Camping Impact

Management on the

Appalachian National Scenic Trail

Camping Impact

Management on the

Appalachian National Scenic Trail

August 2003

by: Jeffrey L. Marion

Unit Leader/Adjunct Professor

Virginia Tech/Department of Forestry
Patuxent Wildlife Research Center
USDI, U.S. Geological Survey

ACKNOWLEDGMENTS

A heartfelt thank you to all the members of our camping management case study teams - we all learned a great deal from each other. These teams have included federal and state land management agency staff, Appalachian Trail Conference staff, scientists, and highly dedicated volunteer trail club members. While too numerous to note here, study team members are listed at the end of each case study included in Appendix 1. I've done my best to incorporate the results of our collective learning within this report.

I am indebted to the Appalachian Trail Conference for "adopting" me into the Appalachian Trail management community. Having section-hiked half of the Appalachian Trail I've always felt a special attachment to it and as I complete that journey I will undoubtedly grow to cherish it even more. Special credit is due to Bob Proudman for investing considerable time into this project and my education regarding A.T. management, policies, and guidance. Bob organized and participated in 16 of the 17 case study team reviews - not bad for a central office desk-jockey! Thanks also to ATC regional office staff who have been instrumental in planning trips, communicating with club members, and reviewing case study and final report drafts: New England Regional staff J.T. Horn and former member Jody Bickel, Mid-Atlantic Regional staff Karen Lutz and John Wright, Central and Southwest Virginia Regional staff Teresa Martinez and former member Mike Dawson, and Deep South Regional staff Morgan Sommerville and former member Ben Lawhon.

Finally, I extend thanks to former Virginia Tech Assistant Professor Troy Hall, for offering the unique perspectives that only a social scientist can provide and to Appalachian Trail Park Office Outdoor Recreation Specialist Rita Hennessy and U.S. Forest Service liaison Pete Irvine, for their participating and project support.

TABLE OF CONTENTS

INTRODUCTION

This report addresses the management of overnight use and associated impacts along the Appalachian National Scenic Trail (A.T.). This effort was initiated in response to agency and Appalachian Trail Conference (ATC) management concerns regarding the resource and social impacts of increasing overnight visitation, particularly in high use areas. Report findings and recommendations are primarily based on series of on-site investigations at 17 problem areas selected by A.T. clubs and ATC staff. However, the report's recommendations also draw on an examination of relevant A.T. legislative, agency, and organization guidance and visitor impact management knowledge derived from research and management experience.

The A.T. was constructed from 1923-37, inspired primarily by the foresight of Benton MacKaye. Much of the original construction was done by volunteers, with coordination by the ATC, founded in 1925. Active cooperation between numerous trail clubs and the federal agencies was formalized in 1938 by a National Park Service (NPS)/U.S. Forest Service (USFS) agreement. It was not until 1968 that the federal government formally recognized the A.T. as a National Scenic Trail, assigning the NPS as the lead management agency. A 1978 amendment increased authorization for land acquisition and corridor protection and directed preparation of a comprehensive plan.

The A.T. remains largely a volunteer-managed trail through the annual contributions of more than 4000 volunteers. The trail runs from Springer Mountain in Georgia to Mt. Katahdin in Maine, traversing 2,170 miles, 14 states, 8 National Forests, 6 NPS units, and over 60 state parks, forests and wildlife areas (Figure 1). An interagency land acquisition program authorized and funded by the U.S. Congress is nearing completion, with 99% of the A.T. corridor now in public ownership. A.T. management is coordinated by the NPS Appalachian Trail Park Office in cooperation with the ATC, 31 affiliated clubs and other federal and state agencies.

Park, forest, and wilderness managers must maintain a balance between resource protection and recreation provision mandates. Though a central purpose for the creation and management of protected areas, visitation has the potential to
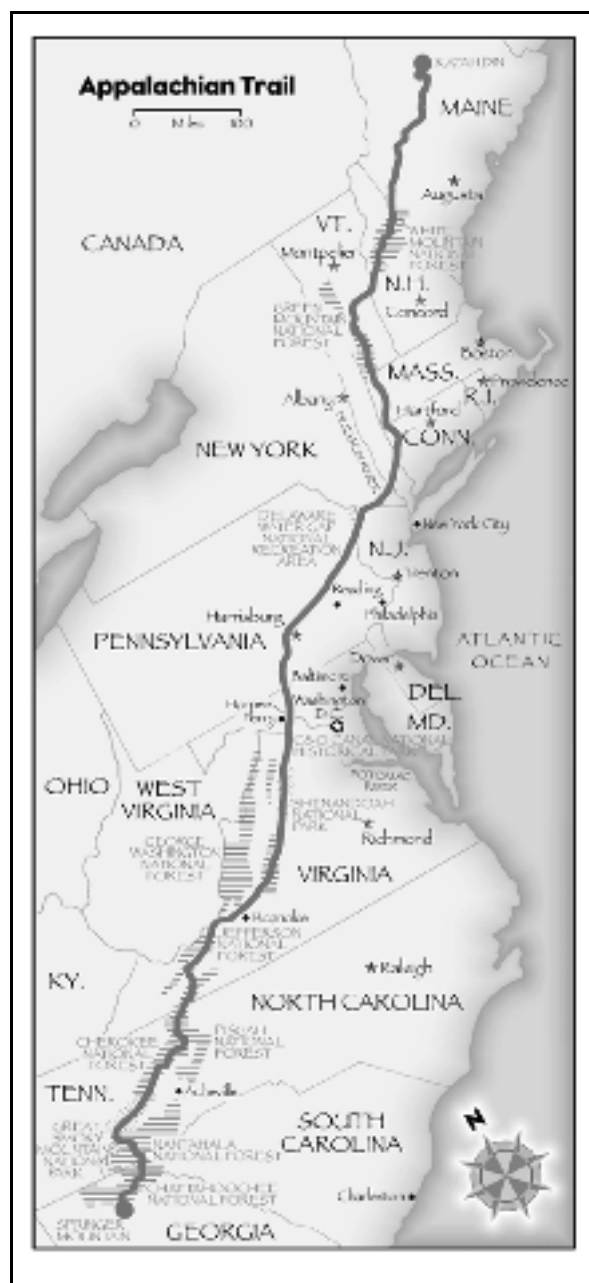

Figure 1. Route followed by the Appalachian National Scenic Trail.

degrade natural resources and the experiences of other visitors. This is particularly true along trails, at overnight campsites and shelters, and at day-use recreation sites like scenic overlooks and waterfalls, where visitor use and associated resource and social impacts are concentrated.

According to the ATC, three to four million people hike some part of the A.T. each year. More than 300 "thru-hikers" walk its entire length each year. The potential consequences of this high visitation include trampling and subsequent loss of ground vegetation, shrubs, and tree seedlings; felling of saplings; erosion of surface litter and humus; exposure, erosion, and compaction of mineral soil; and exposure of tree roots and damage to tree trunks (Table 1) (Cole 1987, Cole and Marion 1988, Hammitt and Cole 1987, Leung and Marion 2000). Visitors also notice and are affected by these resource impacts (Lucas 1979, Shelby and Shindler 1992). A survey of visitors to three eastern wilderness areas found that littering and human damage to campsite trees were among the most highly rated indicators affecting the quality of recreational experiences (Roggenbuck et al. 1993). These and other resource impact indicators, such as the amount of vegetation loss and bare ground around a campsite, were rated above many social indicators, including the number of people seen while hiking and encounters with other groups at campsites.

Table 1. Resource impacts caused by hiking, boating, and camping activities.

Vegetation Changes	Soil Changes	Additional Concerns
● Loss of Vegetation Cover ● Alteration of Composition ● Loss of Species ● Damage to Trees ● Exposure of Tree Roots	● Loss of Organic Matter ● Erosion ● Compaction ● Reduction in Soil Moisture ● Impacts to Soil Fauna	● Littering ● Threats to Water Quality ● Threats to Human Health ● Threats to Cultural Resources ● Threats to Wildlife

Land managers recognize the need for effective visitor management and resource protection programs to balance visitation with its associated impacts. The recurring question, "Are we loving our parks to death?" challenges managers to develop and implement management strategies and actions that permit visitor use without compromising ecological and aesthetic integrity. Furthermore, managers must frequently engage in this balancing act under the close scrutiny of the public, competing interest groups, and the courts.

This report contains four chapters and two Appendices. The first chapter reviews federal, ATC, and club guidance for managing overnight visitation along the A.T. This review documents existing guidance but is also intended to stimulate and facilitate dialogue aimed at developing more comprehensive and specific future guidance, including prescriptive management objectives. Greater specificity in objectives that define desired future conditions for different trail segments (zones) can assist trail managers in reaching agreement on consistent overnight use policies and actions across institutional and geographic boundaries. The second chapter reviews the 17 study sites visited by the case study teams and the methods used to evaluate camping management problems and identify recommended management actions. Chapter three summarizes the core results from the site investigations within two general themes: resource protection issues (e.g., campsite proliferation, camping impacts, human waste management) and visitor experience issues (e.g., crowding, conflicts, large groups).

Chapter four presents twelve recommendations that would promote unified camping management guidance for the A.T. and addresses the major issues and problems identified by the case studies. The need for A.T. zoning and prescriptive desired future condition statements to guide decision making is highlighted. The Recreational Opportunity Spectrum (ROS), a planning tool developed by the USFS (Clark and Stankey 1979, USFS 1980), provides a useful model for this process. ROS characterizes a range of activity, setting, and experience attributes along a zoning continuum from primitive to urban. This system provides a framework for distinguishing and managing separate zones to achieve different resource protection and recreation experience objectives and opportunities. Recommendations also call for an expanded emphasis on camping management, refined guidance on site and facility management, and management of trailside camping, large groups, human waste, food storage, visitor-created trails, and shelter/camping capacities.

Appendix 1 contains the camping management case studies for the 17 sites visited. Each case study describes the shelter or camping area, resource and social impact problems, previous management actions, and recommendations. Case study team members and their affiliations are also listed. Appendix 2 contains a comprehensive review of camping management practices applicable to the A.T. This section begins with a review of the decision making process and constraints, followed by a review of a diverse array of management strategies and tactics. These include use-related factors (user behavior and amount, density and type of use) and environmental/site management factors (site selection, design, construction, facilities, maintenance and closure).

