regulations and policies which support protection and management of wildlife populations at rock outcrops within the Park, in 1994 the U.S. Fish and Wildlife Service prepared a Recovery Plan for the Shenandoah Salamander. That document summarizes what is known about the species, explains why the species is considered endangered, and outlines steps that need to be taken to “recover” the species from imperiled status. Habitat for federally endangered Shenandoah salamander would sustain trampling within part of its range. Several known and potential nesting sites of the state threatened Peregrine Falcon would be vulnerable to human disturbance, reducing the chances of breeding success. Habitat for a rare bat would also be vulnerable to impacts.

Since 2000, the Park’s Natural Resource Management staff has been engaged in a Peregrine Falcon restoration program undertaken in cooperation with the Center for Conservation Biology at William and Mary and the Virginia Department of Game and Inland Fisheries. The recovery program takes young Peregrine falcons from nests on south eastern Virginia bridges, and moves them to a safer foster nest site on the cliffs of Hawksbill Mountain. This increases the survival rate of chicks because they no longer prematurely fledge over open water, and boosts peregrine falcon populations in the Central Appalachians.

Impacts from current practices at Little Stony Man Mountain include Shenandoah salamander habitat compaction from illegal camping and social trails. At Old Rag Mountain potential nesting sites for the Peregrine Falcon would continue to be disturbed by humans resulting in impacts. The Park would take appropriate action to reduce existing impacts in consultation with the USFWS.

Impacts to habitat for the Shenandoah salamander and five state rare invertebrate species would occur at some Management Category 1 sites. Human disturbances and park management activities (e.g., spraying for the Hemlock Woolly Adelgid (*Adelges tsugae*) may affect these wildlife species at the Park’s rock outcrop sites.

At Management Category 2 sites, reduction in habitat vitality for the Shenandoah salamander and one state-rare vertebrate and three state rare invertebrates would result in negative impacts. Human disturbances and park management activities (e.g., spraying for the Hemlock Woolly Adelgid (*Adelges tsugae*) may affect these wildlife species at the Park’s rock outcrop sites.

At Management Category 3 sites, actions would cause negligible impacts to habitat for the Shenandoah salamander and one state rare invertebrate.

Sites in Management Category 4 and 5 would sustain impacts from visitation and management by park personnel.

At Little Stony Man Mountain, rare, threatened and endangered species would sustain highly localized moderate impacts due to loss of habitat and disturbance from human activities. Old Rag would sustain minor impacts from the same activities. Loss of habitat, human disturbances and park management activities would result in minor impacts to Management Category 1 and 2 sites. Loss of habitat at Management Category 3 sites would cause moderate impacts. Visitation and actions from park personnel would cause negligible impacts at Management Categories 4 and 5.

Overall impacts to rare, threatened and endangered species from Alternative A would be negligible to moderate due to habitat impacts from human traffic and potential management activities. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive, rare, threatened or endangered species, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts** The Old Rag parking lot project would not impact rare, threatened or endangered species associated with the rock outcrops nor are there any actions associated with the project that would impact other rare, threatened or endangered species in the Park. Therefore, it would not contribute to cumulative impacts to rare, threatened or endangered species; there are no cumulative impacts.

**Conclusion:** Actions taken under Alternative A would result in adverse, site-specific, negligible to minor long-term impacts to rare, threatened and endangered species. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

#### Impacts of Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Implementation of Alternative B would result in beneficial results to rare, threatened and endangered species. Habitat for the Shenandoah salamander would be largely protected from erosion and trampling. Rare invertebrates would be less vulnerable to human-caused damage. Peregrine falcon nesting sites would be protected from human disturbance through barriers. The habitat for several state rare invertebrate species would be protected from chemical contamination linked to park maintenance activities to control hemlock woolly adelgids and invasive plants. The decreased disturbance may lead to greater reproduction and increased population sizes.

At Little Stony Man Mountain, habitat for the federally endangered Shenandoah salamander along the “chute” trail would be protected from erosion and trampling. Human impacts to salamander habitat adjacent to the Appalachian Trail along the upper cliff would decrease as people are re-directed to the base of the cliffs for viewing opportunities.

At Old Rag Mountain potential nesting sites for the Peregrine Falcon would be monitored and protected by installing temporary barriers that would increase the chances of successful nesting.

At certain Management Category 1 sites portions of the Shenandoah salamander habitat would be protected from human impacts. Rare invertebrates would be protected from insecticide use for NPS management activities.

The Shenandoah salamander and rare invertebrates would be less vulnerable to human-caused habitat impacts at Category 2 sites.

At Category 3 sites, habitat for the endangered Shenandoah salamander, one state-rare vertebrate, and two state rare invertebrates would be protected from impacts by park staff and cooperators but would continue to sustain impacts from visitor use.

There are no known impacts to rare, threatened and endangered species within Category 4 and 5.

Actions under Alternative B would have beneficial results at Little Stony Man Mountain, Old Rag Mountain, Category 1, 2 and 3 sites. Negligible impacts would occur to rare, threatened and endangered species at Category 3 sites.

**Cumulative Impacts:** The Old Rag parking lot project would not impact rare, threatened or endangered species associated with the rock outcrops nor are there any actions associated with the project that would impact other rare, threatened or endangered species in the Park. Therefore, it would not contribute to cumulative impacts to rare, threatened or endangered species; there are no cumulative impacts.

**Conclusion:** Actions taken under Alternative B would result in adverse, site-specific, negligible, long-term impacts to rare, threatened and endangered species. Most of the actions would have beneficial results. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Under Alternative C, preservation of rare, threatened and endangered species and protection of natural areas would be emphasized. Implementation of this alternative through closing certain hiking and climbing areas would result in positive impacts to rare, threatened and endangered species. Trampling and other human-caused disturbances would greatly decrease within Shenandoah salamander habitat, which would lead to less environmental stress on the animals. Peregrine falcon nesting sites would be more protected from human disturbance by area closures. The habitat for several state rare invertebrate species would be protected from negative impacts caused by human disturbance and chemical contamination linked to park maintenance activities to control woolly adelgids and invasive plants. The decreased disturbance may lead to greater reproduction and increased population sizes.

At Little Stony Man Mountain trampling and other human-caused disturbances would greatly decrease within Shenandoah salamander habitat leading to less environmental stress on the animals.

At Old Rag Mountain Peregrine Falcon nesting sites would be protected from human disturbance by temporary closures, leading to less disturbance and stress on the animals. At Management Category 1 sites, the habitat for at least three rare vertebrate species and five rare invertebrate species would be protected from human disturbance and NPS-management related chemical contamination. The decreased disturbance may lead to greater reproduction and increased population sizes. Human disturbances and park management activities (e.g., spraying for the Hemlock Woolly Adelgid (*Adelges tsugae*)) may affect these wildlife species at the Park's rock outcrop sites.

At Management Category 2 sites, most habitats for the Shenandoah salamander and winter wren would be protected from human-use disturbances. At least three rare invertebrate species would be protected from human disturbance and NPS-management related chemical contamination. The decrease in human-use disturbance may lead to greater reproduction and increased population sizes. Human disturbances and park management activities (e.g., spraying for the Hemlock Woolly Adelgid (*Adelges tsugae*)) may affect these wildlife species at the Park's rock outcrop sites.

At Management Category 3 sites the habitats for Shenandoah salamander, the Eastern small footed myotis, and two state rare invertebrates would be protected from human-use disturbances and NPS-management related chemical contamination. Impacts on population vigor are anticipated to be minimal.

At Management Category 4 and 5 sites, there are no known impacts to rare, threatened and endangered species.

There would be benefits to the Shenandoah salamander at Little Stony Man Mountain and the Peregrine Falcon at Old Rag Mountain. Actions under this alternative would also benefit the Shenandoah salamander, rare invertebrate species and other wildlife for Management Categories 1, 2, and 3.

Overall impacts to rare, threatened and endangered species would be beneficial in nature.

**Cumulative Impacts:** The Old Rag parking lot project would not impact rare, threatened or endangered species associated with the rock outcrops nor are there any actions associated with the project that would impact other rare, threatened or endangered species in the Park. Therefore, it would not contribute to cumulative impacts to rare, threatened or endangered species; there are no cumulative impacts.

**Conclusion:** Under Alternative C, rare, threatened and endangered species would benefit from actions taken under this alternative through restored habitat and less human-induced stress on wildlife. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Actions taken under Alternative D would decrease protection for rare, threatened and endangered species as actions would be aimed at enhancing visitor use. Implementation of Alternative D would result in impacts to listed rare, threatened and endangered species. Portions of the habitat for the federally endangered Shenandoah salamander would be degraded by human trampling. Human disturbance would prevent Peregrine falcons from nesting at some nest sites. Habitat for a state rare vertebrate and two state rare invertebrates would be degraded by the increase in human-use, and negative impacts on population size and reproductive success would likely occur. Other rare, threatened and endangered species would sustain isolated moderate impacts associated with a greater number of visitor encounters with wildlife and possible negative impacts to wildlife through exposure to an increase in trash left on rock outcrop sites.

At Little Stony Man Mountain habitat for the federally endangered Shenandoah salamander would be degraded by human trampling. Human impacts to salamander habitat adjacent to the Appalachian Trail along the upper cliff would likely increase as more visitors use the site for hiking and climbing.

At Old Rag Mountain human disturbance would prevent Peregrine falcons from nesting on the summit area of the mountain.

For Management Category 1, 2 and 3 sites, habitat for the Shenandoah salamander, another rare vertebrate, and two state rare invertebrates would be degraded by the increase in human-use. This may cause more environmental stress and possible lower reproductive successes, leading to negative impacts on population size.

At Management Category 4 or 5 sites there are no known impacts to listed rare, threatened and endangered species within this management group.

At Little Stony Man Mountain visitor use would cause minor impacts to salamander habitat. At Old Rag Mountain increased human use would cause minor impacts to Peregrine falcons. Impacts at Management Category 1-3 sites would be minor. There would be no impacts to Management Category 4 or 5 sites.

Overall, impacts to rare, threatened and endangered species from Alternative D would be minor due to increased human disturbance. Construction would be planned and implemented in accordance with all NPS laws, mandates and policies. This means the Park will use all required measures to avoid and minimize impacts to protected resources. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive, rare, threatened or endangered species, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts** The Old Rag parking lot project would not impact rare, threatened or endangered species associated with the rock outcrops nor are there any actions associated with the project that would impact other rare, threatened or endangered species in the Park. Therefore, it would not contribute to cumulative impacts to rare, threatened or endangered species; there are no cumulative impacts.

**Conclusion:** There would be adverse, site-specific, negligible, short-term impacts from construction related activities. Actions taken under Alternative D would result in adverse, site-specific, minor, long-term impacts to rare, threatened and endangered species. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## IMPACTS TO WILDERNESS CHARACTER

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### WILDERNESS CHARACTER

#### Methodology and Impact Thresholds

Information compiled from available Park documents and Park staff was used to analyze the impacts. The definitions for identifying intensity level of an adverse impact are defined as follows:

Impact Intensity	Intensity Level Definition
Negligible	A reduction in wilderness values and character may occur, but any change would be so small that it would not be measurable.
Minor	A reduction in wilderness values and character would occur and would be measurable but would be limited and of little consequence to the viability of the wilderness area.
Moderate	Some reduction in wilderness values and character would occur, and it would be measurable but would result in a small-scale consequence to the viability of the wilderness area.
Major	A noticeable reduction in wilderness values and character would occur. The change would be measurable and of widespread consequence to the viability of the wilderness area.

Beneficial impacts are described but not assigned intensity levels.

Wilderness character consists of all natural resources, natural communities and processes, historic resources, and recreational and societal values within the area designated as “Wilderness.”

Impacts to natural conditions that are part of Wilderness character have been addressed previously in this document for all Management Categories at the specific impact discussions related to Geologic and Soil Resources, Ecological Communities, Rare, Threatened and Endangered Plants, and Rare, Threatened and Endangered Species. The analysis here is for impacts to wilderness character, or the way in which visitors experience wilderness.

For the purpose of evaluating impacts this EA focuses on wilderness values and character which is the intangible experience of visitors when they are in wilderness. The meanings of “wilderness values” and “wilderness character” are explored in the following paragraphs:

“Wilderness values” is a rather complex and intangible concept which can be broadly categorized as Social, Economic, Ecologic, and Ethical. Within these categories functions and services can be described in terms of naturalness, wildness, biologic

resources, etc. (wilderness attributes) and “recreational and experiential setting” and “preservation of natural and wild places,” etc. (wilderness functions), and “scientific discovery” and “personal emotional health and growth,” etc. (wilderness services) (Bergstrom et al, 2002).

“Wilderness character” is not defined by the Wilderness Act of 1964, but “...exploration of writings of framers of the Wilderness Act suggests that the following societal ideals are integral to the historic purpose of wilderness and to understanding wilderness character:

- Natural environments that are relatively free from modern human impacts;
- Personal experiences in natural environments that are relatively free from the encumbrances of and signs of modern society;
- Symbolic meanings and relationships that people and society have with wilderness, including humility, self-restraint, and being interconnected with the larger community of life.

Wilderness character may be described as the combination of biophysical, experiential, and symbolic ideals that distinguishes wilderness from other lands” (Aldo Leopold Wilderness Research Institute, 2005).

### Impacts of Alternative A: No Action

**Impact Analysis:** Under Alternative A, actions to backcountry and wilderness would be guided by the Park’s BWMP and Resource Management Plan. Impacts to wilderness character and quality may occur with increased visitation levels and recreational impacts, unmanaged climbing activities at popular wilderness sites, spread of invasive vegetation and degraded integrity of plant communities.

Little Stony Man Mountain is not contained within the Park’s Wilderness character.

At Old Rag Mountain there would be changes to the wilderness visitor experience as increased visitation may result in a loss of solitude and impact the natural landscape and social conditions. Impacts to wilderness character and quality would occur with increased visitation due to higher densities of human use and associated behavior. Opportunities for solitude and a primitive, “unconfined” recreational experience would be reduced and degraded. Impacts would occur to natural conditions, resulting in impacts to wilderness character and quality.

For rock outcrops in Management Category 1, increased visitation may result in a loss of solitude to wilderness character and quality at high visitation sites. Impacts to wilderness character and quality would occur with increased visitation due to higher densities of human use and associated behavior. Opportunities for solitude and a primitive, “unconfined” recreation experience would be reduced and degraded.

At Management Category 2 sites, impacts to wilderness character and quality might occur with increased visitation due to higher densities of human use and associated behavior. Opportunities for solitude and a primitive, “unconfined” recreational experience might be reduced and degraded with increasing levels of visitation.

At Management Category 3 sites, minimal impacts to the landscape and social conditions would occur with infrequent visitation. Opportunities for solitude and a primitive, “unconfined” recreational experience would be provided at a high quality of wilderness character with infrequent visitation.

At Management Category 4 and 5 sites, minimal to no impacts to wilderness character and quality would occur due to very infrequent visitation. Sites within these categories should reflect the highest quality of Wilderness character.

Impacts to Old Rag Mountain and Management Category 1 and 3 sites would be minor, impacts to Management Category 2 sites would be moderate, and impacts to Management Category 4 and 5 sites would be negligible to none.

Overall, impacts to the Wilderness character would be negligible to moderate. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive resource, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact wilderness character associated with the rock outcrops nor are there any actions associated with the project that would impact other areas with wilderness character in the Park. Therefore, it would not contribute to cumulative impacts to wilderness character; there are no cumulative impacts.

**Conclusion:** Actions under Alternative A would result in adverse, site-specific, negligible to moderate, long-term impacts on the Wilderness character. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

#### Impacts of Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Implementation of Alternative B would result in impacts to wilderness on a few high visitation sites. More popular wilderness rock outcrop sites, specifically the Old Rag Mountain region would have more of a management presence with the installation of signs and physical barriers designed to manage visitor access and recreational impacts to resources. Wilderness character and quality in a very few sites would be affected as human visitation would be more restricted and have more evidence of management’s imprint on the natural landscape. However, enhanced protection of natural resource conditions could balance the impacts on social conditions.

Little Stony Man Mountain is not contained within the Park’s Wilderness character.

At Old Rag Mountain there may be impacts to the wilderness visitor experience from changes to the natural landscape and social conditions from installation of minimal signing and physical barriers to restrict or exclude visitor trampling from sensitive natural areas.

For rock outcrops in Management Category 1, there may be impacts to wilderness character and quality at high visitation sites in terms of the wilderness visitor experience due to changes to the natural landscape and social conditions through installation of minimal signing and physical barriers to restrict or exclude visitor trampling from sensitive natural areas.

At Management Category 2 sites, there may be impacts to the wilderness visitor experience from changes to the natural landscape and social conditions from installation of minimal signing and physical barriers to restrict or exclude visitor trampling from sensitive natural areas.

At Management Category 3 sites, minimal impacts to the landscape and social conditions would occur due to minimal visitation which would provide ample opportunities for solitude and a primitive, “unconfined” recreational experience. The quality of wilderness character would remain high.

At Management Category 4 and 5 sites, no impacts to wilderness character and quality would occur due to very infrequent visitation. Sites within these categories should reflect the highest quality of wilderness character.

Impacts to Old Rag Mountain and Management Category 1, 2, and 3 sites would be negligible. There would be no impacts at Management Category 4 and 5 sites.

Overall, impacts to the Wilderness character would be minor.

**Cumulative Impacts:** The Old Rag parking lot project would not impact wilderness character associated with the rock outcrops nor are there any actions associated with the project that would impact other areas with wilderness character in the Park. Therefore, it would not contribute to cumulative impacts to wilderness character; there are no cumulative impacts.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from the installation of signs and barriers. Actions under Alternative B would result in adverse, site-specific, minor, long-term impacts on the Wilderness character. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

### Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Actions proposed under Alternative C would emphasize resource protection, providing a higher standard of protection for natural resource conditions associated with Wilderness character. Implementation of this alternative would result in adverse impacts to wilderness character as signage, physical barriers, and administrative restrictions and closures of certain rock outcrops to visitor access would be prevalent. More popular wilderness rock outcrop sites would have a larger management presence with installation of signs and physical barriers designed to manage visitor access and

recreational impacts to resources. Wilderness character and quality in several sites would be more restricted and have more evidence of “man’s imprint” on the natural landscape.

Little Stony Man Mountain is not contained within the Park’s Wilderness character.

At Old Rag Mountain there may be impacts to the wilderness visitor experience from changes to the natural landscape and social conditions from the installation of multiple signs and physical barriers to restrict or exclude visitor trampling from sensitive natural areas. Impacts would occur to social conditions, resulting in degradation of the primitive, “unconfined” recreational experience. However, fewer visitors would improve opportunities for solitude.

For rock outcrops in Management Category 1, impacts to the wilderness visitor experience may occur from changes to the natural landscape and social conditions from the installation of multiple signs and physical barriers to restrict or exclude visitor trampling from sensitive natural areas. Impacts would occur to social conditions, resulting in the reduction of social aspects and benefits of wilderness character and quality. However, fewer visitors would improve opportunities for solitude.

At Management Category 2 sites, there may be impacts to the landscape and social conditions from the installation of multiple signs and physical barriers to restrict or exclude visitor trampling from sensitive natural areas.

At Management Category 3 sites, there may be minimal impacts to the wilderness visitor experience from changes to the natural landscape and social conditions from infrequent visitation. Fewer visitors would provide more opportunities for solitude and a primitive “unconfined” recreation experience.

At Management Category 4 and 5 sites, no impacts to Wilderness values and character would occur due to very infrequent visitation. Sites within these categories should reflect the highest quality of Wilderness character.

Impacts at Old Rag Mountain and Management Category 1 and 2 sites would be moderate, Management Category 3 sites would be negligible, and there would be no impacts at Management Category 4 and 5 sites.

Overall, impacts to the Wilderness character would be negligible to moderate.

**Cumulative Impacts:** The Old Rag parking lot project would not impact wilderness character associated with the rock outcrops nor are there any actions associated with the project that would impact other areas with wilderness character in the Park. Therefore, it would not contribute to cumulative impacts to wilderness character; there are no cumulative impacts.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from the installation of signs and barriers. Actions under Alternative C would result in adverse, site-specific, negligible to moderate, long-term impacts on the Wilderness character. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Under Alternative D, actions taken to expand visitor use and access would result in negative impacts to wilderness character. An increase in facility development and management presence would detract from wilderness values and have adverse impacts on natural resource conditions. Adverse changes to natural resource conditions would occur as visitor management strategies most likely would result in impacts of rock outcrop resources and subsequently the natural landscape and wilderness character and quality.

For all Management Categories except Management Category 5, wilderness character would degrade at some sites due to increased visitor use.

Little Stony Man Mountain is not contained within the Park's Wilderness character. At Old Rag Mountain there would be changes to the wilderness visitor experience as deterioration of the natural landscape and social conditions occurs. Impacts would occur to natural conditions, resulting in impacts to wilderness character and quality. Although visitor access would be improved, increased levels of visitation may result in a diminished wilderness visitor experience due to decreased opportunities for solitude.

For rock outcrops in Management Category 1, impacts may occur to wilderness character at high visitation sites. In addition to impacts to natural conditions, impacts to the landscape and social conditions would occur with increased visitation due to higher densities of human use and associated behavior. Although visitor access would be improved at some sites, increased levels of visitation would result in a diminished wilderness visitor experience due to decreased opportunities for solitude.

At Management Category 2 sites, impacts to the landscape and social conditions might occur with increased visitation due to higher densities of human use and associated behavior. Opportunities for solitude might be reduced and diminished with increasing levels of visitation.

At Management Category 3 sites, impacts to the landscape and social conditions would occur with infrequent visitation. Opportunities for solitude would be provided at a high quality of wilderness character with infrequent visitation.

At Management Category 4 and 5 sites, no impacts to wilderness character would occur due to very infrequent visitation. Sites within these categories should reflect the highest quality of wilderness character.

Impacts at Old Rag Mountain and Management Category 1 and 3 sites would be minor. There would be moderate impacts at Management Category 2 sites, and no impacts at Management Category 4 and 5 sites.

