

***Climbing and Natural Resources Management***  
**AN ANNOTATED BIBLIOGRAPHY**

**Table of Contents**

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PREFACE.....page 2

ACKNOWLEDGEMENTS.....page 3

INTRODUCTION.....page 4

WILDLIFE.....page 7

VEGETATION.....page 15

SOCIAL IMPACTS.....page 20

ECONOMIC IMPACTS.....page 22

CLIFF ECOLOGY .....page 24

MANAGEMENT.....page 28

FEDERAL & AGENCY CLIMBING AND GENERAL MANAGEMENT PLANS  
AND MEMORANDUM OF UNDERSTANDING.....page 42

    Federal & Agency Climbing and General Management Plans ...page 43

    Memoranda of Understanding.....page 47

CLIMBING AREA AND RESOURCE INFORMATION BROCHURES....page 49

    Climbing Area Brochures.....page 49

    Resource Information Brochures... .....page 52

KEYWORD INDEX.....page 54

## PREFACE of *Bibliography*

This annotated bibliography is a joint project of North Carolina State University and the Access Fund.

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The Department of Parks, Recreation & Tourism Management (PRTM) specializes in the planning and management of parks, recreation and sport areas and facilities, tourism attractions and leisure activities in a range of environments for all ages and lifestyles.

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The Access Fund is a national non-profit organization working to maintain access to climbing areas and to protect the climbing environment. Working in cooperation with climbers, other recreational users, conservation organizations, public land managers and private landowners, the Access Fund promotes an ethic of personal responsibility, self-regulation, strong conservation values and minimum impact practices among climbers.

### **About the Authors**

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## ***CLIMBING AND NATURAL RESOURCES MANAGEMENT: AN ANNOTATED BIBLIOGRAPHY***

### **INTRODUCTION**

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Since the mid-1980s, climbing has become more popular as a recreational pursuit. It is estimated that there are now as many as 400,000 active climbers in the United States (Outdoor Recreation Coalition of America, 1999). Associated with this rise in popularity is a growing concern about impacts to the cliff environment from increased human use. Land managers are increasingly faced with the challenge of integrating the demand for climbing with their mandates for resource protection and proper administration of public (and in some cases private) land.

In some locations (for example, Yosemite National Park, CA) climbing management dates back to the 1970's, while in other areas it is still in its infancy. Recent studies on cliff ecology and resource impacts associated with climbing have provided improved information and a greater sense of urgency for resource managers. As resource managers respond to changing conditions in climbing environments through interpretation, regulation, and other interventions, resource managers and climbers alike will search for information to aid in management decisions. Unfortunately, a lot of valuable information lies in internal agency reports which often go unnoticed by the climbing community, are frequently difficult to access, or are found in materials not listed in conventional literature searches. Therefore, some decisions are made in isolation, or without the benefit of established research.

This bibliography has been produced to provide land managers, climbers, and other interested parties with an opportunity to increase their knowledge and understanding of climber - environment interactions. Current policies and management plans are being developed in climbing areas throughout the United States that will have significant effects on climbing access and experiences in the future. We offer this document in a spirit of cooperation and shared commitment to the protection and long term enjoyment of America's unique and diverse climbing resources.

### **Purpose of this document**

The purpose of this document is to review the available literature on the interaction between climbers and the natural environment, research, management approaches, and related literature on climbing. The information contained herein can be used to facilitate literature searches, provide resource managers with information to guide them in making management decisions, support requests for funding and study proposals, provide examples of current management and mitigation techniques, and provide background information to assist in the development of climbing management plans.

### **Need for this document**

The need for this document was identified because of the growing number of requests from management and research groups for information and the lack of available knowledge in this subject area. Although there has been a small (but recently growing) number of scientific studies published in academic journals, there is also a wealth of material (reports, studies, discussion documents) that are not listed through conventional literature searches. Much of this material details preliminary investigations and cooperative works and should serve as a valuable source for developing future management approaches and methodologies.

### **Scope of the study**

This report contains over 150 references on climbing and natural resources management. References from other recreation environments that have important management implications, mitigation practices, and address similar impacts for those managing climbing environments have also been included. Literature for this project came from a variety of peer and non-peer reviewed sources. These sources included scientific journals, books, proceedings, reports, popular literature, "in-house"

documents, bibliographic databases, dissertations and theses. The abstracts are intended to provide a brief overview of the entries content and do not reflect the author's opinions or their judgment of the quality of the cited work.

### **Criteria for selection**

Selection criteria for materials were that they provide information:

- (1) Documenting environmental and social effects caused by climbing.
- (2) Assisting in decision making towards resource protection and climbing management.
- (3) Illustrating cooperative approaches to addressing climbing management issues.

### **How to use this document**

The bibliography is divided into 8 primary sections. While some references may fit into multiple sections, one section was selected for each reference based on its relevancy. Searching through the appropriate keyword index can access all items. Six indices are provided at the end of this document to enhance the utility of this bibliography. A series of numbers follows each keyword. These citation numbers refer to their location in the bibliography. Where possible, an organization or contact is provided from where the article or report can be obtained for material not published in journals.

### **Future updates**

The number, scope, and diversity of documents focusing on climbing – natural resource interactions will likely increase in the near future. Therefore, the hope is to continue to add citations to this bibliography in order to improve its value and applicability to a wide range of users. This publication will also be made available on the Access Fund website and subject to revision and updates. Therefore, suggestions for additional citations that will make a positive contribution to this bibliography are welcomed. Please contact the Access Fund with new information.

## WILDLIFE

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Various studies have been conducted exploring the potential effects of recreation activities, including climbing, on wildlife. Results from such studies suggest that human disturbances may result in changes in the behavior, reproduction, population levels or species composition primarily on cliff-nesting raptors (e.g. peregrine falcons, golden eagles, prairie falcons), and diversity of wildlife. Currently, the small number of published studies which investigate the interaction of climbers and wildlife have focused on raptors, ungulates (bighorn sheep, chamois), and the interaction of climbers and grizzly bears. Literature includes information on management approaches, planning, and mitigation techniques to help reduce climber wildlife interactions.

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1. Access Fund. (2000, January). Climbing areas with seasonal restrictions to protect raptors. *Vertical Times*. 32. pp. 5-6.

ABSTRACT: *Vertical Times*, is the membership newsletter of the Access Fund and is published six times a year. A list of revised seasonal raptor restrictions is published in every spring issue.

2. Access Fund. (1998). Submission of comments by the Access Fund on the proposed rule to remove the peregrine falcon in North America from the list of Threatened and Endangered Species [in response to comments *Wildlife-Federal Register* 63 (165)]. Unpublished manuscript, The Access Fund, Boulder, CO. 14 pp.

ABSTRACT: In this submission, the Access Fund (AF) includes a detailed discussion on how the de-listing will affect the management of recreational activities and protection of the peregrine falcon and other cliff nesting raptors. Furthermore, the AF notes that the

proposed de-listing will provide new opportunities for the development of partnerships, research, grant funding, and other forms of cooperation to further develop understanding about raptors and recreation management and to increase public involvement and awareness.

3. Access Fund. (1997). *Raptors & Climbers: Guidance for managing technical climbing to protect raptor nest sites*. The Access Fund, Boulder, CO. 27 pp. with illustrations.

ABSTRACT: This detailed handbook produced in consultation with wildlife biologists provides practical management information targeted at land managers, recreation planners, biologists and climbing representatives involved in setting up or implementing climbing restrictions. Information includes (1) how climber disturbances effect raptors, (2) initiating and maintaining seasonal climbing restrictions and additional climbing management techniques, (3) providing public information and education, (4) annual resource management work plan for incorporating seasonal climbing restrictions, (5) bibliography, and (6) list of seasonal climbing restrictions (1997) to protect cliff-nesting raptors.

4. Bieber, D. (1995). *Possible management options for desert bighorn sheep recovery in the Pusch Ridge Wilderness*. Unpublished manuscript, Santa Catalina Ranger District, Coronado National Forest, Tucson, AZ. 8 pp.

ABSTRACT: Due to the decline in Desert Bighorn Sheep in the Pusch Ridge Wilderness, resource managers from the Coronado National Forest, Arizona Game and Fish, and the University of Arizona collaborated on management options to assist in the protection of habitat and viability of the bighorn sheep herd. Twenty one management options are listed and discussed in relation to resource and recreation management, including climbing.

5. Boise Climbers' Alliance & Idaho Department of Fish and Game. (1999, November). *Guidelines for protecting cliff-nesting raptors and climbing management at the Black Cliffs, Boise, Idaho*. Unpublished manuscript, Idaho Department of Fish and Game, Nampa, ID. 10 pp.

ABSTRACT: The Boise Climbers Alliance (BCA) was formed to address the influence of rock climbing on nesting raptors in the Black Cliffs canyon, near Boise, ID. The canyon is home to a variety of raptors including golden eagles (*Aquila chrysaetos*), prairie falcons (*Falco mexicanus*), red-tailed hawks (*Buteo jamaicensis*), American kestrels (*Falco sparverius*), and great horned owls. (*Bubo virginianus*) The BCA working in collaboration with the Idaho Department of Fish and Game, recommend that climbers refrain from climbing in the immediate vicinity of nesting red-tailed hawks, American kestrels, and great horned owls. Climbers should respect voluntary seasonal restrictions on climbs within a buffer zone around nest sites for golden eagles, and prairie falcons. Additional recommendations are made to mitigate climber impacts on

wildlife viewers. This requires fixed protection on climbs be painted to blend in with the surrounding environment to reduce visual impacts.

6. British Mountaineering Council. (1989). *Peregrines and rock-climbing*. Manchester, UK: British Mountaineering Council. 12 pp.

ABSTRACT: The purpose of this report is to summarize the information on the Peregrine falcon and its relationship to rock climbing enabling the British Mountaineering Council to advise climbers and to make informed observation and representation to conservation organizations on this topic. To accomplish this task, the following information is presented: a list of rock climbing sites which are currently used by peregrines, an inventory of rock climbing sites which have historical records of past nesting or future nesting potential, methods used for informing climbers that nesting peregrines are occupying a cliff and access is restricted, and recommendations for future cooperation between climbers and natural resource organizations.

7. Camp, R. J., Knight, R. L. (1998). Rock climbing and cliff bird communities at Joshua Tree National Park, California. *Wildlife Society Bulletin*, 26 (4), 892-898.

ABSTRACT: The effects of recreational rock climbing on bird communities were investigated at Joshua Tree National Park, CA. Observations were recorded for both climbed and unclimbed cliffs. Analysis revealed bird communities differed between sites with different levels of rock climbing. Birds at unclimbed cliffs were more likely to be perched at cliff faces and more likely to be present, while birds in popular climbing areas were most often observed flying or avoided the face of heavily used cliffs. This finding suggests that human presence alter birds' spatial distribution. Management should focus on developing monitoring programs on cliffs used by climbers to (1) ensure bird communities are not altered and (2) evaluate spatial and temporal changes of bird species and changes in the numbers of invasive species that may impact the integrity of native bird communities.

8. Camp, R. J., Sinton, D. T., Knight, R. L. & Beidleman, C. A. (1997). Viewsheds: a complementary management approach to buffer zones. *Wildlife Society Bulletin*, 25 (3), 612-615.

ABSTRACT: Researchers utilized a geographic information system (GIS) and a global positioning system (GPS) to develop a management approach that took into consideration spatial zones incorporating the viewshed from 6 golden eagle nests. Nests were located on the Nature Conservancy's Phantom Canyon Preserve, Larimer County, Colorado. Through this process both a buffer zone and viewshed were established. Based on their findings, the authors suggest incorporating both a buffer zone and a viewshed as a more comprehensive approach to protecting wildlife from disturbance. Through this management approach, activities potentially harmful to wildlife may be restricted. Compared to buffer zones, viewsheds may require less land area to be protected. The creation of viewsheds may also help managers locate trails,

panoramic sites, etc. to minimize human disturbances to wildlife. Viewsheds have also aided in determining seasonal climbing restrictions and boundaries.

9. Connor, J. (1998). *Protecting birds of prey in the Lumpy Ridge area from rock climbing and park boundary development, Rocky Mountain National Park*. Unpublished manuscript, Rocky Mountain National Park, Estes Park, CO. 8 pp.

ABSTRACT: Current practices to protect birds of prey in the Lumpy Ridge Area from interactions with climbers and the encroachment of human development on raptor habitat is discussed. This evaluative report is based on field observations. Lumpy Ridge is one of the few areas where managers have tried to evaluate disturbance behaviors in raptors from climbers at different proximities. Report also covers disturbance to golden eagles.

10. Cymerys, M. & Walton, B. J. (1988). *Raptors of the Pinnacles National Monument: Past and present nesting and possible impacts of rock climbers*. (Technical Report No. 30). Davis, CA: Cooperative National Park Resources Studies Unit, University of California at Davis.

ABSTRACT: "This investigation was initiated to provide the Pinnacles National Monument (PNM) staff with baseline information needed to (1) begin formulating management decisions concerning conflicts between climbers and raptors and (2) to assess the possibility of reintroducing California condors and peregrine falcons to PNM. Field research was conducted from April to June 1984. Although no conflicts between raptors and climbers were observed in 1984, this study showed that a potential for conflict is present. Management recommendations include: monitoring both active raptor nest sites and climbing activity; designate areas to be used solely by nesting raptors (no climbing areas); decide whether to protect raptor territories in heavily used climbing areas; educate climbers and other visitors about the vulnerability of nesting raptors; include guidelines about raptor nesting in the PNM "rock climbing policy and guidelines"; and any proposed trail construction or habitat management should be evaluated for impacts on raptors prior to initiation".

11. Gander, H. & Ingold, P. (1997). Reactions of male alpine chamois (*Rupicapra r. rupicapra*) to hikers, joggers and mountain bikers. *Biological Conservation* 79, 107-109.