MANAGEMENT GUIDANCE

Legislative Mandates

The Appalachian Trail was designated as a national scenic trail by the 1968 National Trails System Act (P.L. 90-543). Administrative responsibility was assigned to the Secretary of the Interior, in consultation with the Secretary of Agriculture. This Act provides little guidance for overnight visitation, with a single reference authorizing: "campsites, shelters, and related public-use facilities."

The National Park Service (NPS), Appalachian Trail Park Office (ATPO) was given primary administrative authority for the Appalachian Trail (A.T.). This review of A.T. management guidance therefore begins with federal agency legislative mandates, specifically the NPS Organic Act and the Wilderness Act.

The NPS Organic Act of 1916 (16 *United States Code* (U.S.C. 1) established the NPS, directing it to:

> "promote and regulate the use of the Federal areas known as National Parks, Monuments, and Reservations . . . by such means and measures as conform to the fundamental purpose of the said Parks, Monuments, and Reservations, which purpose is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

These provisions were supplemented and clarified by Congress in 1970 and again in 1978 by the "Redwood amendment" (P.L. 95-250, 92 Stat. 163, as amended, 1978) mandating that the "protection, management and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established..."

The Wilderness Act of 1964 (P.L. 88-577) is also applicable to a number of federal areas through which the A.T. passes. These acts overlay national park and forest designations and are intended by Congress to provide a higher degree of protection for selected areas singled out for exceptional ecological or social value. Wilderness areas are managed under the Wilderness Act so as to protect their natural resources and processes and to provide visitors with high quality wilderness experiences.

Wilderness is defined by Congress as:
- an area where the earth and its community of life are untrammeled by man -- where man himself is a visitor who does not remain;
- undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation;
- which is protected and managed so as to preserve its natural conditions;
- which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
- which has outstanding opportunities for solitude or a primitive and unconfined type of recreation.

The Wilderness Act established the same use and preservation management paradox implied by the Organic Act. Wilderness areas:

> "shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness..."

Agency Guidance

Authority to implement congressional legislation is delegated to agencies, who identify and interpret all relevant laws and formulate management policies to guide implementation. For the NPS, these policies are set forth in Management Policies 2001 (NPS 2001) and other guidelines and manuals.

Congressional legislation directs the NPS to manage visitation contingent upon preserving park environments in an "unimpaired" condition. However, research demonstrates that resources are inevitably changed by recreational activities, even with infrequent recreation by conscientious visitors (Cole 1982 1985, Marion 1984a). What constitutes an impaired resource is ultimately a management decision, a judgment. According to the NPS Management Policies:

> "The impairment that is prohibited by the Organic Act and the General Authorities Act is an impact that, in the professional judgement of the responsible NPS managers, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts (section 1.4.5)."

If interpreted overly strictly, the legal mandate of unimpaired preservation may not be achievable, yet it serves as a useful goal for managers striving to balance recreation provision and resource protection objectives. Consistent with park purposes, managers are directed to avoid those impacts that can be avoided, and to minimize those that cannot:

> "NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values (section 1.4.3)."

In backcountry settings, NPS managers are directed to: "identify acceptable limits of impacts, monitor backcountry use levels and resource conditions, and take prompt corrective action when unacceptable impacts occur (section 8.2.2.4)." The number and types of facilities: "will be limited to the minimum necessary to achieve a park's backcountry management objectives and to provide for the health and safety of park visitors."

More specific guidance for wilderness management is contained within federal agency manuals. Information from these sources most relevant to camping management policies are reviewed in this section.

For the NPS, guidance is provided in Reference Manual # 41, Wilderness Preservation and Management (NPS 1999). Recreational uses of wilderness should be those traditionally associated with wilderness and that will leave the area unimpaired. Management should provide for outstanding opportunities for solitude or primitive and unconfined types of recreation (section 6.4.3). The construction of new shelters for public use is not generally allowed, though existing shelters may be maintained or reconstructed if the facility is determined to be necessary to achieve wilderness management objectives identified in the park's management plans (section 6.3.10.3).

Campsite facilities may include a site marker, fire rings, tent sites, food storage devices, and toilets if these are determined to be necessary for the health and safety of visitors or the preservation of wilderness resources and values. Toilets can be used only where their presence will resolve health and sanitation problems or prevent serious resource impacts (section 6.3.10.3). Only signs needed for visitor safety or to protect wilderness resources are permitted (section 6.3.10.4).

For the USFS, guidance is provided in their manual #2300-90-2, Recreation, Wilderness, and Related Resource Management (USFS 1990). Recreation use should be consistent with management of the area as wilderness through experiences that depend on a wilderness setting (section 2323.11). Managers are to maximize visitor freedom and minimize direct controls and restrictions within the wilderness. Information and education should be the primary visitor management tools, with more restrictive measures applied only when essential for protecting wilderness resources (section 2323.12).

No new camping shelters may be constructed, though those that existed at the time of designation may be maintained if allowed by specific legislation, or until they require extensive maintenance (sections 2323.13 & 2323.13b). Generally, facilities are installed only as a last resort and only for protection of the wilderness resource. Managers are directed to relocate or remove existing campsites to allow maximum opportunity for solitude and to minimize the evidence of human use. However, designation of campsites is considered a "last resort" action (section 2323.13a).

The "cat hole" method of human waste disposal is recommended, though pit or vault toilets may be used as a last resort. Sign use should be minimal; justified for either the routing or location of the traveler or the protection of the wilderness resource.

Finally, guidance from both agencies specify that management decisions affecting wilderness resources or visitor experiences must be consistent with the minimum requirement concept (USFS 2000). This concept is applied as a two-step process to determine:

1) If the proposed management action is appropriate or necessary for administration of the area as wilderness; and does not pose a significant impact to wilderness resources and character; and
2) The techniques and type of equipment needed to ensure that impact to wilderness resources and character is minimized (NPS 1999, section 6.3.5).

The 1978 amendment to the National Trails Act directed the federal agencies to prepare a Comprehensive Plan for the Appalachian Trail, approved by the NPS and USFS in 1981 (NPS 1981). This plan contains a single, brief reference to overnight-use management:

"Shelters are a tradition on the A.T., but use of the Trail should not depend upon them. No attempt is made to provide such amenities for every potential user, so each person must be prepared to do without them. Shelter density and design should be consistent with the sense of the natural."

The NPS also has developed several policies that apply to overnight-use areas located on NPS lands acquired for the Appalachian Trail:

"*Designated or Dispersed Camping* - In July 1986, the NPS Appalachian Trail Park Office adopted the following regulation under its regulatory authority in 36 CFR 2.10: "On NPS-acquired Trail lands, camping will remain dispersed except where camping is limited to specific camping and/or shelter sites by ATC member Trail clubs in their local management plans and these plans are endorsed by ATC." Camping policy on NPS corridor lands should be consistent, to the extent feasible, with the policies on adjacent lands to minimize confusion and enhance understanding and coordination between jurisdictions."

"*Environmental Compliance* - On NPS corridor lands, new shelters and large campsites with more than one pit privy must be evaluated by the NPS in an environmental assessment prior to any clearing, excavation, or construction by the club. Improvements to existing shelters and installation of new campsites with one pit privy do not normally require an environmental assessment; they are "categorically excluded" from compliance with NEPA (Federal Register, Vol. 49, No. 194, October 4, 1984)."

Guidance may also be found in the management plans of federal and state agencies that manage lands bisected by the A.T. corridor. For example, the Backcountry Management Plan for Great Smoky Mountains NP (NPS 1993) provides for the continuation of shelters and when they are full, permits thru-hikers to camp in the immediate vicinity (section 2.7-2.9). The Backcountry and Wilderness Management Plan for Shenandoah NP (NPS 1998) assigned a special park zone to the A.T. corridor. The plan employs the ROS framework with zone descriptions of resource, social, and managerial settings and addresses carrying capacity through application of a modified Limits of Acceptable Change decision framework. Relative to camping, the plan provides for continuation of existing huts and cabins administered by the Potomac Appalachian Trail Club. Designated campsites are permitted at huts, but groups should be out of sight and sound of each other at campsites along the trail.

USFS guidance is provided in regional manuals and in each forest plan. The USFS *Regional Standards and Guides for Region 8* state:

"Trail shelters and related facilities will be managed, constructed and maintained in accordance with ATC's *Overnight Use Principles* and the responsible A.T. club local management plan. Primitive camping will be encouraged at appropriate sites, but not within 100 feet of the Trail."

Proposals for new shelters and designated campsites need to be evaluated and, in most cases, environmental assessments must be prepared and approved before work proceeds. Guidance in individual Forest Plans is quite similar, illustrated by the following excerpts from the George Washington National Forest Plan (USFS 1993):

"Facilities are limited to shelters, privies, stiles, spring boxes, registers, trailheads, and other facilities mutually agreed to by the Conference, Clubs, and the Forest Service."

"Where feasible, locate new shelters no closer than two miles from open roads and other access points."

"Primitive camping is allowed where suitable, but recreation facilities are not constructed within 100 feet of the A.T."

State and local guidance must also be investigated and followed. For example, local building codes, sanitation regulations, and fire laws must be complied with and state agencies must approve shelters and campsites on state-owned lands (ATC 1997).

Appalachian Trail Conference Guidance

The ATC has developed the most specific guidance for managing overnight visitation along the A.T. This guidance is contained in numerous documents which are cited and summarized in this section. ATC policy for managing overnight use on the A.T. is contained within the *Local Management Planning Guide* (ATC 1997), which provides a comprehensive reference to volunteer Trail clubs and guidance for developing local management plans, required for each participating club. Chapter 2 (F), *Overnight-Use Areas*, states:

"Since 1925, ATC policy has supported "a connected series of primitive lean-tos and camps" as an integral part of the Trail experience. ATC policy is to perpetuate and improve the shelter and campsite system with well-located, -designed, -constructed, and -maintained facilities. Proposed facilities should comply with the National Environmental Policy Act (NEPA), Section 106 of the National Historic Preservation Act, and state and local building and health codes and environmental laws..."

"In November 1984, the following policy was adopted by ATC's Board of Managers regarding overnight use (and particularly shelters):

Shelter Review Procedure - ATC's regional vice chair will consult with the club proposing the shelter...to assess the basic soundness based on ATC's *Shelter Approval Checklist* (Appendix J. of the Local Management Planning Guide). The vice chair approves proposals contingent on approvals by the landowning agency and state/local permits. This policy is necessary for new shelters or large campsites with more than one pit privy and applies to all club sections and all ownerships crossed by the A.T."