Overall, impacts to the Wilderness character would be minor to moderate. Construction would be planned and implemented in accordance with all NPS laws, mandates and policies. This means the Park will use all required measures to avoid and minimize

impacts to protected resources. If immediate threats are identified that jeopardize the continued existence or viability of a sensitive resource, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact wilderness character associated with the rock outcrops nor are there any actions associated with the project that would impact other areas with wilderness character in the Park. Therefore, it would not contribute to cumulative impacts to wilderness character; there are no cumulative impacts.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from construction related activities. Actions under Alternative D would result in adverse, site-specific, minor to moderate, long-term impacts on the Wilderness character. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## IMPACTS TO CULTURAL RESOURCES

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### CULTURAL LANDSCAPES

#### Methodology and Impact Thresholds

The definitions for identifying intensity of an impact are defined as follows:

Impact Intensity	Intensity Definition
Negligible	Impact is at the lowest levels of detection, barely perceptible and not measurable. For purposes of Section 106, the determination of effect would be <i>no adverse effect</i> .
Minor	Impact is measurable but would not be noticeable to visitors and would not affect the character-defining features of a National Register of Historic Places eligible or listed landscape. For purposes of Section 106, the determination of effect would be <i>no adverse effect</i> .
Moderate	Impact would affect a character-defining feature(s) of a cultural landscape but would not diminish the integrity of the landscape to the extent that its National Register of Historic Places eligibility is jeopardized. For purposes of Section 106, the determination of effect would be <i>no adverse effect</i> .
Major	Impact would alter a character-defining feature(s) of a cultural landscape, potentially diminishing the integrity of the landscape to the extent that it is no longer eligible for the National Register of Historic Places. For purposes of Section 106, the determination of effect would likely be <i>adverse effect</i> , and a Section 106 agreement document (MOA or PA) would be executed between the NPS, SHPO and other appropriate parties.

Beneficial impacts are described but are not assigned intensity levels.

#### Impacts of Alternative A: No Action

**Impact Analysis:** Under Alternative A there would be no changes to the Appalachian Trail, no changes to the Appalachian Trail’s landscape and the landscape would be preserved as it currently exists. The Park would continue to preserve the landscape to

keep it eligible for the National Register of Historic Places. There would be no impacts to the cultural landscape under this alternative.

**Cumulative Impacts:** The Old Rag parking lot project would not impact cultural landscapes associated with the rock outcrops nor are there any actions associated with the project that would impact other cultural landscapes in the Park. Therefore, it would not contribute to cumulative impacts to cultural landscapes; there are no cumulative impacts.

**Section 106 Summary:** After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR 800.5), the National Park Service concludes that implementation of Alternative A would not alter the cultural landscape and would result in a determination of *no historic properties affected* on cultural landscapes.

**Conclusion:** Alternative A would have no direct or cumulative impacts on cultural landscapes and would result in a determination of *no historic properties affected* for purposes of Section 106. There would be no cumulative impacts.

#### Impacts of Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Under Alternative B, actions would be taken to protect rock outcrop resources while allowing for visitor use and enjoyment of rock outcrops. Actions under this alternative would relocate the AT from the cliff to the current location of the Passamaquoddy Trail on the lower cliffs. This action is contingent upon approval for simultaneous relocation of the AT to its original path through the Skyland Resort development one mile south of Little Stony Man Mountain. There is one cultural landscape, the landscape associated with the AT in the area of potential effect

The Appalachian Trail Cultural Landscape would be affected by the relocation of the AT at Little Stony Man. This relocation would not have an adverse effect on the cultural landscape as the trail would be moved to its original location.

**Cumulative Impacts:** The Old Rag parking lot project would not impact cultural landscapes associated with the rock outcrops nor are there any actions associated with the project that would impact other cultural landscapes in the Park. Therefore, it would not contribute to cumulative impacts to cultural landscapes; there are no cumulative impacts.

**Section 106 Summary:** After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR 800.5), the National Park Service concludes that implementation of Alternative B would result in a determination of *no adverse effect* on cultural landscapes located in the Park.

**Conclusion:** Alternative B would result in long-term beneficial impacts to the cultural landscape and would result in a determination of *no adverse effect* for purposes of Section 106. There would be no cumulative impacts.

## Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Under Alternative C natural resources would be protected and actions would be taken to restrict visitor access to rock outcrops. Actions under this alternative would relocate the AT from the cliff to the current location of the Passamaquoddy Trail on the lower cliffs. There is one cultural landscape, the landscape associated with the AT in the area of potential effect.

The Appalachian Trail Cultural Landscape would be affected by the relocation of the trail at Little Stony Man. This relocation would not have an adverse affect on the cultural landscape as the trail would be moved to its original location.

**Cumulative Impacts:** The Old Rag parking lot project would not impact cultural landscapes associated with the rock outcrops nor are there any actions associated with the project that would impact other cultural landscapes in the Park. Therefore, it would not contribute to cumulative impacts to cultural landscapes; there are no cumulative impacts.

**Section 106 Summary:** After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR 800.5), the National Park Service concludes that implementation of Alternative C would result in a determination of *no adverse affect* on cultural landscapes located in the Park.

**Conclusion:** Alternative C would result in long-term beneficial impacts to the cultural landscape and would result in a determination of *no adverse effect* for purposes of Section 106. There would be no cumulative impacts.

## Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Alternative D emphasizes visitor use and enjoyment by increasing the number of accessible rock outcrops and improving visitor access to rock outcrops. Actions proposed through Alternative D could have moderate impacts to cultural landscapes in the Park. The construction of viewing platforms, new trails, additional campsites, or handrails could have an adverse effect on the Appalachian Trail Cultural Landscape by changing the character of the landscape. The Park would protect the cultural landscape's integrity and maintain its eligibility on the National Register of Historic Places. If a proposed action is determined, in consultation with the SHPO, to diminish the integrity of the cultural landscape sufficiently enough to threaten its eligibility for the National Register of Historic Places, that action will not be taken. All new facilities proposed would be designed in consultation with the SHPO in accordance with Section 106 guidelines in order to protect the cultural landscape's integrity and maintain its eligibility for the National Register of Historic Places. Multiple impacts on the cultural landscape could, over time, redefine the character of the resource and reduce its historical integrity. Construction would be planned and implemented in accordance with all NPS laws, mandates and policies. This means the Park will use all required measures to avoid and minimize impacts to protected resources. If immediate threats are identified that jeopardize the continued existence or viability of a cultural landscape,

actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact cultural landscapes found at the rock outcrops nor would it have actions associated with the project that would impact cultural landscapes. Therefore there are no cumulative impacts.

**Section 106 Summary:** After applying the Advisory Council on Historic Preservation’s criteria of adverse effects (36 CFR 800.5), the National Park Service concludes that implementation of Alternative D would be a determination of *adverse effect* for cultural landscapes located in the Park. Any proposed actions would be done in consultation with the SHPO and ACHP. A Memorandum of Agreement (MOA) with appropriate measures would be prepared if needed.

**Conclusion:** Alternative D could result in long-term moderate impacts to the cultural landscape and would result in a determination of *adverse effect* for purposes of Section 106. There would be no cumulative impacts.

## ARCHEOLOGICAL RESOURCES

### Methodology and Impact Thresholds

The definitions for identifying intensity of an impact are defined as follows:

Impact Intensity	Intensity Definition
Negligible	Impact is negative and at the lowest levels of detection, barely measurable with no perceptible consequences, either adverse or beneficial, to archaeological resources. For purposes of Section 106, the determination of effect would be <i>no adverse effect</i> .
Minor	Disturbance of a site(s) is confined to a small area with little, if any, loss of important information potential and no damage to National Register of Historic Places eligible archaeological features. For purposes of Section 106, the determination of effect would be <i>no adverse effect</i> .
Moderate	Disturbance of a site(s) would not result in substantial loss of important information potential or significant damage to National Register of Historic Places eligible archaeological features. While there may be limited disturbance to archaeological features, the resource would remain eligible for listing on the National Register of Historic Places. For purposes of Section 106, the determination of effect would be <i>adverse effect</i> , and a Section 106 agreement document (PA/MOA) would be executed between the NPS, SHPO, and other appropriate parties.
Major	Disturbance of a site(s) is substantial and results in the loss of most or all of the site and its potential to yield information. The site would no longer be eligible for listing on the National Register of Historic Places. For purposes of Section 106, the determination of effect would be <i>adverse effect</i> , and a Section 106 agreement document (PA/MOA) would be executed between the NPS, SHPO, and other appropriate parties.

Beneficial impacts are described but are not assigned intensity levels.

## Impacts of Alternative A: No Action

**Impact Analysis:** Under Alternative A there would be no changes to the archeological resources located near the rock outcrops. The Park would continue to preserve these resources in place. There would be no impacts to archeological resources under this alternative. If immediate threats are identified that jeopardize the continued existence or viability of an archeological resource, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact archeological resources found at the rock outcrops nor would it have actions associated with the project that would impact archeological resources. Therefore there are no cumulative impacts.

**Section 106 Summary:** After applying the Advisory Council on Historic Preservation's criteria of adverse effects (36 CFR 800.5), the National Park Service concludes that implementation of Alternative A would not affect archeological resources and would result in a determination of *no historic properties affected* on archeological resources.

**Conclusion:** Alternative A would have no cumulative impacts on archeological resources and would result in a determination of *no historic properties affected* for purposes of Section 106. There would be no cumulative impacts.

## Impacts of Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Under Alternative B actions would be taken to protect rock outcrop resources while allowing for visitor use and enjoyment of rock outcrops. Moving the AT to a new location may impact unknown archeological resources. Therefore an archeological survey will be conducted prior to moving the trail. In consultation with the SHPO a Programmatic Agreement is in process. There are no known archeological sites in the area of potential effect.

Further archeological investigation may be needed within the project area to determine if resources are present in areas that might be disturbed. The Park would follow all NPS guidelines to survey and evaluate archeological resources that may be affected within the project area. The impact to archeological resources can not be fully determined until project archeological investigation and evaluation are completed if determined necessary.

**Cumulative Impacts:** The Old Rag parking lot project would not impact archeological resources found at the rock outcrops nor would it have actions associated with the project that would impact archeological resources. Therefore there are no cumulative impacts.

**Section 106 Summary:** For purposes of Section 106, the effects of implementing Alternative B cannot be fully determined at this time. The project would need further design and archeological resources may need further identification for a determination of effect to be completed. Consultation with the SHPO would continue as the project is developed further and a Programmatic Agreement with the SHPO and other appropriate

parties would be developed to ensure proper identification and treatment of archaeological resources.

**Conclusion:** Alternative B would have no cumulative impacts on archeological resources. A determination of effect for the purposes of 106 can not be determined at this time. Further planning would require the development of a Programmatic Agreement between the Park Service and SHPO.

### Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Under Alternative C natural resources would be protected and actions would be taken to restrict visitor access to rock outcrops. Actions under this alternative would relocate the AT from the cliff to the current location of the Passamaquoddy Trail on the lower cliffs. An archeological survey will be conducted prior to moving the trail. In consultation with the SHPO a Programmatic Agreement is in process. There are no known archeological sites in the area of potential effect.

Further archeological investigation may be needed within the project area to determine if resources are present in areas that might be disturbed. The Park would follow all NPS guidelines to survey and evaluate archeological resources that may be affected within the project area. The impact to archeological resources can not be fully determined until project archeological investigation and evaluation are completed if determined necessary.

**Cumulative Impacts:** The Old Rag parking lot project would not impact archeological resources found at the rock outcrops nor would it have actions associated with the project that would impact archeological resources. Therefore there are no cumulative impacts.

**Section 106 Summary:** For purposes of Section 106, the effects of implementing Alternative B cannot be fully determined at this time. The project would need further design and archeological resources may need further identification for a determination of effect to be completed. Consultation with the SHPO would continue as the project is developed further and a Programmatic Agreement with the SHPO and other appropriate parties would be developed to ensure proper identification and treatment of archaeological resources.

**Conclusion:** Alternative B would have no cumulative impacts on archeological resources. A determination of effect for the purposes of 106 can not be determined at this time. Further planning would require the development of a Programmatic Agreement between the Park Service and SHPO.

### Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Alternative D emphasizes visitor use and enjoyment by increasing the number of accessible rock outcrops and improving visitor access to rock outcrops. Actions proposed under Alternative D could have moderate impacts to archeological resources. Known archeological sites would be protected from visitor use by installing a

barrier or fencing, however, even with these protective measures use in some locations could have impacts on archeological resources. Proposed new facilities would be done in consultation with the SHPO and measures taken to avoid and minimize impacts to the archeological sites. New facilities or uses that threaten the integrity of known archeological sites would not be implemented. Construction would be planned and implemented in accordance with all NPS laws, mandates and policies. This means the Park will use all required measures to avoid and minimize impacts to protected resources. If immediate threats are identified that jeopardize the continued existence or viability of an archeological resource, actions may be taken at individual sites to reduce or eliminate threats through closures, restrictions or reduced access or use.

**Cumulative Impacts:** The Old Rag parking lot project would not impact archeological resources found at the rock outcrops nor would it have actions associated with the project that would impact archeological resources. Therefore there are no cumulative impacts.

**Section 106 Summary:** After applying the Advisory Council on Historic Preservation’s criteria of adverse effects (36 CFR 800.5), the National Park Service concludes that implementation of Alternative D would be a determination of *adverse effect* for archeological resources located in the Park. Any proposed actions would be done in consultation with the SHPO and ACHP. A Memorandum of Agreement (MOA) with appropriate measures would be prepared if needed.

**Conclusion:** Alternative D would result in long-term moderate impacts to the archeological resources and would result in a determination of *adverse effect* for purposes of Section 106.

## IMPACTS TO VISITOR USE

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### CLIMBING ACTIVITIES

#### Methodology and Impact Thresholds

Information compiled from available Park documents and Park staff was used to analyze the impacts. The definitions for identifying intensity level of an adverse impact are defined as follows:

Impact Intensity	Intensity Level Definition
Negligible	Climbing activities would not be affected or changes would be below or at the level of detection. Any impact would be short-term. Climbers would not likely be aware of the impacts associated with the alternative.
Minor	Changes in climbing activities would be detectable, although the changes would be slight and likely short-term. Climbers would be aware of the impacts associated with the alternative, but the impacts would be slight.
Moderate	Changes in climbing activities would be readily apparent and likely long-term. Climbers would be aware of the impacts associated with the alternative and would likely be able to express an opinion about the changes.
Major	Changes in climbing activities would be readily apparent, severely adverse and have important long-term consequences. Climbers would be

	aware of the impacts associated with the alternative and would likely express a strong opinion about the changes.
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Beneficial impacts are described but not assigned intensity levels.

For the purposes of analyzing the impacts on climbing activities within the Management Categories for each Alternative, the term “climbing activities” is used generically to address the three types of climbing activities identified and described in Chapter 3. The three types of climbing occurring at the Park are rock climbing, bouldering, and ice climbing.

Under the No Action alternative and the 3 action alternatives, there would be no impacts to bouldering. There will be one impact to ice climbing and it is discussed below. The other impacts discussed in this section are associated with rock climbing activities.

#### Impacts of Alternative A: No Action

**Impact Analysis:** Under Alternative A, recreational climbing would be managed by regulations found in 36 CFR. Climbing routes would not be designated. Park staff would respond to emergencies but overall climbing activity would not be monitored. All rock outcrops would be accessible to climbing except where threats have been identified to sensitive resources and the park must close or restrict use to prevent loss. The only exceptions would be in the event that monitoring identifies an immediate threat to a rare, threatened or endangered species, at which time that individual outcrop may be closed to climbing or use may be otherwise restricted in order to prevent further impacts that would likely lead to the loss of the species.

Implementation of Alternative A would have a beneficial impact on recreational climbing at Little Stony Man Mountain, Old Rag Mountain and Management Categories 1-5.

**Cumulative Impacts:** The Old Rag parking lot project would not impact climbing activities associated with the rock outcrops nor are there any actions associated with the project that would impact other climbing activities in the Park. Therefore, it would not contribute to cumulative impacts to climbing activities; there are no cumulative impacts.

**Conclusion:** Actions taken under Alternative A would have beneficial impacts to climbing activities by allowing unrestricted climbing to occur in the Park. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

#### Impacts of Alternative B: Balance Between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Under Alternative B, climbing management would be implemented through the proposed Climbing Management Guidelines. Most rock outcrop management would rely on minimal management tactics like displays, internet and print information and educational programs. North Marshall Summit and Marys Rock would be monitored for climbing impacts and may have further restrictions or prohibitions imposed in the future. Rock climbing access would be maintained for the majority of climbs, but low

barriers and signs would be installed on some access points and informal trail routes. Running anchor ropes and webbing across the AT or other trails would be prohibited.

Climbing activities on cliff areas within 35 meters north of the “chute” trail all points south and climbing activity in the area of large boulders on the northern most end of the cliffs would be prohibited. Some improvements would be made to the “chute” trail. The AT may be relocated to the existing Passamaquoddy Trail to help reduce visitor congestion at upper cliffs. This action is contingent upon approval for simultaneous relocation of the AT to its original path through the Skyland Resort development one mile south of Little Stony Man Mountain. Anchor ropes and webbing that cross the AT or other trails would be prohibited. Rock climbing access would be maintained to the majority of climbs on the Little Stony Man Cliffs. The ability of rock climbers to use or establish routes on the southern cliff or far northern boulders would be eliminated.

At Old Rag Mountain the western summit would be closed to visitation and a trail re-routed and hardened to prevent trampling of the rare species *Huperzia*. Rock climbers would encounter low barriers and signs on informal access trails and would encounter short trail-re-routes, educational signs, and low barriers that direct them around rare plant populations adjacent to climbing staging areas or trails.

Actions at Management Category 1 sites include restricting rock climbing and closing informal trails at North Marshall. At South Marshall, use of the Appalachian Trail would be re-routed away from the cliff and rock outcrops. At Overall Run Falls North informal trails to outcrops would be closed. Visitor access would be focused at non-sensitive areas. At Hawksbill Summit, rock and ice climbing would be prohibited and the multiple informal trails to the cliffs between the Byrds Nest Shelter and the summit viewing platform would be closed. Signage and physical barriers on the Frazier Discovery Trail at Loft Mountain’s northern most summit outcrop would reduce use of the site, protecting plant communities.

Actions at Management Category 2 sites include containing visitation at the overlook outcrop and closing informal trails at Marys Rock. Off-trail rock scrambling in the lichen community would be reduced at Blackrock South District.

For Management Category 3 and 4 sites, monitoring would be established. At Category 3 sites monitoring would be done to assess impacts of visitor use at Franklin Cliffs.

No climbing regulations would be implemented for sites in Management Category 5.

Adverse impacts to Little Stony Man Mountain would be minor and impacts to Old Rag Mountain and sites in Management Categories 1 and 2 would be negligible. There would be no impacts to Management Category 3-5 sites. There would also be beneficial impacts from improvements to climbing facilities at Little Stony Man Mountain.

Overall, impacts to Climbing Activities would be negligible to minor with beneficial impacts.

**Cumulative Impacts:** The Old Rag parking lot project would not impact climbing activities associated with the rock outcrops nor are there any actions associated with the project that would impact other climbing activities in the Park. Therefore, it would not contribute to cumulative impacts to climbing activities; there are no cumulative impacts.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from the installation of signs and barriers. Actions under Alternative B would result in adverse, site-specific, negligible to minor, long-term impacts on climbing activities. There would be beneficial impacts at Little Stony Man Mountain. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

### Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** The same Climbing Management Guidelines proposed under Alternative B would be implemented under Alternative C. In addition to the Climbing Management Guidelines, the following closures would occur:

- Little Stony Man Cliffs: The entire cliff area
- Hawksbill Summit: The summit area and cliff faces
- Old Rag Mountain Eastern Summit: The entire climbing area
- Old Rag Mountain Western Summit: The entire climbing area
- Skyline Wall: The entire climbing area
- Reflector Oven: The entire climbing area
- North Marshall Summit: The entire summit area
- Marys Rock: The entire cliff area
- South Marshall: The summit area
- Blackrock, South District: The summit area
- Bearfence: The summit area

Adverse impacts at Little Stony Man Mountain and Old Rag Mountain would be moderate due to access restrictions. Impacts at Management Category 1 and 2 sites would be minor due to minimal access restrictions. There would be no impacts at Management Category 3-5 sites.

**Cumulative Impacts:** The Old Rag parking lot project would not impact climbing activities associated with the rock outcrops nor are there any actions associated with the project that would impact other climbing activities in the Park. Therefore, it would not contribute to cumulative impacts to climbing activities; there are no cumulative impacts.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from the installation of signs and barriers. Alternative C would result in adverse, site-specific, minor to moderate, long-term impacts on climbing activities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

### Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Under Alternative D, emphasis would be placed on visitor use and experience. This extends to climbing activities in the Park. The Climbing Management Guidelines would not be implemented under this alternative and present management practices would continue. Climbers would have unlimited access to climbing areas in the Park. The only exceptions would be in the event that monitoring identifies an immediate threat to a rare, threatened or endangered species, at which time that individual outcrop may be closed to climbing or use may be otherwise restricted in order to prevent further impacts that would likely lead to the loss of the species.

At Little Stony Man Mountain, rock climbing would remain unrestricted on-site, and would continue to impact access to the AT. At other sites in the park, unmanaged recreational climbing would be allowed. Some signage and educational displays would be installed to encourage climbing activities in areas away from sensitive resources. Physical barriers may be implemented at heavily impacted sites.

Actions associated with Alternative D would likely result in an enhanced climbing experience.

**Cumulative Impacts:** The Old Rag parking lot project would not impact climbing activities associated with the rock outcrops nor are there any actions associated with the project that would impact other climbing activities in the Park. Therefore, it would not contribute to cumulative impacts to climbing activities; there are no cumulative impacts.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from construction related activities. Under Alternative D, actions taken for the proposed project would most likely positively benefit climbing activities in the Park. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## RECREATIONAL ACTIVITIES

### Methodology and Impact Thresholds

Park planning interpretive documents and Park staff observations and experience provided information and guidance about recreational activities. The definitions for identifying intensity of an impact are as follows:

Impact Intensity	Intensity Level Definition
Negligible	Visitors would not be affected or changes in recreational activities would be below or at the level of detection. Any impact would be short-term. The visitor would not likely be aware of the impacts associated with the alternative.
Minor	Changes in recreational activities would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the impacts associated with the alternative, but the impacts would be slight.
Moderate	Changes in recreational activities would be readily apparent and likely long-term. The visitor would be aware of the impacts associated with the alternative and would likely be able to express an opinion about the changes.
Major	Changes in recreational activities would be readily apparent, severely

	adverse and have important long-term consequences. The visitor would be aware of the impacts associated with the alternative and would likely express a strong opinion about the changes.
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For the purposes of analyzing the impacts on recreational activities within the Management Categories for each Alternative, the term “recreational activities” is used generically to address the three types of activities identified and described in Chapter 3: day hiking/viewing, backcountry camping, and hang gliding/paragliding.