ABSTRACT: This study, conducted in the Augstmatthorn game reserve in the Bernese Oberland, Switzerland, explored the responses of male alpine chamois to the recreational activities of hiking, jogging, and mountain biking. Researchers conducted 32 experiments (12 hiking, 10 jogging, 10 mountain biking) by a single person which required jogging, riding or walking on a trail crossing a pasture frequented by chamois. One of four responses was recorded for the first chamois below the trail (alert distance, escape distance, distance fled, site of refuge). Results indicated that all three recreational activities had a similar influence on habitat used by male chamois. Chamois fled over longer distances when exposed to jogging and mountain biking, but only in experiments carried out late in the morning. This finding suggests that chamois may

lose a part of their habitat depending on trail density and recreational use in a specific area.

12. Hicks, L. L. & Elder, J. M. (1979). Human disturbance of Sierra Nevada bighorn sheep. *Journal Wildlife Management*, 43 (4), 909-915.

ABSTRACT: The interaction of hikers and California bighorn sheep (*Ovis canadensis californica*) were investigated in the Baxter Pass area of the John Muir Wilderness Area, Sierra Nevada Mountains, CA. Researchers used a variety of techniques to observe the interaction of sheep and people. Findings indicated that the herd is not declining due to differing environmental preferences by both hikers and sheep. Management recommendations include continuing current regulations with increased restrictions on off trail hiking and alteration of the Baxter Pass trail to route hikers away from areas frequented by sheep.

13. Holmes, T. L., Knight, R. L., Stegall, L. & Craig, G. R. (1993). Responses of wintering grassland raptors to human disturbance. *Wildlife Society Bulletin* 21, 461-468.

ABSTRACT: This study was conducted during the winter, in northern Weld County, Colorado, on land dominated by private ranches and farms growing winter wheat and alfalfa. Flushing responses and flush distances were recorded for 6 species of raptors (American kestrels, merlins, prairie falcons, rough-legged hawks, and golden eagles) as a result of walking and vehicle disturbance. Findings revealed that walking disturbances resulted in more flushes than vehicle disturbance for all species except prairie falcons. Other differences in flushing responses and distances were also noted among species. For walking disturbances a linear relationship existed between flight distance and body mass, with lighter species flushing at shorter distances. This finding was not supported for vehicle disturbances. Management plans should be tailored to each species, habitat, and season. In addition, management plans can offer different restrictions based on disturbance type. Buffer zones can become more effective if placed around foraging areas as well as nest sites.

14. Knight, R. L. & Cole, D. N. (1991). Effects of recreational activity on wildlife in wildlands. *Transcripts of the 56th North American Wildlife & Natural Resources Conference* (238-246).

ABSTRACT: The authors summarize the influence of recreation on wildlife by reviewing the existing literature. Through this process the authors develop a hierarchy of responses of wildlife to recreation. Factors that influence the nature and magnitude of these responses is also presented and discussed. Conclusions concerning causal mechanisms, wildlife responses, and factors that influence responses are presented. Suggestions for future research are also discussed.

15. Knight, R. L. & Skagen, S. K. (1988). Effects of recreational disturbance on birds of prey: A review. In R. L. Glinski et al. (Ed.), *Proceedings of the Southwest Raptor Management Symposium and Workshop* (pp. 355-359). Institute of Wildlife Research, National Wildlife Federation Scientific and Technical Series No. 11.

ABSTRACT: A review of the literature on the effects of recreational activity on birds of prey is presented. Recreational activities can disrupt normal raptor activity by (1) altering their distribution, (2) disrupting nest attentiveness patterns, (3) causing abandonment of breeding territories, (4) reducing productivity, and (5) affecting foraging behavior. Mitigating these problems may be accomplished by restricting public access to raptor habitat or developing management plans that allow humans and raptors to coexist. The need for future research is presented and discussed.

16. Lanier, J. W. & R. A. Joseph. (1989). Managing human recreational impacts on hatched or free-nesting peregrines. In B. G. Pendelton (Ed.), *Proceedings of the Northeast Raptor Management Symposium and Workshop* (pp.149-153). Institute of Wildlife Research National Wildlife Federation Scientific and Technical Series No. 13.

ABSTRACT: This case study focuses on the human-peregrine problems resulting in interference with either the hacking program or with free nesting adults in New Hampshire's White Mountains (Owl's Head, Cannon Mountain, Holt's Ledge, Cathedral Ledge). Two of the four case studies, Cannon Mountain and Cathedral Ledge address climbing activity. Authors describe the conflicts for each area and provide an analysis.

17. Ream, C. H. (1980). *Impact of backcountry recreationists on wildlife: An annotated bibliography*. (General Technical Report INT-84). Ogden, UT: United States Department of Agriculture Forest Service Intermountain Forest and Range Experiment Research Station.

ABSTRACT: An annotated bibliography and evaluation of the literature on the effects of backcountry recreationists on wildlife. Literature was gathered from biological, managerial, sociological, and popular publications. Orientation includes descriptions of impacts and methods of reducing impacts of recreationists on wildlife.

18. Richardson, C. T. & Miller, C. K. (1997). Recommendations for protecting raptors from human disturbance: A review. *Wildlife Society Bulletin*, 25 (3), 634-638.

ABSTRACT: This comprehensive literature review examines the importance of establishing buffer zones to protect raptors from recreational activity. The authors begin by identifying the need for nest site protection. These guidelines focus on site specific information, source or type of disturbance, and prior disturbance history of individual raptors. Recommendations for spatial and temporal buffers are also presented. Two useful tables' (1) summarizing recommendations for spatial and temporal buffer zones and (2) flushing distances for a variety of raptors are included.

19. Richardson, K., Mohler, S. & Fowler, M. (1997). *The City of Boulder Mountain Parks raptor management program*. Unpublished manuscript, Boulder Mountain Parks, Boulder, CO. 10 pp.

ABSTRACT: A historical overview of the City of Boulder, Colorado Mountain Parks Division raptor management approach. Up to seven areas serve as cliff nesting raptor sites annually. These areas are also popular for rock climbing. Information on climbing use patterns is described as a background to the management approach.

20. Romin, L. A. & Muck, J. A. (1999). *Utah field office guidelines for raptor protection from human and land use disturbance*. Unpublished manuscript, United States Fish and Wildlife Service, Utah Field Office, Salt Lake City, UT. 40 pp.

ABSTRACT: The guidelines presented in this document were prepared in cooperation with federal, state, tribal, and private organizations with an interest in raptor issues. The purpose of these guidelines is intended to provide an advisory framework for consistent raptor management approaches throughout the state of Utah. Information presented is comprehensive. Major headings focus on: regulatory authority, resource identification, potential level of impacts to raptor populations guidelines for habitat management, avoiding and minimizing impacts, mitigating unavoidable impacts, and nest and roost site protection. This manuscript also includes an extensive literature review.

21. The Peregrine Fund. (1996). *Guide to management of Peregrine Falcons at the eyrie*. T. J. Cade, J. H. Enderson & J. Linthicum (Eds.). Boise, ID: The Peregrine Fund. 97 pp.

ABSTRACT: This manual provides guidance to agency personnel and other individuals who may need information about the techniques, procedures, and the biological and practical considerations, involved in management and care of Peregrine Falcons at their eyries. Specific references regarding climber cooperation in survey work (pg. 8), seasonal climbing restrictions (pg. 67) and education outreach (pg. 68) are included.

22. Therres, G. D. (1988). Protecting raptor habitat on private lands through voluntary agreements. In M. N. Lafranc & M. B. Moss (Eds.), *Northeast Raptor Management Symposium and Workshop* (pp. 197-201). Washington, DC: National Wildlife Federation.

ABSTRACT: "Much of the raptor habitat in the Northeastern United States is under private ownership. To ensure healthy raptor populations in this region, protection and maintenance of habitat on private lands is necessary. This paper addresses alternatives to acquisition or conservation easements for protecting raptor habitat on private lands. Voluntary, cooperative agreements between the landowner and the state wildlife agency or other conservation organizations can effectively protect raptor habitat. The following areas are presented and discussed: (1) habitat management plans, (2) signed cooperative agreements, (3) registry programs, and (4) tax incentive programs. Both advantages and disadvantages of the various agreements are discussed.

23. White, D. (1999). Potential energetic effects of mountain climbers on foraging grizzly bears. *Wildlife Society Bulletin*, 27 (1), 146-151.

ABSTRACT: "Most studies on the effects of human disturbance on grizzly bears (*Urcos horribilis*) have not quantified the energetic effects of such interactions. In this study, researchers characterized activity budgets of adult grizzly bears as they foraged on aggregations of adult army cutworm moths in Glacier National Park, MT, during 1993, 1994, and 1995. Activity budgets of climber-disturbed bears were compared to those of undisturbed bears to estimate the energetic impact of climber disturbance. When bears detected climbers they subsequently spent 53% less time foraging on moths, 52% more time moving within the foraging area, and 23% more time behaving aggressively, compared to when they were not disturbed. It was estimated that grizzly bears could consume approximately 40,000 moths/day. At 0.44 kcal/moth, disruption of moth feeding costs bears approximately 12 kcal/minute in addition to energy expended in evasive maneuvers and defensive behaviors. To reduce both climber interruption of bear foraging and the potential for aggressive bear - human encounters, researchers recommend routing climbers around moth sites used by bears or limiting access to these sites during bear use periods".

24. Whittaker, D. & Knight, R.L. (1998). Understanding wildlife responses. *Wildlife Society Bulletin*, 26 (2), 312-317.

ABSTRACT: The authors review the definition of basic terms (attraction, habituation, and avoidance) and concepts of wildlife responses to humans in this opinion article. Three issues are identified that wildlife professionals should consider when working in the area of human – wildlife interactions: (1) wildlife responses and causality, (2) response events or response tendencies, and (3) evaluation of wildlife responses.

## VEGETATION

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Vegetation can be disturbed through climbing activity, particularly in heavily used areas or where environmental factors cause vegetation to be more susceptible to damage from human presence. Effects are concentrated at points of high use including the base of climbs, on belay ledges, or on cliff tops. The influence of climbing on cliff vegetation has received a limited amount of attention from researchers. Much of the research has been directed towards cliff environments in Canada, the Midwestern United States, southern California, and Wyoming. Attention has been focused on the impacts to unique cliff plant communities and the effects of trampling.

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25. Camp, R. J. & Knight, R. L. (1998). Effects of rock climbing on cliff plant communities at Joshua Tree National Park, California. *Conservation Biology*, 12 (6), 1302-1306.

ABSTRACT: Plant communities were compared on climbed and unclimbed cliffs in Joshua Tree National Park, CA. Six cliffs each with no climbing, moderate climbing and intensive climbing were sampled for plant diversity and community structure. Results indicated that the number of individual plants decreased with increased climbing use both on and off the cliff face. Management approaches are recommended to help minimize the effects of rock climbing on plant communities including closures, limiting access, initiation of monitoring programs, and other indirect management measures.

26. Farris, M. A. (1998). The effects of rock climbing on the vegetation of three Minnesota cliff systems. *Canadian Journal of Botany* 76, 1-10.

ABSTRACT: The distribution and abundance of major plants on unique cliff systems found in three Minnesota State Parks (Blue Mounds, Interstate, and Tettegouche State Parks) were investigated to determine the influence of recreational rock climbing on that vegetation. Each of the cliff systems examined differed significantly in the amount and type of vegetation present in undisturbed plots. Both climbed and unclimbed plots were studied. Findings suggested that the frequency of most plants were lower in climbed areas, although differences were generally not significant. In all three locations, total plant cover was significantly lower. In addition to human activity, causal links between human disturbance and vegetation structure must include a careful assessment of the many factors that influence human and vegetation dynamics.

27. Kelly, P. E. & Larson, D. W. (1997). Effects of rock climbing on populations of pre-settlement eastern white cedar on cliffs of the Niagara. *Conservation Biology*, 11 (5), 1125-1132.

ABSTRACT: Investigators explored the effects of rock climbing on populations of pre-settlement eastern white cedar on the cliffs of the Niagara Escarpment, Canada. Findings revealed that living tree density on the cliff face was lower in climbed areas vs. unclimbed areas. In addition, age structures of the forests revealed that the numbers of older and younger age classes have fallen on climbed rock faces vs. unclimbed faces. Trees damaged by humans were also evident on climbed rock faces. Recommendations and management implications are presented.

28. Larson, D. W. (1990). Effects of disturbance on old-growth *Thuja occidentalis* at cliff edges. *Canadian Journal of Botany*, 68, 1147-1155.

ABSTRACT: *Thuja occidentalis* (eastern white cedar) is common along cliff edges and faces of the Niagara Escarpment in southern Ontario, Canada. This species tends to decline in frequency away from the cliff edge. This study was initiated to investigate the influence of hiking and climbing on several stand characteristics of this species (age, size, stem number, size, and mass; average annual productivity, and change with increasing distance from cliff edge in the presence of disturbance). In undisturbed areas most of these characteristics declined in value away from the cliff edge. In disturbed areas their values increased. Results suggest that active regulation of hiking

and climbing is an important consideration. Also, the presence or absence of trampling by hikers and climbers resulted in significant changes in many of the stand characteristics listed.

29. Malkin, D. R. (in progress). *Effects of rock climbing on populations of *Silene seelyi*, a rare perennial plant*. Master's thesis, University of Washington, Seattle. (expected completion May 2000)

ABSTRACT: "This study evaluated the effects of rock climbing and aspects of the biology of *Silene seelyi*, a herbaceous plant endemic to the Wenatchee Mountains of Washington, USA. Restricted to cliffs and rock outcrops, this plant's distribution centers around the town of Leavenworth, a popular traditional and sport climbing destination. Total cover of *Silene seelyi* was measured and indexed to a measure of available habitat in transects established on climbed and unclimbed rockfaces. This index of plant cover per unit of available habitat was compared among climbed and unclimbed faces using nonparametric statistical tests. Climbed rock faces supported significantly less cover of *S. seelyi* per unit of available habitat. Size distributions and germination experiments suggested that climbing disproportionately impact the early life stages of *S. seelyi*. However, a considerable portion of each occurrence of *S. seelyi* existed outside of habitat judged likely to be climbed. This, and the numerous previously unknown occurrences documented during this study, suggests that there is no pressing need for regulatory measures regarding *S. seelyi*."

30. Monz, C. A., Cole, D. N., Johnson, L. A., & Spildie, D. R. (1994). Vegetation response to trampling in five native plant communities in the Wind River Range, Wyoming. *Bulletin, Ecological Society of America*, 75, 158.