Chapter 2 (I), *Managing the Trail for a Primitive Experience*, states:

"The Appalachian Trail Conference should take into account the effects of Trail-management programs and policies on the primitive and natural qualities of the Appalachian Trail and the primitive recreation experience the Trail is intended to provide. Although these guidelines are intended to apply primarily to the effects of actions or programs on predominantly natural, wild, and remote environments along the Trail, they may apply to certain pastoral, cultural, and rural landscapes as well. Even in sections of the Trail that do not pass through remote or primitive

landscapes, care should be taken not to inadvertently overdevelop or improve the Trail tread or facilities in these environments."

"Trail improvements, including shelters, privies, and other facilities, should be constructed only when appropriate to protect the resource or provide a minimum level of public safety. Design and construction of these facilities should reflect an awareness of, and harmony with, the Trail's primitive qualities. Materials and design features should emphasize simplicity and not detract from the predominant sense of a natural, primitive environment."

Other chapters in ATC's Local Management Planning Guide speak to other aspects of overnight use management: 2(G) Drinking Water Supplies and Water Quality, 2(H) Sanitation, and Appendix J, the Shelter Approval Checklist.

A broader, visionary statement guiding A.T. management is provided by the ATC's Board of Managers, who defined the desired Trail Experience as:

"The sum of opportunities that are available for hikers on the Appalachian Trail to interact with the wild, scenic, pastoral, cultural, and natural elements of the environment of the Appalachian Trail, unfettered and unimpeded by competing sights or sounds, and in as direct and intimate a manner as possible. Integral to this Trail Experience are opportunities for observation, contemplation, enjoyment, and exploration of the natural world; a sense of remoteness and detachment from civilization, opportunity to experience solitude, freedom, personal accomplishment, self-reliance, and self discovery; a sense of being on the height of the land; a feeling of being part of, and subordinate to, the natural environment; and opportunity for travel on foot, including opportunities for long-distance hiking."

More specific ATC publications that guide management of overnight visitation, include Overnight Use Principles (ATC 1977), a Checklist for the location, design, and maintenance of campsites and shelters on the Appalachian Trail (Proudman 1989), the Appalachian Trail Fieldbook (Burchard and Proudman 1982), and Guidelines for sanitation, water supplies, and overnight facilities along the Appalachian Trail on National Forest lands (ATC undated).

Overnight Use Principles (ATC 1977): This brief report reaffirms the purpose and traditional use of shelters for accommodating overnight visitation along the A.T. Collaborative case-specific decision making is recommended when shelters are evaluated for reconstruction or removal. It recognizes that new shelters will not be constructed within wilderness but existing structures should be "retained unless the existence of the shelter(s) results in significant and demonstrative deterioration of the resource and/or the experience of the Trail user." Furthermore, "Retention of a shelter is defined to include the use, maintenance, rehabilitation, and reconstruction of the facility, so long as these activities do not result in an increase in the size, capacity, or intensity of the shelter."

Checklist for the location, design, and maintenance of campsites and shelters on the Appalachian Trail (Proudman 1989): This is the most definitive guidance for locating and building new campsites and shelters. This guidance directs decision makers to concentrate use and increase facilities in areas that are underutilized and to decrease use by relocating facilities and increasing regulations in high use or problem areas. However, as a general policy, educational and site development approaches are favored over

regulations to preserve recreational opportunities and visitor freedom. More specific guidance regarding management of overnight visitation is included in the following selected excerpts:

> "The primary objective in modern overnight use management is to contain the environmental and social impacts of camping to hardened, prepared sites. Indiscriminate camping strewn along the length of the Trail, or concentrated at poor locations, is reduced when thorough planning is executed for the whole shelter/campsite system."

> "If a particular area is very popular, adding a shelter may cause an overload. The most durable sites are on relatively bland terrain removed from major attractions such as summits, ponds, gorges, waterfalls, etc. If a shelter is a mile away from such attractions, it will draw use to it, diluting concentrations at the Trail's major features. Avoid popular areas with heavy day use and especially scenic or environmentally significant or sensitive lands."

> "Some park areas are appropriately open to camping in their entirety. This may work well, especially if restrictions on fires are imposed. Dispersed camping is most suitable where use is moderate and the land has well-drained soils and moderate slopes. Monitor these situations closely."

> "Problems with vandalism are directly proportional with proximity to motorized access. Shelter sites are ideally sited at least 2 miles from roads."

> "Layout campsites at the end of dead end side trails off the main A.T. This eliminates day traffic and makes site closure more practical if necessary in the future."

> "Layout site components (the side trail access, the shelter and toilet) in a linear format that enables traffic between these facilities to be contained on site trails. Nonlinear design increases campground trampling over large areas. (Try to achieve a "terrace effect" whereby most trampling takes place on the contour of most moderate slopes),"

Appalachian Trail Fieldbook (Burchard and Proudman 1982): This booklet provides guidance to trail volunteers in evaluating trail maintenance standards and in conducting tread construction and maintenance work. However, recommendations for evaluating the location of shelters and campsites are also included. For example, shelters and campsites "should be readily accessible from the Trail, but be sufficiently distant, when possible, to completely separate campers from A.T. hikers not interested in stopping." They are also best located at least two miles from vehicle access, in lower elevations where vegetation is resistant and resilient to trampling impact, in heavy growth that channels traffic and provides visual screening between sites, and in areas that protect water supplies yet provide good privy sites. Fire sites, when permitted, should be limited to fixed, designated locations.

The Fieldbook also notes that "heavy use of non-designated campsites along the Trail may indicate that existing sites are inadequate ... [and that] constructing new sites and redesigning, relocating, or repairing existing overnight facilities should be evaluated to identify ways to reduce trail-side camping impacts. Unwanted trail-side sites deteriorating the surrounding area should be barricaded with brush, cleaned of litter, cleared of fire rings, and, sometimes, posted with "No Camping" signs."

Guidelines for sanitation, water supplies, and overnight facilities along the Appalachian Trail on National Forest lands (ATC undated: This paper introduces the Limits of Acceptable Change (LAC) carrying capacity framework and recommends its use for A.T. planning and management. For example, unacceptable levels of camping impacts could be used to trigger construction of new shelters or designated campsites, while improper waste disposal could prompt installation of a toilet facility. However, the majority of recommendations pertain to management of overnight and sanitation facilities and water supplies along the A.T. Selected excerpts characterize its guidance relative to the management of overnight visitation:

"Where Trail managers determine that undesignated camping is causing unacceptable impacts, they should develop designated campsites or shelter facilities at intervals of three miles or less along that section of the A.T."

"To foster the "sense of the wild and primeval" as part of the Trail experience, evidence of campsites (including facilities and resource impacts) should not be visible from the A.T. Campsites should be a minimum of 100 feet from the Trail footpath and surface water."

"Designated campsites should be located as carefully as shelter sites. A standard sign for designated campsites and shelters should be designed, constructed, and posted on the A.T. footpath at its junction with side trails to these sites."

"Designated campsites should include no more than a raised tent pad (only where necessary), a fire ring, a privy, and a water source (with some minor modification to improve the collection of water)."

"To meet traditional goals for the A.T. experience, new shelters built along the A.T. should be of rustic design and constructed of native or rough sawn materials. Planed lumber (except for sleeping platforms) and modern "stick"-frame construction should be avoided ... shelters should be located out of sight of the Trail footpath and at least 100 feet from the Trail footpath and any surface water."

"Trail managers should consider spacing shelters at intervals of five miles to accommodate the shorter daily distances hiked by many hikers and to provide more space with less impact on the resources and other users. If the spacing interval between shelters is decreased, Trail managers should consider building shelters that accommodate no more than eight to ten hikers."

"Dispersed camping should be discouraged within 100 feet, and preferably 200 feet, of the A.T. footpath or surface water."

"Campfires should be discouraged wherever possible alont the A.T.; however, if campfires are permitted, they should be confined to fire rings located at designated campsites or shelter sites."

"All camping facilites should be monitored by Trail-club members and agency personnel to ensure that impacts do not exceed the limits of acceptable change."

"If unacceptable sanitation conditions are present in a latrine area, a pit privy or composting toilet should be installed. If acceptable sanitation conditions cannot be achieved, the site should be closed."

Volunteer Trail Club Guidance

As directed by Congress, the Comprehensive Plan for the Appalachian Trail (NPS 1981) prescribes a "Cooperative Management System" of partnerships with individual trail clubs and agency partners in a decentralized consultation and decision-making process. Currently, there are 31 trail clubs that manage and maintain separate Trail segments in cooperation with the ATC and agency partners. As described in the ATC's Local Management Planning Guide, each club must prepare an approved management plan for their trail segment(s). These plans often include area-specific guidance on managing overnight visitation at both shelters and campsites. For example, plans may designate areas that are closed to camping, open to dispersed camping, designated campsites, or campfire prohibitions.

Trail clubs also maintain inventories of overnight use facilities and track their condition over time. Maintenance plans for shelters and action plans for constructing new shelters are also developed by local trail clubs.

STUDY SITES AND METHODS

Study Sites

Seventeen study sites were visited and evaluated, including 11 shelters and 6 camping areas (Table 2). Study sites were located in seven different states and were visited from October, 1999 toMarch, 2001. The selection of study sites was made by the ATC in consultation with the NPS Appalachian Trail Park Office and based on nominations from A.T. management clubs. Selections were predominantly based on areas that were receiving heavy overnight visitation that was resulting in either significant resource or social impacts. Study sites were located on both federal (USFS, NPS) and state lands. Additional area-specific descriptions of site's use, location, and management attributes may be found within individual case study writeups prepared following the site visits and included in Appendix 1.

Table 2. Shelters and campsites visited.