### Impacts of Alternative A: No Action

**Impact Analysis:** Under this alternative, the GMP, BWMP, and Resource Management Plan would continue to be used as guidance documents to manage recreational use. All rock outcrop sites would be accessible to visitors. Popular rock outcrop sites would continue to be used heavily by day hikers and campers which may result in crowding and diminishment of visitor enjoyment. The AT would not be affected by any actions other than the application of management tools and techniques presently authorized by the BWMP for site and visitor management. The only exceptions would be in areas where immediate threats to sensitive resources and closure or restriction at an individual site are needed to prevent loss.

At Little Stony Man Mountain there would be no change in the access for day hikers, and campers using the site. Day hikers would continue to periodically encounter climbing ropes blocking the Appalachian Trail. The site would continue to be popular and used by day hikers. Barriers would continue to be in place on the southern outcrops to protect rare plant communities.

At Old Rag Mountain, visitors would have unrestricted exploration possibilities within the summit area. The site would continue to be used by day hikers.

For Management Category 1 through 5 sites no actions would be taken by the Park that would change recreational access.

Implementation of Alternative A would not result in any change in current recreational uses of Little Stony Man Mountain and Old Rag Mountain.

Overall, there would be no impacts to recreational activities from Alternative A.

**Cumulative Impacts:** Improvements to the Old Rag parking lot would have long-term beneficial impacts to recreational activities by improving the park’s facilities and by directing appropriate visitor recreation use. Under the No Action Alternative visitor use would be minimally regulated and would result in no impacts on recreational activities. There would be no cumulative impacts.

**Conclusion:** Under Alternative A, there would be no impacts on recreational activities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

## Impacts of Alternative B: Balance Between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Actions implemented through Alternative B would enhance some aspects of recreational activities and prohibit others. Visitors would encounter physical barriers designed to direct and concentrate use and impacts to certain areas. Portions of rock outcrop sites would be closed to recreational activities. The BWMP would be used to manage backcountry conditions.

At Little Stony Man Mountain, day hikers would experience a shorter hike with a similar view of the valley from the cliff-base view point. Visitors would encounter low barriers directing them to more concentrated use areas on the northern cliffs and cliff base.

At Old Rag Mountain, visitors would encounter educational signs and barriers while hiking the eastern summit that would concentrate use in areas that are already heavily impacted. Barriers would be installed to concentrate visitor use to the Main Summit. Hikers would encounter barriers on informal trails which would limit access to the Western Summit.

At Management Category 1 sites, visitors would encounter low barriers and signs at trailheads and rock outcrops. Portions of rock outcrop sites would be closed to recreational activities. Actions at Management Category 1 sites include restricting rock climbing and camping and closing informal trails at North Marshall. At South Marshall, use of the Appalachian Trail would be directed away from the cliff and rock outcrops. At Overall Run Falls North, camping would be restricted and informal trails to outcrops would be closed. Visitor access would be focused at non-sensitive areas. At Hawksbill Summit, rock and ice climbing, and camping would be prohibited and the multiple informal trails to the cliffs between the Byrds Nest Shelter and the summit viewing platform would be closed. The southwestern summit outcrops would be closed to the public to protect falcon and vegetation habitat. Signage and physical barriers on the Frazier Discovery Trail at Loft Mountain's northernmost summit outcrop would reduce use of the site, protecting plant communities. Bettys Rock trail would be abandoned.

At Management Category 2 sites, visitors would encounter low barriers and signs at trailheads and at rock outcrops containing visitation at the overlook outcrop, closing informal trails, and restricting camping at Marys Rock. Off-trail rock scrambling in the lichen community would be reduced at Blackrock South District.

There would be no change in recreational uses at Management Category 3 and 5 sites.

There would be no change in recreational uses at Management Category 4 sites, except in the rare case when a prescribed fire is in progress.

For Management Category 3 and 4 sites, monitoring would be established. At Management Category 3 sites monitoring would be done to assess impacts of visitor use at Franklin Cliffs. For Management Category 4 sites, Compton Peak campsite conditions would be monitored.

Impacts to day hiking/viewing and backcountry camping at Little Stony Man Mountain, Old Rag Mountain and Management Category 1 sites are minor. Impacts to day hiking/viewing for Management Category 2 sites are negligible. There are no impacts to backcountry camping for Management Category 2 sites and no impacts for day hiking/viewing or backcountry camping for Management Category 3-5 sites. There are no impacts to hang gliding/paragliding under this alternative.

Overall, impacts to recreational activities under Alternative B would be negligible to minor.

**Cumulative Impacts:** Improvements to the Old Rag parking lot would have long-term beneficial impacts to recreational activities by improving the park's facilities and by directing appropriate visitor recreation use. The combination of the two projects would not result in beneficial cumulative impacts. There would be no cumulative impacts.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from the installation of signs and barriers. Actions under Alternative B would result in adverse, site-specific, negligible to minor long-term impacts on recreational activities. There would be no cumulative impacts from past, present and reasonably foreseeable future actions.

### Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Closing many summit areas to visitor use under Alternative C would result in additions and restrictions to recreational activities. Visitor access to some popular hiking destinations would be eliminated. Signs and large physical barriers would be installed at rock outcrops along some popular trails and viewpoints including Old Rag Mountain and Little Stony Man Mountain.

At Little Stony Man Mountain, hiking and climbing would be discontinued on-site, and the "chute" trail would be closed. The AT would be relocated to the lower cliffs or rerouted to the east and out of sight of the upper cliffs. Day hikers would view the valley from the lower cliff viewpoint. Low barriers and signs would be installed to direct visitor use to the northern end of the upper cliffs. Tall barriers and signs would be installed to close visitor access to the cliffs south of the "chute" trail. The BWMP would be used to manage backcountry conditions.

At Old Rag Mountain, access to recreational areas would be reduced as access to the Eastern and Western summits would be eliminated. Campers would only be able to camp below 2,000 feet. Educational signs, closure signs, and barriers at summit and other outcrop sites would be installed to close some areas and redirect visitors to non-sensitive sites.

At Management Category 1 sites, educational signs and large barriers would be installed at outcrops along popular trails and viewpoints.

At Management Category 2 sites, barriers and signs would be installed at trailheads and rock outcrops. Some social trails would be closed to visitor use.

In Management Category 3, Millers Head would be closed to hang gliding/paragliding. Recreational activities would be largely unaffected at Management Category 4 sites except in rare cases when a prescribed fire is in progress.

No actions would be taken to alter access at Management Category 5 sites so there would be no changes in recreational uses.

Closing trails and summits to visitor access for day hiking/viewing opportunities at Little Stony Man Mountain would result in moderate impacts to day hiking/viewing and minor impacts to backcountry camping. Restricting access at Old Rag Mountain may lead to moderate impacts to day hiking/viewing and minor impacts to backcountry camping. Closing some trails would result in minor impacts to day hiking/viewing and backcountry camping at Management Category 1 and 2 sites and negligible impacts to day hiking/viewing at Management Category 3 sites. There would be no impacts for day backcountry camping for Management Category 3 sites but there would be moderate impacts to hang gliding/paragliding as the Millers Head launch sites would be closed. There would also be no impacts to day hiking/viewing and backcountry camping in Management Category 4 and 5 sites.

Overall, impacts to recreational uses from trail closures and restrictions under Alternative C would be negligible to moderate.

**Cumulative Impacts:** Alternative C has overall adverse impact on recreational uses because it limits available recreation opportunities. Old Rag parking lot project will benefit recreational uses by improving access to trails. Cumulatively, the impact is likely still adverse because the new lot won't offset the loss of access.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from the installation of signs and barriers. Actions associated with Alternative C would likely result in adverse, site-specific, negligible to moderate long-term impacts. Cumulative impacts from past, present and reasonably foreseeable future actions would likely remain adverse, with Alternative C contributing an appreciable amount to the cumulative impact.

#### Impacts of Alternative D: Emphasis on Visitor Use

**Impact Analysis:** Actions taken under Alternative D would maximize recreational uses and opportunities for recreation. Implementation of Alternative D would result in beneficial impacts to recreational activities. Beneficial impacts include improved information to visitors about the recreational opportunities. Visitors would have access to new hikes and an increased number of rock outcrop viewpoints, and enhanced viewing areas at some popular rock outcrop viewpoints. The only exceptions would be in the event that monitoring identifies an immediate threat to a rare, threatened or endangered species, at which time that individual outcrop may be closed to visitor use or use may be

otherwise restricted in order to prevent further impacts that would likely lead to the loss of the species.

At Little Stony Man Mountain the “chute” trail would be hardened and added to the established trail system. Views of the valley would be available from the upper and lower cliff viewpoints.

At Old Rag Mountain, visitors would have access to a summit viewing platform and 306 degree view. Social trails to private viewpoints and the Western summit would be formalized.

At Management Category 1 sites, hikes to more rock outcrop view points would be available.

At Management Category 2 sites, new signs would be installed and literature would be made available regarding new hikes and viewpoints on rock outcrops.

At Management Category 3 sites, new hikes would be available along with an increased number of rock outcrop viewpoints.

No change would occur to recreational activities at Management Category 4 and 5 sites.

Actions under this alternative would be beneficial to recreational activities at Little Stony Man Mountain, Old Rag Mountain, and sites in Management Categories 1, 2 and 3. There are no impacts to hang gliding/paragliding under this alternative.

Overall, impacts to recreational activities from Alternative C would be beneficial.

**Cumulative Impacts:** Improvements to the Old Rag parking lot would have long-term beneficial impacts to recreational activities by improving the park’s facilities and by directing appropriate visitor recreation use. Alternative D would also have long-term beneficial impacts to recreational activities by increasing the number of trails and access to rock outcrops. In combination, these projects would have a beneficial cumulative impact on recreational activities.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from construction related activities. Actions under Alternative D would result in long-term beneficial impacts on recreational activities. There would be beneficial cumulative impacts from past, present and reasonably foreseeable future actions.

## VISITOR EXPERIENCE

### Methodology and Impact Thresholds

Park planning interpretive documents and Park staff observations and experience provided information and guidance about visitor experience. The definitions for identifying intensity of an impact are as follows:

Impact Intensity	Intensity Level Definition
Negligible	Visitors would not be affected or changes in visitor use and/or experience would be below or at the level of detection. The visitor would not likely be aware of the impacts associated with the alternative.
Minor	Changes in visitor use and/or experience would be detectable, although the changes would be slight and likely short-term. The visitor would be aware of the impacts associated with the alternative, but the impacts would be slight.
Moderate	Changes in visitor use and/or experience would be readily apparent and likely long-term. The visitor would be aware of the impacts associated with the alternative and would likely be able to express an opinion about the changes.
Major	Changes in visitor use and/or experience would be readily apparent, severely adverse and have important long-term consequences. The visitor would be aware of the impacts associated with the alternative and would likely express a strong opinion about the changes.

Beneficial impacts are described but are not assigned intensity levels.

### Impacts of Alternative A: No Action

**Impact Analysis:** Under Alternative A, no specific actions would be taken to change the existing visitor experience. Visitors would be able to view all of the rock outcrops that are currently accessible to the public. The only exceptions would be in the event that monitoring identifies an immediate threat to a rare, threatened or endangered species, at which time that individual outcrop may be closed to visitor use or use may be otherwise restricted in order to prevent further impacts that would likely lead to the loss of the species. Visitors may enjoy having mostly unrestricted access to rock outcrops in the park for climbing and recreational activities but may be negatively affected when informal campsites and trails are closed.

At Little Stony Man Mountain, visitors would continue to view the valley from the upper and lower cliff viewpoints with no restrictions, resulting in beneficial impacts.

At Old Rag Mountain, visitors would have a 360 degree summit view. The site would continue to be heavily used by visitors which may diminish visitor experience due to crowding.

For Management Category 1 through 5 sites, no actions would be taken by the Park that would change visitor experience. Some visitors may notice resource degradation, which would detract from their enjoyment of the rock outcrops.

Impacts at Little Stony Man Mountain would be beneficial. Impacts at Old Rag Mountain from heavy use and impacts to resources at Management Category 1-5 sites would result in minor impacts to visitor experience.

Overall, impacts from Alternative A would result in minor negative impacts and beneficial impacts.

**Cumulative Impacts:** Improvements to the Old Rag parking lot would have long-term beneficial impacts to visitor experience by improving the park's facilities and by directing appropriate visitor recreation use. Under the No Action Alternative, visitor use would be minimally regulated and there would be minor adverse impacts plus beneficial impacts. Overall, the cumulative impacts on visitor experience are likely to be beneficial.

**Conclusion:** Under Alternative A, actions to visitor's experience and enjoyment of the park would have adverse, site-specific, minor, long-term impacts and beneficial impacts. Cumulative impacts from past, present and reasonably foreseeable future actions are likely to be beneficial.

### Impacts of Alternative B: Balance Between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

**Impact Analysis:** Implementation of actions under Alternative B would enhance some aspects of visitor experience and prohibit others. Visitors would encounter educational signs and physical barriers, trailhead bulletin displays discussing rock outcrop natural resources and low barriers designed to direct and concentrate use and impacts to certain areas of the rock outcrops. Portions of rock outcrop sites would be closed to visitor use. The BWMP would be used to manage backcountry conditions and the Climbing Management Guidelines would manage rock climbing, bouldering and ice climbing in the Park.

Barriers would likely be perceived as a hindrance to the visitor experience. Educational literature, signs and programs would be beneficial to the visitor experience.

Visitors would encounter a trailhead bulletin display and signs discussing rock outcrop natural resources. Shorter hikes and concentrating visitor use to a specific area on the mountain may diminish the experience for some visitors. The same applies to Old Rag Mountain where barriers would concentrate visitor use to the Main Summit which may make it appear more crowded. Relocating climbing trails at both mountains may diminish climbers' enjoyment.

Climbing, camping and hiking would be restricted at some Management Category 1 and 2 sites and redirecting use to specific sites may led to a negative visitor experience. Educational signage may improve visitor experience.

Visitor experience would be unaffected at Management Category 3 and 5 sites except for minimal restrictions to day hiking/viewing and hang gliding/paragliding at a few Management Category 3 sites.

Visitor experience would be unaffected at Management Category 4 sites, except in the rare case when a prescribed fire is in progress.

Impacts to visitor experience at Little Stony Man Mountain, Old Rag Mountain and sites in Management Categories 1 and 2 would be moderate and adverse. There would also be

beneficial impacts at Little Stony Man Mountain, Old Rag Mountain and Management Category 1 and 2 sites.

Overall, impacts from actions under Alternative B would be moderate and adverse.

**Cumulative Impacts:** Improvements to the Old Rag parking lot would have long-term beneficial impacts to visitor experience by improving the park's facilities and directing appropriate visitor recreational use. Alternative B has moderate adverse impacts to visitor experience and would also have long-term beneficial impacts to visitor experience through improved education, some facility improvements and the appreciation of resources that are being appropriately protected. Overall, the cumulative impacts on visitor experience are likely to be beneficial.

**Conclusion:** Under Alternative B, there would be adverse, site-specific, short-term impacts from the installation of signs and barriers to visitor experience. There would be long-term beneficial and negative adverse, site-specific, moderate, long-term impacts to the overall visitor experience of the Park associated with the implementation of this alternative. There would be beneficial cumulative impacts.

### Impacts of Alternative C: Emphasis on Natural Resource Protection

**Impact Analysis:** Closing many summit areas to visitor use under Alternative C would result in additions and restrictions to visitor experience. Implementation of this alternative would result in mostly adverse impacts to the visitor experience. Visitor access to some popular hiking destinations would be eliminated. Hikers and rock climbers would encounter restrictive signs and large physical barriers at rock outcrops along popular trails and viewpoints including Old Rag Mountain and Little Stony Man Mountain. Rock climbing would no longer be permitted in the summit area of Little Stony Man Mountain or Old Rag Mountain. Some visitors would perceive beneficial impacts in response to increased educational programs, literature, displays, and over time the return of natural resources to levels before human disturbance. The BWMP would be used to manage backcountry conditions and the Climbing Management Guidelines would manage rock climbing, bouldering and ice climbing in the Park.

Actions under Alternative C would reduce the number of trails provided for recreational activities at Little Stony Man. Recreational visitors including climbers would encounter reduced recreational activities and physical barriers which may lead to a visitor experience that is less satisfactory than the one currently available. Over time, reduced impacts to resources would improve visitor experience. Visitors would enjoy a similar view from the lower cliffs viewpoint to that available from the upper cliffs.

At Old Rag Mountain, visitor access would be reduced as access to the Eastern and Western summits would be eliminated. Visitors would no longer be able to enjoy a 360 degree view from the summit, and the feeling of accomplishment of reaching the actual summit. Campers would only be able to camp below 2,000 feet, all of which may contribute to decreased enjoyment of the Park. Recreational visitors, including climbers

would encounter educational signs, closure signs, and barriers at summit and other outcrop sites. Increase in visitation may result in loss of solitude at some sites as visitor use is concentrated to a few areas.

At Management Category 1 and 2 sites visitor access along popular trails, viewpoints, and climbing areas would be restricted through restrictive signs and barriers. This may lead to a negative visitor experience for some visitors. Interpretive and educational signage at these sites may contribute to a positive visitor experience.

Visitor experience would be largely unaffected at Management Category 4 sites except in rare cases when a prescribed fire is in progress.

No actions would be taken to alter access at Management Category 3 or 5 sites and visitor experience would be unaffected.

Closing trails and summits to visitor access at Little Stony Man Mountain would result in moderate adverse impacts. Restricting access at Old Rag Mountain may lead to moderate adverse impacts but educational opportunities would lead to a positive visitor experience for some visitors. By closing some trails visitors may experience minor adverse impacts at Management Category 1 and 2 sites. Visitors would experience negligible impacts at Management Category 4 sites during prescribed burns. Educational tools available near the summits may increase visitor experience and satisfaction.

Overall, adverse impacts from trail closures and restrictions to visitor experience from Alternative C would be negligible to moderate. Visitor experience would benefit from educational opportunities provided by signage.

**Cumulative Impacts:** Improvements to the Old Rag parking lot would have would have long-term beneficial impacts to visitor experience by improving the park's facilities and by directing appropriate visitor recreation use. Actions under Alternative C would result in moderate adverse impacts and some beneficial impacts. The cumulative impact is likely to remain adverse, as the improvement in visitor experiences due to the new parking lot and increased informational materials would likely not offset the adverse impacts of closures, restricted access and possible crowding.

**Conclusion:** Actions associated with Alternative C may result in adverse, site-specific, negligible to moderate long-term impacts and some beneficial impacts. Cumulative impacts from past, present and reasonably foreseeable future actions would likely be adverse, with Alternative C contributing an appreciable amount to the total cumulative impact.

## Impacts of Alternative D: Emphasis on Visitor Use

### **Impact Analysis:**

Actions taken under Alternative D would maximize visitor experience over protection of natural resources. Implementation of Alternative D would result in beneficial and negative impacts to visitor experience. Beneficial impacts include improved information to visitors about the recreational opportunities and natural history of rock outcrop sites.

Visitors would be directed by signs and literature to enjoy new hikes and an increased number of rock outcrop viewpoints. Visitors would also encounter more enhanced viewing areas at some popular rock outcrop viewpoints. The only exceptions would be in the event that monitoring identifies an immediate threat to a rare, threatened or endangered species, at which time that individual outcrop may be closed to visitor use or use may be otherwise restricted in order to prevent further impacts that would likely lead to the loss of the species. In some areas, visitors may encounter fewer people at some viewpoints because use would be distributed among a greater number of viewpoints, while at others, crowding and increased access would bring more visitors to the rock outcrops. Platforms and handrails would provide safer viewing at some popular areas. Climbing would be unrestricted and may lead to an enhanced visitor experience.

At Little Stony Man Mountain, trails would be improved, improving the visitor experience. Day users would continue to view the valley from the upper and lower cliff viewpoints. Visitors may encounter more crowding and other signs of human use as the site's popularity increases with increased opportunities for use.

At Old Rag Mountain, visitor experience would improve from educational signs and programs about the natural resources and recreational opportunities on the Mountain. Visitors would have access to a summit viewing platform and 306 degree view. Social trails to private viewpoints and the Western summit would be formalized.

At Management Category 1 sites, visitors would have an improved experience from new signs and hikes to more rock outcrop viewpoints. Platforms and handrails would be provided for safer viewing. Visitor experience for some may be diminished because of crowding and exposure to undesirable visitor behavior.

At Management Category 2 sites, visitor experience would be improved as visitors would encounter new signs and literature regarding new hikes and viewpoints on rock outcrops. Visitors would also have more enhanced viewing areas. Visitor experience for some would likely diminish because of crowding and exposure to undesirable visitor behavior.

At Management Category 3 sites, visitors would enjoy new hikes and increased number of rock outcrop viewpoints. Visitor experience for some would likely diminish because of crowding and exposure to undesirable visitor behavior.

No change would occur to recreational activities at Management Category 4 and 5 sites and visitor experience would likely be unaffected.

At Little Stony Man Mountain, Old Rag Mountain, and sites in Management Categories 1-3, actions under this alternative would be beneficial to the visitor experience. Minor negative impacts may occur at these areas due to crowding from increased visitation.

Overall, impacts from actions under Alternative D would be minor.

**Cumulative Impacts:** Improvements to the Old Rag parking lot would have long-term beneficial impacts to visitor experience by improving the park's facilities and by directing appropriate visitor recreational use. Alternative D would also have long-term

beneficial impacts to visitor experience by increasing access to rock outcrops as well as minor adverse impacts due to crowding. The overall cumulative impact on visitor experience would likely be beneficial.

**Conclusion:** There would be adverse, site-specific minor, short-term impacts from construction related activities. Under Alternative D, visitor experience would be enhanced by the great increase in hiking and climbing access. This may be offset by adverse, site-specific, minor, long-term adverse impacts to visitor experience due to potential crowding and loss of natural resources. There would be beneficial impacts to the overall visitor experience of the Park associated with the implementation of Alternative D. Cumulative impacts would likely be beneficial.

## SECTION 106 SUMMARY BY ALTERNATIVE

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The environmental consequences, including an assessment of effect for Section 106 of the NHPA, were documented within individual impact topics in Chapter 4 of this EA/AoE. In the analysis, an Assessment of Effect for purposes of Section 106 was included for the listed or potentially eligible National Register cultural resources including: cultural landscapes and archeological resources. Impacts were assessed for each topic by each of the four alternatives. Below is a summary discussing an overall assessment of effect for each alternative.