ABSTRACT: "The response of five native vegetation types (woody and herbaceous forest understories, a subalpine meadow, alpine grass community and an alpine fellfield) to two years of applied trampling was investigated. Sites were located between an elevation of 2800m and 3200m in the Wind River Range located in central Wyoming. Experimental plots were subjected to trampling during the middle of the growing season at the rate of 25, 75, 200, and 500 passes, with the exception of the alpine fellfield and the alpine grass community. Each of these areas received 800 and 1000 passes respectively. Results indicated that alpine communities exhibited the least decrease in plant cover while both forest understory communities showed significant decreases with as little as 25 passes. Intense trampling resulted in nearly 100% vegetation loss in some forest understory plots. Soil penetration resistance increased significantly in both forest understory sites, but did not respond to trampling at other sites. Statistical analysis revealed significant changes in plant community structure in all vegetation types, with low levels of trampling affecting forest understory communities and higher levels affecting the subalpine meadow and alpine communities".

31. Nuzzo, V. A. (1995). Effects of rock climbing on cliff goldenrod (*Solidago sciaphila* Steele) in Northwest Illinois. *The American Midland Naturalist*, 133 (2), 229-241.

ABSTRACT: This study examined the influence of climbing on cliff goldenrod on currently climbed, previously climbed, and unclimbed cliffs. Findings revealed that position (where plants were growing) on the rock face were the most significant factor affecting growth. Climbing activity on the upper portion of the cliff reduced lichen cover and species by half and significantly reduced goldenrod density. To protect this species, priority should be given to the upper 3m of the cliff, since this is where 70% of the plants are located.

32. Nuzzo, V. A. (1996). Structure of cliff vegetation on exposed cliffs and the effect of rock climbing. *Canadian Journal of Botany*, 74, 607-617.

ABSTRACT: Limestone cliffs in northwest Illinois were investigated to determine what, if any impact rock climbing had on cliff vegetation. Results indicated that climbing significantly reduced lichen cover and species, but did not have an effect on vascular vegetation.

33. Overlin, A., Chong, G. W., Stohlgren, T. J. & Rodgers, J. (1999). *Vertical veg: Partnership project to address resources protection and quality visitor experience in rock climbing areas of Joshua Tree National Park*. Unpublished manuscript, United States Department of the Interior, National Park Service, Joshua Tree National Park, Twentynine Palms, CA. (in cooperation with the Access Fund and the California Native Plant Society).  
34 pp.

ABSTRACT: "The objective of Project Vertical Veg was to develop a long-term vegetation inventory and monitoring (I&M) system for high visitor use areas within Joshua Tree National Park through a community partnership approach. Human influence on cryptobiotic soil crusts and plant cover in relation to rocky outcrops that are popular climbing areas were addressed. Related management issues include 1) a need to manage social trails, 2) a lack of baseline data and a system for long term monitoring of soil and vegetation adjacent to boulder formations, 3) a lack of outreach to the climbing community regarding resource impact issues, 4) the need for baseline data on park species of concern, and 5) the need for baseline data on exotic plant species. The I&M system is based on stratified random sampling using large multi-scale plots for collection of soils and vegetation data. In 1999, 30 plots were established. 124 native plant species were encountered (6 are of concern), and 8 exotic plant species. Overall, native vegetation and cryptobiotic soil crusts were negatively affected by disturbance. However, simple delineation of trails and the development of outreach materials on minimizing visitor impacts hold great potential to reduce negative impacts. This report recommends that park managers continue to monitor vegetation and soil crusts, work

closely with park users, and modify management as necessary to insure the protection of plant and soil resources”.

34. Parikesit, P., Larson, D. W. & Matthes-Sears, U. (1995). Impact of trails on cliff edge forest structure. *Canadian Journal of Botany*, 73, 943-953.

ABSTRACT: Plant community structure and soil characteristics were studied along the forested cliff edges of the Niagara Escarpment, southern Ontario, Canada. The primary purpose of this study was to differentiate between the effects of two gradients on vegetation structure: the environmental gradient between the cliff edge and dense forest and an anthropogenic gradient generated by the presence of major hiking trails parallel to the cliff edges. Species frequencies were determined along 69 transects distributed over eight sites with different amounts of past and present trampling. Data analysis revealed that soil characteristics were the primary influence organizing the vegetation of cliff-edge forests and that soil properties and plant community structure were strongly influenced by human factors versus the environmental gradient. Trampled and cliff edge plots shared common properties. Trails with intermediate use exhibited a greater number of plants. Abandoned trails resulted in the restoration of species richness. Soil properties did not recover, even after ten years of trail abandonment. Results suggest that the current cliff edge use is non-sustainable and reversing its effects on the cliff edge forest structure may take a significant length of time.

35. Petit, C. W. (1999, April 12). Clinging to life: Cliffs are hazardous to humans but prove surprisingly hospitable to tiny, ancient trees. *U. S. News & World Report*, 127, pg. 49.

ABSTRACT: A short article describing the unique ecosystem of the Niagara cliff escarpment that extends from the Great Lakes into southern Ontario, Canada. Rock climbing is mentioned as a possible threat to cliff ecology.

36. Pyke, K. (1998). *Beneficial effects of climbing on endemic plant species and cooperative ventures on a nationally protected conservation site, Avon Gorge (South Side), Bristol, UK*. Unpublished manuscript, British Mountaineering Council. 4pp.

ABSTRACT: This case study shows how climbing can be compatible with managing a conservation site to protect rare plant communities. Management issues are listed for the formerly livestock grazed cliffs which support 37 nationally and regionally listed rare plants found on open limestone cliff ledges and slopes. Beneficial effects from climbers are described in preventing scrub encroachment and facilitating seed dispersal. An understanding of the pattern and the effects of climbing together with expert knowledge about the plants growing requirements have allowed these conclusions to be made.

37. Spear P. W. & Schiffman, M. J. (1979). Rock climbing and endangered plants: A case study. *In Proceedings of the Specialty Conference, National Conference on*

*Recreation Planning and Development* (pp. 630-636). New York, NY: American Society of Civil Engineers.

ABSTRACT: The potential influence of climbers in Franconia Notch, NH on plant species proposed for protection under the Endangered Species Act is discussed in this case study. The conflict between damage to plants and their habitat versus the freedom of climbers is outlined. Recommendations to mitigate this problem are discussed.

52. Stohlgren, T. J., Chong, G. W., Kalkhan, M. A. & Schell, L. D. (1997). Rapid assessment of plant diversity patterns: A methodology for landscapes. *Environmental Monitoring and Assessment*, 48, 25-43.

ABSTRACT: A rapid, cost - efficient methodology was developed to connect plant diversity surveys from plots to landscapes using (1) unbiased site selection based on remotely sensed information; (2) multi-scale field techniques to assess plant diversity; (3) mathematical models to estimate the number of species in larger areas corrected for within type heterogeneity; and (4) mathematical techniques total species richness and patterns of plant diversity in a landscape. This methodology was demonstrated in an area located in Rocky Mountain National Park. Benefits of this multi-faceted approach produce valuable information on the patterns of native plant species and keystone ecosystems and can be easily adapted for other natural environments.

## SOCIAL IMPACTS

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Social impacts effect an individual's recreation experience through the interaction with or the behavior of others (climber-to-climber or climber-to-non-climber). A growing number of climbing related social impacts have been reported. The documentation of social impacts can be subjective and influenced by personal values and aesthetics. The literature in this section focuses on: visitor conflicts, safety, improper disposal of human waste, dogs, and crowding at climbing sites.

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39. Berl, L. T. & Chilman, K. C. (1980). A typology of rock climbers and the perceptions of conflict and safety at Giant City State Park, Illinois. *In Proceedings of the Conference on Social Research in National Parks and Wildland Areas* (pp. 62-66). Knoxville: University of Tennessee, Department of Forestry, Fisheries & Wildlife.

ABSTRACT: An early study focusing on the development of a typology of rock climbing activities, climber characteristics, and activity sequences related to the typology. Also includes identification of perceived conflicts occurring among climber types and other visitors, and management approaches to enhance climber safety. Results identified five distinct climber types and reported minimal conflict. Management should monitor "scramblers", since this group is prone to the most accidents and injuries.

40. Botkin, M. A. (1985). *Crowding tolerances and preferences for climbers at Seneca Rocks, West Virginia: A comparative study*. Unpublished doctoral dissertation, University of Maryland, College Park.

ABSTRACT: A total of 416 respondents were surveyed using an on-site questionnaire to examine crowding tolerances and preferences of beginner to expert rock climbers. Findings indicated that a climber's tolerance and preference to crowding lowers as one's experience with the sport increases. In addition, tolerances and preferences for crowding among an individual vary according to the sport of participation (climbing, backpacking, canoeing). The final set of findings suggested that crowding tolerances and preferences differed from corresponding measures for separate, independent samples of hikers and canoeists. Seneca Rocks respondents, whether climbing, backpacking, or canoeing, had lower tolerance and preference scores for crowding than the other independent studies.

41. Cilimburg, A., Monz, C. & Kehoe, S. (1997). *Wildland recreation and human waste: A review of problems, practices and concerns*. Unpublished manuscript, National Outdoor Leadership School, Lander, WY. 31 pp.

ABSTRACT: "This paper reviews the state-of-knowledge regarding pathogens and human waste disposal in dispersed backcountry recreation areas in the United States. Of concern is the impact of travelers such as backpackers, backcountry skiers, and mountaineers in areas where toilets are not provided. At this time, the magnitude of problems related to human waste disposal in wildlands is unclear. Aesthetics and water contamination with the resultant potential for disease transmission are the predominant issues. Few studies have analyzed the aesthetics of human waste disposal. In wildlands, contamination of water sources primarily originates from surface soil. The fate of enteric pathogens on or in soils is highly variable and dependent on the complex interactions of many factors, most importantly soil type, moisture, and temperature. It is difficult to make general recommendations that apply to all ecosystems. There are a number of studies, which allow the manager or visitor to come up with specific practices that are the best for their area. The preferred method of disposal remains to dig a small hole (cat hole) and bury the waste. Other site-specific methods are also discussed. Treatment of drinking water has become standard practice for most backcountry travel. With such treatment, there is little evidence currently to suggest that the health hazard to humans is great enough to impose further regulation in areas currently using catholes".

42. Shaw, S. (1999, March 15). Doggie dilemmas. *Climbing*, 163, pp. 152, 150.

ABSTRACT: A series of guidelines for managing dogs at climbing sites is presented. *Climbing* is a national rock-climbing magazine, published eight times a year.

43. Stableford, T. (1999, February 1). The last great problem: Crowds. *Climbing*, 182, p. 14 .

ABSTRACT: Editorial comment about crowding at popular climbing areas and practices climbers can undertake to help mitigate crowding problems. *Climbing* is a national rock-climbing magazine, published eight times a year.

## ECONOMIC IMPACTS

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A limited number of studies have been undertaken exploring travel cost valuation and economic impacts on communities where rock climbing is a significant recreation activity. Demands for goods and services can provide financial opportunities for local businesses.

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44. Cavlovic, T. A., Berrens R. P., Bohara, A., Jakus, P. & Shaw, W. D. (2000). *Valuing the loss of rock climbing access in wilderness areas: A national level random utility model*. Unpublished manuscript, Department of Economics, University of New Mexico, Albuquerque.

ABSTRACT: “The public management of rock climbing access in wilderness areas is an issue of considerable national controversy in the U.S. A proposed rule change by the U.S. Forest Service (USFS) would prohibit the use of fixed climbing protection in wilderness areas effectively eliminating safe access to many sites. Changing the USFS's position on rock climbing in wilderness areas requires that a *prima facie* case be made. This requires substantiating evidence that the USFS proposal constitutes a major regulatory change and imposes significant economic losses on climbers that warrant consideration in a benefit-cost analysis (BCA). If rock climbing in wilderness areas is a privilege and not a right, then the proposed policy change does not constitute a regulatory taking. However, federal agencies face some constraints on their ability to make major regulatory changes. According to Executive Orders 12866 and 12291, if the proposed change results in an annual loss of \$100 million, the USFS would be restricted in its ability to make new rationing rules without a full BCA. Using a unique data set on rock climbing trips, a repeated nested logit random utility model is used to analyze the economic losses to climbers resulting from the USFS proposal. Results indicate that economic losses to climbers exceed \$100 million annually, and thus the USFS proposal may indeed constitute a major regulatory change. Additional evidence shows that losses increase significantly as more sites are removed from climbers' choice sets. Such an analysis is relevant if the USFS proposal has expected precedent-setting effects on other public land agencies.

45. Ekstrand, E. R. (1994). *Economic benefits of resources used for rock climbing at Eldorado Canyon State Park, Colorado*. Unpublished doctoral dissertation, Colorado State University, Ft. Collins.

ABSTRACT: This study surveyed climbers to determine the value of rock climbing resources. Travel cost and contingent valuation methods used data collected from questionnaires to value resources. Four models were estimated using the travel cost method, comparing continuous and discrete distribution assumptions. Consumer surplus values were estimated for these values.

46. Espey, J., Longhurst, J., Lopez, J. & Shaw, W. D. (1998). *Rock climbing access and the Red Rock Canyon National Conservation Area*. (Cooperative Extension Fact Sheet 98-50). Las Vegas: University of Nevada, Cooperative Extension.

ABSTRACT: A mail back opinion survey designed to collect data on the reaction of proposed rule changes and implementation of user fees at the Red Rock Canyon National Conservation Area was sent to 284 rock climbers. A total of 119 climbers responded. Climbers' reaction to the user fee was mixed. A small percentage (15%) indicated a negative response, while 45% "didn't care". 88% stated they took the same number of trips before and after the fee was imposed. When asked to respond to questions regarding rule changes, 89% strongly disagreed with the statement "climbers could not use existing fixed anchors." 37% strongly disagreed with the statement "climbers would be allowed to do whatever they wish in regard to bolting, including power drills." Approximately one-third said they would take slightly less trips to Red Rock Canyon if the BLM adopted an anchor ban. Authors speculate that possible economic impacts to the community may be realized if the proposed rule changes take place.

47. Shaw, W. D. & Jakus, P. (1996, October). Travel cost models of the demand for rock climbing. *Agricultural and Economics Review*, 131-142.