Shelter / Campsite Name	State	Land Management Agency	Trail Club	Date Visited
Cloud Pond Shelter	ME	NPS, ATPO	Maine Appalachian TC	10/5/99
Bigelow Col	ME	ME Bur. Parks & Lands	Maine Appalachian TC	10/6/99
Full Goose Shelter	ME	ME Bur. Parks & Lands	Appalachian Mtn. Club	10/8/99
Stratton Pond	VT	USFS, Green Mtn. NF	Green Mountain Club	7/19/00
Goddard Shelter	VT	USFS, Green Mtn. NF	Green Mountain Club	7/20/00
Bear Rock Falls	MA	MA Dept. Env. Mgmt.	Appalachian Mtn. Club	3/18/01
Sunfish Pond	NJ	NJ Div. Parks & For.	NY-NJ Trail Conference	12/10/99
Tom's Run Shelter	PA	PA Dept. of Conservation & Natural Resources	Potomac Appalachian TC	12/9/99
Tumbling Run Shelter	PA	PA Dept. of Conservation & Natural Resources	Potomac Appalachian TC	12/9/99
Annapolis Rocks	MD	MD Dept. of Natural Resources	Potomac Appalachian TC	12/8/99
Pine Knob Shelter	MD	NPS, ATPO	Potomac Appalachian TC	12/8/99
Maupin Field Shelter	VA	USFS, George Washington NF	Tidewater Appalachian TC	11/11/99
Harper's Creek Shelter	VA	USFS, George Washington NF	Tidewater Appalachian TC	11/12/99
Priest Mountain Shelter	VA	USFS, George Washington NF	Natural Bridge Appalachian TC	11/11/99
Blood Mountain Shelter	GA	USFS, Chattahoochee NF	Georgia Appalachian TC	3/31/00
Slaughter Gap	GA	USFS, Chattahoochee NF	Georgia Appalachian TC	3/31/00
Springer Mtn. Shelter	GA	USFS, Chattahoochee NF	Georgia Appalachian TC	4/1/00

Problem Analysis Method

Each study site was visited by a team of individuals comprised of a diverse mix of experienced land management staff, ATC professional staff, natural resource and social scientists, and volunteer A.T. management club members. This allowed the effective sharing and integration of information and expertise from these groups, with club members also representing the interests of trail users and the public. Lists of team participants are included at the end of each case study. A standardized two-step problem analysis process was followed during site visits (Table 3).

Identify and Evaluate the Problem

The problem analysis begins by developing the group's collective knowledge of the area, amounts and types of recreational uses, and the resource and social problems currently present. Group members most knowledgeable about these topics were asked to share their knowledge with the group. The sharing of differing perspectives, land management agency vs. trail club, were encouraged. The significance of the problems and degree to which current conditions are unacceptable were considered when deciding whether management actions were needed.

Next, participants with the longest experience in the area were asked to relate the history of the problems or impacts. Previous management actions were described and their effectiveness was discussed and evaluated, including why implemented actions were or were not effective.

The core of a good problem analysis is a thorough evaluation of an impact's underlying causes and identification of factors that influence impact severity. For example, heavy camping use may be the cause for excessive vegetation loss but fragile ground vegetation and ill-defined campsites may significantly contribute to the creation of unacceptably large campsites. Similarly, too many campers may be the cause for excessive crowding and noise at a shelter but the lack of separation between campsites and the presence of large groups may also significantly contribute to problems with visitor crowding and conflict. The relative influence of three groupings of factors: use-related, environmental, and managerial, were examined (see Table 3). An improved understanding of these causes and factors are essential to evaluating alternative actions and selecting the most effective management actions.

Identify and Evaluate Strategies and Tactics

Step two involved brainstorming by study team members to list and then evaluate a diverse array of management strategies and tactics. Table 7 (Appendix 2) contains a listing of potential strategies and tactics for managing camping-related resource and social impacts. A review of this list will help to ensure that no potentially effective actions are overlooked. Additional reviews of alternative camping management actions may be found in Cole et. al. (1987), Leung and Marion (2000), Marion and Proudman (1999), and in Appendix 2 of this report. Following list development, study team discussions focused on careful evaluations of the advantages and disadvantages of each action. A number of important attributes were considered, including potential effectiveness, management feasibility, costs to visitor freedom and satisfaction, expected visitor compliance, and others as appropriate.

The final step is selecting one or more preferred actions recommended for implementation. Careful consideration of the history of camping impacts and their management, the Trail Experience, and factors which either cause or influence camping impacts can help guide more objective and effective decision making. The history of camping impact illustrates use and impact trends and the relative effectiveness of prior management interventions. Considerations for protecting the Trail Experience will suggest the

appropriateness of alternative actions relative to the natural, social, and managerial settings of the zone the area is situated within.

Generally, initial actions are those which are feasible, have a low "cost" to visitors, and are judged to have a good chance at effecting the desired change in conditions. For example, indirect actions such as education or site maintenance should be considered before regulatory or site development actions as they are less obtrusive and do not compromise visitor freedom. More restrictive, expensive, and/or obtrusive actions are generally deferred until justified by the failure of one or more preceding actions. However, severe or unacceptable impacts may warrant bypassing such light-handed efforts in favor of actions necessary to achieve more effective or immediate results. Alternative actions should be identified for potential implementation in the event that initial actions are ineffective.

For each action, identify likely individuals or organizations responsible for implementing the action and describe the necessary resources they will require. An implementation schedule should also be developed and efforts to obtain funding and staff initiated. At this time it is also useful to consider how a planned action should be monitored for evaluating effectiveness. For example, measurements or a photographic record of existing site sizes and conditions provide a baseline for future comparison and should be conducted prior to implementing corrective actions.

Conversations by the case study team in the field were tape recorded and later played back during the preparation of written case studies for each site visited. Case studies were prepared according to a standardized format and are contained in Appendix 1 of this report. These were circulated to team members to verify that they adequately captured and summarized the core information and recommendations.

Table 3. A problem analysis process for evaluating and managing camping-related resource and social impacts.

I. **IDENTIFY AND EVALUATE THE PROBLEM**

‣ *Describe area and use(s)* - provide background information about the area , facilities, and visitor use.

‣ *Describe problem(s)* - briefly describe the facility, resource and social impact problems that are occurring.

‣ *Problem significance* - consider why the impacts are significant or unacceptable to land managers and trail users.

‣ *Previous management actions* - describe the history of the problems and previous actions; discuss the effectiveness of these actions and why they did or didn't work.

‣ *Causes and influential factors* - discuss the underlying causes for the impacts and the role of non-causal but influential factors that may intensify impacts. Consider use-related factors (type and amount of visitor use, visitor behavior, use density), environmental factors (soil and vegetation type, topography), and managerial factors (siting, design, construction, and maintenance of facilities, visitor management).

II. **IDENTIFY AND EVALUATE STRATEGIES AND TACTICS**

‣ *List potential strategies and tactics* - create a comprehensive list of appropriate and potentially effective management strategies and tactics. Strategies are broad approaches (e.g., modify visitor behavior, manage sites and facilities) and tactics are the specific means or actions used to implement a strategy (e.g., educate visitors, relocate campsites).

‣ *Evaluate strategies and tactics* - discuss and evaluate the following attributes for each strategy and tactic: potential effectiveness, management feasibility (cost, staffing, long-term maintenance), costs to visitor freedom/satisfaction, expected visitor compliance, etc.

‣ *Formulate recommendations* - through group discussion, develop and write recommendations that reflect the group's consensus views.

CASE STUDY RESULTS

Introduction

This section reviews results from the seventeen site visits and case study writeups (Appendix 1). The range of resource and social impact problems encountered are reviewed to illustrate their prevalence.

Resource Protection Issues

Campsite Proliferation

Three decades ago the A.T.'s shelter system included 237 shelters which accommodated the majority of overnight visitation in most areas. Shelters were located every 8.6 miles along the trail, on average (Table 4). Today, ATC staff estimate that shelters accommodate about 60% of the overnight visitation. More A.T. visitors are now camping outside of shelters and both the number and proportion of visitors who do so will are expected to continue to grow in the future.

Table 4. Historical statistics on A.T. shelters.

Year	Shelters (#)	A.T. Length (mi)	Interval (mi)
1971	237	2048	8.6
1980	215	2085	9.7
1990	230	2143	9.3
2000	262	2167	8.3

A consequence of the greater numbers of tent and tarp campers is a proliferation of visitor-created campsites within the A.T. corridor. Many of these campsites occur in the vicinity of shelters, often because they are located at reliable water sources and are obvious "destinations" identified on trail maps and in guidebooks. Many are also located near streams or other water bodies but "trail-side" campsites along the A.T. are becoming increasingly common.

Without guidance, visitors often select and develop campsites that are poorly located with respect to resource protection and visitor experience considerations. Our case study surveys revealed that visitor-created campsites are often located on the banks of water bodies, in fragile vegetation, and in areas with a high potential for expansion or are close to shelters, other campsites, or the A.T. Campsite proliferation problems in our surveys were most prevalent at Annapolis Rocks and Slaughter Gap, though the issue was cited in most of the case studies.

Many campsites are created during peak use periods yet are used with sufficient frequency on a rotating basis that they rarely recover. Research has shown that campsites can be created from only a few nights of use but that recovery requires many years on non-use (Leung and Marion 2000, Marion and Proudman 1999). Campsite numbers can accumulate over time even though many are infrequently used. For example, at Shenandoah NP, current research has revealed that travel zones that typically receive only 10 small groups of campers on high use weekends can have up to 100 permanent campsites. The same phenomena is likely occurring on the A.T. From a resource protection perspective, the cumulative resource disturbance caused by these unnecessarily large numbers of campsites represent potentially avoidable impacts.

Campsite Expansion

Once a new campsite is pioneered, subsequent visitors enlarge it by camping in different areas on different nights. Enlargement pressures are also substantial when visitors in larger groups stay on a single site and need to create additional tent sites. Campsites thus expand in size over time, often growing together with adjacent campsites to form exceptionally large impacted areas. Campsite expansion is a particularly prevalent problem when camping occurs in flat terrain and open vegetation. As with site proliferation, campsite expansion problems were particularly pronounced at Annapolis Rocks and Slaughter Gap but were also concerns at most of the areas visited.

Vegetation, Soil, and Water Resource Impacts

The most common impacts occurring on campsites included loss of original vegetation cover, loss of organic litter, and exposure, compaction and erosion of mineral soil. Water contributed by trails and shelter roofs was creating soil erosion problems on some sites (Goddard, Tumbling Run, and Springer). Sheet erosion from bare soils on shelter and campsites located too close to streams was also a potential problem at many sites (Full Goose Shelter, Goddard, Bear Rock Falls, Tom's Run, Tumbling Run, Harper's Creek, and the Priest). Fragile plants are often replaced by more resistant species so an evident change is species composition in the groundcover was seen in many areas. Invasion by more trampling-resistant exotic species was also seen at some sites, particularly those in sunnier locations like Statton Pond, Tumbling Run, Maupin Field and Springer Mountain.