### Alternative A: No Action

Alternative A, which maintains current management practices, would result in a *no historic properties affected* determination for cultural landscapes and archeological resources. These resources would continue to be managed to retain eligibility for listing on the National Register.

### Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

This alternative has a *no adverse effect* determination on cultural landscapes. Actions under Alternative B would relocate the AT to its original location, bringing the Appalachian Trail Cultural Landscape to its original configuration. A determination of effect for the purposes of 106 can not be determined at this time. Further planning would require the development of a Programmatic Agreement between the Park Service and SHPO. An archeological survey will be conducted prior to moving the trail.

### Alternative C: Emphasis on Natural Resource Protection

This alternative has a *no adverse effect* determination on cultural landscapes and *no historic properties affected* for archeological resources. As in Alternative B, the AT would be relocated to its original location and the Appalachian Trail Cultural Landscape would be brought to its original configuration. An archeological survey will be conducted prior to moving the trail.

## Alternative D: Emphasis on Visitor Use

This alternative has an *adverse effect* determination on cultural landscapes and archeological resources. Actions proposed under this Alternative have the potential to change the cultural landscape and impact archeological resources. The Park would preserve archeological resources in place and maintain the integrity of the Appalachian Trail Cultural Landscape. Archeological resources located near outcrops that receive impacts from visitors would be protected by barriers or fencing. Visitor amenities would not be built in places that would diminish the integrity of the cultural landscape.

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## SUMMARY OF IMPACTS BY ALTERNATIVE

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### Alternative A: No Action

Alternative A would maintain current conditions at the Park. Rock outcrop areas that are currently accessible to the public would continue to be accessible. Recreational activities such as campsite and trail management would continue as directed by the BWMP. The Climbing Management Guidelines would not be implemented and climbing would be managed by regulations found in 36 CFR. Monitoring of rare natural resources and impacted areas would continue.

For Section 106 a determination of *no historic properties affected* is anticipated for cultural landscapes and archeological resources.

There would be no impacts to recreational activities. Adverse, site-specific, negligible to moderate, long-term impacts would occur to geologic and soils resources; ecological communities; rare, threatened, and endangered plants; and Wilderness character. Adverse, site-specific, negligible to minor long-term impacts would occur to rare, threatened, and endangered species. There would be beneficial impacts to climbing activities and adverse, site-specific, minor, long-term impacts to visitor experiences.

### Alternative B: Balance between Natural Resource Protection and Visitor Use (NPS Preferred Alternative)

Alternative B would balance natural resource protection with visitor use. Actions under this alternative would allow visitor use of selected rock outcrop areas while minimizing deterioration to natural resource conditions. Visitor access to some rock outcrops would be limited. Recreational climbing management would be guided by the Climbing Management Guidelines that would enforce the rock climbing areas and practices outlined in the guidelines. Recreational opportunities would be directed away from protected areas. Natural resources monitoring and management would occur.

For Section 106, a determination of *no adverse effect* is anticipated for cultural landscapes and *no historic properties affected* for archeological resources.

Natural resources would receive some impacts from visitor use, but there would be more protection and restoration for these resources than under Alternative A or D. This alternative may increase visitor experience and visitor satisfaction from the proposed

project due to educational opportunities from proposed signage, the regeneration of impacted areas over an extended period of time and directed recreational opportunities.

### Alternative C: Emphasis on Natural Resource Protection

Alternative C would emphasize the protection of natural resources and minimize recreational and visitor use to reduce impacts. Visitor use of rock outcrops and places for recreational activities would be heavily restricted. The Climbing Management Guidelines would be implemented and additional sites would be closed to climbing. Natural resources monitoring and management would occur.

For Section 106 a determination of *no adverse effect* is anticipated for cultural landscapes and *no historic properties* affected for archeological resources.

Under Alternative C, natural resources would be heavily protected allowing maximum regeneration and restoration to occur and visitor use would cause relatively little impacts. Recreational activities would be reduced and visitor satisfaction may decrease as there would be fewer opportunities to recreate in the Park.

### Alternative D: Emphasis on Visitor Use

Actions associated with Alternative D would emphasize the preservation and enhancement of visitor access and opportunities for the enjoyment of rock outcrops. Visitor use of rock outcrops would be encouraged through improved trail access, viewing platforms, interpretive and directional signage, and informational publications. Climbing activity would be regulated under current management practices but extensive recreational climbing would be allowed. Places for recreational activities such as hiking would increase. Natural resource monitoring and management would occur.

For Section 106 a determination of *adverse effect* is possible for cultural landscapes and archeological resources.

Natural resources would not be protected under this alternative. Opportunities for recreational and climbing activities would increase. Visitor experience and satisfaction would be high under this alternative as visitors would have improved recreational opportunities such as new viewing platforms and railings and unlimited access to sites in the Park. Although some visitor dissatisfaction may occur as vegetation and other resources are depleted by human trampling.

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## CHAPTER 5

# CONSULTATION AND COORDINATION

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*Photo courtesy of Gary Fleming.*

### **Appalachian Fir Clubmoss**

## AGENCY, TRIBAL, AND ORGANIZATION CONSULTATION

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NPS DO #12 requires the NPS to make “diligent” efforts to involve the interested and affected public in the NEPA process. This process, known as scoping, helps to determine the important issues and eliminate those that are not; allocate assignments among the interdisciplinary team members and/or other participating agencies; identify related projects and associated documents; identify other permits, surveys, consultations, etc. required by other agencies; and create a schedule that allows adequate time to prepare and distribute the environmental document for public review and comment before a final decision is made.

### Brief History of Planning and Scoping

As discussed in “Chapter 1: Purpose and Need for Action,” the Park completed a sequence of planning efforts that lead to this ROMP to address the need to protect, restore, and perpetuate rock outcrops and natural resources associated with the outcrops while providing a range of recreational opportunities for visitors to experience. Discussions about rock outcrop issues in the Park began in 2001 between NPS and VA-DNH regarding human-caused damage to rare plant populations. Between 2003 and 2005 studies to inventory resources and evaluate human impacts and a project to examine park-wide cliff resource conditions and the impacts recreational activities have on those resource conditions was designed and proposed for Natural Resource Protection Program (NRPP) funding. In 2005 the Park obtained three year NRPP funding and the Rock Outcrop Management Project was implemented with the assistance of other agency partners and universities to study the Park's rock outcrops. Based on information gathered the need to create a ROMP emerged.

As the project progressed, the Park contacted federal and state agencies with jurisdiction and/or special expertise to inform them of the proposed action, to request information, and identify potential issues with the preferred alternative. The Park has initiated consultation with federal and state agencies and will continue to consult these agencies, as needed, through the planning process and, as necessary, implementation of the project.

This EA/AoE will be on formal public and agency review for 30 days and has been distributed to a variety of interested individuals associated with the Park's mailing list and outreach, agencies, and organization. This document is also available on the Internet at <http://parkplanning.nps.gov> and hard copies are available at Shenandoah National Park by calling the Superintendent's Management Assistant at (540) 999-3300.

The following agencies, tribes, and organizations were contacted for information, assisted in identifying issues, developing alternatives, analyzing impacts, or identified compliance requirements:

### Federal Agencies

U.S. Department of the Interior, Fish and Wildlife Service  
U.S. Geological Survey

### American Indian Tribes

This Environmental Assessment will be provided to the Catawba Indian Nation, the Monacan Indian Nation, Inc., the Virginia Council on Indians, and any other Tribal organizations who express an interest.

### State and Local Agencies

Virginia Department of Conservation, Division of Natural Heritage  
Virginia State Historic Preservation Office

### Organizations and Individuals

Appalachian Trail Conservancy  
Shenandoah Mountain Guides and Teamlink, Inc.  
Shenandoah National Park Climbers' Alliance  
The Access Fund  
University of Cincinnati  
Virginia Polytechnic Institute and State University

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## ACRONYMS AND ABBREVIATIONS

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ACHP	Advisory Council on Historic Preservation
AT	Appalachian Trail
ATC	Appalachian Trail Conservancy
ATPO	Appalachian Trail Park Office
BMP	Best Management Practices
BWMP	Backcountry and Wilderness Management Plan
CEQ	Council on Environmental Quality
CLI	Cultural Landscape Inventory
CZMA	Coastal Zone Management Act of 1972 as amended
DO-12	NPS Director's Order #12: Conservation Planning, Environmental Impact Analysis and Decision-Making
DO-28	NPS Director's Order #28: Cultural Resources Management
DO-77-1	NPS Director's Order #77-1: Wetland Protection and accompanying Wetland Procedural Manual
EA/AoE	Environmental Assessment/Assessment of Effects
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESF	Environmental Screening Form
FPPA	Farmland Protection Policy Act
GIS	Geographic Information Systems
GMP	General Management Plan
IPCC	Intergovernmental Panel on Climate Change
MOA	Memorandum of Agreement
NEPA	National Environmental Policy Act of 1969, as amended
NHPA	National Historic Preservation Act
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRPP	Natural Resources Preservation Program
PA	Programmatic Agreement
Park, The	Shenandoah National Park
PATC	Potomac Appalachian Trail Club
RMP	Resource Management Plan
ROMP	Rock Outcrop Management Plan
SOF	Statement of Findings
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
USNVC	United States National Vegetation Classification
VA DCR	Virginia Department of Conservation and Recreation
VA-DNH	Virginia Division of Natural Heritage
VA SHPO	Virginia State Historic Preservation Office
VDGIF	Virginia Department of Game and Inland Fisheries
VT	Virginia Tech (Virginia Polytechnic Institute and State University)

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## APPENDICES

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*Photo courtesy of Gary P. Fleming*

### **Hawksbill Summit**

APPENDIX A: PHOTOGRAPHIC KEY TO ROCK EXPOSURE CLASSIFICATIONS AT THE PARK

	<p>Cliff – Near-vertical exposure that dominates or creates surrounding topography. Usually continuous across slope, though may be interrupted by talus slopes or other erosional features. Generally sheer, with minor ledges along the vertical drop.</p> <p>Face – Continuous, rounded, gently sloping exposure (&lt;45) of smoothly weathered rock. Not steep enough to be a cliff, too continuous and smooth to be an outcrop, and too sloping and rounded to be a ledge.</p> <p>Outcrop – Intermittent exposures that stand out from surrounding topography but do not influence it. Most commonly sloping, rugged exposures with many associated ledges. May also consist of intermittent protruding rock ribs that are not continuous or wide enough to be a cliff.</p> <p>Ledge – Near-horizontal exposure along top or sides of cliffs and outcrops, where a local break in slope occurs, but trees and thick soil have not yet accumulated. Often hosts vegetation.</p> <p>Talus – Continuous to scattered rock debris with little to no soil development, covering general topography. May or may not be associated with in-place bedrock exposures.</p>
	
	

## APPENDIX B: EXPLANATION OF THE NATURAL HERITAGE RANKING AND ROCK OUTCROP PLANT RANKING SYSTEMS

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### NATURAL HERITAGE RANKING

Each of the significant natural features (species, community type, etc.) monitored by DCR-DNH is considered an element of natural diversity, or simply an element. Each element is assigned a rank that indicates its relative rarity on a five-point scale (1 = extremely rare; 5 = abundant). The primary criterion for ranking plant and animal elements is the number of occurrences, i.e., the number of known distinct localities or populations. Also of great importance is the number of individuals at each locality or, for highly mobile organisms, the total number of individuals. Other considerations include the condition of the occurrences, the number of protected occurrences, and threats. However, the emphasis remains on the number of occurrences, so that ranks essentially are an index of known biological rarity. These ranks are assigned both in terms of the element's rarity within Virginia (its state or S-rank) and the element's rarity over its entire range (its global or G-rank). Subspecies and varieties are assigned a taxonomic (T-) rank in addition to their G-rank. Taken together, these ranks give an instant picture of an element's rarity. For example, a designated rank of G5S1 indicates an element which is abundant and secure range-wide, but extremely rare in Virginia. Ranks for community types are provisional, or in many cases lacking, due to ongoing efforts by the natural heritage network to classify community taxa. Rarity ranks used by DCR-DNH are not legal designations, and they are continuously updated to reflect new information.

The primary ranking factors used in assessing the appropriate conservation status rank for a community element are: 1) the total number of occurrences and (2) the total area (acreage) of the element. Secondary factors such as the level of threats to the occurrences and the viability of existing occurrences also affect the rank. Additional factors that have been used to arrive at an assessment of a community's range wide (global) rank include the geographic range over which the type occurs, the long-term decline of the type across the range, the degree of site specificity exhibited by the type, and the rarity across the range based on state ranks assigned by state Natural Heritage Programs. Current global ranks for community types are provided in the U.S. National Vegetation Classification (USNVC; Grossman et al., 1998; NatureServe, 2006a; NatureServe, 2006b), and are constantly reviewed and updated through ongoing collaborative efforts by ecologists throughout the NatureServe / Natural Heritage Network.

#### **Global Ranks**

Global ranks are assigned by a consensus of the network of natural heritage programs, scientific experts, and NatureServe to designate a rarity rank based on the range-wide status of a species or variety. This system was developed by The Nature Conservancy and is widely used by other agencies and organizations as the best available scientific and objective assessment of a taxon's rarity and level of threat to its existence. The ranks are assigned after considering a suite of factors, including number of occurrences, number of individuals, and severity of threats. These ranks should not be interpreted as legal designations. The global ranks are defined as follows:

<b>G1</b>	Critically Imperiled	At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors
<b>G2</b>	Imperiled	At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors
<b>G3</b>	Vulnerable	At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors
<b>G4</b>	Apparently Secure	Uncommon but not rare; some cause for long-term concern due to declines or other factors
<b>G5</b>	Secure	Common, widespread and abundant
<b>GH</b>	Possibly Extinct (Species)	Missing; known from only historical occurrences but still some hope of rediscovery = <b>Presumed Eliminated</b>
<b>GH</b>	Possibly Extinct (Historic, ecological communities)	Presumed eliminated throughout its range, with no or virtually no likelihood that it will be rediscovered, but with the potential for restoration, for example, American Chestnut Forest
<b>GX</b>	Presumed Extinct (species)	Not located despite intensive searches and virtually no likelihood of rediscovery = <b>Eliminated</b>
<b>GX</b>	Presumed Extinct (ecological communities)	Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic species
<b>G#G#</b>	Range Rank	A numeric range rank (e.g., G2G3) is used to indicate the range of uncertainty in the status of a species or community
<b>GU</b>	Unrankable	Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. Whenever possible, the most likely rank is assigned and the question mark qualifier is added (e.g., G2?) to express minor uncertainty, or a range rank (e.g., G2G3) is used to delineate the range of uncertainty
<b>G_?</b>	Inexact Numeric Rank	Denotes inexact numeric rank (e.g., G3?)

<b>G_Q</b>	Questionable taxonomy	Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower conservation priority (e.g., G3Q)
<b>G_T</b>	Intraspecific Taxa	Signifies the rank of a subspecies or variety. For example, the rank G5T1 would be assigned to a very rare and localized variety of an otherwise widespread and common taxon
<b>GNR</b>	Unranked	Global rank not yet assessed
<b>GNA</b>	Not applicable	A conservation status rank is not applicable because the species is not a suitable target for conservation activities

### State Ranks

State ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Virginia. For example, whereas a species which is endemic to Virginia will have the same global and state ranks, a species which may be common in the northeastern United States, but only known from a few occurrences in Virginia will have different global and state ranks. By comparing the global and state ranks, the status, rarity, and the urgency of conservation needs can be ascertained. DCR-DNH maintains lists of rare and watchlist plant and animal taxa (Townsend, 2006; Roble, 2006). Plant and animal taxa designated as rare in Virginia include those having a state rank of S1, S1S2, S2, S2S3, or SH. Plant taxa placed on the watchlist include those taxa with uncommon status, including those ranked S3 and S?. (A separate review list contains plant taxa of uncertain status, including those taxa ranked SU, SNR, SNA, and SE?.) Animal taxa designated as watchlist taxa include those with ranks of S3, S3?, S3S4, and SU. State ranks are defined as follows:

**S1 Critically Imperiled** For plants and animals: at very high risk of extirpation from the state due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors. For communities: generally with 5 or fewer occurrences state-wide, and/or covering < 50 ha (124 ac) in aggregate; or covering a larger area but highly threatened with destruction or modification.

**S2 Imperiled** For plants and animals: at high risk of extirpation from the state due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors. For communities: generally with 6 to 20 occurrences state-wide, and /or covering < 250 ha (618 ac) in aggregate; or covering a larger area but threatened with destruction or modification.

**S3 Vulnerable** For plants and animals: at moderate risk of extirpation from the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors. For communities: generally with 21 to 100 occurrences, or a larger number subject to higher levels of threat; may be relatively frequent in specific localities or habitats.

**S4 Apparently Secure** For plants and animals: uncommon but not rare; some cause for long-term concern due to declines or other factors. For communities: common, at least in certain regions of the state, and apparently secure.

**S5 Secure** For plants, animals, and communities: common, widespread and abundant.

**SH Possibly Extirpated** (Historical) Species or community occurred historically in the nation or state, and there is some possibility that it may be rediscovered.

**SX Presumed Extirpated** Species or community is believed to be extirpated from the nation or state. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered

**SU Unrankable** Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

**S# S# Range Rank** A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community.

**S\_? Inexact Numeric Rank** Denotes inexact numeric rank (e.g., S3?).

**SNR Unranked** State conservation status not yet assessed.

**SNA Not Applicable** A conservation status rank is not applicable because the species is not a suitable target for conservation activities.

**S\_B** Breeding status of an animal (primarily used for birds) in Virginia; these species typically inhabit Virginia only during the breeding season.

**S\_B/S\_N** Breeding and nonbreeding status of an animal (primarily used for birds) in Virginia, when they differ.

The spot on the landscape that supports a natural heritage resource is an **element occurrence**. DCR-DNH has mapped almost 10,000 element occurrences in Virginia. Information on the location and quality of these element occurrences is computerized within the Division's Biotics system, and additional information is recorded on maps and in manual files.

In addition to ranking each element's rarity, each element occurrence is ranked to differentiate large, outstanding occurrences from small, vulnerable ones. In this way, protection efforts can be aimed not only at the rarest elements, but at the best examples of each. Species occurrences are ranked in terms of quality (size, vigor, etc.) of the population; the condition (pristine to disturbed) of the habitat; the viability of the population; and the defensibility (ease or difficulty of protecting) of the occurrence. Natural community occurrences are ranked using three criteria: 1) condition, 2) size, and 3) landscape context (*i.e.*, the degree to which the occurrence is embedded or connected to a natural, functioning landscape). The three criteria are weighted somewhat differently depending on whether the community in question is typically a matrix, large-patch, or small-patch type.

These **element occurrence ranks** range from A (excellent) to D (poor). Sometimes these ranks are combined to indicate intermediate or somewhat unclear status, e.g. AB or CD, etc. In a few cases, especially those involving cryptic animal elements, field data may not be sufficient to reliably rank an occurrence. In such cases a rank of E (extant) may be given. Element occurrence ranks reflect the current condition of the species' population or community. A poorly-ranked element occurrence can, with time, become highly-ranked as a result of successful management or restoration.

Element ranks and element occurrence ranks form the basis for ranking the overall significance of sites. Site **biodiversity ranks** (B-ranks) are used to prioritize protection efforts, and are defined as follows:

- B1 Outstanding Significance** Only site known for an element; an excellent occurrence of a G1 species; or the world's best example of a community type.
- B2 Very High Significance** Excellent example of a rare community type; good occurrence of a G1 species; or excellent occurrence of a G2 or G3 species.
- B3 High Significance** Excellent example of any community type; good occurrence of a G3 species.
- B4 Moderate Significance** Good example of a community type; excellent or good occurrence of state-rare species.
- B5 General Biodiversity Significance** Good or marginal occurrence of a community type or state-rare species.

**Note:** sites supporting rare subspecies or varieties are considered slightly less significant than sites supporting similarly ranked species.

The U.S. Fish and Wildlife Service (USFWS) are responsible for the listing of endangered and threatened species under the Endangered Species Act of 1973, as amended. Federally listed species (including subspecific taxa) are afforded a degree of legal protection under the Act, and, therefore, sites supporting these species need to be identified. USFWS also maintains a review listing of potential candidate endangered and threatened taxa. The list below illustrates the various status categories used by USFWS

and followed in this report. The status category of candidate species is based largely on the Service's current knowledge about the biological vulnerability and threats to a species.

U.S. Fish and Wildlife Service species status codes, with abbreviated definitions.

<b>LE</b>	Listed endangered
<b>LT</b>	Listed threatened
<b>PE</b>	Proposed to be listed as endangered
<b>PT</b>	Proposed to be listed as threatened
<b>S</b>	Synonyms
<b>C</b>	Candidate (formerly C1-Candidate category 1)
<b>E(S/A)</b>	Treat as endangered because of similarity of appearance
<b>T(S/A)</b>	Treat as threatened because of similarity of appearance
<b>SOC</b>	Species of Concern species that merit special concern ( <b>not a regulatory category</b> )

In Virginia, two acts have authorized the creation of official state endangered and threatened species lists. The Virginia Endangered Species Act (§29.1-563 through 570, *Code of Virginia*), administered by the Virginia Department of Game and Inland Fisheries (DGIF), authorizes listing of fish and wildlife species, not including insects. The Virginia Endangered Plant and Insect Species Act (§3.1-1020 through 1030, *Code of Virginia*), administered by the Virginia Department of Agriculture and Consumer Services (VDACS), allows for listing of plant and insect species. In general, these acts prohibit or regulate taking, possessing, buying, selling, transporting, exporting, or shipping of any endangered or threatened species appearing on the official lists. The list below states the categories for state legal status. DGIF has also created an informal category of Special Concern (SC) for animals that merit special attention. This is a non-regulatory category that affords no legal protection.

State legal status.

<b>LE</b>	Listed Endangered
<b>PE</b>	Proposed Endangered
<b>SC</b>	Special Concern - animals that merit special concern according to VDGIF (not a regulatory category)
<b>LT</b>	Listed Threatened
<b>PT</b>	Proposed Threatened
<b>C</b>	Candidate for listing as threatened or endangered

### **VA-DNH Stewardship Biologist Human Impact Rank**

A qualitative assessment was made for each site based on observations made during site visits. Observations made by other researchers were also incorporated.