ABSTRACT: Surveys were mailed to 2500 Members of the Mohonk Preserve, New York. Of the 892 surveys returned, 220 indicated they visited the Preserve primarily for rock climbing. Data were collected from this group of climbers. Information included number of trips taken to the preserve, as well as trips to other climbing areas. Usable trip and travel cost data were obtained from 183 respondents. From this data, three models were developed to estimate demand for rock climbing. Models included a multiple site choice model, a trip frequency model for one site, and a combined multiple site choice/total seasonal trips frequency model. Empirical demand models and consumer surplus estimates are also presented.

48. Cordell, H. K. and others. (1999). *Outdoor recreation in America: A national assessment of demand and supply trends*. Champaign, IL: Sagamore Publishing. 449 pp.

ABSTRACT: A comprehensive assessment of the current and future trends of outdoor recreation demand and supply are presented. New and different aspects of national

demand, similarities to the past, and trends in the supply of outdoor recreation opportunities, both from the private and public sectors are examined. In addition, short papers from academic specialists, public agency personnel, recreation user groups, and industry groups are also included. Useful tables and statistics on participation trends on a variety of outdoor recreation activities are also presented. Multiple references to rock climbing.

49. Vossler, C., Shaw, W. D., Hilger, J., Peterson, M., & Mitchell, G. (1997). *The economic and recreational importance of rock climbing and recreation at the Red Rock Canyon National Conservation Area: Preliminary study results*. (Cooperative Extension Fact Sheet 97-12) Las Vegas: University of Nevada, Cooperative Extension.

ABSTRACT: This study examined the influence of imposed rock climbing regulations on the economic value of rock climbing and other forms of recreation at Red Rocks Canyon National Conservation Area. Attention is given to the ban on the placement of new permanent anchors and whether or not the benefits of this ban outweigh its potential negative impacts on rock climbers and the Las Vegas economy. The results of this study demonstrate the economic and recreational importance of Red Rock. A ban on the use of fixed protection suggests important consequences for climbers and negative impacts on the local economy.

## CLIFF ECOLOGY

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The literature cited in this section focuses on the effects of climbing on cliff environments rather than research on specific wildlife or plant species (listed elsewhere in this bibliography). Recent publications highlight the uniqueness of such habitats that have been shown to support relic or unusual flora and fauna associations.

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50. Driese, K. L. & Roth, D. A. (1992). *A description of the vascular flora and mammal fauna and the effects of human disturbance on the summit of Devils Tower*. Unpublished manuscript, University of Wyoming, Laramie. 19 pp.

ABSTRACT: "An investigation was undertaken to understand the influence of increased climber usage on the summit of Devils Tower National Monument, WY. Data gathered from this study will serve as a baseline for monitoring the summit in the future and as a means of identifying areas that have been impacted. Vegetation and small mammals were surveyed at three times over the summer, 1992. Twenty-one plant species were identified, including grasses, shrubs, and forbs. Total vegetative cover is 51%. Three small mammal species were identified including the deer mouse, bushy tailed wood rat, and the yellow-pine chipmunk. No reptiles were observed on the summit. One area of severe human impact and several of moderate impact were identified and mapped. Management recommendations include steps to protect and restore areas already damaged and climber education to help mitigate future impact".

51. Giuliano, W. The impact of hiking and rock climbing in mountain areas. *Environmental Conservation*, 21 (3), 287-279.

ABSTRACT: The impact of tourism on the Alps is discussed. The high number of visitors (overcrowding), the effects of trampling, litter, disturbance to wildlife (ungulates and raptors), damage to soils and alpine vegetation, and the integrity of the alpine environment (fixed anchors) are briefly discussed. It is recommended that research studies and programs be initiated that will “provide a firm foundation on which to base precise rules for the practice of sport in natural surroundings, so as to ensure that the environment does not suffer and that its natural evolution is not jeopardized”.

52. Graham, L. & Knight, R. L. (1999). *Bird and plant communities associated with cliffs in Jefferson County, Colorado*. Unpublished manuscript, Colorado State University, Department of Fishery and Wildlife Biology, Fort Collins.

ABSTRACT: “Jefferson County, Colorado, found along the Front Range of the Rocky Mountains just west of Denver, is experiencing an increase in population. Many of those arriving are attracted to the environmental and recreational amenities that Colorado has to offer. With the growth in population, recreational use has increased. This in turn has placed a heavy burden on open space lands. Jefferson County occupies a narrow and unique band between the plains and the mountains. Canyons running west into the mountains bisect the area. These canyons contain large numbers of cliffs. Little is known of the role that these cliffs play in enhancing the region's bird and plant species richness and biological diversity. However, these cliff areas are facing increasing pressure with a rise in the popularity of recreation in the area. Open Space personnel are faced with the task of balancing recreational needs with the needs of the plants and wildlife that depend on these areas. To address the need for more information regarding cliff plant and bird communities, a study was undertaken to increase the current knowledge of cliff ecology and aid in decisions on cliff management. The cliffs sampled in this study are unclimbed and all on south-facing hillsides. The objectives of the study are as follows. 1) To determine whether the plant and bird communities associated with cliffs differ from similar areas without cliffs. 2) To determine whether differences in cliff height, cliff length, cliff verticality, and face complexity are correlated with differences in plant and bird communities. No results exist as the data are currently being analyzed”.

53. Jodice, P., Pyke, K. & Davidson, S. (1999, April, 16). *Science*, pg. 434.

ABSTRACT: This article was written in response to the item by Krajick [(1999, March 12). Scientists and climbers discover cliff ecosystems. *Science*, 283, 1623-1625]. The response by the Access Fund highlighted national sites with climbing restrictions to protect cliff vegetation and wildlife. Cooperative projects with resource managers, education outreach, and research partnerships by the Access Fund were also mentioned.

54. Kelly, P. E. (1998). Environmental stewardship along the Niagara Escarpment. *The Canadian Alpine Journal*, 81, 79-81.

ABSTRACT: The Cliff Ecology Research Group at the University of Guelph has been conducting research in this area of southern Ontario, Canada since 1985. During this period a variety of plants and animals have been cataloged. This unique cliff environment is also exposed to human disturbance, primarily through hiking and rock climbing activities. While these activities have some impact on cliff vegetation and animal life, they can be compatible activities with this environment. To maintain the integrity of this resource it is recommended that the climbing community take the initiative to educate its members about the Niagara Escarpment. Emphasis should be placed on discouraging new routes. Trees and other vegetation on the cliff face should not be removed, and trees should not be used as rappel or belay anchors. Recent conversations with climbers indicate a high awareness about conservation issues.

55. Knoll, M. (in progress). *Soil compaction due to rock climbing and hiking activity at cliff margins on the Southern Cumberland Plateau, Tennessee*. University of the South, Department of Forestry and Geology, Sewanee, TN.

ABSTRACT: "This investigation focuses on the southern Cumberland Plateau of Tennessee and includes the popular climbing areas of the Tennessee Wall, Foster Falls, Stone Door, and the University of the South Domain at Sewanee. The purpose of this project is to 1) quantify the degree of soil compaction due to rock climbing, rappelling, and hiking at cliff bases and tops, 2) characterize the alteration of soil profiles and structures due to each activity, and 3) determine the total area of impact of each activity. Soil bulk density will be measured under trails and climbing and rappelling staging areas. Results will be compared to control samples from the adjoining, undisturbed forest floor. Soil profiles from former and latter locations will be also be investigated.

56. Krajick, K. (1999, March 12). Scientists and climbers discover cliff ecosystems. *Science*, 283, 1623-1625. [see reaction to this article: Young, W. (1999, November 1 ). *Climbing*, pg. 44-45.]

ABSTRACT: This two page news article discusses the uniqueness of cliff ecosystems and the influence that climbers are placing on raptor nest sites and cliff vegetation (trees, lichen, and other rare plants).

57. Larson, D. W., Matthes, U. & Kelly, P. (1999, September-October). Cliffs as natural refuges. *American Scientist*, 411-417.

ABSTRACT: The authors provide an overview of the origins of cliff ecology research from its beginning at the turn of the century to its current status. Highlighted are studies conducted on the Niagara Escarpment, Ontario, Canada. Cliff ecosystems are unique

environments that support a diversity of plants (including ancient tree species) and animals. Rock climbing is mentioned as a possible threat to this ecosystem.

58. Larson, D. W., Matthes, U. & Kelly, P. (1999). *Cliff Ecology*. Cambridge, UK: Cambridge University Press.

ABSTRACT: This book reviews information about the geology, geomorphology, microclimate, flora and fauna of both sea and inland cliffs. Human influence and disturbance (including rock climbing) are also included. For the first time evidence is presented to suggest that cliffs worldwide may represent an invaluable type of ecosystem, consisting of some of the least disturbed habitats on earth and contributing to the biodiversity of a region that their surface coverage would indicate. An important resource for ecologists studying this unique habitat and of interest to others curious about this previously under researched environment.

59. McMillan, M. (in progress). *The effect of recreational rock climbing on the flora and land snail fauna of the Niagara escarpment in southern Ontario, Canada*. Master's thesis, University of Guelph, Ontario, Canada.

ABSTRACT: "The exposed cliffs of the Niagara Escarpment support an old growth forest dominated by *Thuja occidentalis*. This study was conducted in an attempt to determine the effects of rock-climbing on the cliff-face and surrounding community. Sampling was conducted from a total of 150 1m x 2m quadrants located within 50 transects, 25 of which were climbed and 25 of which were unclimbed. Quadrants were sampled from the plateau, cliff-face and talus slope of each transect. Analysis of variance indicated that climbing had a significant negative impact on abundance, percent cover, richness and diversity of vascular plants and bryophytes. Climbing did not influence the percent cover of lichens, but richness was significantly lower in climbed areas. Land snails showed a significant decline in abundance, richness and diversity with climbing. Based on these results, it is recommended that rock-climbing in southern Ontario be allowed to continue in pre-existing climbing areas, but that the establishment of new climbs should not be permitted. The most effective method for the preservation of the cliffs will be through educating climbers about the impact of their sport on the cliff-face community".

## MANAGEMENT

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This section offers insight into the management of rock climbing and resource protection of the cliff environment. Topics covered in this section include: fixed anchors, legal liability, wilderness, the resource inventory process, management approach towards different types of climbing opportunities, mitigation actions, managing the visitor experience, and the development of climbing management plans.

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60. Access Fund. (in progress). *Model climbing management plan*. Boulder, CO: Access Fund. (estimated 200 pp. Available from the Access Fund, approximately October 2000).

ABSTRACT: Guidance on how to produce a climbing management plan, an overview on climbing activity and its effects on natural resources, and a detailed analysis of management options for preventing and mitigating climbing impacts.

61. Access Fund. (in progress). *How to produce a climbing management plan*. Boulder, CO: Access Fund. (estimated 40 pp. Available from the Access Fund, approximately June 2000)

ABSTRACT: A summary document that provides information on how to develop a climbing management plan.

62. Access Fund. (1999). *Restoration, conservation and policy proposal for rock climbing - McConnells Mill State Park, Pennsylvania*. Boulder, CO: Access Fund. 25 pp.

ABSTRACT: A report documenting types of climbing, use patterns, and resource interactions at a very popular Pennsylvania State Park with multi-recreation use. The document outlines and restoration management approach for 2 areas; one showing extremely heavy use, another where proactive management measures are designed to reduce impacts in a sensitive area experiencing increasing use. Techniques proposed include relocating parking areas, rerouting approach paths, installing fixed anchors to protect cliff edge vegetation, erosion stabilization at the cliff base, and supporting education, outreach, and signage. **Note: This document is posted on web site: <http://www.geocities.com/millsbouldering/accessfund/>**

63. Access Fund. (1999). *Access & Conservation: The access fund membership handbook*. Boulder, CO: Access Fund. 38 pp.

ABSTRACT: The Access Fund is a national non-profit organization dedicated to keeping climbing areas open and to conserving the climbing environment. This membership handbook includes an outline on how to address climbing access problems, a list of volunteer regional coordinators, an overview of U. S. land management agencies, minimum rock climbing practices, and getting involved as an "access activist".

64. Access Fund. (1995). *Climbing in wilderness. An inventory of recreational climbing use in the National Wilderness Preservation system*. Unpublished manuscript, Access Fund, Boulder, CO. 62 pp.

ABSTRACT: This manuscript is a comprehensive compilation of climbing history and current activities in designated and proposed wilderness areas throughout the United States. Information for the Climbing in Wilderness Database was gathered through a variety of sources (*Rock 'n Road: Rock Climbing Areas of North America*, guidebooks,

resource managers, and climbers). Through a multiple page introduction, the author briefly discusses related issues, including climbing in Wilderness, and the fixed anchor controversy. A short section on fixed anchors is also presented. Based on the author's findings, fixed anchors are used in only 15% of all wilderness areas. Climbing with or without fixed anchors, occurs in only 30% of all wilderness areas.

65. Access Fund. (1993, September). *The Access Fund position paper on the regulation and management of fixed anchors in wilderness*. Unpublished manuscript, Access Fund, Boulder, CO. 21 pp.

ABSTRACT: A comprehensive response by the Access Fund to the National Park Service Advance Notice of Proposed Rulemaking and the U. S. Forest Service Draft regulations on Fixed Anchors in Wilderness. Provides federal agencies with guidance in preparing climbing management and wilderness management plans and policies regarding the use of fixed anchors in wilderness

66. Achey, J. (1998, November). Access denied. *Climbing*, 180, 75-80, 140-145.

ABSTRACT: The author explores the United States Forest Service fixed anchor ban. Consequences, questions, reactions, and future concerns are presented. Good source of information. Many of the issues surrounding the use of fixed anchors in wilderness is also discussed. *Climbing* is a national rock-climbing magazine, published eight times a year.

67. Archer, C. J. (1995). *Survey of legal issues affecting climbing*. Presented at the Access Fund regional Coordinator Summit, November 10-12, 1995. Unpublished manuscript, Access Fund, Boulder, CO. 16 pp.