Generally all shrubs and tree regeneration (seedlings and saplings) are lost on campsites. Physical damage to trees from broken or cut limbs and axe scarring was common in areas that permitted campfires but also occurred in areas that prohibited fires. Such damage, along with soil compaction and tree root exposure, generally accelerates the mortality rate of trees on campsites. Visitors also cut campsite trees for firewood or agency staff may remove hazard trees for safety purposes. One concern is that forest canopy openings could occur over time at shelters and high use camping areas due to the high mortality rates for campsite trees and limited regeneration. Such openings have been created at some shelters in Great Smoky Mountains NP and in other popular camping areas along the A.T.

Eroded soils from campsites and trails are finding their way into water bodies, either through sheet erosion off of trampled areas or from gully erosion along trails. Excessive amounts of soil introduced to water can increase turbidity and cause sedimentation problems that can degrade aquatic habitats for fish and macroinvertebrates. Improper dish washing practices next to or in water bodies were also commonly cited by land managers and club members. The introduction of soaps and food particles can pollute these water bodies, which also serve as water sources.

Campfire Site Proliferation and Impacts

For those areas where campfires are permitted, the proliferation of visitor-created campfire sites is often a perennial problem. One campsite at Annapolis Rocks had three fire rings. Land managers and club-members reported that visitors frequently establish new fire sites in a different location or move existing sites. Such practices enlarge campsites by creating different traffic patterns and core use areas. Research has also shown that campfires consume organic soils and alter soils in ways that substantially slow natural recovery. Firewood collection impacts were also significant around some of the sites where campfires are permitted. For example, the area surrounding Annapolis Rocks was completely depleted of firewood-sized woody debris. Illegal campfires in areas where fires are prohibited were also commonly cited as a problem, particularly during the off-season (e.g., Sunfish Pond and Slaughter Gap).

Proliferation of Visitor-Created Trails

Visitor-created trails were often numerous in the vicinities of these high-use shelters and campsites. Trails are created by visitors to access the A.T., a shelter, another campsite, water source, viewpoint, firewood collection areas, bear bag hanging tree/cable, and toilet or bathroom area. Even when prepared trails exist to these features, visitors will often create their own alternate routes. Many are poorly located from both a resource protection and social perspective. Some occur on steeper slopes and a few, such as those to water sources, directly descend slopes and contribute eroded soils to water bodies. Campsite access trails often take visitors through one campsite to reach another, a common occurrence at Sunfish Pond. Water access trails sometimes passed directly in front of the shelter (Priest Mountain) or through a campsite (Tumbling Run).

Human Waste Management

The management of waste at the more popular shelters and camping areas was a significant management issue and frequent topic of concern during study site visits. Many managers and club members noted that high use was causing them to relocate pit toilets every one to two years. Low decomposition rates at higher elevations and in the northern states also contribute to this problem, along with the rocky soils in these locations that make digging new pits extremely difficult. Case study members expressed significant concerns about the appropriateness of digging new pits at this rate and how long former pits would require before reuse could occur. Trash and food thrown into the toilets by visitors was also a commonly cited problem. The bad smells and flies associated with well-used toilets also caused visitors to attempt cat-holing, often thwarted by rocky soils and leading to improper surface deposition of wastes and toilet paper. Improperly disposed human waste was also a common problem around the two areas that lacked toilets: Annapolis Rocks and Slaughter Gap. Impacts to water sources are possible, though difficult to document without careful water quality testing.

Wildlife and Human Food

Wildlife are obtaining human food in all of the study sites visited, leading to attraction behavior (scavenging and begging) for a variety of species. Human food is unhealthy for wildlife and feeding alters their natural behaviors, exposing them to predators and other dangers. Most of the feeding is unintentional, associated with spilled food during preparation, eating or cleaning. Improper food storage also contributes to the problem. Many visitors do not suspend their food or packs and wildlife have become adept in acquiring such easy food sources. In particular, mice and sometimes rats are a significant problem at shelters. The availability of human food in these areas have unnaturally and substantially increased the numbers of rodents, which live in the walls, ceilings and floors of shelters. These rodents frequently damage packs and food bags and represent a significant safety hazard due to the occurrence of Hantaviruses. The Hantavirus pulmonary syndrome is a potentially deadly disease carried by rodents, especially deer mice, with infection by exposure to their droppings. Other animals attracted to these sites include various species of squirrels and birds (seen at Bigelow Col, Full Goose and Annapolis Rocks), skunks, raccoons, deer and bear. Bears are a frequent problem at Sunfish Pond campsites, in spite of the installation of bear poles and a food locker.

Visitor Experience Issues

Crowding, Solitude, and Natural Quiet

The high densities of A.T. visitors camping within shelters and on campsites at the study sites caused the issue to crowding and noise to be a frequently cited problem and a common discussion topic. Solitude is a prominent management objective for the A.T. and is even more critical for lands managed

as wilderness. The larger capacities of newer shelters, up to 20 at Stratton Pond, were one topic of concern (shelters at Full Goose and Springer Mountain are also large). Such shelters could support up 8-10 different groups, including their separate conversations, stoves and cooking activities. The chances of at least one person who snores loudly and individuals tripping over sleeping bags in the dark to make night-time toilet visits diminishes the social qualities associated with camping in large shelters. The activities of four-footed night-time visitors and of campers awakened to respond to them further contribute to a restless night for everyone.

Even when shelters have smaller capacities, the co-location of tent platforms, other shelters, or campsites can contribute to crowding by just the mere numbers of campers seen and heard in the area. Three large tent platforms were located directly behind the Full Goose shelter, each within clear view of the others and in such proximity that conversations on each could be easily overheard by neighboring platform and tent campers. Tents, activities, and noise from campsites located directly in front of the shelters at Tom's Run, Tumbling Run, Maupin Field, and the Priest undoubtedly contribute to a sense of crowding for visitors at these sites.

When total numbers begin to reach 20-30 there are frequently elevated noise levels, multiple groups pumping water at the spring, and lines at the outhouse in the morning. Numerous group discussions focused on this issue, seeking to identify if a total camper "capacity" ought to be established for backcountry camping areas along the A.T. Visitor-created campsites in other areas, particularly at Annapolis Rocks, Sunfish Pond, and Slaughter Gap, were frequently located quite close to one another. Trails often ran through or along the border of campsites to access other sites, the shelter, water, or the toilet.

The issue of trail-side campsites along the A.T. was also commonly cited. In areas where they are common, the occurrence of these campsites, even when unoccupied, contributes to the sense of crowding and diminishes solitude for hikers. Large numbers of campsites violate the ATC and agency management specifications of a 100-foot setback from the A.T.

Conflicts
Site visits revealed relatively few examples of direct conflicts between visitors. The A.T. is not open to horse riders (one exception) and motorized visitors, resulting in a fairly homogenous group of either day-use or overnight hikers. No significant examples of conflict were cited between these groups at camping areas. Some conflict exists between thru-hikers and other short-distance hikers, primarily over space in the shelters. Somewhat more significant occurrences of conflict were described between small- and large-group visitors. For example, large organized groups frequently camp at shelters or other popular areas and their presence can exclude other campers or degrade the camping experiences of others. Night-time partying, including alcohol and drug use, were also cited as a significant problem at shelters located close to roads.

Litter
The presence of litter was a commonly cited problem at nearly all of the study sites. Litter was most prevalent at the shelters and campsites closest to roads. Team participants attributed this to the higher occurrence of day-visitors and campers who lacked camping experience and the environmental ethics associated with backcountry and wilderness visitors. Litter included cans and bottles, damaged camping gear, and various food items left in shelters for others. Fire pits were also common receptacles for litter, including non-burnable trash, broken bottles, and partially burned food.

Visitor Safety

Visitor safety was a significant concern at Bear Rock Falls and Annapolis Rocks due to the proximity of campers and taller cliffs; several injuries have occurred at these sites. Other injuries could be associated with broken glass on sites (Annapolis Rocks). Wildlife issues included bears, rodents and Hantaviruses, and other wildlife that might bite visitors or damage personal property. The transmission of disease through insects from improperly disposed fecal material or through water bodies was also a common concern. Theft of personal belongings was cited as an infrequent problem at Annapolis Rocks.

Large Groups

Land managers and club members involved in our case studies continue to perceive resource protection and visitor experience problems associated with visitors traveling in larger groups. Most land management agencies define group use as groups with 10 or more individuals. Generally they are organized groups from summer camps, college outing clubs, Boy Scouts, youth outdoor adventure programs and schools, churches, and hiking clubs. A.T. thu-hikers are also increasingly linking up and camping in large groups.

Research and management experience indicate that visitors traveling in larger groups have the potential to cause a disproportionate amount of impact to natural resources and to the recreational experience of other visitors. For example, a big group can substantially enlarge a campsite if there are too few tenting or cooking areas, or can disturb other visitors if they are noisy or camp nearby. On trails, larger groups that stop for rest breaks or map reading tend to do greater damage to trailside vegetation, particularly when other hikers must step off-trail to move past. Larger groups are generally noisier than small groups, increasing the potential for disturbing wildlife and other visitors. Wilderness visitors generally say that encountering large groups reduces their feeling of wilderness. The presence of large groups can exacerbate problems with crowding and conflicts, particularly when they preempt smaller groups in popular areas with limited campsites or space in shelters. Large groups tend to be less careful in managing food and dish washing, resulting in more spills and scraps of food left for wildlife or contamination of streams and lakes from dish washing. Members of large groups may also be less skilled in the proper disposal of human waste, increasing the potential for contaminating water resources.

Nor is smaller always better. Wildlife may be more disturbed from the repeated passage of small groups than from a single pass by a larger group. The aggregate area of ground disturbance from several small groups camping may be greater than that of a single large group. The specific behavior of individual, "high" vs. "low" impact, is likely a much stronger determinant of resource and social impact than the size of a group.

RECOMMENDATIONS

Introduction

This chapter reviews recommendations developed through the case study review trips and discussions. They reflect the consensus views of land managers, scientists, ATC staff, and club members. The recommendations are arranged from broad to specific, many reach beyond the narrower issue of camping management. They are intended for consideration and application by a variety of organizations and individuals, including the NPS ATPO, ATC, ATC Board of Managers and Committees, federal and state land management agencies, and trail maintainer clubs.