**None**      0      No discernable impact. Fairly continuous cover of vegetation or lichens on level areas of outcrop.

<b>Low</b>	1	Some light trampling; some loss of lichen or mosses; mostly confined to trail.
<b>Medium</b>	2	Moderate trampling; loss of herbs, soils; confined to trail-outcrop interface.
<b>High</b>	3	Heavy trampling; loss of grasses; trampled area largely denuded except perhaps in crevices; impact throughout outcrop area or important component of outcrop (e.g. the one large flat open area of an outcrop complex).

### Stewardship Biologist Invasive Plant Rankings

A qualitative assessment was made for each site based on observations site visits. Observations made by other researchers were also incorporated. The invasiveness of a given non-native species also factored into the ranking. For example, presence of a highly invasive species, such as spotted knapweed (*Centaurea biebersteinii*), would increase the threat and, therefore, the invasive plant rank for the site.

<b>None</b>	0	No non-native plants present in outcrop community
<b>Low</b>	1	Non-native species may be present, but not a threat
<b>Medium</b>	2	Non-native species competing with native species, but not abundant
<b>High</b>	3	Non-native species competing with native species and abundant

### VA-DNH Stewardship Biologist Threat Assessment Rankings

The sum of the Human Impact Rank and the Invasive Plant Rank yields the Threat Assessment Rank. On this scale of 0 to 6, the larger the number, the greater the threat to natural heritage resources at the site.

### Geologist Rankings

#### Impacts – Evidence of human activity on the outcrop:

<b>pristine</b>	No impacts; trails/compaction nonexistent, absolutely no signs of human use or visitation
<b>mild</b>	Minor impacts; minor trails, slight compaction, , vegetation sporadically affected, most of site is untouched
<b>moderate</b>	Significant impacts; trails and compaction are common, areas of use are clearly visible, vegetation clearly affected and diminished
<b>heavy</b>	Ubiquitous impacts; trails and compaction are prevalent, rocks are carved, polished, or otherwise obviously impacted, and trash or other debris may be common, vegetation severely diminished

#### Access – ability of visitors to reach the outcrop from starting point on an access road

- remote** Not accessed by any trail or road. Generally not visible from trails or roads; if visible, requires negotiation of significant backcountry and/or topography to reach
- difficult** Generally greater than 2 trail km from road OR nearer road but requires negotiation of strenuous topography or trail conditions to reach
- moderate** Generally located within 2 trail km from road, visible from trails; may have some obstacles to access (slope, vegetation, etc...)
- easy** Generally located within 500m of road along clearly marked trails with signs leading to site OR located within 20m of road and clearly visible with obvious trails, no topography or other difficulties preventing access

## APPENDIX C: DEFINITIONS

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The following geologic definitions are adapted from Blatt & Tracy (1999), Deer et al., (1966), Gathright (1976), and Parker (1994), as well as personal knowledge and experience from the author.

**Basalt** – A dark-colored volcanic rock composed primarily of the minerals plagioclase, pyroxene, and olivine. Generally erupted from volcanoes or rift areas, forming fluid lava flows that cool on the surface of the earth. Individual crystals are small and rarely visible, due to the rapid cooling of the lava above ground. Can be used as an adjective describing the general mineral composition of a rock; e.g. basaltic.

**Basement Rock** – A general descriptive term for the complex set of igneous and metamorphic rocks, 1-1.2 billion years in age, that underlie the Blue Ridge in Shenandoah and the surrounding region. Used in this report in favor of the old “Pedlar Formation” designation; see that entry for details.

**Bedrock** – General term referring to any solid rock that remains fully attached to the earth (i.e. not soil, river sediments, or loose boulders). It does not refer only to the lowest in a sequence of rocks, but to any and all that fit the above definition.

**Breccia** – A sedimentary rock formed from angular fragments of other rocks, mixed together and cemented by other minerals. This often reflects a landslide or other active erosional process. A volcanic breccia is formed when lava flows or other volcanic processes rip up and collect rock fragments into a distinct unit. A conglomerate is similar, but contains mostly rounded fragments, generally reflecting an origin in river or stream gravels.

**Boulder field** – see Talus.

**Charnockite** – A specific type of granitic rock where pyroxene is the dominant dark-colored mineral rather than biotite. Generally unusual, it is common in parts of Shenandoah.

**Catoctin Formation** – A unit of greenstone lava flows that extends from southern Pennsylvania through Maryland and portions of Virginia, erupted onto the surface around 570 million years ago.

**Chilhowee Group** – A group of three related quartzite formations deposited over the Catoctin Formation. Chilhowee rocks are predominately found in the South District, with minor occurrences in the Central and North Districts.

**Cliff** – In this report, a specific type of exposure morphology. See Plate 2 or Appendix A for definition.

**Conglomerate** – See Breccia.

**Erwin Formation** – This uppermost unit of the Chilhowee Group is known for its thick, white quartzite beds that dominate ridgelines in the South District. These layers commonly form sheer cliffs and large, open boulder fields on the steep flanks of narrow ridges.

**Exposure** – See Open Rock Exposure.

**Face** – In this report, a specific type of exposure morphology. See Plate 2 or Appendix A for definition.

**Formation** – When used as a noun, any unit of bedrock or associated units that are locally classified together as part of the interpretation of their geologic history. Formations do not have to be the same rock type, but generally share similar histories. For example, the Catoctin Formation contains both volcanic and quartzite rocks, but these are classified together based on a shared origin and history, and to distinguish them from other, less related rocks.

**Granite** – A generally light-colored igneous rock composed primarily of quartz, orthoclase, and plagioclase, with lesser amounts of other minerals such as biotite, garnet, and pyroxene. Forms from molten rock which cools slowly underground into a solid, crystalline body; individual minerals are almost always visible. Can be used as an adjective describing the general mineral composition of a rock; e.g. granitic.

**Greenstone** – A rock formed by the low-grade metamorphism of basalt. Under these conditions, the original mineral composition of the basalt is altered to form the minerals chlorite, epidote, and actinolite. These new minerals give the rock a greenish tint; thus the name. This rock is also commonly referred to as metabasalt. Its physical appearance preserves many original features of the basalt, and is generally similar, except for the common green tinge, a slight trend toward being more coarse-grained, and the common presence of cleavage structures formed by alignment of chlorite crystals during the metamorphism.

**Hampton Formation** – This central unit of the Chilhowee Group is composed primarily of fine-grained metasediments and phyllites, commonly containing a strong, planar cleavage structure that appears similar to layering. The unit also contains several distinct quartzite beds that are similar in appearance to the Erwin Formation, though darker in color.

**Igneous** – Any rock formed by the cooling and solidification of molten rock, whether underground or on the Earth's surface.

**Ledge** – In this report, a specific type of exposure morphology. See Plate 2 or Appendix A for definition.

**Limestone** – A sedimentary rock composed primarily of calcite, formed in marine environments from the detritus of living organisms. Limestone is generally white-grey and massive (little to no prominent layering or structures), and will react with hydrochloric acid to produce bubbles of carbon dioxide.

**Metamorphic** – Any rock formed through the physical and/or chemical alteration of a pre-existing rock to the point that it becomes distinct from the original rock. Metamorphism refers to the process of these changes, and the prefix Meta- can be attached to most rock types to indicate that metamorphism has occurred, especially if the effects were not strong and the rock retains many of its original features (e.g. metabasalt).

**Mineral** – Any naturally occurring, solid substance with a known chemical composition and crystal structure. Minerals are most easily thought of as individual crystals that make up a rock (some rocks are made up entirely of crystals of a single mineral type, e.g. limestone {calcite}).

**Open rock exposure** – Any area of bedrock or talus area that is mostly open to the sun, i.e. not shaded or obscured by tree canopy, shrubs, or soil. Lichen coverage is not considered in this definition.

**Outcrop** – A general term used for any exposed bedrock area. In this report, a specific type of exposure morphology. See Plate 2 or Appendix A for definition.

**Pedlar Formation** – An old collective designation for the complex set of igneous and metamorphic rocks, 1-1.2 billion years in age, that underlie the Blue Ridge in Shenandoah and the surrounding region. This term has fallen out of favor among some geologists in recent years as further work establishes how diverse this suite of rocks really is. In this view, “Formation” implies too much shared history and character. In this report, the term “basement rock” is used instead to avoid controversy.

**Plate tectonics** – The slow movement of solid portions of the Earth’s crust (plates), interacting to form mountains, oceans, volcanoes, and all other features of the Earth’s surface.

**Quartzite** – A metamorphic rock formed by heat and pressure acting on sandstone. The term specifically refers to rocks containing virtually all quartz (originating in a clean sandstone), where the individual sand grains have been fused together to form a very solid mass of pure crystalline quartz. A metamorphosed sandstone which contains significant amounts of mineral grains other than quartz would be a metasandstone.

**Sandstone** – A sedimentary rock formed primarily of sand grains cemented together. This rock most commonly reflects the presence of a beach, river, or dune at the time of its formation. Sandstones vary from “clean” (containing virtually all quartz sand) to “dirty” (containing sand grains of many different minerals mixed together), the composition reflecting the age and energy of the original environment. A mature beach or dune is most likely to produce clean sandstone, while an actively eroding river is more likely to produce a dirty sandstone.

**Shale** – A sedimentary rock formed primarily of very fine silt and clay particles, forming thin layers along which the rock easily breaks. Generally, little to no individual

minerals can be seen in shale, which appears most often as a solid grey-black, platy rock. This rock reflects an original environment of deep, calm water such as lakes and oceans, in which very fine sediments are able to settle to the bottom in thin layers.

**Siltstone** – A sedimentary rock compositionally between sandstone and shale, containing a mixture of fine-grained silt and clay minerals combined with coarser sand grains. This rock is quite variable in appearance, generally containing noticeable layering which still appearing grainy. This rock often reflects lagoon/delta environments, where both flowing and calm water can be found.

**Social trail** – Any trail, path, or route created or maintained by humans, but not sanctioned, recognized, or maintained by authorities. Commonly found leading from official trails to overlooks, campsites, or other areas of interest to visitors.

**Structures** – Any physical feature other than minerals present in a rock. Structures may be internal and integral to the rock, such as layering and foliation, or may be imposed upon the rock, such as cleavage, joints, and faults.

**Talus** – Loose rock fragments accumulated on a slope. Generally used to describe areas where these fragments are dominating the slope, at the expense of soil or vegetation growth. Usually, but not always, associated with a bedrock cliff or other exposure from which the fragments have eroded. Also referred to as Boulder Field. Also used in this report as a specific type of exposure morphology; see Plate 2 for definition.

**Weverton Formation** – This is the lowermost unit of the Chilhowee Group, deposited directly onto the final Catoctin Formation lava flow. The formation is most commonly composed of metasandstone, quartzite, and some pebble/cobble beds, and represents the onset of erosion and river system development once the Catoctin eruptions had ceased.

## APPENDIX D: SHENANDOAH NATIONAL PARK CLIMBING MANAGEMENT GUIDELINES

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## **Climbing Management Guidelines**

### **1.0 Background**

#### **1.1 Purpose and Need for Action**

The rock outcrops of Shenandoah National Park (SHEN) are some of the largest in the region and contain numerous significant vegetation communities and rare plant and animal populations. In 2005, SHEN initiated the three-year Rock Outcrop Management Project to conduct natural resources and recreation use assessments that culminated in the preparation and implementation of the 2012 Rock Outcrop Management Plan (ROMP) and Environmental Assessment (EA) to mitigate impacts of visitor recreation activities, accommodate visitor use, and direct the future management of fragile rock outcrop areas.

The National Park Service (NPS) *2006 Management Policies* directs that Superintendents develop and implement visitor use management plans and take action to ensure that recreational use and impacts do not cause unacceptable impacts to park resources or values. These SHEN Climbing Management Guidelines have been developed to protect the park's natural and cultural resources and values while providing climbing-related recreational opportunities for park visitors and address rock climbing, bouldering, and ice climbing recreational activities.

The basis for the Climbing Management Guidelines is at Alternative B, the "Preferred Alternative" of the 2012 ROMP and EA. A comprehensive assessment of natural resource conditions and recreation uses and impacts are provided in that document.

#### **1.2 Climbing Management Goals**

The goals of the Climbing Management Guidelines are to:

- (1) meet the National Park Service mandate to manage appropriate recreational use;
- (2) protect natural and cultural resources from recreational use impacts;
- (3) provide rock climbing and other climbing-related opportunities; and,
- (4) protect the backcountry and wilderness experiences of other park visitors.

### **2.0 Description of the Rock Outcrop Resource and Climbing Activities**

#### **2.1 Physical Description of the Climbing Resource**

The report *A Natural Heritage Inventory of the Rock Outcrops of Shenandoah National Park – Final Report* (Fleming *et al.*, 2007), states that "rock exposures comprise approximately two percent of the park's more than 196,000 acres." Outcrops are found throughout the park's elevation range from below 1,000 ft to 4,050 ft at the summit of Hawksbill Mountain.

According to the report “many of the largest of the park’s rock outcrops have always been popular visitor destinations due to the dramatic scenery and vistas they afford, and some areas have received heavier impacts in recent years due to the increased popularity of rock climbing.”

SHEN’s rock outcrops support numerous rare plant and animal populations and significant natural communities. Human impacts and invasive plants were identified as the primary threats to the natural heritage resources of SHEN’s rock outcrops prior to and during the study. Trampling by visitors is the foremost human impact and is associated with all other visitor uses at SHEN rock outcrops: hiking, camping, climbing. Frequent visitation to outcrops results in loss of vegetation, lichen cover, and soils. Sites with high levels of visitation typically exhibit a high proportion of bare rock.

Presently, pre-historic archeological resources have not been identified at SHEN rock outcrop sites. Cultural resources at outcrop sites exist as historic trail features constructed by the Civilian Conservation Corps, in particular the Appalachian Trail (AT), and historic features associated with the Skyline Drive Historic District.

SHEN contains 79,579 acres of federally designated wilderness. Nearly all rock outcrops located within and in close proximity to the Skyline Drive Historic District and AT are located outside wilderness. However, most rock outcrop sites outside those zones are in wilderness.

## **2.2 Description of Climbing Activities**

The following recreational activities are generally rock outcrop-dependent in SHEN:

### *2.2.1 Rock Climbing*

Rock climbing opportunities are rather limited at SHEN due to inaccessibility of many satisfactory park rock outcrop sites for this activity. Most climbing activity occurs in close proximity to the Skyline Drive at overlook rock outcrop vista clearings and at rock outcrop sites along or near the Appalachian Trail, and on Old Rag Mountain.

### *2.2.2 Bouldering*

Bouldering activity is infrequent at SHEN, with only 5% of climbers at Old Rag and no climbers at Little Stony Man Cliffs describing themselves as participating in that activity as documented during the 2005 climber survey. Bouldering activity does not necessarily require rock outcrops, but requires only a substantial boulder or set of boulders.

### *2.2.3 Ice Climbing*

Ice climbing activity is infrequent in the park, due to the seasonal requirements and specific conditions for the activity to occur. The activity is very specialized and most adequate ice climbing areas are located in backcountry and wilderness.

### **3.0 Description of Climbing Recreational Setting**

#### **3.1 Park Climbing History**

Rock climbing has exploded in popularity in the United States over the last 20 years. In SHEN, the earliest known technical climbing was done in the late 1930s and early 1940s by members of the Potomac Appalachian Trail Club (PATC). Most climbing and bouldering activities occur in close proximity to the Skyline Drive at overlook rock outcrop vista clearings and at rock outcrop sites along or near the Appalachian Trail, which parallels the Drive on the ridgetop and is easily accessible from the Drive along its 101-mile length.

Little Stony Man Cliffs has long been the Park's most popular climbing site, and Old Rag Mountain provides unique climbing opportunities but requires a substantial hike to access the summit area rock outcrops. A couple of climbing guidebooks, *The Virginia Climber's Guide* (Watson, 1998) which describes over 400 climbing routes at 27 separate locations throughout the park, and *Rock Climbing Virginia, West Virginia and Maryland* (Horst, 2001) and various websites and blogs provide information about climbing opportunities in SHEN.

Some adverse impacts to the environment have occurred as a result of climbing and other recreation activities on rock outcrops. Rock climbing was addressed briefly by the 1998 SHEN *Backcountry and Wilderness Management Plan* (BWMP) and stated as a future action: "*Develop a Climbing Plan as a subplan to the BWMP with public involvement from organizations such as the PATC Mountaineering Section, The Access Fund, National Outdoor Leadership School and local climbing enthusiasts. SNP needs to better understand and address impacts to resources associated with climbing activity and assure that actions taken are consistent with NPS recreation and wilderness management directives and guidelines.*"

### **4.0 Management Actions**

#### **4.1 Climbing Areas**

Climbers are encouraged to use pre-existing "established" climbing routes as identified in online or commercially available climber's guides to minimize recreation impacts to fragile rock outcrop natural resources. However, all of the park's backcountry and wilderness rock outcrop areas are open to climbing activity unless specifically designated as "closed" on a permanent or seasonal basis. SHEN managers recognize that undeveloped "wilderness" climbing areas provide outstanding opportunities for exploration, challenge and solitude for

climbers, but those users should be especially highly skilled and experienced in Leave No Trace climbing ethics and techniques.

## 4.2 Group Size Limits

Although the impacts of larger groups can be offset by Leave No Trace practices and techniques, larger group size nevertheless does contribute to crowding conditions and expansion of impacted sites. It is recommended that climbing groups limit their size to no more than **12 people** total to help minimize impacts of their activities on rock outcrop resources and in consideration of other visitors.

## 4.3 Climbing Practices

### 4.3.1 Leave No Trace and “Clean Climbing”

Climbers are strongly urged to use the seven principles of Leave No Trace (LNT) to promote “clean climbing” practices and in all other associated recreational activities in SHEN. The LNT Principles of outdoor ethics form the framework of Leave No Trace's message:

1. Plan Ahead and Prepare
2. Travel and Camp on Durable Surfaces
3. Dispose of Waste Properly
4. Leave What You Find
5. Minimize Campfire Impacts
6. Respect Wildlife
7. Be Considerate of Other Visitors

The *Rock Climbing Ethics and Skills* guide is available to the public by the Leave No Trace Center for Outdoor Ethics.

### 4.3.2 Fixed Anchors

Fixed anchors should be uncommon park-wide and rare in designated wilderness. The following policy applies to management of fixed anchors in the park:

Definition: Fixed anchors shall be deemed any man-made article made up of hardware (bolts, pitons) that require drilling or alteration of rock for installation and are left in the rock for future use.

The following conditions have been established regarding Fixed Anchors:

- The placement of new fixed anchors requiring rock alteration for installation will be prohibited when the ability to place removable protection is available.
- The use of non-climbing specific hardware (ie, concrete anchors, home-made equipment) is prohibited.

### **4.3.3 Fixed Belay/Rappel Stations**

Definition: A fixed belay/rappel station shall be deemed any configuration of fixed anchor hardware, requiring rock alteration for installation, placed at the top of a climbing pitch for the primary purposes of belaying or rappelling.

The following conditions have been established regarding Fixed Belay/Rappel Stations:

- The placement of new fixed belay/rappel stations will be prohibited when the ability to place adequate removable protection is available.
- New fixed belay/rappel stations shall not be installed where their presence would visually impact the park (ie – within view of an overlook or trail).
- New fixed belay/rappel stations shall be constructed with modern climbing bolts or pitons.
- Bolt placement shall be kept to a minimum and shall not exceed three bolts.
- Chains used in the construction of the station shall be kept to a minimal length to avoid visual impacts.
- The use of webbing and accessory cord fixed stations is prohibited.
- Belay/rappel stations shall be constructed using hardware which has been painted a color similar to the natural rock color in the surrounding area.

### **4.3.4 Use of Trees as Anchors**

- The use of trees as anchors shall be prohibited if such use causes interference with any park-maintained trail. Interference includes any rope or webbing that extends across a park trail, whether elevated off the ground or not. The anchor must be made in such a way as to avoid all physical damage to trees and plants, such as damage to bark or lichen growth and the removal of any branches.

### **4.3.5 Motorized Equipment**

- The use of motorized drilling device used for the purpose of placing bolts, anchors or climbing equipment is prohibited.

### **4.3.6 Practices including gardening, gluing, chipping, etc**

The following activities are prohibited park-wide:

- Chipping or gluing

- “Gardening” or the intentional removal of vegetation to “clean” or improve access to the route
- Other modification or alterations of resource features
- Leaving fixed ropes and other equipment for a period longer than 24 hours.

#### **4.4 Climbing Area Closures and Restrictions**

##### **4.4.1 Temporary Closures to Climbing Activity:**

###### **Peregrine Falcon Restoration Project**

Temporary seasonal closures may occur annually at some rock outcrop sites and

Adjoining trails due to peregrine falcon restoration project activities.

During certain seasons, typically February through July breeding and nesting seasons, specific cliff areas and trails may be closed to visitor use to minimize human disturbance to peregrines to give them the best chance of successful breeding. It is essential to provide nesting peregrines with adequate buffer from human disturbances such as noise and activity in close proximity to the birds. Peregrine nesting activity has required closures near Hawksbill Summit and Franklin Cliffs. Most recently, the lower cliffs of Stony Man and some sites on Old Rag Mountain have been closed to visitor activity.

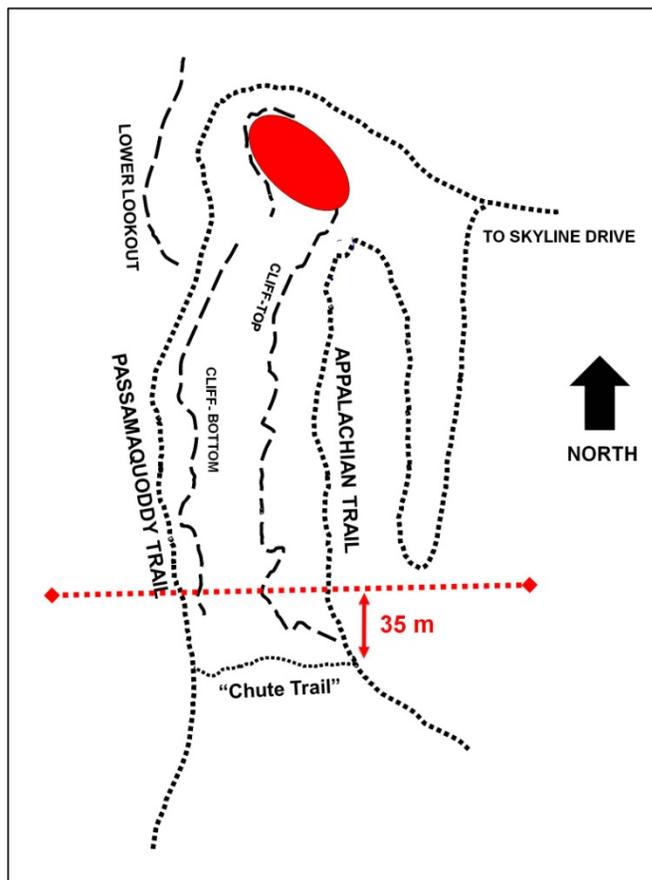
In March to April park staff and volunteers conduct cliff surveys of high probability peregrine nesting areas and historic aeries throughout the park, including Old Rag Mountain, Hawksbill Mountain, Brown Mountain Cliffs, and other sites. Temporary seasonal closures of outcrop sites and trails will be implemented as necessary if breeding pairs or nesting activity is detected.