ABSTRACT: An overview of pertinent legal terminology, premises liability (invitee, licensee, trespasser); limitations on landowner liability (recreational use statutes, assumption of risk, releases and waivers, government immunity acts); forming a local or non-profit climbing organization; and miscellaneous legal issues (trespassing, insurance).

68. Attarian, A. (1999). Collaborative resource management: The Stone Mountain project. *Parks and Recreation*, 38 (7), 75-79.

ABSTRACT: Collaborative management between agencies and special interest groups is gaining popularity as a means of managing and protecting our nation's natural resources. The primary goal of collaborative resource management is to enhance and maintain natural resources in ways that support the objectives of interest groups and resource managers. This article describes a unique and successful collaborative project undertaken by the North Carolina Division of State Parks and a grassroots

organization, the Carolina Climbers' Coalition to replace aging fixed anchors on Stone Mountain (State Park, NC).

69. Attarian, A. (1999). *Factors influencing responsible rock climbing behavior*. Unpublished manuscript, The American Alpine Club, Golden, CO. 28 pp.

ABSTRACT: The primary purpose of this study was to investigate the factors related to responsible rock climbing practices. Rock climbers who climbed in the New River Gorge National River (NERI) from April through August 1997 were contacted to gather relevant data for this study. From these contacts, 287 usable postal addresses were collected. The mail-back questionnaire indicated that 92% of climbers contacted responded that they were satisfied to extremely satisfied with their climbing experience on the day they were interviewed. Most encouraging was the finding that climbers exhibited positive behaviors towards the 23 Leave No Trace (LNT) practices and behaviors listed. However, it is not known to what extent knowledge of responsible LNT skills and behaviors are translating into better behavior at climbing sites. Almost half (44%) of the climbers reported being a member of at least one climbing or environmental organization. An overwhelming number of climbers (93%) read at least one climbing related publication. This finding suggests that rock-climbing publications may be a convenient way for resource managers and others to convey important LNT information to climbers. Almost every climber (98.6%) felt that they should share the responsibility of maintaining climbing areas. One fourth of the climbers indicated that they had participated in annual maintenance projects sponsored by NERI. An additional 64% had participated in volunteer projects at other climbing areas. This finding should prove promising to resource managers, since this provides managers with a source of possible volunteers for maintenance projects. Additional demographic information is presented. Management implications and needs for future research are also discussed.

70. Attarian, A. (1996). Re-establishing a clean climbing ethic. In R. Koesler & R. Watters (Eds.), *Proceedings of the 1995 International Conference on Outdoor Recreation and Education*. (pp. 97-104). Pocatello, ID: Idaho State University.

ABSTRACT: This paper places emphasis on how outdoor educators can teach and reinforce the principles and practices of clean climbing (or minimum impact rock climbing). A variety of strategies, including role modeling, climber education, teachable moments, and service are presented.

71. Attarian, A. (1994). *Management strategies for reducing climbing related impacts*. Unpublished manuscript, North Carolina Department of Environment, Health and Natural Resources, Division of Parks and Recreation, Raleigh, NC. 33 pp.

ABSTRACT: Resource managers from federal, state and local climbing areas were contacted to provide information on direct and indirect management techniques used to mitigate climbing related impacts. A collection of these techniques are presented and discussed.

72. Attarian, A. (1992). An investigation of the ecological and social impacts caused by rock climbers. In C. Rademacher & R. Watters (Eds.), *Proceedings of the 1991 International Conference on Outdoor Recreation and Education*. (pp. 7-16). Pocatello, ID: Idaho State University Press.

ABSTRACT: Resource managers from 14 federal, state and local climbing areas were contacted to provide information on climbing related issues. Information received revealed observable effects to soil, vegetation, wildlife, and other recreationists. Current management practices undertaken by resource managers to help reduce impacts were also identified.

73. Attarian, A, & Kascenska, J. (1991). *A program for environmental ethics among climbers: Implications for managers*. Paper presented at the 1991 Southeastern Recreation Research Symposium, Asheville, NC. 22 pp.

ABSTRACT: Resource managers from major Southeastern climbing areas were asked to provide information on the impacts caused by rock climbers. Information received from resource managers revealed both social and environmental impacts. The secondary purpose of this study was to collect and synthesize information to develop an audio-visual program to foster a minimal impact-climbing ethic. Management implications are presented and discussed.

74. Baker, B. (1999). Controversy over use of rock-climbing anchors may be missing the mark. *Bioscience*, 49 (7), 529.

ABSTRACT: This short article briefly discusses the proposed United States Forest Service rule to ban fixed anchors in wilderness. Selected researchers comment on the effects of climbing on cliff environments. Solutions to climbing issues are also presented and include the continuation of research, education of the public about the potential effects of rock climbing, and restricted access to unique cliff environments.

75. Blackwell, S. D. (1999). *Environmental impacts of rock climbing in Yosemite Valley, Yosemite National Park*. Unpublished master's thesis, San Diego State University.

ABSTRACT: "This study tracks and maps the physical impacts of climbing in Yosemite Valley, California, perhaps the most prominent climbing area in the United States. This investigation is a series of surveys designed to chronicle physical impacts in staging areas, approach trails, and at the base of climbs. The results are recorded and graphed. Statistical analysis is conducted comparing findings with a 1992 National Park Service Draft Climbing Management Plan to identify what areas are most affected and what characteristics are most common. The research methodology is described in detail and can be applied to other landscapes. Findings can be used to direct education and remedial efforts."

76. Cairo, J. A. & Cobb, T. L. (1998). Integrating technical rock climbing into protected area management: A case example of Minnewaska State Park preserve, New York State. In H. G. Vogelsong (Ed.), *Proceedings of the 1997 Northeastern Recreation Research Symposium* (pp. 282-284). Radnor, PA: United States Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.

ABSTRACT: This paper describes the creation of a climbing management plan implemented by the New York State Office of Parks, Recreation and Historic Preservation. In order to accommodate rock climbing within the legal framework of the Minnewaska State Park Preserve, a management plan addressing three key issues was developed. These included (1) resource protection (maintaining the ecological integrity of the area), (2) safety and rescue (accident prevention and preparation for emergency situations), and (3) administrative operations (developing a management system for administering the program).

77. Cole, D. L. & Knight, R. L. (1990). Impacts of recreation on biodiversity in wilderness. In *Proceedings of a Symposium on Wilderness Areas: Their Impact* (pp. 33-40). Logan: Utah State University.

ABSTRACT: Seven recreational impacts on biodiversity in wilderness areas are presented and briefly discussed. These include: (1) trail construction, (2) trampling of vegetation and soils on trails and campsites, (3) collection and burning of firewood for campfires, (4) pollution of surface water through camping activities, (5) unintentional harassment of wildlife, (6) hunting, fishing and associated management programs, and (7) grazing by recreational packsack. These influences can be considered detrimental, since each alters the natural processes and functions of ecosystems.

78. British Mountaineering Council. (1999). *Recommendations for the redevelopment and first ascent of rock climbing routes in alpine regions*. Manchester, UK: British Mountaineering Council.

ABSTRACT: A draft proposal from the UIAA to establish ethical guidelines for the redevelopment (placement of fixed protection) of rock climbing routes.

79. Bremer, J. (1985). *Management recommendations for rock climbing at Seneca Rocks*. Unpublished manuscript, Potomac Ranger District, Monongahela National Forest, WVA.

ABSTRACT: Climbers, Seneca Rocks resource managers, and resource managers from other climbing areas were contacted to determine their perceptions on social and environmental impacts, safety concerns, management issues, commercial use, and liability considerations. Findings suggested that use levels were within acceptable limits, conflict between visitors was minimal, commercial use was not a problem, and search and rescue operations were adequate. Study findings also revealed that camping and sanitation facilities were inadequate and a better system of conveying information to

climbers was needed. Recommendations to mitigate these problems are presented and discussed.

80. DeBenedetti, S. (1990). *Impacts of rock climbing and mitigation actions taken at Pinnacles National Monument*. Paper presented at the George Wright Society Conference on Research and Resource Management in Parks and Public Lands, El Paso, TX. 13 pp.

ABSTRACT: Impacts attributable to rock climbing in Pinnacles National Monument (PNM), CA are identified and briefly discussed: (1) disturbance to cliff nesting birds, (2) erosion and disturbance to vegetation, (3) effects to rock, (4) aesthetics, and (5) safety. Management actions undertaken by PNM are presented and discussed.

81. Doucette, R. (1999). *Erosion control and trail rehabilitation plan, Crow Hill, Leonminster State Forest, MA*. Unpublished manuscript, Boston, MA. 7 pp. (Available from the Access Fund)

ABSTRACT: An example of a detailed analysis and grant application to the Access Fund seeking funding to initiate erosion control and trail improvements at Crow Hill, MA a popular climbing area.

82. Ellis, M. (1999). The development of a cooperative climbing management plan at Stone Mountain State Park, North Carolina. In D. Harmon (Ed.) *On the Frontiers of Conservation: Proceedings of the Tenth Conference on Research and Resource Management in Parks and on Public Lands*. (pp. 58-60). Hancock, MI: The George Wright Society:

ABSTRACT: This paper focuses on the implications of the Stone Mountain State Park (NC) Rebolting Project, a cooperative effort between the Carolina Climbers Coalition and the North Carolina Division of Parks and Recreation. The project resulted in a positive working relationship among the two groups and the development of a system-wide climbing management policy and fixed anchor replacement protocol. Recommendations for effective collaboration are also presented.

83. Freeman, M. S., McAvoy, L. H., & Lime, D. W. (1997). *Characteristics, perceptions, and management preferences of rock climbers at Mount Rushmore National Memorial*. Research Summary, Cooperative Park Studies Unit, University of Minnesota College of Natural Resources, St. Paul, MN. 8 pp.

ABSTRACT: This summary report investigates a number of research questions: (1) Characteristics of Mt. Rushmore's rock climbers and how they use the park. (2) What are rock climber's perceptions of crowding in the park's climbing areas? (3) What are the most significant problems encountered by rock climbers in the park? and (4) What management actions do rock climbers support and oppose? Selected results are presented and discussed.

84. Ferguson, J. F. (1995). *Rock climbing and the geology of the Wichita Mountains, Oklahoma. A report prepared for the Wichita Mountains Climbers' Coalition.* Unpublished manuscript, University of Texas at Dallas. 31 pp. (Available from the Access Fund)

ABSTRACT: This report details the geologic history and petrologic make-up of the Wichita Mountains, located in southwest Oklahoma. The author discusses rock weathering and erosion, and the effects of rock climbing and climbing anchors on the integrity of the geological resource.

85. Genetti, C. & Zenone, P. (1987). *The effect of rock climbers on the environment at Pinnacles National Monument, Monterey and San Benito counties, California.* (Technical Report No. 27). Davis, CA: Cooperative National Park Resources Studies Unit, University of California at Davis.

ABSTRACT: "Forty six rock formations containing 103 climbing routes at Pinnacles National Monument, California were assessed for the effects of climbing on vegetation, soil erosion, and raptors. Access trails to the climbs were mapped and use frequency estimates were gathered to determine climbing patterns throughout the Monument. Surface and visual impacts on rock faces were also noted. Roughly 32 percent of the climbs were assessed and results show that substantial damage to vegetation and erosion has resulted at areas of higher climber usage. Removal of vegetation on access trails and staging areas and consequent loss of topsoil have resulted in gullies over 128 cm (4 ft) deep in places. Two sensitive plant species were also being impacted. Management alternatives have been described with the objective of offsetting existing and potential impacts and monitoring future use patterns and rates of impact".

86. Hollenhorst, S. J. (1987). *The relationship between specialization and characteristics, behaviors, and preferences of selected rock climbers.* Unpublished doctoral dissertation, The Ohio State University, Columbus.

ABSTRACT: The purpose of this study was to identify user characteristics, behaviors, and preferences related to the recreation specialization of rock climbers. Eighty-four subjects were selected from eight climbing sites that exhibited different social and ecological characteristics. Data were collected using behavioral observations and self-report techniques. Using a variety of univariate and multivariate techniques, expertise was found to be significantly related to social group context, use density of the site, and years of rock climbing experience, frequency of participation in lead rock climbing, and participation in other risk activities. Findings support the notion that outdoor recreationists can be arranged on a continuum of recreation specialization and that distinctly different participant characteristics, behaviors, and preferences attend each level. Management implications are presented and discussed.

87. Huffman, M. G. & Harwell, R. (1991). Park manager's attitudes towards climbing: Implications for future management. In C. Birmingham & K. Schuler (Eds.),

*Association for Experiential Education: 1991 Conference Proceedings and Workshop Summaries* (pp. 137-142). Boulder, CO: The Association for Experiential Education.

ABSTRACT: The relationship of resource managers' attitudes towards rock climbing as possible reasons for using regulations to managing rock climbing activity is explored in this study. Managers were asked to compare the use of rock climbing regulations to other outdoor recreation activities from three perspectives: environmental effects, potential visitor conflicts, and issues related to legal liability and search and rescue operations. Findings suggested that climbing as well as other outdoor recreation activities would be regulated equally, with the exception of search and rescue operations. Strategies for mitigating regulations and or prohibition of climbing are presented.

88. Hutchison, M. F. (1998). *Climbing and fixed anchor reference manual: Wichita Mountains Wildlife Refuge, Oklahoma*. Unpublished manuscript, Wichita Mountains Climbers' Coalition, Norman, OK. (Available from Wichita Mountains Wildlife Refuge, OK)

ABSTRACT: This manual is a detailed summary document produced by a grass roots climbing organization to educate and inform a land management agency on the sport of rock climbing, and some of the current issues affecting this sport. This manual contains sections on (1) current management information relevant to the Wichita Mountains Wildlife Refuge (WMWR), (2) discussion on fixed anchors in wilderness, (3) photographs, illustrations, and information on removable vs. fixed anchors, (4) rock climbing and the Wichita Mountains, (5) the City of Rocks, ID resource study, (6) fixed anchor and wilderness articles and (7) documents concerning management initiatives and other issues related to rock climbing at the WMWR.

89. Jakus, P. M. & Shaw, W. D. (1997). Congestion at recreation areas: Empirical evidence on perceptions, mitigating behavior and management preferences. *Journal of Environmental Management*, 50, 389-401.