Unified Camping Management Guidance

Given the decentralized nature of A.T. management and decision making it is imperative that unified direction be provided to ensure consistent and uniform management actions. As reviewed in the Management Guidance chapter of this report, the legislative mandates for the A.T. are relatively broad and generic. Agency and Appalachian Trail Conference policy guidance provides more comprehensive and specific guidance but our reviews also found this to be lacking for a number of critical issues. For example, large-capacity huts (White Mtns.) and shelters with two stories and even a shower (Mt. Rogers, VA) have been built in some areas yet shunned in others. Visitors in nearby campsites frequently add to the congestion at shelters. Highly concentrated unregulated camping areas with up 150 overnight visitors have developed in some areas (Annapolis Rocks, Slaughter Gap) but other areas (Sunfish Pond, Great Smokies, AMC-land) restrict and manage such uses. Some clubs actively manage conditions and visitors to prevent trailside camping, others ignore it. Current guidance is largely silent on these and other important camping management issues. Much of the existing guidance is widely located in documents from separate organizations and much of it is dated. In the absence of clear, uniform guidance, different clubs and land managers will continue to make inconsistent decisions within different regions and over time.

It is critical that uniform camping management guidance be established and communicated to all professional and volunteer staff with responsibility for A.T. management. Thus, the first recommendation is:

1) Identify and implement a process for developing uniform camping management guidance for the A.T. after considering and acting on the recommendations contained within this report.

A favored suggestion for accomplishing this is to convene a task force with a diversified membership to deliberate, select, and recommend A.T. camping management strategies to the ATC Trail and Land Management Committee and Board. Decisions could be communicated through updates to the Local Management Planning Guide and other more specific ATC publications.

Define Desired Future Condition Statements
Camping management guidance should be grounded in visioning statements that define the kinds of recreation opportunities that managers are seeking to create and sustain over time. The ATC's Board of Managers have provided such guidance through their definition of the "Trail Experience" (see chapter

on Management Guidance). Such statements describe a "shared vision" to guide local decision making and promote consistent responses to decision making that affects the visitor experience along the A.T. The Trail Experience definition is limited to descriptions of the recreation experience. It could be made more explicit if supporting prescriptive desired future condition statements (DFC's) addressing natural, social and managerial settings were also developed. The natural setting relates to the quality of natural resource conditions. The social setting relates to the quality of social conditions relative to the potential for crowding and conflicts with other visitors. The managerial setting refers to the perceived presence or obtrusiveness of management actions, including regulations, facilities, and signs. Draft descriptions of DFC statements for three generic A.T. zones are offered as examples in Table 5.

DFC statements should serve as the foundation of planning and management efforts. These prescriptive statements provide guidance for defining and sustaining high quality visitor experiences and natural resource conditions. Their intent is to formally characterize the timeless and potentially measurable resource and social conditions that land managers seek to create and sustain over time. Over time, high visitor use and impacts can substantially alter resource conditions and recreational opportunities - some that may later be viewed as unacceptable or that are irreversible. Such areas could be developed and "hardened" to accommodate recreation activities. However, altering sites to accommodate more use also alters the characteristics of those places and kinds of visitor experiences they provide. As noted by Cole and Stankey (1997), the lack of specific and attainable descriptions of desired conditions makes it impossible to distinguish problem situations, identify management strategies or evaluate management success.

Recommendation:
2)   Evaluate the usefulness of DFC statements for A.T. management. Prepare, review, and adopt statements for A.T. management zones if found to be helpful.

Inventory and Monitor Campsite Conditions
The capability to monitor the conditions of resources altered by recreation use is essential to effective camping management. Monitoring can be defined as the systematic collection and analysis of data at regular intervals, in perpetuity (USD1 2001). As with other prominent and critical resource issues, managers can no longer afford a wait-and-see attitude or rely upon subjective impressions of deteriorating resource conditions. When establishing policy for backcountry camping, such data should describe the condition of campsites, relationships between campsite condition and visitor use or environmental attributes, and the likely effects that visitor activities have on biophysical, social, and managerial environments. These relationships are complex and not always intuitive. A reliable information base, therefore, is essential for managers who seek to develop and implement effective visitor and resource management policy.

Monitoring programs can be of significant value by providing reliable information necessary to establish and evaluate resource protection policies, strategies, and actions. Monitoring programs provide an objective record of resource conditions, even though individual managers come and go. A monitoring program may help detect and evaluate trends when data are compared between present and past resource assessments. It may detect deteriorating conditions before severe or irreversible changes occur, allowing time to implement corrective actions. Analysis of monitoring data may assist in the selection of appropriate management actions and reveal their effectiveness over time.

Table 5. Prospective draft desired future condition statements for three generic Appalachian Trail zones.

Setting	Appalachian Trail Zone		
Natural	**Threshold**	**Backcountry**	**Wilderness**
Contact with developed environments	Roads or developed areas are often within sight or close by.	Roads or developed areas are occasionally in sight or close by.	Roads or developed areas are rarely in sight or close by.
Change to natural characteristics of the landscape	Predominantly retain the existing character of the landscape with changes to provide visitor facilities to protect the resources and accommodate visitor use. The natural features of the landscape should be central, though management features will be obvious to visitors.	Predominantly retain the existing character of the landscape with changes to provide limited visitor facilities to protect the resources and accommodate visitor use. The natural features of the landscape should be central, though management features may be obvious to visitors.	Predominantly retain the existing character of the landscape with changes permitted only where essential for protecting natural resources and visitor safety. The natural features of the landscape should be central, with changes that are highly rustic and subtle.
Management of natural processes; maintenance of cultural resources	Limited alteration of natural processes permitted; high maintenance of cultural resources, including facilities to protect them from visitor impacts.	Interference with natural processes permitted only to protect private property or human safety; moderate maintenance of cultural resources.	Interference with natural processes permitted only to protect private property or human safety; low maintenance of cultural resources.
Social	**Threshold**	**Backcountry**	**Wilderness**
Use Level	High, maximum campers per single location: 40	Moderate, max. campers per single location: 30	Low, maximum campers per single location: 20
Level of contact with other visitors	Probability of encountering others is high, particularly near popular access points and features. However, solitude and natural quiet can generally be found for those who seek it.	Probability of encountering others is moderate, with occasional periods of high activity and interaction. Solitude and natural quiet can always be found for those who seek it.	Probability of encountering others is low. High likelihood of experiencing solitude and natural quiet.
Time required	Moderate - considerable day use often occurs along with overnight visitation.	High - mostly overnight visitation, often on short trips.	High - predominantly overnight visitation, often on long-distance trips.
Level of effort, risk and knowledge required	Visitors feel like they are in "nature" but not too far removed from the developed environment. Moderate effort or challenge possible that require some outdoor skills.	Primarily self-directed visitor experience in primitive backcountry settings. High degree of challenge and risk that requires experienced outdoor skills.	Highly self-directed visitor experience with a high degree of risk, challenge and wilderness knowledge required.

Setting	Appalachian Trail Zone		
Managerial	**Threshold**	**Backcountry**	**Wilderness**
Facilities	Trail, shelter, and campsite facilities are constructed from natural materials that blend with the adjacent environment. More artificial and visually obvious facilities may be needed to protect resources and accommodate use in popular areas.	Trail, shelter, and campsite facilities are generally constructed from natural materials that blend with the adjacent environment. Dimensional lumber, steel bridges or fire grates are used only sparingly. More artificial and visually obvious facilities may be needed to protect resources in popular areas.	Trail, shelter, and campsite facilities are constructed from native and rustic materials. Dimensional lumber, steel bridges or fire grates and picnic tables are not used. Shelters are primitive in design and rustic, outhouses are provided only in areas where needed.
Level of contact with agency or club staff	High contact with outreach/enforcement staff and frequent exposure to informational signs.	Moderate contact with outreach or enforcement staff; limited posting of information.	Low to no contact with outreach or enforcement staff; information predominantly at wilderness boundaries.
Alternatives for use allocation	Advise visitors of alternative opportunities and discourage use during popular times. Limit visitors through access point quotas or facility size constraints. Where needed, limit party sizes and length of stay, or require designated site camping.	Advise visitors of alternative opportunities and discourage use during popular times. Limit visitors through access point quotas or facility size constraints. Where needed, limit party sizes and length of stay, or restrict camping to existing sites.	Advise visitors of alternative opportunities and discourage use during popular times. Limit visitors through access point quotas. Where needed, limit party sizes or length of stay.

(Adapted from unpublished work by Kerri Cahill, 2002, Virginia Tech Cooperative Park Studies Unit, Forestry Dept.

Finally, a campsite monitoring program provides an essential component of recreation resource planning and management frameworks such as the Limits of Acceptable Change (LAC) (Stankey and others 1985) and Visitor Experience and Resource Protection (VERP)(NPS 1997a, I997b). These frameworks evolved from, and are currently replacing, management approaches based on the more traditional carrying capacity model. The National Park Service Management Policies requires approaches that identify and monitor acceptable limits of change in backcountry settings. Under these new frameworks numerical standards are set for individual biophysical or social condition indicators. These limits define the critical boundary line between acceptable and unacceptable conditions, establishing a measurable reference point against which future conditions can be compared. Monitoring provides the mechanism to periodically assess conditions for comparison with standards.

Recommendation:
3) Develop and apply methods to inventory and monitor resource conditions on A.T. campsites.

Adopt a Problem Assessment and Decision Process
The problem assessment and decision process employed during field visits was instrumental in developing a thorough understanding of resource and social problems, their history and local context, underlying causes and influential factors, and the merits of a diverse array of alternative solutions. The process was comprehensive yet efficient and represents an objective, defensible, and professional response to visitor impact decision making. The process is described in the Study Sites and Methods Chapter of this report.

Recommendation:
4) Adapt and promote the application of the problem assessment and decision process employed in these case studies to future visitor impact management problems along the A.T.