##### **4.4.2 Summary of Permanent Area Restrictions or Closures to Climbing Activity**

A range of management tools used to preserve resources while providing for visitor enjoyment of SHEN’s rock outcrops is provided in the 2012 ROMP and EA. Most rock outcrop management relies on off-site educational trailhead bulletin displays, internet and print information, informational and education programs, and improvement of informal trails to concentrate recreation use to minimize site impacts. Some areas require the use of physical barriers and signage to protect sites impacted by recreation use. A few sites used for climbing activities require more intensive management actions to restore damaged resources or preserve valuable, sensitive resources from degradation by human recreational activities.

Those sites closed to off-trail uses including climbing are:

- **Little Stony Man Cliffs (Fig. 1):** All off-trail areas of Little Stonyman mountain located south of an east/west line situated 35 meters north of the informal “chute trail” are closed to climbing and all other off-trail uses. Also closed to climbing and other off-trail uses is the area of large boulders on the northernmost end of the Little Stonyman cliffs between the AT and Passamaquoddy Trail (Figure 1).



**Figure 1.** The red portion of the above diagram and all points on Little Stonyman Mountain south of the red dashed line are closed to climbing and all other off-trail uses.

- **Hawksbill Summit:** The summit area and cliff faces are closed to all climbing activity.

Other sites have been targeted for close monitoring of climbing and visitor impacts, because they harbor highly restricted globally rare natural communities that are showing signs of human impact. These sites may

have further restrictions or prohibitions imposed in the future if resource damage intensifies. These “watch” sites include:

- **North Marshall Summit**
- **Old Rag West Summit area**
- **Marys Rock**

#### **4.5 Education**

Education of the visiting public and park staff is key to protecting rock outcrop resources. The ROMP seeks to implement a vigorous education program, including on-site programs, printed and electronic literature including a Climbing brochure, climbing information at the park’s website, and trailhead bulletin displays.

#### **4.6 Wilderness**

Climbing management in the park’s designated wilderness areas will be conducted in the spirit of the Wilderness Act of 1964 and ensuing wilderness legislation. Any actions which have potential to impact wilderness character and quality, and/or may include one of the “prohibited uses” of wilderness must be evaluated by a “Minimum Requirements Analysis.”

In accordance with the Wilderness Act of 1964, NPS Director’s Order #41, and the SHEN Backcountry and Wilderness Management Plan, the “minimum requirements” for administration of Shenandoah National Park wilderness is documented by a Decision Guide. The Guide is used to evaluate proposed uses and activities in wilderness and, if they are allowed, the most appropriate methods (“minimum tool”) to accomplish those actions. *The minimum requirement decision process applies to all actions, programs, and activities within wilderness.*

#### **4.7 SHEN Administrative Uses of Rock Outcrops**

SHEN staff and cooperators engage in a variety of activities that may impact rock outcrop resources. Leaders and participants in activities such as scientific research, educational programs, and technical search and rescue training must maintain an awareness of the sensitivity of these resources to human impacts.

##### **4.7.1 Search and Rescue**

SHEN staff are frequently involved in Search and Rescue incidents throughout the park, and SHEN maintains a trained technical rescue team to respond to technical and semi-technical rescue needs. The Technical Rescue Team trains frequently, often utilizing practical training sessions at rock outcrop/cliff sites to hone their skills. The team uses much of the same equipment, practices and techniques as that of recreational climbers.

Consistent with National Park Service policy, park staff will undertake rescue operations for those in need, unless the level of risk to the rescue party is found to be unacceptably high and until conditions improve or other options become available. . Efforts will be made to provide necessary treatment and services to the sick, injured, and stranded consistent with National Park Service policy. In all cases, the safety and well-being of the rescue personnel and the public will be of utmost importance.

Rescue work has a high potential for causing damage to natural resources due to the focused nature of rescue, treatment, and transport of an injured or ill patient. Training sessions and rescue emergencies require a group of at least several individuals congregating on rock outcrop sites, and will very likely involve litter lowering and raising along a cliff face.

Technical Rescue Team members should be aware of rock outcrop protection issues, and ensure rock outcrop natural resource protection during their training activities and, to the extent possible, during emergency responses.

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## APPENDIX E: SELECT LAWS AND REGULATIONS

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### NPS Organic Act of 1916

The NPS Organic Act of 1916 (39 Stat. 535, 16 USC 1) established the NPS, directing it to:

promote and regulate the use of the Federal areas known as National Parks, Monuments, and Reservations ... by such means and measures as conform to the fundamental purpose of the said Parks, Monuments, and Reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.

Clearly, Congress intended park visitation to be contingent upon the ability of the NPS to preserve park environments in an unimpaired condition. What constitutes an "impaired" resource is ultimately a management determination.

Authority for implementing Congressional laws is delegated to agencies, which identify and interpret all relevant laws and formulate management policies to guide their implementation. For the NPS, these policies are set forth in a document titled *Management Policies*, revised in 2006.

### Management Policies, 2006

The 2006 edition of *Management Policies*, Chapter 8, "Use of the Parks", describes the concept of "appropriate use" (section 8.1.1) as "...especially important with regard to visitor enjoyment because, in accordance with the Organic Act, the fundamental purpose of all parks also includes providing for the enjoyment of park resources and values by present and future generations," and "appropriate forms of visitor enjoyment emphasize appropriate recreation consistent with the protection of the park."

Recreational activities inevitably result in impacts to park resources, but "The fact that a park use may have an impact does not necessarily mean it will be unacceptable or impair park resources or values..." However, park managers "must ensure that these impacts are unavoidable and cannot be further mitigated" and "the Service (NPS) will not knowingly authorize a park use that would cause unacceptable impacts."

Management Policies states (section 8.2.2) that the NPS "will manage recreational activities according to the criteria listed in sections 8.1 (Appropriate Use) and 8.2 (Visitor Use) (and 6.4 in wilderness areas). Rock climbing is cited as an example of the broad range of recreational activities that may take place in the parks, but the determination of what activities will be appropriate or allowable in parks "must be made on the basis of park-specific planning." Furthermore, section 8.2.2.1, "Management of Recreation Use" states:

Superintendents will develop and implement visitor use management plans and take action, as appropriate, to ensure that recreational uses and activities in the

park are consistent with its authorizing legislation or proclamation and do not cause unacceptable impacts on park resources or values.

## Wilderness Act of 1964

The Wilderness Act of 1964 is Public Law 88-577 (16 USC 1131-1136), enacted by the 88<sup>th</sup> Congress “To establish a National Wilderness Preservation System for the permanent good of the whole people, and for other purposes.”

From wilderness.net:

Wilderness is an indispensable part of American history... In 1964 our nation's leaders formally acknowledged the immediate and lasting benefits of wild places to the human spirit and fabric of our nation. That year, in a nearly unanimous vote, Congress enacted landmark legislation that permanently protected some of the most natural and undisturbed places in America. The Wilderness Act of 1964 established the National Wilderness Preservation System, the system of all America's wilderness areas, to *"secure for the American people of present and future generations the benefits of an enduring resource of wilderness."*

The United States was the first country in the world to define and designate wilderness areas through law. Subsequently, countries around the world have protected areas modeled after the Wilderness Act. Wilderness is part of our history and heritage and is passed as a legacy to future generations. Indispensable to the American past, the legacy that is wilderness will remain indispensable to the American future.

Language similar to that used in the NPS Organic Act is used in the Wilderness Act, applicable to parks with designated wilderness areas within their boundaries. Wilderness areas:

shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness...

The Wilderness Act describes use of wilderness areas (16 U.S.C. 1133), including prohibition of certain uses:

...except as necessary to meet minimum requirements for the administration of the area for the purpose of the Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.”

## The Park's Wilderness Designation in 1976

In October 1976, Congress designated 32,205 ha (79,579 acres) of the Park's backcountry as wilderness (Public Law 94-567). The Shenandoah wilderness is contained in eleven non-contiguous parcels dispersed throughout the park's backcountry. The park's wilderness area offers outstanding opportunities for solitude and recreation. Many park trails are in designated wilderness. Most overlooks along Skyline Drive view wilderness. Wilderness offers respite from hectic daily life, provides natural habitat for wildlife and wildflowers and preserves the human history held within the park's mountains.

Many of the park's rock outcrops are contained within and protected as wilderness, providing unconfined wilderness climbing experience opportunities for visitors. One of the two most popular rock climbing areas in the Park, Old Rag summit area, is in designated wilderness.

### NPS Director's Order #41 (Wilderness Management)

The purpose of Director's Order #41 is to provide accountability, consistency, and continuity to the National Park Service's wilderness management program, and to otherwise guide Service wide efforts in meeting the letter and spirit of the 1964 Wilderness Act. This Director's Order clarifies, where necessary, specific provisions of *NPS Management Policies*; and establishes specific instructions and requirements concerning the management of all NPS wilderness areas.

Director's Order #41 should be applied to management actions carried out within the framework of a park's general management plan, the Government Performance and Results Act, a park's natural and cultural resources plans, and the park's wilderness management plan.

### **Government Performance and Results Act**

The 1993 Government Performance and Results Act (GPRA), holds federal agencies accountable for using resources wisely and achieving program results. GPRA requires agencies to develop plans for what they intend to accomplish, measure how well they are doing, make appropriate decisions based on the information they have gathered, and communicate information about their performance to Congress and to the public.

GPRA requires agencies to develop a five-year Strategic Plan, which includes a mission statement and sets out long-term goals and objectives; Annual Performance Plans, which provide annual performance commitments toward achieving the goals and objectives presented in the Strategic Plan; and Annual Performance Reports, which evaluate an agency's progress toward achieving performance commitments.

Long-term GPRA Goals related to rock outcrop management in the Park include:

<b><u>Identifier</u></b>	<b><u>Goal</u></b>	<b><u>Identifier</u></b>	<b><u>Goal</u></b>
IA10	Wilderness Character	IaIE	Monitor Vascular Plants
Ia1A	Visitor Satisfaction	Ia1H	Condition of Current Land
Ia01A	Other Disturbed Land	Ia2A	Threatened and Endangered Animal Species
Ia2B	Species of Management Concern	Iib1	Visitor Understanding and Appreciation
IaIB	Invasive Plants		

## Backcountry and Wilderness Management Plan

The 1998 SHEN Backcountry and Wilderness Management Plan (BWMP) is a “comprehensive backcountry management guide which describes not only a planning framework and recommended management actions, but addresses topics including historical Park backcountry management, relationship to other park planning documents, the Park’s backcountry facilities and recreational uses, wilderness awareness education, management of recreation impacts (i.e. campsite and trails management strategies), budget and staffing assessment, and park boundary issues.”

The BWMP sets management objectives for backcountry and wilderness conditions to manage recreation carrying capacity; resource, social and managerial settings and management zones (recreation opportunity classes) are described. Wilderness is zoned ranging from “primitive wilderness” to “threshold wilderness” and management strategies are designed to manage backcountry and wilderness recreation use and impacts park-wide. Rock outcrops are contained within this range of management zones.

Recreational uses of the backcountry are addressed at Chapter 7 in the BWMP. The BWMP briefly discusses rock climbing activities in the park, describes the history of climbing in the park, and documents Park staff and Virginia Division of Natural Heritage observations of existing and potential impacts of climbing to rock faces and vegetation in the early 1990s.

The BWMP recommends that “a climbing management plan needs to be developed as a subplan to the BWMP.” The BWMP further states:

...this (climbing) plan... will need to address NPS wilderness management directives, and...A complete inventory of existing and potential impairment to resources should be part of this plan as well as an inventory of climbing areas and popular routes. Controversial issues such as use of fixed anchors (bolts) in wilderness as well as in non-wilderness must be addressed. An LAC approach (Limits of Acceptable Change planning framework) will be developed to manage climbing (and impacts). It is strongly recommended that public involvement be obtained in development of the plan, and that the climbing community, as well as botanists be actively involved in policing this activity and minimizing resource impacts while assuring good opportunities for a quality rock climbing experience at SHEN.

The BWMP suggested that until such a climbing management plan was developed, appropriate existing regulations at Title 36 Code of Federal Regulations provide the regulatory authority to manage climbing activity.

## Resource Management Plan

The Resource Management Plan (RMP) is a continually evolving broad action plan developed to provide direction and continuity and to establish priorities for the protection and preservation of park natural and cultural resources. The RMP was last updated in 1998. The RMP addresses numerous natural and cultural resource program areas for strategic planning, including backcountry and wilderness management planning, to protect and perpetuate the resources of the Park. The RMP also includes descriptions of the various resource management programs.

## The National Trails System Act & Related Appalachian Trail Plans

At the Park, 101 miles of the Appalachian Trail (AT) traverses most of the Park's ridge top, paralleling and crossing the Skyline Drive numerous times. The AT also traverses many rock outcrops and provides the primary access to ridge top rock outcrops. The AT serves as the spine of the Park's extensive trail system.

The National Trails System Act (NTSA, P.L. 90-543, as amended) designated the AT as one of the nation's first two national scenic trails. In 1978, the NTSA was amended by Public Law 95-625, which is frequently referred to as "the Appalachian Trail Bill." Public Law 95-625 directed the Secretary of the Interior (in consultation with the Secretary of Agriculture) to develop and submit a comprehensive plan for the protection, development, use, and maintenance of the Appalachian Trail. In 1981, the Director of the NPS and the Chief of the USDA Forest Service approved the Comprehensive Plan for the Appalachian Trail.

According to the Comprehensive Plan for the Appalachian Trail:

The Appalachian Trail is a way, continuous from Katahdin in Maine to Springer Mountain in Georgia, for travel on foot through the wild, scenic, wooded, pastoral, and culturally significant lands of the Appalachian Mountains. It is a means of sojourning among these lands, such that the visitors may experience them by their own unaided efforts. In practice, the Trail is usually a simple footpath, purposeful in direction and concept, favoring the heights of land, and located for minimum reliance on construction for protecting the resource. The body of the Trail is provided by the lands it traverses, and its soul is in the living stewardship of the volunteers and workers of the Appalachian Trail community.

The Comprehensive Plan describes the AT's unique history, traditions, and management approach. The plan states:

The primary purpose of the plan is to provide Congress information it needs to meet its oversight responsibility for the Appalachian Trail. To some extent, therefore, the plan is a report on the progress achieved to date in the administration of the Trail. In

addition, the plan provides an opportunity to organize the accumulated policy directions, guidelines and understanding about administration of the Trail for the benefit of the private, state, and federal partners in the Trail project.

and,

The plan is intended to provide a framework for development and management of the Trail and its immediate environs. Detailed guidance for managers is provided by other documents...

The Comprehensive Plan for the Appalachian Trail describes a management system for the AT called the "Cooperative Management System," which relies on local partnerships among individual trail clubs and agency partners in a decentralized consultation and decision-making process. Management and maintenance of the AT in the Park is a cooperative effort of the Potomac Appalachian Trail Club (PATC), the Appalachian Trail Conservancy (ATC), the Appalachian Trail Park Office (ATPO), and the Park.

The PATC, which maintains the AT and many other trails within the park, is a nonprofit service organization dedicated to preserving the AT. Founded in 1927 by seven hiking enthusiasts whose dream was to create a 2,000-mile footpath from Maine to Georgia, PATC now has approximately 6000 members. The Park maintains a General Agreement with the PATC for volunteer partnership management and maintenance of the AT, other designated Park trails, and huts (shelters) associated with the AT. Additional formal agreements are in place with the PATC for AT Ridgerunner, Trail Patrol, Cabins, and search and rescue support programs.

The ATC, a nonprofit organization of approximately 24,000 members dedicated to protecting and promoting the AT, also serves as a federation for the 32 Trail clubs that manage and maintain the Trail in cooperation with their agency partners. The ATC has provided Trail clubs with the Local Management Planning Guide, a comprehensive reference document to aid them in the process of local planning. This guide is used both as an active tool during the preparation and updating of a local management plan and as a permanent reference of current policies for management of the AT. ATC has also adopted standards for clearing, construction, marking, and maintenance of the AT, which are described in ATC's stewardship handbook, Trail Design, Construction, and Maintenance.

The ATPO, a unit of the NPS which is located in Harpers Ferry, West Virginia, is responsible for ensuring that the requirements of the NTSA for the protection and management of the AT are fulfilled. The Park Office and other park units are guided by the Appalachian Trail Comprehensive Plan in administering the AT.

A "4-way" Memorandum of Understanding (MOU) signed by officials of the PATC, ATC, ATPO, and the Park documents the roles of the respective AT management partners, as well as each party's responsibilities for consultation and coordination prior to any actions that might affect the management of the AT within and adjacent to the park..

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## APPENDIX F: CONSULTATION DOCUMENTATION

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### United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Ecological Services  
6669 Short Lane  
Gloucester, VA 23061



April 21, 2008

Ms. Wendy Cass  
National Park Service  
Shenandoah National Park  
3655 US Hwy. 211 East  
Luray, Virginia 22835-9036

Re: Request for Information  
Rock Outcrop Management  
Plan EA/AoE, Shenandoah  
National Park, Virginia,  
Project # 51411-2008-SL-  
0258

Dear Ms. Cass:

The U.S. Fish and Wildlife Service (Service) has received your request for information regarding listed or proposed endangered and threatened species and designated critical habitat that might occur in the project vicinity. This letter is provided pursuant to the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*). Attached are lists of species with Federal status and species of concern that have been documented or may occur in the counties where your project is located. These lists were prepared by this office and are based on information obtained from previous surveys for rare and endangered species.

In order to ensure coordination with the State agencies, we consistently recommend that individuals contact the Virginia Department of Conservation and Recreation, Division of Natural Heritage **and** the Virginia Department of Game and Inland Fisheries, since each agency maintains a different database and has differing expertise and/or regulatory responsibility. You can contact these agencies at the following addresses:

Virginia Department of Game and Inland Fisheries  
Environmental Services Section  
P.O. Box 11104  
Richmond, VA 23230  
(804) 367-1000

Virginia Department of Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street, 2nd Floor  
Richmond, VA 23219  
(804) 786-7951

**If either of these agencies determines that your project may impact a federally listed, proposed, or candidate species OR federally designated critical habitat, please contact this office and provide a copy of the response letter from each agency and the above referenced project number; otherwise, further contact with this office is not necessary.**

You can find species information and other pertinent information on project reviews within Virginia at our website [http://www.fws.gov/northeast/virginiafield/Project\\_Reviews.html](http://www.fws.gov/northeast/virginiafield/Project_Reviews.html). If you have any questions or need further assistance, please contact Sumalee Hoskin at (804) 693-6694, extension 136.

Sincerely,



Tylan Dean  
Assistant Supervisor  
Endangered Species/Federal Activities  
Virginia Field Office

Enclosures

**ALBEMARLE COUNTY, VIRGINIA**  
**Federally Listed, Proposed, and Candidate Species**

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
<u>INVERTEBRATES</u>		
Pleurobema collina	James spinymussel	LE
<u>MAMMALS</u>		
Myotis sodalis <sup>1</sup>	Indiana bat	LE
<b>Species of Concern (No official Federal status)</b>		
<u>BIRDS</u>		
Haliaeetus leucocephalus	Bald eagle	G5
<u>INVERTEBRATES</u>		
Fusconaia masoni	Atlantic pigtoe	G2
Pyrgus centaureae wyandot	Appalachian grizzled skipper	G5TIT2
<u>VASCULAR PLANTS</u>		
Phlox buckleyi	Sword-leaved phlox	G2

<sup>1</sup>This species has been documented in an adjacent county and may occur in this county.

September 28, 2007  
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

**AUGUSTA COUNTY, VIRGINIA**  
**Federally Listed, Proposed, and Candidate Species**

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
<u>INVERTEBRATES</u>		
Antrolana lira	Madison Cave isopod	LT
<u>MAMMALS</u>		
Corynorhinus townsendii virginianus <sup>1</sup>	Virginia big-eared bat	LE
Myotis sodalis <sup>1</sup>	Indiana bat	LE
<u>VASCULAR PLANTS</u>		
Arabis serotina	Shale barren rock cress	LE
Helenium virginicum	Virginia sneezeweed	LT
Helonias bullata	Swamp pink	LT
Platanthera leucophaea	Eastern prairie fringed orchid	LT
Scirpus ancistrochaetus	Northeastern bulrush	LE

**Species of Concern (No official Federal status)**

<u>BIRDS</u>		
Thryomanes bewickii altus	Appalachian Bewick's Wren	G5T2Q
<u>FISH</u>		
Notropis semperasper	Roughhead shiner	G2G3
<u>INVERTEBRATES</u>		
Apochthonius coecus	A cave pseudoscorpion	G1G2
Kleptochthonius sp. 1	A cave pseudoscorpion	G1
Pseudosinella granda	A cave springtail	G1G2
Pyrgus centaureae wyandot	Appalachian grizzled skipper	G5T1T2
Striaria sp. 1	A millipede	G1
Stygobromus sp. 7	Sherando spinosoid amphipod	G2
Stygobromus stegerorum	Madison cave amphipod	G1
<u>VASCULAR PLANTS</u>		
Carex roanensis	Roan Mountain sedge	G2
Isoetes virginicia	Virginia quillwort	G1
Paxistima canbyi <sup>1</sup>	Canby's mountain-lover	G2
Phlox buckleyi	Sword-leaved phlox	G2
Potamogeton tennesseensis	Tennessee pondweed	G2
Trillium pusillum var. virginianum	Virginia least trillium	G3T2

<sup>1</sup>This species has been documented in an adjacent county and may occur in this county.

September 28, 2007

Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

**GREENE COUNTY, VIRGINIA**  
**Federally Listed, Proposed, and Candidate Species**

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
<u>INVERTEBRATES</u>		
Pleurobema collina	James spiny mussel	LE
<u>MAMMALS</u>		
Myotis sodalis <sup>1</sup>	Indiana bat	LE

**Species of Concern (No official Federal status)**

No species of concern have been documented.