ABSTRACT: Both on-site and mail back surveys were utilized to collect data from member and non-members of the Mohonk Preserve, New York. The use of these surveys allowed comparison of perceived (on-site) congestion with expected or anticipated (mail respondents) congestion. Statistical analysis provides data on perceptions, mitigating behavior and management preferences to stress the importance of the difficulties related to the empirical analysis of congestion. Evidence is offered that may be of value to individuals constructing measures of congestion for use in an observed behavioral model. Managers may also find this information useful, especially those that implement a quota or permit system or charge entry fees.

90. Jakus, P. M. & Shaw, W. D. (1996). An empirical analysis of rock climbers' response to hazard warnings. *Risk Analysis*, 16 (4), 581-586.

ABSTRACT: This study field-tests the hazard warning system used in rock climbing. The system is concise, since it distinguishes between magnitudes of hazard and establishes a "warnings vocabulary" (G, PG, R, X). The model also includes an "individualizing factor" which influences the likelihood and severity of injury as independent variables. The model suggests that climbers consider personal probability of injury, thus incorporating the hazard warning when choosing routes. In addition, climbers with higher technical ability are more likely to climb hazardous routes, but reduce the likelihood of the hazardous outcome by reducing the technical difficulty of the route chosen. The response increases with the degree of hazard involved.

91. Kuss, F. R., Graefe, A. R. & Vaske, J. J. (1990). *Visitor impact management: A review of research*. Washington, DC: National Parks and Conservation Association.

ABSTRACT: This comprehensive document seeks to explain the theory behind visitor impact relationships as currently understood and defined through scientific study. Contents include a review of the literature on the influence of recreation on vegetation and soils; water resources; wildlife; and the recreation experience. A summary of research findings, future research needs, management implications, and references are also presented.

92. Leung, Y. F. & Marion, J. L. (1996). Trail degradation as influenced by environmental factors: A state of the knowledge review. *Journal of Soil and Water Conservation*, 51 (2), 130.

ABSTRACT: Authors clarify the terminology used in trail condition research, assess the development of trail condition research, review and summarize the influence of environmental factors on trail degradation. Also includes a comprehensive bibliography.

93. MacDonald, D. (1997). *The journalists guide to climbing: A resource for reporters, editors, and producers*. Boulder, CO: Outdoor Recreation Coalition of America. 12 pp.

ABSTRACT: This guide produced by the Climbing Sports Group is designed to assist writers, journalists, and other interested individuals in the preparation of articles and stories on the sport of rock climbing. Key terminology, practices, types of climbing, equipment, and information sources are presented and defined.

94. Marion, J. L. (1991). *Developing a natural resource inventory and monitoring program for visitor impacts on recreation sites: A procedural manual*. (Technical Report NPS/NRVT/NRR-91/06). United States Department of the Interior, National Park Service Cooperative Park Studies Unit, Virginia Polytechnic University, Blacksburg, VA.

ABSTRACT: Evaluating and initiating a natural resource inventory and monitoring program for visitor impacts on recreation sites, reviewing an existing program, developing monitoring procedures, documentation protocols, conducting the fieldwork and developing analysis and reporting procedures are presented and discussed in this thorough manual.

95. McAvoy, L., Freeman, M. & Lime, D. (1997). Rock climbers, specialization and management alternatives. *Abstracts of the Paper and Poster Presentations at the 1997 Leisure Research Symposium, 1997 National Recreation and Parks Association Congress*, 76.

ABSTRACT: "The purpose of this study was to explore the influence a rock climber's level of specialization has on his or her preference for rock climbing management alternatives. The underlying premise on which this study was based suggests that as one's level of specialization increases, acceptance and support for rules, norms, and procedures associated with climbing will likely increase. 353 climbers at Mt. Rushmore National Monument completed an onsite questionnaire. Results showed no significant differences between level of specialization and perceptions on crowding. When compared to less specialized climbers, highly specialized climbers were less supportive of proposed management actions, educational material provided by management agencies (information on minimum impact techniques, safety issues, climbing ethics), and indicated less support for proposed management actions for bolting. Highly specialized climbers tended to support more cooperative management efforts that involved climbing organization input and educational messages that originated within the climbing community (vs. managers). Results suggest that resource managers utilize the specialization research to assist them in making management decisions and how to include climbers when making management decisions".

96. Merrill, K. & Grafe, A. (1997). The relationship between activity specialization and preferences for setting and route attributes of selected rock climbers. In H. G. Vogelsong (ed.), *Proceedings of the 1997 Northeastern Recreation Symposium* (pp. 282-284). Radnor, PA: United States Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.

ABSTRACT: The purpose of this study was twofold: (1) develop and operationalize the concept of recreation specialization as it relates to rock climbing and (2) investigate preferences for the physical characteristics of rock climbing routes and the general recreation setting. Implications for management are presented and discussed.

97. National Outdoor Leadership School (1997). *Leave no trace skills and ethics series (vol. 8 rock climbing)*. Boulder, CO: Leave No Trace, Inc. 16 pp.

ABSTRACT: Seven Leave No Trace principles are listed and applied to rock climbing environments. Jointly prepared with the Access Fund.

98. Nickel, J. (1994, September/October). No shit! *Rock & Ice*, 63, pp. 26-28.

ABSTRACT: The problems of disposing solid human waste on big walls, in backcountry and on snow and ice are discussed. Methods for disposal are presented and include "poop tubes", catholes, smearing, toilets, "pack it out", or burial in crevasses. *Rock & Ice* is a national rock climbing magazine, published nine times a year.

99. Red River Gorge Climbers Coalition. (1998). *Survey of the Martin Fork Area, Red River Gorge Geological Area*. Unpublished manuscript, Daniel Boone National Forest, Lexington, KY. 5 pp. (Available from the Access Fund)

ABSTRACT: A detailed study recording distribution of rock climbing activity in a sport climbing area over an entire season. Methodology developed can be applied elsewhere. Findings: The number of individual climbers is a reflection of standard of climb, ease of approach and parking access, and the overall popularity of climbing. It is a multi-factor issue and requires management by determination of Limits of Acceptable Change through development of a climbing management plan.

100. Rocky Mountain National Park (1990). *Task force findings: Climbing in Rocky Mountain National Park*. Unpublished manuscript, Rocky Mountain National Park, Estes Park, CO.

ABSTRACT: This document briefly describes the history of climbing in Rocky Mountain National Park, some of the problems and causes associated with climbing, strategies to manage climbing, research and project needs. The following areas are also presented: raptors and other birds, mammals, vegetation, impacts of soil and rock, and sociological impacts.

101. Schuster, R. M. (under review). An exploration of conflict issues within the rock climbing community. *Journal of Park and Recreation Administration*.

ABSTRACT: "This study was designed to determine whether there was a significant conflict within the rock climbing community, especially on the issue of fixed anchors. The objective of this study was to provide information on and management of conflicts in recreation settings, while assisting in the management of rock climbing areas. This research attempts to verify and understand conflict within the climbing community resulting from the increase in the number of climbers, the diversity of users' backgrounds, and their differing means of participating in the activity. A factor analysis confirmed the existence of three of the Jacob and Schreyer (1980) factors associated with goal interference related conflict; it also identified a fourth factor (status). Two areas of conflict were identified: 1) conflicts within the climbing community and 2) conflicts between climbers and land managers. Results from this study suggests that sport climbers (high ability level and high level of participation) were likely to perceive the least amount of conflict. Traditional climbers (high ability, low frequency participation) were more likely to perceive the greatest amount of conflict. The use of fixed anchors contributed to the largest difference of opinion between the two groups. Both inter-group and intra-group conflicts were identified. Management implications: 1). Managers responsible for administering climbing resources should be aware of sub-groups, their characteristics, conflicting views, and be aware of the group dynamics associated with social conflict; 2) the use of fixed anchors while a philosophical view of climbers presents a unique challenge for managers which should be addressed".

102. Swineford, S. (1994, July/August). Chalk talk. *Rock & Ice*, 62, pp. 24-25.

ABSTRACT: An overview of chalk use is presented and discussed. The author also presents ways to minimize the visual impact created by chalk use. Recommendations include using a chalk-ball to eliminate chalk spills and waste, the use of colored chalk to match the rock color or mix soil from the base of the climb with white chalk; or consider using chalk substitutes. Regardless of the approach taken, efforts should be made to clean-up chalk residue upon completing a climb. This practice is being followed in Eldorado State Park, CO. Climbers are encouraged to remove chalk residue when rappelling or when being lowered from top-rope routes. Clean-up days have also been organized, especially on high-use or popular routes. *Rock and Ice* is a national rock climbing magazine published 9 times a year.

103. Toula, T., (1995). *Rock n' road: Rock climbing areas of North America*. Evergreen, CO: Chockstone Press. 469 pp.

ABSTRACT: The most current and summarized guide for rock climbing areas in North America. Climbing areas are listed alphabetically by state and their resources identified: state/province maps, climbing type, rock type, grades, height, quantity of rock, development, cliff aspect, season, ownership, camping, quality, driving directions, classics, references, star rating, and notes.

104. Trench, K. & Wallace, G. N. (1994). Norms held by rock climbers for different settings in Joshua Tree National Monument. In C. Sydoriak (Ed.), *Wilderness, The Spirit Lives: 6<sup>th</sup> National Wilderness Conference* (pp. 78-90). Los Alamos, NM: Bandelier National Monument.

ABSTRACT: The goal of this study was to 1) examine climbers' motivations and preferred experience outcomes; 2) examine the setting and management preferences of climbers, the norms they assign to each setting, and 3) the degree of wilderness dependency of the climbing that occurs at Joshua Tree National Monument (JTNM). Researchers implemented a stratified random sample, utilizing both on-site and mail-back surveys to collect data from 650 rock climbers. A mail-back response rate of 68.7% was achieved, with 457 returns. Results indicated that climbers gave high motivation to viewing the scenery, being close to nature, and being in an area where nature is protected over time. Competing with others, gaining recognition from others and pioneering new routes least motivated them. Climbers supported the following management practices: allowing the replacement of bolts in the frontcountry, no glue, epoxy or other adhesives, and increasing information on climbing routes. Climbers were opposed to no more bolting in wilderness, removal of all slings and protection (except bolts), and no more power drills in all areas of JTNM. Implications for management are presented and discussed.

105. Vaske, J. J. & Donnelly, M. P. (1999). *Generalizing the encounter, crowding, norm relationship*. Paper presented at the 1999 Congress on Recreation and Resource Capacity, Aspen, CO. 4 pp.

**ABSTRACT:** “This paper explores the hypothesis that when encounters exceed a visitor’s tolerance limit (norm) for seeing others, crowding will increase. Data from 11 studies, representing 53 evaluation contexts (one type of user encountering another) conducted across the United States were examined. Activities included both water (canoeing, rafting, kayaking, tubing, motorboating, and angling) and land-based activities (CLIMBING, day hiking, mountain biking, wildlife viewing, and hunting). Measures of recreation encounters were asked to indicate the number of individuals they remembered seeing in different evaluation contexts. A 9-point Likert scale (1= “not crowded at all” – 9 “extremely crowded”) was used to measure crowding. A single item measure asked respondents to stipulate the highest number of encounters they would tolerate for a given situation by completing the statement “OK to have as many as \_\_\_ encounters per day”. Impact acceptability curves were generated for each evaluation context. These curves were used to define each individual’s tolerance norm. Results in 48 of the 53 evaluation contexts indicated when encounters exceeded normative tolerance limits, crowding increased.

106. Waldrup, R., & McEwen, D. (1994). Rock climbing and wilderness: A study of climbers' attitudes toward wilderness, climbing impacts, and regulation. *Trends*, 31 (3), 38-42.

**ABSTRACT:** A survey of 356 climbers was conducted within the Red Rock Canyon National Conservation Area (NV) to gather information on climbers' attitudes towards wilderness and climbing impacts, their motivations for choosing a place to climb and their preferences for management regulations. Climbers were contacted on site or in a local climbing shop and asked to complete a questionnaire. Results suggested that three distinct groups represented climbers: traditional, sport, and modern climbers (combination traditional and sport). Attitudes towards climbing impacts, motivations, and management regulations varied according to group. Additional comparisons are made and management implications presented and discussed.

107. Wallace, G. N. & Trench, K. (1996). *A study of rock climbers in Joshua Tree National Park: Implications for the Visitor Experience and Resource Protection (VERP) management framework*. Unpublished manuscript, Joshua Tree National Park, Twentynine Palms, CA.

**ABSTRACT:** On-site interviews and mail back questionnaires were used to gather information on climber characteristics; climber motivations and preferred experience outcomes; setting preferences; attitudes of climbers towards park and wilderness values; climbers perceptions towards crowding or conflict among climbers; evaluate existing and proposed management practices. Additional data were collected to judge future trends in climbing and associated impacts in Joshua Tree National Park. Recommendations are presented and discussed.

108. Yosemite National Park (1987). *Climbing impacts in Yosemite: A preliminary assessment*. Unpublished manuscript, Yosemite National Park, CA. 10 pp.

**ABSTRACT:** This preliminary report was undertaken to determine if park management should be concerned about climbing related impacts and if a more detailed investigation might be warranted. Information was gathered through interviews with park staff, managers from other national park units, one state park, and a review of articles and opinion columns in climbing magazines. Recommendations are also presented.

## **FEDERAL & AGENCY CLIMBING AND GENERAL MANAGEMENT PLANS**

### **MEMORANDUM OF UNDERSTANDING**

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The following is a list of agency documents that address climbing specifically or as part of a general management plan. Many of the documents remain in draft versions. In some of the climbing management plans, topics are covered in far greater detail than in others. In shorter documents the issues addressed have been highlighted. Readers are directed to the more comprehensive documents for a thorough discussion on climbing issues.

A Memorandum of Understanding (MOU) or Agreement (MOA) is a written understanding that frames a cooperative relationship between two or more parties. The MOU works to define the common interests that parties share. It also defines the way they will work together to reach common goals. These documents can cover a range of objectives, from very broad partnership and stewardship responsibilities to very specific applications, such as land acquisition. Documents may be obtained from the agency or organization listed.

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### **Federal & Agency Climbing and General Management Plans**

109. Acadia National Park (1997). *Final climbing management plan/finding of no significant impact*. Unpublished manuscript, United States Department of Interior, National Park Service, Bar Harbor, ME. 9 pp.