Expand Emphasis on Camping Management
As a general strategy, there appears to be a consensus within the A.T. community that increasing demands for overnight visitation will be met by campsites rather than expansion of the shelter system. Shelters are a traditional feature of the A.T. and will remain so, even in designated wilderness where existing shelters were specifically permitted due to their historic precedence. Camping impact surveys have also shown that shelters are far more effective than campsites in concentrating visitor activities and minimizing resource impacts (Marion and Leung 1997; Marion and Farrell 2002). However, their numbers have increased only 10% (to 262 in 2000) since 1971, in part due to an increase in the length of the A.T. (Table 4). However, replacement shelters are generally larger than the former structures, so shelter capacity has been increasing from this factor as well (there is no accurate data to document the extent of this trend). Note: the ATC Overnight Use Principles and federal agency guidance limit any increases in the size and capacity of shelters located in wilderness.

As previously noted, three decades ago huts and shelters accommodated a majority of overnight visitation in most areas. Currently, ATC staff estimate that huts and shelters accommodate about 60% of the overnight visitation, less in popular sections, more in remote sections. A recent survey of A.T. visitors found that 56% of overnight visitors stayed in huts and shelters, 12% camped near shelters, 23% stayed in a designated camping area or tent site and 9% camped elsewhere along the trail (Manning et al. 2000). It is clear that more A.T. visitors are now camping outside of shelters and that both the number and proportion of visitors who do so will continue to grow in the future.

Unregulated camping maximizes the freedom of visitors to select a campsite that meets all of their needs (location, size, aesthetics). Unfortunately, campsite surveys have shown that visitors frequently select campsites that are too close to trails, water bodies, scenic attractions features, shelters and other campsites. Visitors also often select campsites in fragile rather than durable vegetation and in large flat areas that exacerbate site expansion and proliferation problems. Actively implemented visitor education programs such as Leave No Trace can help to modify visitor site selection practices. In areas receiving high overnight visitation a more structured program involving manager-selected campsites and visitor guidance or regulations will generally be necessary. Many camping-management options exist, including established site camping and designated site camping, with or without assigned campsites (Leung and Marion 1999).

Recommendation:
5) Expand emphasis on camping management. This may require campsite surveys, identification of areas where more structured camping management programs are needed, campsite management training, and monitoring programs to track changes in the number and condition of campsites.

Refine Guidance on Site Management and Facilities
Site management actions and facilities are powerful management tools that can limit the areal extent and severity of camping-related resource impact by spatially concentrating visitor activities, creating travel patterns that limit off-site traffic, and focusing use on durable or previously disturbed surfaces. Facilities include shelters, tent platforms or improved tent pads, toilets, picnic tables, fire grates, and food storage devices. Fixed (immovable) facilities create static use patterns in camping areas that provide a focus for visitor activities, concentrating and limiting tramping disturbance to consistent locations.

The selection of preferred management responses must also consider the appropriateness of alternative strategies and actions. Federal management planning guidelines link the type and number of visitor facilities to land zoning classifications. Thus, facilities such as shelters, picnic tables, and toilets are appropriate and common in accessible frontcountry settings but are generally viewed as less appropriate or inconsistent with backcountry settings. For example, the NPS Management Policies (NPS, 2001, Section 8.2.2.4) state that backcountry facilities "will be limited to the minimum necessary to achieve a park's backcountry management objectives and to provide for the health and safety of park visitors." Particularly in wilderness, agency management policies stress application of the minimum action necessary to accomplish management objectives (Hendee et al., 1990). For example, NPS wilderness management guidance directs managers to evaluate whether a facility: "is required to preserve wilderness character or values, not considerations of administrative convenience, economy of effect, or convenience to the public or park staff" (NPS, 1999). While pre-existing shelters may be exempted, picnic tables are specifically disallowed. How visitors perceive shelter or campsite construction practices and facilities and whether they unacceptably detract from the natural setting is also pertinent. Additional research is needed on this topic.

Managers must also consider the consequences of inaction or use of ineffective measures. Insufficient action could lead to unacceptable resource or social impacts, including some that may be extensive, long-term or even irreversible. If visitation cannot be reduced in high-use areas, then more intensive management actions may be justified, though their use may compromise backcountry or wilderness objectives that advocate minimizing human manipulation and control (Cole 1995; Cole et al., 1997).

Recommendation:
6) Evaluate the appropriateness of site management and facility actions in light of existing A.T. guidance. Establish policy and more specific guidance to ensure trail-wide consistency in their use.

Manage Overnight Visitation Within Specified Maximum Capacities
Large shelter capacities and the occurrence of tent platforms and campsites near shelters are creating crowded and noisy camping settings that are inconsistent with the desired Trail Experience. According to a recent survey of A.T. visitors, 10% found crowding to be "A big problem" at shelter and about one-third of hikers saw more people than they preferred to see camping within sight and sound of them (Manning et al. 2000). Hikers reported that they preferred to see an average of three other parties of people camped within sight and sound of them and that nine other parties were the maximum that should be allowed. The trend toward higher camping capacities at popular locations is transforming the

overnight experience to one that involves greater interaction with other groups. Sociological research on this topic would be useful and a trail-wide discussion on the desirability of this phenomenon is needed. The consensus view from case study members was that this is undesirable and that management efforts need to be focused on reducing overnight visitation at popular locations.

A variety of camping management options exist to accomplish this objective. Maximum intended capacities could be established for shelters and combined shelter/tent platform/campsite areas (see Table 5, Use Level). These would need to vary by A.T. segment (zone). For example, capacities could be greater for popular zones such as the White Mountains, intermediate for typical backcountry areas, and lower for designated wilderness. To achieve these capacities campsites and tent platforms could be moved away from shelters and during replacement shelter capacities could be kept the same or reduced. In locations where shelter capacities must be expanded clubs could construct two smaller-capacity shelters located away from each other (e.g., 100 yards apart).

Recommendation:
7) Evaluate the desirability of increasingly social overnight experiences. If found to be undesirable, consider the specification of overnight capacities that vary by A.T. zone. Implement management efforts to restrict overnight visitation to the specified capacities.

Discourage Trailside Camping
Trailside camping is an element of the previous issue that requires specific attention. Camping directly along the borders or close to the A.T. is becoming more common. This is predominantly an aesthetic issue; a common occurrence of trail-side campsites reduces a hiker's sense of solitude and of moving through a pristine backcountry setting. A recent A.T. list server message characterized the trail-side camping issue as "a hodgepodge of camping sites everywhere along the trail" resulting in "a string of continuous compacted sites along the Trail's edge. This worn-out Trail border is not a desirable woodland condition for the A.T., which is meant to meander through untrampled forest land. The immediate foreground viewshed is what hikers see the most and what creates the first A.T. impression for walkers. Having one trampled and stripped out campsite after another was not in the game plan."

The consensus view from discussions with case study members was that trailside camping is a trail-wide problem that requires consistent educational and site management responses. For example, guidance could be placed in a variety of A.T. publications instructing campers to select sites that are out-of-sight or at least 100 feet (preferably 200 feet) from the A.T. Trail club volunteers would also need to begin a permanent program of site closure and rehabilitation for campsites that violated established criteria. A supporting program of campsite selection and/or construction in areas where trailside campsites are most common would also be important to the success of this effort.

Recommendation:
8) Discourage trail-side camping through education, site closure and rehabilitation, and site selection and construction efforts.

Manage Large Groups
Managers and club members continue to see and perceive resource protection and visitor experience problems associated with visitors traveling in larger groups. Many agencies have established group size limits, particularly for wilderness, to address resource and social impact issues. However, few studies have examined the relationship between group sizes and resource or social impacts, nor is it expected

that they could they provide specific guidance for selecting a meaningful size limit. Decisions about group size limits require subjective judgements and a limit of 10 is unlikely to be any more "correct" or "appropriate" than 6 or 14. There is no magic "best" number.

To a large extent, resource and social impacts are primarily a function of visitor behavior rather than group size. Thus, the core A.T. management challenge lies in encouraging all outdoor enthusiasts to learn and practice low impact skills, regardless of their group affiliation. An educational focus recognizes and avoids or reduces the significant visitor-related costs associated with group size regulations. The safety of group members, particularly in remote settings, may be compromised. Volunteer, non-profit and commercial organizations are also significantly disadvantaged by group size limits, which necessitate additional leadership. Smaller staff/participant ratios translate into higher costs for participants which reduces the economic viability of outdoor education programs or displaces them from public lands. A.T.-specific education efforts targeting organized groups have already been pioneered and implemented in the northern states. Case study members strongly supported the continuation of these efforts and their trail-wide expansion.

Organized groups present A.T. managers with some unique opportunities. Most outdoor enthusiasts are introduced to the out-of-doors by some type of group-related outdoor program. The organizations that operate these largely novice and youth-oriented programs can be efficiently targeted, allowing cost-effective education of large numbers of public land visitors. Young, inexperienced visitors tend to be more receptive to adopting Leave No Trace practices, providing an opportunity for instilling life-long LNT skills and ethics. Group leaders are receptive to educational literature and outreach efforts and are also skilled in teaching their members outdoor practices. An LNT pamphlet that specifically targets LNT practices for large groups has recently been developed (http://www.LNT.org).

Site management actions offer a final option to address large-group impacts. Group-use campsites have been designated in some areas and could be developed in others. Accommodating groups of up to 12 on carefully selected sites would likely involve less resource impact than splitting them up to camp on separate sites. Group campsites could also avoid social impacts by placing them away from other campsites and the trail. Informal or formal reservation systems may be needed to facilitate their use by organized groups. Case study members debated whether the provision of group campsites would encourage additional group use. To some extent it probably would, but the improvements to resource and social conditions form adding group campsites would likely justify such actions.

Recommendation:
9)	Evaluate and select educational and site management actions for resolving large group resource and social impacts.

Prohibit Wildlife From Obtaining Human Food
Wildlife are obtaining human food from food spillage, dumping of leftover food, poor dishwashing and food storage practices, and some intentional feeding. Impacts to wildlife and threats to visitor safety, particularly from the threat of Hantaviruses, make this a significant trail-wide issue. Wildlife feeding is also entirely avoidable.

A combined program of visitor education and site management is recommended. Leave No Trace messages can communicate why wildlife feeding is a significant problem and proper food handling, dish washing and food storage practices. In particular, an emphasis on food spillage and "micro-garbage" is

needed, along with the importance of eating or carrying out all leftover food. This information is already available in existing LNT literature.