<sup>1</sup>This species has been documented in an adjacent county and may occur in this county.

September 16, 2005  
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

**MADISON COUNTY, VIRGINIA**  
**Federally Listed, Proposed, and Candidate Species**

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
<u>AMPHIBIANS</u>		
Plethodon shenandoah	Shenandoah salamander	LE
<u>MAMMALS</u>		
Myotis sodalis <sup>1</sup>	Indiana bat	LE
<u>VASCULAR PLANTS</u>		
Isotria medeoloides	Small whorled pogonia	LT

**Species of Concern (No official Federal status)**

<u>INVERTEBRATES</u>		
Elliptio lanceolata	Yellow lance	G2G3

<sup>1</sup>This species has been documented in an adjacent county and may occur in this county.

September 16, 2005  
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

**PAGE COUNTY, VIRGINIA**  
**Federally Listed, Proposed, and Candidate Species**

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
<u>AMPHIBIANS</u>		
Antrolana lira <sup>1</sup>	Madison Cave isopod	LT
Plethodon shenandoah	Shenandoah salamander	LE
<u>MAMMALS</u>		
Myotis sodalis <sup>2</sup>	Indiana bat	LE
<u>VASCULAR PLANTS</u>		
Arabis serotina	Shale barren rock cress	LE

**Species of Concern (No official Federal status)**

<u>INVERTEBRATES</u>		
Pseudanophthalmus hubbardi	Hubbard's cave beetle	G1
Pseudanophthalmus petrunkevitchi	Petrunkevitch's cave beetle	G1G2
Stygobromus pseudospinosus	Luray Caverns amphipod	G1
<u>VASCULAR PLANTS</u>		
Paxistima canbyi <sup>2</sup>	Canby's mountain-lover	G2

<sup>1</sup>This species has not been documented in this county, but may occur in this county.

<sup>2</sup>This species has been documented in an adjacent county and may occur in this county.

June 1, 2007  
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

**RAPPAHANNOCK COUNTY, VIRGINIA**  
**Federally Listed, Proposed, and Candidate Species**

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
<u>AMPHIBIANS</u>		
Plethodon shenandoah	Shenandoah salamander	LE
<u>MAMMALS</u>		
Myotis sodalis <sup>1</sup>	Indiana bat	LE

**Species of Concern (No official Federal status)**

<u>INVERTEBRATES</u>		
Elliptio lanceolata	Yellow lance	G2G3

<sup>1</sup>This species has been documented in an adjacent county and may occur in this county.

September 16, 2005  
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

**ROCKINGHAM COUNTY, VIRGINIA**  
**Federally Listed, Proposed, and Candidate Species**

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
<u>INVERTEBRATES</u>		
Antrolana lira	Madison Cave isopod	LT
<u>MAMMALS</u>		
Corynorhinus townsendii virginianus	Virginia big-eared bat	LE
Myotis sodalis <sup>1</sup>	Indiana bat	LE
<u>VASCULAR PLANTS</u>		
Helenium virginicum	Virginia sneezeweed	LT
Scirpus ancistrochaetus	Northeastern bulrush	LE

**Species of Concern (No official Federal status)**

<u>INVERTEBRATES</u>		
Chitrella sp. 1	A cave pseudoscorpion	G1
Nannaria shenandoah	Shenandoah Mt. xystodesmid millipede	G1
Pseudanophthalmus avernus	Avernus cave beetle	G1
Stygobromus sp. 9	A cave amphipod	G1
<u>VASCULAR PLANTS</u>		
Heuchera alba	White alumroot	G2Q
Paxistima canbyi <sup>1</sup>	Canby's mountain-lover	G2
Phlox buckleyi	Sword-leaved phlox	G2
Trillium pusillum var. virginianum	Virginia least trillium	G3T2

<sup>1</sup>This species has been documented in an adjacent county and may occur in this county.

July 13, 2005  
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

**WARREN COUNTY, VIRGINIA**  
**Federally Listed, Proposed, and Candidate Species**

<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>	<u>STATUS</u>
<u>INVERTEBRATES</u>		
Antrolana lira	Madison Cave isopod	LT
<u>MAMMALS</u>		
Myotis sodalis <sup>1</sup>	Indiana bat	LE

**Species of Concern (No official Federal status)**

<u>INVERTEBRATES</u>		
Pseudanophthalmus petrunkevitchi	Petrunkevitch's cave beetle	G1G2
Striaria columbiana	A millipede	G2
<u>VASCULAR PLANTS</u>		
Paxistima canbyi <sup>1</sup>	Canby's mountain-lover	G2

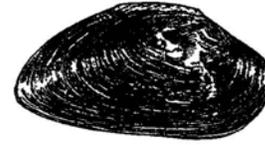
<sup>1</sup>This species has been documented in an adjacent county and may occur in this county.

August 5, 2005  
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

U.S. Fish & Wildlife Service

# James Spiny mussel

## *Pleurobema collina*



**Description** - This freshwater mussel is found in the upper James and Dan River basins. The species has declined rapidly during the past two decades and now exists only in small, headwater tributaries of the upper James River basin in Virginia and West Virginia. In 2000, it was discovered in the Dan River basin in North Carolina and Virginia. The James spiny mussel is a small freshwater mussel slightly less than three inches in length. Adults have a dark brown shell with prominent growth rings and occasionally, short spines on each valve. Young mussels have a shiny yellow shell with or without one to three short spines.

**Life History** - Suitable habitat for this species includes free-flowing streams with a variety of flow regimes. The James spiny mussel is found in a variety of substrates that are free from silt. Like other freshwater mussels, this species is a filter feeder. It feeds on plankton collected from water that is passed over its gills. Reproduction

occurs sexually. Females carry eggs in their gills. During spawning, the male releases sperm into the water column and the sperm is taken into the female through the gills. The resulting larvae (known as glochidia) are released from the female into the water column and must attach to a fish host to survive. While attached to the fish host, development of the glochidia continues. Once metamorphosis is complete, the juvenile mussel drops off the fish host and continues to develop on the stream bottom. Known fish hosts for this species include the bluehead chub (*Nocomis leptocephalus*), rosyside dace (*Clinostomus funduloides*), blacknose dace (*Rhinichthys atratulus*), mountain redbelly dace (*Phoxinus oreas*), rosefin shiner (*Lythrurus ardens*), satinfish shiner (*Cyprinella analostana*), central stoneroller (*Camptostoma anomalum*), and swallowtail shiner (*Notropis procne*).

**Conservation** - The James spiny mussel was federally listed as an endangered species on July 22, 1988. The primary reason for its decline is habitat loss and modification. Threats to this species include siltation, invasion of the non-native Asiatic clam (*Corbicula fluminea*), impoundment of waterways, water pollution, stream channelization, sewage discharge, agricultural runoff including pesticides and fertilizers, poor logging and road/bridge construction practices, and discharge of chlorine.

**What You Can Do To Help** - If you reside on property that borders a stream or other waterway, avoid using chemicals or fertilizers. To help control erosion and reduce

runoff, maintain a buffer of natural vegetation along streambanks. Install fencing to prevent livestock from entering streams to reduce trampling of mussels, siltation, and input of waste products. Protecting water quality is the most effective way to conserve mussels.

To find out more about the James spiny mussel contact:

Virginia Department of Game and  
Inland Fisheries  
P.O. Box 11104  
Richmond, Virginia 23230  
(804) 367-1000

### References

Hove, M.C. and R.J. Neves. 1994. Life history of the endangered James spiny mussel *Pleurobema collina* (Conrad, 1837) (Mollusca: Unionidae). American Malacological Bulletin 11(1):29-40.

Neves, R.J. 1991. James spiny mussel. Pages 281-282 in K. Terwilliger, ed. Virginia's Endangered Species, Proceedings of a Symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

U.S. Fish and Wildlife Service. 1990. James spiny mussel (*Pleurobema collina*) recovery plan. Newton Corner, Massachusetts.



U.S. Fish and Wildlife Service  
Virginia Field Office  
6669 Short Lane  
Gloucester, Virginia 23061  
(804) 693-6694  
<http://www.fws.gov>  
June 2003

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# Indiana Bat

## *Myotis sodalis*



**Description** - The Indiana bat occurs throughout 27 states in the eastern and mid-western U.S. It is found in the western portion of Virginia during hibernation, but seldom found in Virginia during the summer. This medium-sized bat weighs six to nine grams and has an average life span of four years. This short-eared bat is two inches from head to toe and has a wing span of nine to eleven inches. Its fur is dull grayish-brown and the underparts are pinkish.

**Life History** - After mating in the fall, the Indiana bat travels up to 300 miles to hibernate in large caves and abandoned mines that have stable, cold temperatures during the winter. The fact that the Indiana bats congregate and form large aggregations in only a small percentage of known caves suggests that very few caves meet their requirements. During hibernation they can be found on flat ceilings of caves in clusters containing 500 to 1,000 or more bats. Half of all hibernating Indiana bats winter in Indiana. Hibernation begins in

mid-October and ends in April; females are the first to leave. Males roost in caves or mines during the summer. Maternity colonies are located in riparian forests along streams. Females roost together in hollow trees or under loose bark and have one young per pregnancy. The young are born in late June or early July. After one month, young are capable of flight and begin independent feeding. Foraging takes place along forested streams. They feed exclusively on insects.

**Conservation** - The Indiana bat was federally listed as an endangered species on March 11, 1967. This bat has declined primarily due to human disturbance during hibernation. This species is easily disturbed by human activity such as vandalism, caving, and research during the hibernating months. Other threats are flooding of caves, blockage of cave entrances, and pesticide poisoning.

**What You Can Do To Help** - Avoid using pesticides and other chemicals near caves and waterways. Do not enter gated caves or mines. These gates have been installed to protect bats and human safety. Cave habitats are fragile and easily disturbed; if you must enter a cave, do so only as an observer and leave everything as you found it. Never shoot, poison, or otherwise harm bats. Bats are extremely beneficial insect eaters, and nuisance bats can be encouraged to move elsewhere. If you find a bat, please do not disturb it!

Contact one of the following agencies for assistance:

Virginia Department of Game and  
Inland Fisheries  
P.O. Box 11104  
Richmond, Virginia 23230  
(804) 367-1000

Virginia Department of  
Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street, 3rd Floor  
Richmond, Virginia 23219  
(804) 786-7951

U.S. Fish and Wildlife Service  
Virginia Field Office  
6669 Short Lane  
Gloucester, Virginia 23061  
(804) 693-6694

### References

Dalton, V.M. and C.O. Handley, Jr.  
1991. Social myotis. Pages 569-  
570 in K.Terwilliger, ed. Virginia's  
Endangered Species, Proceedings of  
a Symposium. McDonald and  
Woodward Publishing Company,  
Blacksburg, Virginia.

U.S. Fish and Wildlife Service.  
1999. Agency Draft: revised draft of  
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(*Myotis sodalis*). Fort Snelling,  
Minnesota.



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Virginia Field Office  
6669 Short Lane  
Gloucester, Virginia 23061  
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<http://www.fws.gov>  
December 2000

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# Madison Cave Isopod

## *Antrolana lira*



M. Drummond

**Description** - The Madison Cave isopod is an eyeless, unpigmented, freshwater crustacean. It belongs to a family that consists of mostly marine species and a small number of freshwater species. The species is the only member of its genus and is the only freshwater cirrolanid isopod north of Texas. Its body is flattened and bears seven pairs of long walking legs. The first pair of legs are modified as grasping structures. It has a pair of short antennae and a pair of long antennae. Males reach a length of 0.6 inches; females reach a length of 0.7 inches. While most cave isopods spend the majority of their time walking along the bottoms of streams and pools, *Antrolana lira* spends much of its time swimming freely through flooded caves formed in ancient limestone.

**Distribution and Habitat** - The Madison Cave isopod is found in flooded limestone caves beneath the Great Valley of Virginia and West Virginia where it swims freely through calcite-saturated waters of deep karst aquifers. Recent discoveries in caves and wells have extended the range of the species 200

miles. The range of the isopod is now known from a 15 mile wide belt stretching from Lexington VA to Charles Town, WV. There are documented population centers in the Waynesboro-Grottoes area (Augusta County, VA), the Harrisonburg area (Rockingham County, VA), and the valley of the main stem of the Shenandoah River (Warren and Clarke counties, VA, and Jefferson County, WV).

**Life History** - The population size of the Madison Cave isopod is unknown at most sites. Sampling results suggest that the population is dominated by adults. The population structure of the Madison Cave isopod suggests that it has a lengthy life span with a low rate of reproduction. It is not known how this species reproduces. Its feeding habitats are also unknown however, it is believed to be carnivorous.

**Conservation** - The Madison Cave Isopod was federally listed as a threatened species on November 3, 1982. Agriculture and encroaching industrial and urban development threaten the quality of groundwater habitat and thus the survival of this species.

**What You Can Do To Help** - If you reside on property that borders a stream or other waterway within the range of this isopod, avoid using chemicals or fertilizers. To help control erosion and reduce run-off, maintain a buffer of natural vegetation along waterbodies and sinkholes. Sinkholes are natural depressions in the land surface that are formed by the collapse of an underground cavern roof. Never place anything into sinkholes because

harmful materials can end up in underground streams. Install fencing to prevent livestock from entering streams, which will reduce siltation and input of waste products. Properly dispose of household wastes, including used motor oil, at recycling facilities and permitted landfills. Have your septic tank inspected regularly by a licensed professional. By following these land use practices, you are not only protecting the habitat of cave creatures but also protecting the quality of your drinking water.

To find out more about the Madison cave isopod contact:

Virginia Department of  
Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street, 3rd Floor  
Richmond, Virginia 23219  
(804) 786-7951

Virginia Department of Game and  
Inland Fisheries  
P.O. Box 11104  
Richmond, Virginia 23230  
(804) 367-1000

### References

Orndorff, W.D., and C.S. Hobson. 2007. Status Survey for the Madison Cave Isopod (*Antrolana lira*) in Virginia, 2005-2007. Natural Heritage Technical Report 07-11. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, Virginia. 17pp.

U.S. Fish and Wildlife Service. 1996. Madison Cave isopod (*Antrolana lira*) recovery plan. Hadley, Massachusetts.



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6669 Short Lane  
Gloucester, Virginia 23061  
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December 2007

U.S. Fish & Wildlife Service

# Northeastern Bulrush

## *Scirpus ancistrochaetus*



G. Bisbee

**Description** - The northeastern bulrush is a member of the sedge family and is known from Maryland, Massachusetts, New Hampshire, Pennsylvania, Vermont, Virginia, and West Virginia. This plant is extremely rare in Virginia where it is found in mountain ponds. These ponds are approximately 11,000 years old and harbor some of the older elements of Virginia's native vegetation.

**Life History** - This plant is found in ponds, wet depressions, and shallow sinkholes within small wetland complexes less than one acre in size. The wetlands are characterized by seasonally variable water levels. This bulrush occupies the deeper parts of the emergent zone. Some of these plants are found in wetland bogs with a pH variation from acidic to slightly alkaline. This species flowers from mid-June to July. Fruits from this plant mature from July to September. Most details of the life history of this species are unknown.



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**Conservation** - The northeastern bulrush was federally listed as an endangered species on June 6, 1991. Threats include habitat loss and degradation caused by wetland drainage, dredging, and filling for residential development and agricultural use. Any modifications which reduce the water level or dry out a pond could eliminate all or most of the individuals in a population. Other threats include agricultural runoff, logging roads, fire roads, off-road vehicle use, and unauthorized collection. Siltation, vegetation succession, herbivory, and non-native plant species may also be threats. Potential natural threats include deer herbivory, beavers, natural water level fluctuations, fire, and succession.

**What You Can Do To Help** - Avoid using chemicals or fertilizers near ponds and wetlands. Maintain a buffer of natural vegetation around ponds and wetlands. If you find a plant that appears to be the northeastern bulrush, take note of the location and photograph the plant, if possible. Please do not remove the plant! Contact one of the following agencies for assistance:

Virginia Department of Agriculture  
and Consumer Services  
Office of Plant Protection  
P.O. Box 1163  
Richmond, Virginia 23209  
(804) 786-3515

Virginia Department of  
Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street, 3rd Floor  
Richmond, Virginia 23219  
(804) 786-7951

U.S. Fish and Wildlife Service  
Virginia Field Office  
6669 Short Lane  
Gloucester, Virginia 23061  
(804) 693-6694

### References

- U.S. Fish and Wildlife Service. 1993. Northeastern bulrush (*Scirpus ancistrochaetus*) recovery plan. Hadley, Massachusetts.
- Wieboldt, T.F. 1991. Northeastern bulrush. Pages 80-82 in K. Terwilliger, ed. Virginia's Endangered Species, Proceedings of a Symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

U.S. Fish & Wildlife Service

# Shale Barren Rock Cress

## *Arabis serotina*



A. Wieboldt

**Description** - The shale barren rock cress is a biennial plant in the mustard family. This plant occurs only in West Virginia and Virginia and is found on mid-Appalachian shale barrens of the Ridge and Valley Province of the Appalachian Mountains. This plant is highly habitat restricted and the number of individuals per population is low, most with fewer than 20 individuals. Because this species is a biennial, it has two age classes containing nonreproductive and reproductive individuals. Young, nonreproductive individuals have leaves in a basal rosette. Potentially reproductive individuals are present in the form of erect, flowering plants lacking a basal rosette. The flowering stem is composed of 3 to 41 branches. The flowers are small with white or creamy petals. Seeds are yellowish-brown and contain a narrow wing. Mature plants reach a height of 16 to 40 inches.

**Life History** - Mid-Appalachian shale barrens are characterized by an open, scrubby growth of pine, oak, red cedar, and other woody

species adapted to dry conditions and are found most frequently on eroding slopes undercut by a stream. Shale barrens are isolated islands of habitat with steep southern exposures with elevations of 1099 to 2494 feet, dry, relatively sparse vegetative cover, high temperatures, and low moisture in the summer. This plant reproduces sexually and diminished reproductive output brought about by deer grazing may lead to extirpation of some populations. The shale barren rock cress may not be a strict biennial, meaning that the rosettes may persist longer than one year, thus delaying flowering and fruiting beyond the second year. Flowering occurs from mid-July until the first killing frost, usually around November, at which time the plant dies.

**Conservation** - On August 14, 1989, the shale barren rock cress was federally listed as an endangered species due to the small number of populations and low numbers of individuals within those populations. Threats to this species include destruction of habitat by road construction or other human activities, herbivory by deer and insects especially during dry conditions, and drought. It has been documented that five shale barrens were destroyed due to road construction, two sites were partially destroyed from railroad construction, one site was crossed by a hiking path, and an additional site was destroyed by damming a stream. This plant is found in very stressed environments and cannot tolerate much disturbance.

**What You Can Do To Help** - If you find a plant that appears to be the shale barren rock-cress, take note of

the location and photograph the plant, if possible. Please do not remove the plant!

Contact one of the following agencies for assistance:

Virginia Department of Agriculture  
and Consumer Services  
Office of Plant Protection  
P.O. Box 1163  
Richmond, Virginia 23209  
(804) 786-3515

Virginia Department of  
Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street, 3rd Floor  
Richmond, Virginia 23219  
(804) 786-7951

U.S. Fish and Wildlife Service  
Virginia Field Office  
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### References

U.S. Fish and Wildlife Service.  
1989. Endangered and Threatened  
Wildlife and Plants: determination of  
endangered and threatened status for  
the shale barren rock cress; final  
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29655-29658.

U.S. Fish and Wildlife Service.  
1991. Shale barren rock cress  
(*Arabis serotina*) recovery plan.  
Newton Corner, Massachusetts.



U.S. Fish and Wildlife Service  
Virginia Field Office  
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Gloucester, Virginia 23061  
(804) 693-6694  
<http://www.fws.gov>  
February 2002

U.S. Fish & Wildlife Service

# Shenandoah Salamander

## *Plethodon shenandoah*



Haskell

**Description** - The Shenandoah salamander is a small terrestrial amphibian known only from three mountains, all within the boundaries of Shenandoah National Park in Virginia. It occurs on northwest to northeast facing talus slopes 2,900 feet above sea level. This is a slender, moderate-sized salamander with a total length of 3.5 to 4.5 inches. The body is dark brown, with two color phases. The striped color phase has a narrow red to yellow stripe down the center of the back. In the unstriped phase, the back is dark brown with scattered brass-colored flecks. In both phases, white or yellow spots occur along the sides.

**Life History** - This woodland salamander has no aquatic stage. It is generally found in forested conditions, where the presence of an overstory promotes surface moisture. Respiration occurs through the skin surface, which must be kept constantly moist for this purpose.



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Primarily nocturnal, this salamander spends its days in rock crevices or under other objects; its movements are restricted during droughts. The salamander's diet generally consists of mites, springtails, flies, small beetles, and other soil invertebrates. Breeding takes place in late spring or summer. In contrast with most salamanders, complete development of the embryo takes place within the egg. Small egg clusters, containing three to seventeen eggs, are laid in damp logs, moss, or other available crevices, and the females guard the eggs. Incubation lasts one to three months, during which time the female does not forage for food. Females do not breed before four years of age, and breed only every other year. Adult survival is high, with a small percentage surviving twenty-five years or longer. Activity and movements are restricted during dry periods.

**Conservation** - The Shenandoah salamander was federally listed as an endangered species on September 18, 1987. This species was believed to be endangered due to natural biological causes, the encroachment of woodlands on the talus slopes. However, it now appears that certain human-related factors are likely to have adverse effects on the salamander. Threats are wide-ranging and include habitat deterioration, acid deposition, defoliation of the overstory by gypsy moths, and soil acidification.

**What You Can Do To Help** - To learn more about the Shenandoah salamander visit:

Shenandoah National Park  
National Park Service  
3655 U.S. Highway 211 East  
Luray, Virginia 22835  
(540) 999-2243

When visiting the Park, follow all signs and do not enter restricted areas. If you find a salamander, please do not disturb it!

### References

- U.S. Fish and Wildlife Service. 1994. Shenandoah salamander (*Plethodon shenandoah*) recovery plan. Hadley, Massachusetts.
- Wynn, A.H. 1991. Shenandoah salamander. Pages 439-442 in K. Terwilliger, J.R. Tate, and S.L. Woodward, eds. A guide to endangered and threatened species in Virginia. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

U.S. Fish & Wildlife Service

# Small Whorled Pogonia

## *Isotria medeoloides*



© D.D. Tyler

**Description** - The small whorled pogonia is a herbaceous perennial orchid. It has a widely scattered distribution in the eastern United States along the Atlantic coast from Maine to Georgia with outlying occurrences in the midwest and Canada. This species has pale green, elliptical leaves, usually five or six, that grow in a single whorl at the top of a hairless, grayish-green stem. The one or two flowers per plant are yellowish-green, unscented, and form in the center of the whorl.