**ABSTRACT:** A source of information on collaboration, education, and outreach, on cliff nesting raptor restrictions.

110. American Mountain Foundation. (1993). *Shelf Road climbing area site management and development study*. Unpublished manuscript, Rocky Mountain Field Institute, Colorado Springs, CO. 17pp.

ABSTRACT: Report to local authority and Bureau of Land Management about management options for vehicle access, camping, and education materials for a site, which has experienced a rapid transition into a sport, climbing area. Also contains a 2-page description on how a sport climb is established.

111. Big South Fork National River and Obed Wild and Scenic River. (1997). *Climbing management plan*. Unpublished manuscript, United States Department of the Interior, National Park Service, Oneida, TN. 17 pp., w/ glossary.

ABSTRACT: Provides management direction for two popular climbing areas in the "Sandstone Belt." Addresses condition of natural and cultural resources, climbing techniques and equipment necessary for the area, mitigation and prevention of resource impacts, zoning (designated "developed" or "nondeveloped"), site closures, safety and liability, bolting, commercial guiding, permits for power drills, new route reporting, trails, maintenance of existing routes, rappelling, and creation of a climbing advisory group.

112. Cave Rock. (1999). *Cave Rock management direction, draft environmental impact statement*. Unpublished manuscript, United States Department of Agriculture, Forest Service, Lake Tahoe Basin Management Unit, South Lake Tahoe, CA. 117 pp. with glossary and appendices.

ABSTRACT: Analyzes possible changes in management direction for Cave Rock study area. Preferred planning alternative would "strike a balance between all those who consider Cave Rock important, while protecting the heritage resources in the area." Protects heritage values by reducing number of climbing routes, prohibiting establishment of new routes, prohibiting commercial activities, and developing climber education and outreach efforts to encourage use of alternative climbing sites. Cave Rock is a Traditional-Cultural Property nominated to the National Register for Historic Places.

113. Chickamauga and Chattanooga National Military Park (1998). *Final climbing management plan*. Unpublished manuscript, United States Department of the Interior, National Park Service, Fort Oglethorpe, GA. 25pp.

ABSTRACT: Establishes management direction and actions for Lookout Mountain/Sunset Rock. Closes some routes to protect historic viewshed. Authorizes placements of bolt top-anchors below rim of mountain to protect summit vegetation and soils. Sets group size limits, links future limits to success of efforts to protect and restore natural resources. Directs park staff to analyze potential for use fees. Urges voluntary trailhead registration by climbers for monitoring purposes. Provides for inventory of all climbing anchors, prohibits new fixed anchors and use of power drills without NPS approval.

114. City of Rocks National Reserve, Idaho. (1988). *City of Rocks National Reserve climbing management plan and finding of no significant impact*. Unpublished

manuscript, United States Department of the Interior, National Park Service, Almo, ID: 77pp.

ABSTRACT: One of the most comprehensive climbing-specific management plans available. Addresses historic values (Oregon-California pioneer trail), safety issues, zoning, resource impacts (includes results of scientific studies), new route establishment, climber education and outreach, visitor use levels, climbing history commercial guiding, wildlife, scenic quality, and quiet.

115. Devils Tower National Monument (1995). *Final climbing management plan and finding of no significant impact*. Unpublished manuscript, United States Department of the Interior, National Park Service, Devils Tower, WY. 112 pp.

ABSTRACT: ABSTRACT: Precedent-setting management plan based on negotiations between NPS, climbers, and Native Americans. Aims to protect cultural values and climbing opportunities by establishing a "voluntary closure" to climbing during month of June each year. Also provides direction for management of resource impacts associated with climbing, including fixed anchors, trails, chalk, slings/webbing, plus restrictions to protect wildlife.

116. Eldorado Canyon State Park (1991). *Climbing management plan*. Unpublished manuscript, Eldorado Springs, CO: 15 pp.

ABSTRACT: One of the nation's first climbing management plans to be produced. Provides information on developing a climbing advisory group. Does not reflect current issues and management given current levels of use.

117. Grand Staircase-Escalante National Monument (1999). *Proposed management plan - final environmental impact statement*. Unpublished manuscript, Department of the Interior, Bureau of Land Management, Cedar City, UT. 246 pp.

ABSTRACT: Comprehensive plan. Addresses recreational effects on natural and cultural resources in a desert environment. Limited reference to rock climbing.

118. Granite Mountain Wilderness, Prescott National Forest, AZ. (1996). *Environmental assessment for the Granite Mountain Wilderness: decision notice and finding of no significant impact and pre-decision*. Unpublished manuscript, United States Department of Agriculture, Forest Service, Prescott, AZ. 125 pp., includes appendices & amendments.

ABSTRACT: Establishes management direction for placement and replacement of fixed anchors, implementation of Limits of Acceptable Change in allocation of Wilderness Opportunity Classes.

119. Joshua Tree National Park. (1998). *Supplement to the draft general management plan amendment supplemental environmental impact statement: Backcountry and wilderness management plan*. (climbing management, pp. 24-32). Unpublished manuscript, United States Department of the Interior, National Park Service, Joshua Tree National Park, Twentynine Palms, CA. 55pp.

ABSTRACT: Establishes park wide policy for climbing, including use of fixed anchors.

120. Mohonk Preserve ("the Shawangunks"). (1990). *Revised statement of rock climbing policy*. Unpublished manuscript, Mohonk Preserve Trust Board of Directors, New Paltz, NY.

5 pp.

ABSTRACT: Sets management policy and access requirements for climbing at this famous privately-owned area near New York City. Establishes policy for fees, user registration, facilities (parking, camping, trails, litter, and sanitation), environmental protection and responsibility of visitors, new routes and fixed protection, commercial operations.

121. New River Gorge National River (in progress). *Draft climbing management plan*. Unpublished manuscript, United States Department of the Interior, National Park Service, Glen Jean, WV. 35 pp.

ABSTRACT: Currently in progress. Due date 2000/2001. When completed will be comprehensive. Oriented towards visitor education and outreach, and a description of climber influences on natural resources.

122. North Carolina Division of State Parks (1997). *North Carolina State Parks climbing management plan*. Unpublished manuscript, Division of State Parks and Recreation, Raleigh, NC. 10 pp.

ABSTRACT: Addresses fixed anchor policy, staff responsibility, and collaborative management with grassroots climbers' coalition.

123. Red Rock Canyon National Conservation Area. (1999). *Proposed general management plan and draft environmental impact statement* (see "Recreation Management," pp. 47-51). Unpublished manuscript, United States Department of the Interior, Bureau of Land Management, Las Vegas, NV. 288 pp., w/out appendices.

ABSTRACT: Provides management direction for climbing use. Foundation of strategy is establishment of Climbers Liaison Council that helps with resource monitoring, review of new route proposals, bolting issues, trail maintenance. Addresses commercial climbing (guiding) issues, bivouacking, cultural resource and wildlife protection. Bolting in Wilderness policy subject to revision based on likely revision of BLM Interim Management Policy for Wilderness Study Areas.

124. Snow Canyon State Park, UT. (1988). *Resource management plan* (including 11 page Climbing management plan). Unpublished manuscript, State of Utah, Department of Natural Resources, Division of Parks and Recreation, Salt lake City, UT.

ABSTRACT: Provides detailed information on how to create a climbing work group to assist in the development of climbing policy and resource protection.

125. Spring Mountains National Recreation Area, Toiyabe National Forest. (1996). *Record of decision, final environmental impact statement, general management plan*. Unpublished manuscript, United States Department of Agriculture, Forest Service, Las Vegas, NV. Approximately 200 pp. in three documents.

ABSTRACT: Amends Land and Resource Management Plan for Toiyabe National Forest. Provides new management direction on Wilderness issues, ecosystem health and integrity, wildlife concerns, cultural values and archeological sites, public safety, user conflicts, commercial uses, establishment of new climbing routes, cooperative education and monitoring with climbing community, ability to monitor and enforce management guidelines. Adopts the "Choosing by Advantages" approach to decision-making.

126. State of Maine. (1994). *Climbing management policy*. Unpublished manuscript, State of Maine, Department of Conservation, Bureau of Parks and Recreation. 9 pp.

ABSTRACT: Sets policy for permission and management of technical rock climbing on state lands. Addresses resource impacts, safety and liability, visual impacts, carrying capacity, and commercial use. Establishes procedures for closures and restrictions.

127. Wichita Mountains Wildlife Refuge, OK. (1995). *Final environmental assessment for technical rock climbing: Decision notice and finding of no significant impact*. Unpublished manuscript, United States Department of the Interior, United States Fish and Wildlife Service, Indianahoma, OK. 26pp.

ABSTRACT: Report and assessment of the influence of rock climbing on natural resources. Covers wildlife, geology, riparian areas, vegetation, and socioeconomic issues. Provides general appraisal of environmental effects in a climbing area, and evaluation in relation to impacts from other types of recreation. Provides a model for dealing with fixed anchors, permission for new routes and fixed anchor replacements in a USFW refuge.

128. Yosemite National Park. (1993). *Draft climbing management plan Yosemite National Park..* Unpublished manuscript, United States Department of the Interior, National Park Service, Yosemite, CA.

ABSTRACT: Thorough consideration of environmental issues of climbing. Identifies and provides management approaches to a spectrum of environmental issues. Also

addresses the unique management considerations of big wall climbing. Draft plan never finalized or adopted.

### **Memoranda of Understanding**

129. Access Fund and the National Park Service, New River Gorge National River

**ABSTRACT:** The purpose of this MOU is to establish a framework of cooperation upon which the Access Fund and National Park Service (NPS) will work to establish permanent trailhead access points and facilities to NPS lands within New River Gorge National River in the vicinity of Nuttallburg Mine and Upper Endless Wall/Beauty Mountain areas.

130. Coronado National Forest and the Southern Arizona Climbers' Coalition

**ABSTRACT:** An arrangement between the Coronado National Forest and the Southern Arizona Climbers' Coalition (SACC) was initiated in order for the SACC to monitor peregrine falcon nest sites to assess occupancy and nesting success.

131. Rumney Climbers Association and the White Mountain National Forest

**ABSTRACT:** The Rumney Climber's Association has the sole responsibility for overseeing fixed anchors, erosion control, new route activity, trail maintenance, posting peregrine falcon closures, and monitoring the status of rare plants at this popular New Hampshire climbing area.

132. Shawnee National Forest and the Southern Illinois Climbers Alliance

**ABSTRACT:** The purpose of this MOU is to establish a cooperative framework upon which mutually beneficial programs, work projects, and rock climbing activities may be planned and implemented by the Forest Service and Southern Illinois Climbers Alliance working cooperatively at the local level.

133. Wichita Mountains Climbers' Coalition and the Department of Interior U. S. Fish and Wildlife Service Wichita Mountains Wildlife Refuge

**ABSTRACT:** The Wichita Mountain Climbers' Coalition will provide volunteer assistance to the Wichita Mountains Wildlife Refuge by (1) providing and advisory bolting committee, (2) educating and informing the climbing community about conservation issues, resource protection, leave no trace ethics, and stewardship philosophy, (3) assist refuge managers in monitoring the effectiveness of the FWS rock climbing management plan, (4) maintain all rock climbing areas free of trash or abandoned equipment, (5) remove excess gymnastic chalk from the rock as needed, and (6) work in partnership with the FWS.

## CLIMBING AREA AND RESOURCE INFORMATION BROCHURES

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Climbing area and resource information brochures usually range from single to tri-folded sheets or in some cases small booklets. Non-governmental organizations and educational groups in cooperation with management agencies usually produce these publications. Information contained in brochures focus primarily on specific climbing areas or addressing sensitive resource issues. Brochures are mainly used as management tools for education outreach on resource protection issues and are usually distributed free to visitors. Climbing area brochures usually provide the climber with a brief overview of the climbing area. Brochures that focus on addressing specific local resource issues provides the visitor with information on how to mitigate the potential impacts associated with the resource in question.

Information usually includes an area map, a list of guidelines on Leave No Trace practices, area rules and regulations, safety and emergency information, and information on where to camp, purchase food and supplies, vehicle parking and access points. Additional information usually includes a “climb smart” message, weather information, a list of guidebooks and local guide services, any seasonal closures, cultural and historical information, climbing etiquette, and any private property concerns.