**Life History** - In Virginia, the small whorled pogonia is found in ordinary looking third-growth upland forests with an open understory and a closed canopy where the topography is typically moderately sloping or almost level. The plants are usually associated with decaying vegetative matter such as fallen trunks and limbs, leaf litter, bark, and tree roots. The pogonia is found in soils that are acidic sandy loams with low nutrient

content. The flowers appear in late April to mid-May. The small whorled pogonia reproduces primarily through self-pollination and occasionally vegetatively. It is often confused with the Indian cucumber-root (*Medeola virginiana*) and the large whorled pogonia (*Isotria verticillata*). The Indian cucumber-root has deep green leaves with a stem that is thin, hairy, and wiry. The large whorled pogonia has a reddish-purple stem and dark green leaves; its flower is reddish-purple.

**Conservation** - The small whorled pogonia was federally listed as an endangered species on September 10, 1982. It was reclassified as threatened on November 7, 1994. This was possible because at the time of reclassification 61% of the viable populations had been protected. The small whorled pogonia and its habitat continue to be threatened, directly and indirectly, by residential and commercial development. The upland habitat where it is found is seldom protected by federal or state laws unless it occurs on federally-owned property. Without voluntary landowner protection many pogonia populations have been and will be destroyed. Other threats to this species are collection by plant enthusiasts and browsing by white-tailed deer and invertebrates.

**What You Can Do To Help** - If you find a plant that appears to be the small whorled pogonia, take note of the location and photograph the plant, if possible. Please do not remove the plant!

Contact one of the following agencies for assistance:

Virginia Department of Agriculture  
and Consumer Services  
Office of Plant Protection  
P.O. Box 1163  
Richmond, Virginia 23209  
(804) 786-3515

Virginia Department of  
Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street, 3rd Floor  
Richmond, Virginia 23219  
(804) 786-7951

U.S. Fish and Wildlife Service  
Virginia Field Office  
6669 Short Lane  
Gloucester, Virginia 23061  
(804) 693-6694

### References

U.S. Fish and Wildlife Service.  
1992. Small whorled pogonia  
(*Isotria medeoloides*) recovery plan,  
first revision. Newton Corner,  
Massachusetts.

Ware, D.M.E. 1991. Small whorled  
pogonia. Pages 95-97 in K.  
Terwilliger, ed. Virginia's  
Endangered Species, Proceedings of  
a Symposium. McDonald and  
Woodward Publishing Company,  
Blacksburg, Virginia.



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# Virginia Big-Eared Bat

*Corynorhinus townsendii virginianus*



J.B. Schulz

**Description** - The Virginia big-eared bat is only known from a few caves in east-central Kentucky, western North Carolina, western Virginia, and northeastern West Virginia. This medium-sized bat has huge ears, weighs less than 0.5 ounces and is four inches in length from head to toe. It has long brown fur with pale brown underparts.

**Life History** - The Virginia big-eared bat lives in caves year-round at elevations greater than 1,500 feet above sea level. Although a colony may occupy the same cave throughout the year, it may have one or more roosts in other caves. Individuals move to other roosts even in cold weather. After mating in the fall and winter, the bats search for caves for hibernation. During hibernation males and females hibernate together in cool, well-ventilated portions of caves. These caves are typically located in regions dominated by oak-hickory or beech-maple-hemlock forests. Females congregate in a few maternity caves

in summer. Females arrive pregnant and have one young per pregnancy. Young are born around mid-June, and by mid-July they begin to leave the cave at night to forage. Most bats leave the maternity cave by late September. Males are found in caves in summer, scattered singly and in larger numbers. The Virginia big-eared bat feeds mainly on moths.

**Conservation** - The Virginia big-eared bat was federally listed as an endangered species on November 30, 1979. These bats have declined primarily due to human disturbance and loss of habitat. This species is easily disturbed by human activity including vandalism, caving, and frequent visitation. These disturbances can cause adults to abandon caves, abandon their young, and force them to use valuable energy reserves needed to survive while in hibernation.

**What You Can Do To Help** - Avoid using pesticides and other chemicals near caves and waterways. Do not enter gated caves or mines. These gates have been installed to protect bats and human safety. Cave habitats are fragile and easily disturbed; if you must enter a cave, do so only as an observer and leave everything as you found it. Never shoot, poison, or otherwise harm bats. Bats are extremely beneficial insect eaters, and nuisance bats can be encouraged to move elsewhere. If you find a bat, please do not disturb it!

Contact one of the following agencies for assistance:

Virginia Department of Game and  
Inland Fisheries  
P.O. Box 11104  
Richmond, Virginia 23230  
(804) 367-1000

Virginia Department of  
Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street, 3rd Floor  
Richmond, Virginia 23219  
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U.S. Fish and Wildlife Service  
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#### References

Dalton, V.M. and C.O. Handley, Jr. 1991. Western big-eared. Pages 573-575 in K. Terwilliger, ed. Virginia's Endangered Species Proceedings of a Symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

U.S. Fish and Wildlife Service. 1984. Recovery plan for the Ozark big-eared bat and Virginia big-eared bat. Twin Cities, Minnesota.



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Gloucester, Virginia 23061  
(804) 693-6694  
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# Virginia Sneezeweed

## *Helenium virginicum*



VDCR

**Description** - The Virginia sneezeweed was first discovered in 1936. It is a rare perennial wildflower found only in Virginia. This herbaceous plant has yellow flowers and can reach a height of 3.5 feet.

**Life History** - This wetland plant is found on the shores of naturally-occurring shallow, seasonally flooded limestone ponds (less than 0.1 to 8 acres in size) along the western edge of the Blue Ridge Mountains in the Shenandoah Valley. This plant inhabits poorly drained, acidic, silty loam soils, that are generally flooded from January to July. Flowering occurs from July through November after the plant is one year old. It appears that the primary insect pollinators for this species are bees, wasps, butterflies, and hoverflies. Seeds are dispersed in late fall and winter and germination occurs in late summer or early fall of the following year if conditions are suitable. This plant can tolerate disturbance such as mowing and grazing. However, the effects of soil compaction and

increased nutrient loads related to cattle grazing within the wetlands needs further study. It cannot tolerate shade or long periods of flooding. Each year, Virginia sneezeweed populations vary greatly due to water level fluctuations.

**Conservation** - The Virginia sneezeweed was federally listed as a threatened species on December 3, 1998. This plant is threatened by residential development, off-road vehicle use, incompatible agriculture practices, logging, filling and ditching of wetlands, and other disruptions of its habitat and the hydrology that maintains it.

**What You Can Do To Help** - Landowners can protect ponds by following best management practices that maintain or enhance water quality and quantity in these fragile wetland communities. Land uses in surrounding uplands should be carefully evaluated to avoid hydrologic changes and increased nutrient inputs to ponds. If you find a plant that appears to be the Virginia sneezeweed, take note of the location and photograph the plant, if possible. Please do not remove the plant! Contact one of the following agencies for assistance:

Virginia Department of  
Conservation and Recreation  
Division of Natural Heritage  
217 Governor Street, 3rd Floor  
Richmond, Virginia 23219  
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U.S. Fish and Wildlife Service  
Virginia Field Office  
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Gloucester, Virginia 23061  
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### References

Johnson, M.F. and D.M. Porter. Virginia sneezeweed. 1991. Pages 145-146 in K. Terwilliger, ed. Virginia's Endangered Species, Proceeding of a Symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

U.S. Fish and Wildlife Service. 1998. Endangered and threatened wildlife and plants; Determination of threatened status for Virginia sneezeweed (*Helenium virginicum*), a plant from the Shenandoah Valley of Virginia. Federal Register 63(212):59239-59244.



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Virginia Department of Agriculture  
and Consumer Services  
Office of Plant Protection  
P.O. Box 1163  
Richmond, Virginia 23209  
(804) 786-3515

**Indiana Bat (*Myotis sodalis*), Gray Bat (*Myotis grisescens*), and Virginia big-eared bat (*Corynorhinus townsendii virginianus*) Survey Contacts in Virginia**

This list contains individuals who we have already determined are qualified to conduct surveys for the species listed above. This list does not include all individuals qualified or authorized to survey for this species. If you select someone not on this pre-approved surveyor list, please provide the proposed surveyor's qualifications to this office 30 days prior to the start of the survey. Please send copies of all survey results to this office. If the survey determines that any rare species are present, please contact this office to allow us the opportunity to work with you to ensure that a project avoids or minimizes adverse effects to rare species and their habitats. Inclusion of names on this list does not constitute endorsement by the U.S. Fish and Wildlife Service or any other U.S. Government agency. Listed alphabetically. April 14, 2008.

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**ATLANTIC SLOPE FRESHWATER MUSSELS  
SURVEY CONTACTS IN VIRGINIA**

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**SMALL WHORLED POGONIA**  
*(Isotria medeoloides)*  
SURVEY CONTACTS IN VIRGINIA

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**MADISON CAVE ISOPOD (*Antrolana lira*) AND  
LEE COUNTY CAVE ISOPOD (*Lirceus usdagalun*)  
SURVEY CONTACTS IN VIRGINIA**

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September 18, 2008

Patricia Kicklighter, Acting Superintendent  
United States Department of the Interior  
National Park Service  
Shenandoah National Park  
3655 U.S. Highway 211 East  
Luray, Virginia 22835-9036

Re: Rock Outcrop Management Plan/Environmental Assessment  
Shenandoah National Park  
DHR File No. 2007-1446

Dear Ms. Kicklighter,

Thank you for providing us with additional information about archaeological resources with respect to the Rock Outcrop Management Plan.

It is now our understanding that all areas of potential ground disturbance, with one exception, have previously been surveyed. Based upon the documentation provided in Dr. Carole Nash's report entitled *A Phase I Cultural Resources Survey of Seven Locations Associated with Appalachian Trail Campsite Improvements in Shenandoah National Park* (Jan. 2001), we understand that there are no recorded archaeological sites located within the area of potential effects for the current project alternatives.

Alternative B includes relocation of the Appalachian Trail to its original location, an area that has not been previously surveyed. We agree that a survey is needed to ensure that no archaeological sites are subject to further degradation. As it will not be possible to make a determination of effect until the results of that survey are available, a programmatic agreement may need to be developed and executed to bring the Section 106 process to completion prior to approval of the of the Rock Outcrop Management Plan/Environmental Assessment.

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Sincerely,



Ethel R. Eaton, Ph.D., Senior Policy Analyst  
Office of Review and Compliance

c. Ann Kain, Cultural Resource Manager

APPENDIX G: NATURAL RESOURCE TABLES

**Table A: Rare plants located at the Park's rock outcrop study sites in 2005-6.**

Scientific Name	Common Name	Global Rank / State Rank	Number of ROMP Study Sites Where Found
<i>Abies balsamea</i>	Balsam fir	G5/S1	6
<i>Aralia hispida</i>	Bristly sarsaparilla	G5/S2	5
<i>Arctostaphylos uva-ursi</i>	Bearberry	G5/S1	1
<i>Asplenium bradleyi</i>	Bradley's spleenwort	G4/S2	1
<i>Betula cordifolia</i>	Mountain paper birch	G5/S2	2
<i>Clematis occidentalis</i> var. <i>occidentalis</i>	Purple clematis	G5T5/S2	2
<i>Conioselinum chinense</i>	Hemlock parsley	G5/S1	1
<i>Cornus rugosa</i>	Roundleaf dogwood	G5/S1	1
<i>Cuscuta coryli</i>	Hazel dodder	G5/S2?	1
<i>Huperzia appalachiana</i>	Appalachian fir-clubmoss	G4G5/S2	9
<i>Juncus trifidus</i>	Highland rush	G5/S1	1
<i>Minuartia groenlandica</i>	Mountain sandwort	G5/S1	1
<i>Muhlenbergii glomerata</i>	Marsh muhly	G5/S2	3
<i>Oligoneuron rigidum</i> var. <i>rigidum</i>	Stiff goldenrod	G5T5/S2	1
<i>Paxistima canbyi</i>	Canby's mountain-lover	G2/S2	1
<i>Populus tremuloides</i>	Quaking aspen	G5/S2	2

**Table B: Watchlist plants located at the Park's rock outcrop study sites in 2005-6.**

Scientific Name	Common Name	Global Rank / State Rank	Number of ROMP Study Sites Where Found
<i>Adlumia fungosa</i>	Climbing fumitory	G4/S3	1
<i>Amelanchier sanguinea</i> var. <i>sanguinea</i>	Roundleaf serviceberry	G5T5/S3	7
<i>Crataegus pruinosa</i>	A hawthorn	G5/S3	8
<i>Gymnocarpium appalachianum</i>	Appalachian oak fern	G3/S3	3
<i>Juglans cinerea</i>	Butternut	G3G4/S3?	1
<i>Liatris turgida</i> (= <i>L. helleri</i> )	Shale-barren blazing-star	G3/S3	8
<i>Linum sulcatum</i> var. <i>sulcatum</i>	Grooved yellow flax	G5T5/S3	1
<i>Prunus alleghaniensis</i> var. <i>Alleghaniensis</i>	Alleghany plum	G4T4/S3	2
<i>Taenidia montana</i>	Mountain pimpernel	G3/S3	7
<i>Solidago hispida</i> var. <i>hispida</i>	Hairy goldenrod	G5T5/S3	1
<i>Taxus canadensis</i>	American yew	G5/S3	2
<i>Zanthoxylum americanum</i>	Northern prickley-ash	G5/S3	1

**Table C: Rare lichens found at the Park’s rock outcrop study sites.**

Scientific Name	Global Rank / State Rank	Biogeography
<i>Arctoparmelia centrifuga</i>	G3G5 / S1	arctic-boreal; disjunct in higher Appalachians of VA and WVA
<i>Buellia stellulata</i>	GNR / S1	western US
<i>Cladonia coccifera</i>	G5 / S1?	arctic-boreal; disjunct in higher Appalachians of VA, NC, GA
<i>Parmelia omphalodes</i>	G2G4 / S2?	arctic-boreal; disjunct in higher Appalachians of VA, WVA, NC, TN
<i>Porpidia lowiana</i>	G2G3 / S1	arctic-boreal; disjunct from northern NY
<i>Porpidia tuberculosa</i>	G2G4 / S1	arctic-boreal; disjunct in higher Appalachians of VA and NC (Roan Mt)

**Table D: List of watchlist animals collected from or observed at the Park’s rock outcrop sites.**

Class	Family	Scientific Name (Common Name)	Global Rank/ State Rank	Number of ROMP Study Sites
Reptilia	Colubridae	<i>Liochlorophis vernalis</i> (Smooth green snake)	G5/S3	1
Amphipoda	Crangonyctidae	<i>Stygobromus spinosus</i> (Blue Ridge Mountain amphipod)	G3/S3	1
Lepidoptera	Geometridae	<i>Caripeta angustiorata</i> (Brown pine looper moth)	G?/S1S3	1
Lepidoptera	Geometridae	<i>Cyclophora myrtaria</i> (A geometrid moth)	G5/S2S4	1
Lepidoptera	Geometridae	<i>Euchlaena marginaria</i> (A geometrid moth)	G?/S2S4	1
Lepidoptera	Geometridae	<i>Euchlaena muzaria</i> (A geometrid moth)	G?/S2S4	1
Lepidoptera	Geometridae	<i>Euchlaena tigrinaria</i> (Mottled Euchlaena moth)	G/S2S4	3
Lepidoptera	Geometridae	<i>Eulithis molliculata</i> (Dimorphic Eulithis moth)	G4/S2S4	2
Lepidoptera	Geometridae	<i>Heliomata infulata</i> (Rare spring moth)	G2G4/S2S4	1
Lepidoptera	Geometridae	<i>Homochlodes disconventa</i> (Dark Homochlodes moth)	G?/S2S4	1
Lepidoptera	Geometridae	<i>Hydriomena bistriolata</i> (A geometrid moth)	G?/S1S4	1
Lepidoptera	Geometridae	<i>Itame abruptata</i> (A geometrid moth)	G4/S1S4	1
Lepidoptera	Geometridae	<i>Itame exauspicata</i> (A geometrid moth)	GNR/S1S3	1
Lepidoptera	Geometridae	<i>Itame subcessaria</i> (Barred Itame moth)	G4?/S2S4	4
Lepidoptera	Geometridae	<i>Mesoleuca ruficillata</i> (White-ribboned carpet)	G4/S2S4	3
Lepidoptera	Geometridae	<i>Metarranthis mestusata</i> (A geometrid moth)	G?/S2S4	5

Lepidoptera	Geometridae	<i>Nemoria mimosaria</i> (An emerald moth)	G3G4/ S2S4	2
Lepidoptera	Geometridae	<i>Rheumaptera hastata</i> (Spear-marked black moth)	G5/S2S3	2
Lepidoptera	Geometridae	<i>Xanthorhoe labradorensis</i> (Labrador carpet)	G4/S2S4	3
Lepidoptera	Noctuidae	<i>Apamea lignicolor</i> (Wood colored Apamea moth)	G5/S2S4	3
Lepidoptera	Noctuidae	<i>Apamea plutonia</i> (A noctuid moth)	G4/S2S4	1
Lepidoptera	Noctuidae	<i>Autographa ampla</i> (Large looper moth)	G5/S1S3	1
Lepidoptera	Noctuidae	<i>Catocala relictata</i> (White underwing)	G5/S2S4	1
Lepidoptera	Noctuidae	<i>Catocala serena</i> (Serene underwing)	G5/S2S4	1
Lepidoptera	Noctuidae	<i>Cucullia floriae</i> (A noctuid moth)	G?/S2S4	1
Lepidoptera	Noctuidae	<i>Hypena sordidula</i> (Sordid Hypena moth)	G4/S2S4	1
Lepidoptera	Noctuidae	<i>Leucania commoides</i> (A noctuid moth)	G?/S1S4	1
Lepidoptera	Noctuidae	<i>Lithacodia concinnamacula</i> (Red-spotted Lithacodia moth)	G4/S2S4	5
Lepidoptera	Noctuidae	<i>Phlogophora iris</i> (Olive angle shades)	G?/S2S4	2
Lepidoptera	Sphingidae	<i>Darapsa versicolor</i> (Hydrangea sphinx)	G4/S1S3	1
Lepidoptera	Sphingidae	<i>Sphinx kalmiae</i> (Laurel sphinx)	G5/S2S4	2
Orthoptera	Tettigoniidae	<i>Scudderia septentrionalis</i> (Northern bush katydid)	G3?/S3	6

**Table E: Rare animals identified from the Park’s rock outcrop study sites.**

Class	Family	Scientific Name (Common Name)	Global Rank/ State Rank	Number of ROMP Study Sites
Chiroptera	Vespertilionidae	<i>Myotis leibii</i> (Eastern small-footed myotis)	G3/S1	1
Lepidoptera	Geometridae	<i>Itame ribearia</i> (Currant spanworm moth)	G4/S1S3	4
Lepidoptera	Noctuidae	<i>Catocala herodias gerhardi</i> (Herodias underwing)	G3T3/S2S3	1
Lepidoptera	Noctuidae	<i>Hadena ectypa</i> (A noctuid moth)	G3G4/S1S3	1
Lepidoptera	Noctuidae	<i>Properigea costa</i> (A noctuid moth)	G4/S1S3	3
Trichoptera	Philopotamidae	<i>Wormaldia thyria</i> (A philopotamid caddisfly)	G3/S2	1

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## APPENDIX H: OVERVIEW OF CLIMBING ORGANIZATIONS

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### Rock Climbing Organizations

Positive interaction by The Park with the rock climbing community is very important to obtaining the public cooperation necessary in protecting the Park's rock outcrop resources. Climber organizations can promote understanding and education of climbers and other park visitors about important park rock outcrop resources and recreation use practices and techniques to minimize impacts to those resources. These organizations can provide valuable volunteer resource support in protecting and managing the park. Climbers participated in the Rock Outcrop Management Project, contributing advice and public input to the ROMP and the Climbing Management Guidelines.

#### *Shenandoah National Park Climbers Alliance (SNPCA)*

The Shenandoah National Park Climbers Alliance (SNPCA) is an informal, volunteer, grassroots group that represents rock climber interests in the Park. Initially, SNPCA focused on building a constructive relationship with the staff of the Park upon preparation of the climbing management plan under the Rock Outcrop Management Project. Ultimately, the SNPCA serves as a channel for input from the climbing community to the Park staff that will be essential to preserving the high quality of climbing that climbers have come to enjoy in the Park.

#### *Potomac Appalachian Trail Club (PATC), Mountaineering Section*

The PATC Mountaineering Section is a diverse group of local rock climbers which organizes climbs regionally nearly every weekend and conducts longer trips afield several times a year. The Mountaineering Section, also known as the *Potomac Mountain Club (PMC)*, provides climbing instruction on their trips. The PATC is headquartered at Vienna, Virginia.

#### *American Alpine Club*

The American Alpine Club was founded in 1902 and is the leading national organization in the United States devoted to mountaineering, climbing, and the multitude of issues facing climbers. With an emphasis on adventure, scientific research and education, the Club is dedicated to:

- the promotion and dissemination of knowledge about the mountains and mountaineering through its meetings, publications and libraries;
- the cultivation of mountain craft, and the promotion of good fellowship among climbers;
- the study of the high mountains of the world, the gathering of facts and the observation of phenomena pertaining to them;
- the production of a series of illustrated publications to present a complete description of the alpine mountains of the world;

- the scientific exploration of high mountain elevations and of the regions lying within or about the Arctic and Antarctic circles;
- the conservation and preservation of the mountain environment; and
- the representation of the interests and concerns of the American climbing community

The AAC is a not-for-profit organization supported by gifts and grants from individuals, corporations and foundations, income from restricted endowments, membership dues, and the sale of publications.

*The Access Fund*

Since 1991, the Access Fund has been the **only** national advocacy organization that keeps climbing areas open and conserves the climbing environment. The Access Fund supports and represents over 1.6 million climbers nationwide in all forms of climbing; Rock Climbing, Ice Climbing, Mountaineering, and Bouldering. Five core programs support the mission on national and local levels: public policy, stewardship & conservation (including grants), grassroots activism, climber education, and land acquisition.