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### Climbing Area Brochures

134. Bridal Veil Falls, CO  
*Bridal Veil Falls Climbing Information*  
Telluride Mountain Club  
Telluride, CO 81435
  
135. Devil's Lake State Park, WI  
*Rock Climbing Safety and Etiquette: Devil's Lake State Park, Wisconsin*  
Devil's Lake State Park  
S5975 Park Road  
Baraboo, WI 53913-9299  
608.356.8301
  
136. Eastern Sierra Mountains, CA  
*Climbing and staying around Bishop and the East Side of the Sierra (CA)*  
Wilson's Eastside Sports  
224 N. Main St.  
Bishop, CA 93514  
760.873.7520
  
137. Eldorado Canyon State Park  
*Climbing Guidelines: Eldorado Canyon State Park*  
Eldorado Canyon State Park  
P. O. Box Eldorado Springs, CO 80025

303.494.3943

138. Joshua Tree, CA  
*Climb Joshua Tree National Park*  
Joshua Tree National Park  
74485 National Park Drive  
Twentynine Palms, CA 92277  
760.367.5500
139. Minnewaska State Park, NY  
*Climbing in Minnewaska State Park Preserve*  
Minnewaska State Park Preserve  
P. O. Box 893  
New Paltz, NY 12561  
914.255.0752
140. Mohonk Preserve, NY  
*Climbing in the Mohonk Preserve*  
Mohonk Preserve at Mohonk Lake  
New Paltz, NY 12561  
914.255.0919
141. New River Gorge, WVA  
*Important Climber Information: New River Gorge National River*  
New River Gorge National River  
P. O. Box 246  
Glen Jean, WV 25846  
304.465.0508
142. Paradise Forks, AZ  
*Paradise Forks Climber Information*  
City of Williams/Kaibab National Forest Visitor Center  
200 W. Railroad Ave.  
Williams, AZ 86046  
520.635.4707
143. Pinnacles National Monument  
*Climbing at Pinnacles National Monument*  
Pinnacles National Monument  
Paicines, CA 95043  
408.389.4485
144. Red River Gorge, KY  
*Rock Climbing at the Red River Gorge: A Visitor's Guide to Rock Climbing at the Red River Gorge Geological Area and Surrounding Areas in Kentucky*  
Daniel Boone National Forest  
705 W. College Avenue  
Stanton, KY 40380  
606.663.2852

145. Rifle Mountain Park, CO  
*Rock Climbing in Rifle Mountain Park*  
City of Rifle  
202 Railroad Avenue  
P.O. Box 1908  
Rifle, CO 81650  
970.625.2121
146. Rocky Mountain National Park, CO  
*Rocky Mountain National Park Technical Climbing and the Bivouac Permit*  
Rocky Mountain National Park  
Estes Park, CO 80517  
970.586.1206
147. Wichita Mountains Wildlife Refuge  
*Rock Climbing: Wichita Mountains Wildlife Refuge*  
U. S. Department of Interior  
Fish and Wildlife Service  
Wichita Mountains Wildlife Refuge  
Rt. 1, Box 448  
Indianapolis, OK 73552  
405.794.8535
148. Yosemite National Park  
*Yosemite Climbing*  
Yosemite National Park, CA  
P. O. Box 577  
Yosemite, CA 95389

### Resource Information Brochures

149. Access Fund (1993). *Sharing crags with raptors*. [Brochure]. Los Angeles, CA.

ABSTRACT: Information on how to recognize peregrine falcons, explanation of climbing closures during the nesting season, and practices climbers can initiate to protect peregrines from the disturbance by climbing activity

150. American Alpine Club. (1990). *Climber's code*. [Brochure]. Los Angeles, CA.
151. Boulder Mountain Parks, Eldorado Canyon State Park & Rocky Mountain National Park. (undated). *Conscious climbing*. [Brochure]. Boulder, CO.

ABSTRACT: Leave No Trace practices and techniques are presented in this tri-fold brochure.

152. Colorado Division of Wildlife. (1995). *Recommended buffer zones and seasonal restrictions for Colorado raptor nests*. Colorado. Division of Wildlife. [Brochure]. Fort Collins, CO. 2pp.

153. Exum Mountain Guides (undated). *A climber's guide to protecting the lower saddle*. [Brochure]. Moose, WY.

ABSTRACT: This public service brochure briefly describes the unique alpine flora and fauna of the Grand Teton's lower saddle and the potential impacts caused by climbers. Nine Leave No Trace practices are listed to help climbers preserve and minimize potential impact in this area.

154. Rocky Mountain National Park (1998). *Raptor protection closures*. [Brochure]. United States Department of the Interior National Park Service, Estes Park, CO.

ABSTRACT: A tri-fold climber education brochure that provides information and mapped locations of seasonal climbing restrictions in Rocky National Park.

## KEYWORD INDEX

---

### PART I. Location Index

Acadia National Park, ME 109  
Augstmatthorn Game Reserve, Switzerland 11  
Baxter Pass, CA 12  
Big South Fork National River and Recreation Area and Obed Wild and Scenic River,  
TN 111  
Bishop, CA 136  
Blue Mound State Park, MN 26  
Boulder, CO 19, 60, 61, 62, 63, 64, 65, 67, 68, 87, 97, 151  
Boulder Mountain Parks, CO 3, 151  
Boise, ID 5, 21  
Bridal Veil Falls, CO 134  
California 7, 10, 12, 25, 33, 75, 85, 114  
Canada 27, 28, 34, 35, 54, 57, 59  
Cannon Mountain, NH 16  
Cathedral Ledge, NH 16  
Cave Rock, CA 112  
Chickamauga & Chattanooga National Military Park, TN 113  
City of Rocks National Reserve, ID 88, 114  
Colorado 8, 13, 19, 45, 52, 110, 152  
Coronado National Forest 4, 130  
Daniel Boone National Forest, KY 99, 144  
Devils Lake State Park, WI 135  
Eldorado Canyon State Park, CO 45, 116, 137, 151  
Eldorado Springs, CO 116, 137  
Estes Park, CO 9, 100, 146, 154  
Franconia Notch State Park, NH 37  
Giant City State Park, IL 39  
Glacier National Park, MT 23  
Grand Staircase Escalante NM, AZ 117  
Grand Teton National Park, WY 153  
Granite Mountain, AZ 118  
Holt's Ledge, NH 16  
Idaho 5, 70, 72, 114  
Illinois 31, 32, 39, 132  
Interstate State Park, MN 26

## KEYWORD INDEX

---

### PART I. Location Index (continued)

Jefferson County, CO 52  
John Muir Wilderness, CA 12  
Joshua Tree National Park, CA 7, 25, 33, 103, 107, 119, 138  
Kentucky 99, 144  
Kaibab National Forest 142  
Leavenworth, WA 29  
Lumpy Ridge, CO 9  
Maine 126  
McConnells Mill State Park, PA 62  
Minnesota 26, 83  
Minnewaska State Park, NY 76, 139  
Mohonk Preserve, NY 47, 89, 120, 140  
Montana 23  
Mt. Rushmore National Monument, SD 83, 94  
Nevada 12, 46, 49  
New Hampshire 16  
New River Gorge National River, WVA 69, 121, 129, 141  
New Paltz, NY 120, 139  
New York 37, 47, 76, 89, 120  
North Carolina 68, 71, 82, 122  
Oklahoma 84, 88  
Ontario, Canada 28, 34, 35, 54, 57, 59  
Owl's Head, NH 16  
Paradise Forks, AZ 142  
Pennsylvania 62  
Phantom Canyon Preserve, CO 8  
Pinnacles National Monument, CA 10, 80, 85, 143  
Pusch Ridge Wilderness, AZ 4  
Red River Gorge Geologic Area, KY 99, 144  
Red Rock Canyon NCA, NV 46, 49, 106, 123  
Rifle Mountain Park, CO 145  
Rocky Mountain National Park, CO 9, 38, 52, 100, 146, 151, 154  
Seneca Rocks, WVA 40, 79

## KEYWORD INDEX

---

### PART I. Location Index (continued)

Shelf Road, CO 110  
Sierra Nevada Mountains, CA 12  
Snow Canyon State Park, UT 124  
Spring Mountains National Recreation Area, NV 125  
Stone Mountain State Park, NC 67, 82  
Switzerland 11  
Telluride, CO 134  
Tettegouche State Park, MN 26

Tennessee 39, 55  
Toiyabe National Forest, NV 125  
Utah 20, 77, 124  
Washington 22, 29, 91  
Wenatchee Mountains, WA 29  
West Virginia 135  
White Mountains, NH 16  
Wichita Mountains NWR, OK 84, 87, 127, 133, 147  
Wisconsin 135  
Wyoming 24, 30, 50  
Yosemite National Park, CA 75, 109, 128, 148

## **PART II. Resource & Ecosystem Management**

Abundance 26, 59  
Aesthetics 41  
Alpine 11, 23, 30, 51, 54, 69, 78, 150, 153  
Backcountry 17, 41, 98, 119  
Behavior 9, 15, 23, 38, 69, 78, 150, 153  
Biodiversity 58, 77  
Buffer Zone 5, 8, 13, 18, 152  
Cathole 41, 98  
Clean Climbing 70  
Cliff Ecology 35, 53, 54, 57, 58  
Cliff Ecosystem 53, 56, 57  
Climber Characteristics 39, 107

## **KEYWORD INDEX**

---

### **PART II. Resource & Ecosystem Management (continued)**

Climbing Management 3, 5, 60, 61, 65, 75, 76, 82, 94, 99, 109, 111, 113, 114, 115, 116, 119, 121, 122, 124, 126, 128, 133  
Climbing Restrictions 3, 8, 21, 51, 153  
Collaborative Management 66, 121  
Conflict 10, 16, 36, 38, 77, 85, 99, 106, 124  
Cooperative management 92  
Crowding 37, 39, 42, 49, 81, 99, 106, 124  
Desert 4, 116  
Direct Management 25  
Economic Impact 44  
Ecosystem 35, 37, 40, 51, 54, 55, 56, 75, 124  
Education 3, 21, 48, 51, 57, 60, 68, 70, 72, 73, 85, 92, 108, 109, 111, 113, 120, 124, 153  
Endangered Species Act 36  
Entry Fees 87

Environmental Ethics 71  
Erosion 60, 78, 79, 82, 83, 130  
Fixed Anchors 44, 49, 60, 62, 63, 64, 66, 72, 86, 99, 103, 112, 114, 117, 118, 126, 130  
Geology 53, 56, 82, 126  
GIS 8  
GPS 8  
Hazard 40, 88  
Human Disturbance 8, 12, 13, 18, 23, 26, 48, 52  
Human Waste 40, 96  
Indirect Management 25, 69  
Inventory 6, 32, 63, 943, 113  
Leave No Trace 96, 133, 151, 153  
Liability 66, 78, 86, 111, 126  
Limits of Acceptable Change 98, 118  
Management Actions 78, 82,  
Management Implications 27, 69, 73, 86, 91, 101, 106  
Management Policy 82, 120, 123, 126  
Management Strategies 71  
Mitigation 59, 62, 80, 111  
Monitoring 7, 10, 25, 33, 38, 50, 85, 94, 113, 123, 125, 131, 133

## **KEYWORD INDEX**

---

### **PART II. Resource & Ecosystem Management (continued)**

Natural Resource Inventory 94  
Outreach 21, 33, 53, 62, 109, 112, 114, 121  
Overcrowding 51  
Partnership 2, 33, 53, 133  
Permits 111  
Plant Diversity 25, 38  
Quota 89  
Raptor Management 15, 16, 19, 20, 22  
Recreation Specialization 86  
Regulation 12, 28, 41, 49, 87, 119  
Resource Protection 76, 107, 124, 133  
Safety 38, 39, 76, 79, 80, 95, 111, 114, 125, 126, 135  
Sanitation 79, 120  
Soil 30, 33, 34, 40, 52, 55, 72, 77, 85, 91, 92, 100, 102, 113  
Spatial Zone 8  
Species Richness 34, 38, 52  
Toilets 41, 98  
Trails 8, 33, 34, 55, 75, 77, 85, 111, 115, 120  
Trail Degradation 92  
Trampling 24, 28, 30, 34, 51, 77  
Travel Cost 45, 47  
Tree density 27

Typology 39  
Vegetation 26, 30, 32, 33, 34, 50, 51, 53, 54, 56, 62, 72, 77, 80, 85, 91, 100, 113, 127  
Viewshed 8, 103  
Visitor Experience 33, 107  
Visitor Impact 33, 91, 94  
Visual Impact 5, 85, 102, 126  
Volunteers 69  
Wilderness 4, 12, 44, 59, 64, 65, 66, 74, 77, 88, 104, 106, 107, 118, 119, 123, 125  
Wilderness Management 65, 119  
Wildlife 2, 3, 5, 7, 8, 12, 13, 14, 15, 16, 17, 18, 20, 22, 23, 24, 39, 51, 52, 53, 72, 77, 88, 91, 105, 114, 115, 123, 125, 127, 133, 147, 152  
Wildlife Refuge 88, 127, 133, 147

## **KEYWORD INDEX**

---

### **PART III. Federal, State Agencies and Other Organizations**

Access Fund 1, 2, 3, 33, 53, 60, 61, 62, 63, 64, 65, 67, 81, 84, 97, 99, 129, 149  
American Alpine Club 69, 150  
American Mountain Foundation 110  
British Mountaineering Council 6, 36, 78  
Bureau of Land Management 110, 117, 123  
Carolina Climbers' Coalition 68  
Climbing Sports Group 93  
Colorado Division of Wildlife 153  
Exum Mountain Guides 153  
National Conservation Area 46, 49, 106, 123  
National Forest 4, 79, 99, 118, 125, 130, 132, 142, 144  
National Park 7, 9, 10, 23, 25, 33, 38, 39, 65, 75, 85, 94, 100, 107, 108, 109, 111, 113, 114, 115, 119, 121, 128, 129, 138  
National Park Service 146, 148, 151, 154  
Nature Conservancy 8  
Rumney Climbers' Coalition 131  
Southern Illinois Climbers Coalition 132  
State Park 26, 39, 45, 62, 68, 76, 82, 102, 108, 116, 122, 124, 135, 137, 139, 151  
United States Fish and Wildlife Service 20, 127

### **PART IV. Flora and Fauna**

Alpine Chamois 11  
American kestrel 5, 13  
Army Cutworm Moth 23  
*Aquila chrysaetos* 5  
Birds 7, 9, 15, 80, 100  
Bryophytes 59  
*Bubo virginianus* 5  
*Buteo jamaicensis* 5

California Condor 10  
Cliff Goldenrod 31  
Cryptobiotic Soils 33  
Desert Bighorn Sheep 4

## **KEYWORD INDEX**

### **PART IV. Flora and Fauna (continued)**

---

Dogs 42  
Eastern White Cedar 27, 28  
*Falco mexicanus* 5  
*Falco sparverius* 5  
Golden Eagle 5, 8, 9  
Great Horned Owl 5  
Grizzly Bear 23  
Land Snail 59  
Lichen 31, 32, 56, 59  
*Ovis canadensis californica* 12  
Peregrine Falcon 2, 6, 10, 16, 21, 130, 131, 149  
Raptors 1, 2, 3, 5, 10, 13, 15, 18, 51, 85, 100, 149  
Red-tailed Hawk 5  
*Rupicapra r. rupicapra* 11  
Sierra Nevada Bighorn Sheep 12  
*Silene seelyi* 29  
*Solidago sciaphila* Steele 31  
*Thuga Occidentalis* 27, 28  
*Ursus arctos horribilis* 23

### **PART V. Miscellaneous Terms**

Annotated Bibliography 17  
Big Walls 98  
Camping 77, 79, 103, 110, 120  
Consumer Surplus 45, 47  
Economic 44, 45, 46, 49, 127  
Jogger 11  
Landowner 22, 67  
Mountain Biking 11, 105  
Native American 11  
Random Utility Model 44  
Sport Climbing 29, 99  
Traditional Climbers 103