Site management options include the placement of improved food storage systems at shelters and high use camping areas and possibly sump facilities. The installation of cable systems are recommended in areas where bears have begun to visit shelters and campsites. The cable systems developed and installed within Great Smoky Mountains NP are widely considered to be the current state-of-the art. An improved and standardized method for hanging food bags and/or packs at shelters and high use camping areas is also needed to prevent smaller animals and rodents from obtaining human food. Currently shelter visitors employ a diverse assortment of cords, wires, and cans to suspend food with varying degrees of success.

Recommendation:
10) Evaluate and select educational and site management actions for resolving wildlife feeding impacts. Develop and implement improved food storage methods for deterring small animals in shelters and campsites.

Resolve Human Waste Management Problems in High Use Areas
Human waste management is a perennial concern of A.T. managers, particularly in high use camping areas like those visited by the case study teams. Fortunately, a comprehensive treatment of this issue and management options are included in the recently published "Backcountry Sanitation Manual" (ATC, Green Mountain Club 2002). In particular, the moldering privy facility may provide an improved alternative for locations where high use has necessitated the frequent relocation of pit toilets. An expanded program of visitor education regarding proper "cat-hole" disposal practices is also needed to inform hikers and campers in areas where toilet facilities are not provided. Finally, one case study member wryly suggested that free distribution of Immodium AD could resolve this problem.

Recommendation:
11) Evaluate and select from management options described in the Backcountry Sanitation Manual. Improve education on the "cat-hole" disposal method.

Reduce Proliferation of Visitor-Created Trails
Poorly located visitor-created trails can cause significant vegetation impact and soil erosion, and can degrade visitor experiences by increasing interactions between visitors. Many of these trails are unneeded and those which do serve a useful purpose can often be rerouted to better protect natural resources and/or recreational experiences. Improved campsite designs and configurations, including the layout of constructed access trails, can often deter the development of visitor-created trails. Greater emphasis on this aspect of facility and site design is needed when developing or relocating shelters and campsites. Trail club maintainers could also use some general guidance for evaluating the utility and layout of visitor-created trails. Continued use of unnecessary trails can be deterred through a consistent program of blocking them with logs, brush, rocks, or shrub transplants (preferably thorned).

For trails that do serve a useful purpose, an assessment of their layout should be conducted. Alignments parallel to slopes should be rerouted to side-hill alignments. Reroutes may also be needed to protect visitor solitude. For example, campsite or water access trails should not cut through or close to other campsites. Vegetation and tread drainage maintenance should be extended to these trails to keep them in primitive but good condition. Visitor education can also play a role. Visitors can be asked to stay on

existing well-established trails, i.e., do not cut through pristine vegetation or use faint or "brushed-in" trails.

Recommendation:
12) Create guidance for trail maintainers to evaluate visitor-created trails. Describe procedures for their closure or improvements needed to protect natural resources and visitor experiences.

LITERATURE CITED

Anderson, Dorothy H.; Lime, David W.; Wang, Theresa L. 1998. Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers. TC-777. St. Paul, MN: University of Minnesota, Department of Forest Resources, Cooperative Park Studies Unit. l34p.

Appalachian Trail Conference. (Undated). Guidelines for sanitation, water supplies, and overnight facilities along the Appalachian Trail on National Forest lands. Appalachian Trail Conference, Report 16 by the Trail Facilities Task Group, Harpers Ferry, WV.

Appalachian Trail Conference. 1977. Appalachian Trail overnight use management principles. Appalachian Trail Conference, Use-Problem Work Committee, Harpers Ferry, WV.

Appalachian Trail Conference. 1997. Local Management Planning Guide. Appalachian Trail Conference, Harpers Ferry, WV.

Appalachian Trail Conference and Green Mountain Hiking Club. 2002. Backcountry sanitation manual. Appalachian Trail Conference, Harpers Ferry, WV.

Birchard, William and Proudman, Robert D. 1982. Appalachian Trail Fieldbook: A Self-Help Guide for Trail Maintainers. Appalachian Trail Conference, Harpers Ferry, WV.

Brown, Perry J.; McCool, Stephen F.; Manfredo, Michael J. 1987. Evolving concepts and tools for recreation user management in wilderness: A state-of-knowledge review. In: Lucas, Robert C., comp. Proceedings-National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; Fort Collins, CO. Gen Tech Rep INT-220. Ogden, UT: USDA Forest Service, Intermountain Research Station: 320-346.

Clark, Roger N. and Stankey, George H. 1979. The recreation opportunity spectrum: A framework for planning, management and research. USDA, Forest Service, Pacific Northwest Forest Experiment Station; General Technical Report PNW-98, Portland, OR.

Cole, David N. 1987. Research on soil and vegetation in wilderness: A state-of-knowledge review. In: Lucas, Robert C., comp. Proceedings-National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; Fort Collins, CO. General Technical Report INT-220. Ogden, UT: USDA Forest Service, Intermountain Research Station: 13 5-177.

Cole, David N. 1989. Low-impact recreational practices for wilderness and backcountry. USDA, Forest Service, Intermountain Forest and Range Expt. Stn. General Technical Report INT-265. Ogden, UT. 131 pp.

Cole, David N. 1990. Ecological impacts of wilderness recreation and their management. In: Hendee, John C.; Stankey, George H., and Lucas, Robert C. Wilderness Management (2nd Ed.). Golden, CO: North American Press: 425-466.

Cole, David N. 1992. Modeling wilderness campsites: Factors that influence amount of impact. Environmental Management 16(2): 255-264.

Cole, David N. 1993. Trampling Effects on Mountain Vegetation in Washington, Colorado, New Hampshire, and North Carolina. Research Paper INT-464. Ogden, UT: USDA Forest Service, Intermountain Research Station. 56p.

Cole, David N. 1995. Disturbance of natural vegetation by camping: Experimental applications of low-level stress. Environmental Management 19(3): 405-4 16.

Cole, David N. and Jim Benedict. 1983. How to pick a campsite you can leave without a trace. Backpacker 11(5):40, 44, 87.

Cole, David N. and J. DalIe-Molle. 1982. Managing campfire impacts in backcountry. USDA Forest Service General Technical Report INT-135, 16 pp.

Cole, David N.; Marion, Jeffrey L. 1988. Recreation impacts in some riparian forests of the eastern United States. Environmental Management 12(1): 99-107.

Cole, David N., Margaret E. Petersen and Robert E. Lucas. 1987. Managing wilderness recreation use: Common problems and potential solutions. USDA, Forest Service, Intermountain Forest and Range Experiment Station. General Technical Report INT-230. Ogden, UT. 60 pp.

Cole, David N.; Ranz, Beth 1983. Temporary campsite closures in the Selway-Bitterroot Wilderness. Journal of Forestry 81(11): 729-732.

Cole, David N. and Edward G. S. Schreiner. 1981. Impacts of backcountry recreation: Site management and rehabilitation--An annotated bibliography. USDA, Forest Service, Intermountain Forest and Range Experiment Station. General Technical Report INT-121. Ogden, UT. 58 pp.

Cole, David N. and George H. Stankey. 1998. Historical development of Limits of Acceptable Change: Conceptual clarifications and possible extensions. In: McCool, S.F. and Cole, D.N. and others (Comps.), Proceedings: Limits of Acceptable Change and Related Planning Processes: Progress and Future Directions, pp. 5-9; May 20-22, 1997, Missoula, MT. Gen. Tech. Rpt. INT- GTR-371. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Demrow, Carl; Salisbury, David. 1998. The Complete Guide to Trail Building and Maintenance (3rd Ed.). Boston, MA: Appalachian Mountain Club Books. 256p.

Doucette, Joseph E.; Cole, David N. 1993. Wilderness Visitor Education: Information About Alternative Techniques. General Technical Report 1NT-295. Ogden, UT: USDA Forest Service, Intermountain Research Station. 37p.

Dustin, Daniel L.; McAvoy, Leo H. 1982. The decline and fall of quality recreation opportunities and environments? Environmental Ethics 4(1): 49-57.

Hammitt, William E. and David N. Cole. 1987. Wildland Recreation: Ecology and Management. John Wiley: New York, NY. 341 pp.

Hampton, Bruce and David N. Cole. 1995. Soft Paths: How to Enjoy the Wilderness Without Harming It. Stackpole Books: Mechanicsburg, PA. 222 pp.

Hanbey, Russell. 1992. On-site restoration methods for mountainous areas of the West. USDA, Forest Service, Intermountain Research Station. Missoula, MT. 40 pp.

Harmon, Will. 1994. Wild Country Companion: The Ultimate Guide to No-trace Outdoor Recreation and Wilderness Safety. Falcon Press: Helena, MT. 195 pp.

Hendee, John C., George H. Stankey and Robert C. Lucas. 1990. Wilderness Management. North American Press: Golden, CO. 546 pp.

Hesselbarth, Woody; Vachowski, Brian 1996. Trail Construction and Maintenance Notebook. 9623-2833-MTDC. Missoula, MT: USDA Forest Service, Technology and Development Program. 139p.

Hooper, Lennon 1983. NPS Trails Management Handbook. Denver, CO: USD1 National Park Service, Denver Service Center. 53p.

Kuss, Fred R. 1986b. A review, of major factors influencing plant responses to recreation impacts. Environmental Management 10(5): 637-650.

Kuss, Fred R.; Hall, Christine N. 1991. Ground flora trampling studies: Five years after closure. Environmental Management 15(5): 715-727.

Leave No Trace Skills & Ethics Series. Pamphlets, booklets, and other materials available from the Leave No Trace Center for Outdoor Ethics. Information is both generic and specific to different geographic regions, recreation environments, and uses. 1-800-332-4100 (http://www.LNT.org)

Leonard, R.E., E.L. Spencer and H.J. Plumley. 1981. Backcountry facilities: Design and maintenance. Appalachian Mountain Club, Boston, MA

Leung, Yu-Fai and Jeffrey L. Marion. 1999. Spatial strategies for managing visitor impacts in National Parks. Journal of Park and Recreation Administration 17(4): 20-38.

Leung, Yu-Fai and Jeffrey L. Marion. 2000. Recreation impacts and management in wilderness: A state-of-knowledge review. In: Cole, D.N. and others (eds.), Proceedings: Wilderness Science in a Time of Change; Vol 5: Wilderness ecosystems, threats, and management, pp. 23-48; May 23-27, 1999, Missoula, MT. Proceedings RMRS-P-15-Vol-5. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. (http://www.wilderness.net/pubs/science1999/volume5.htm)

Lime, David W.; Buchman, R. G. 1974. Putting wilderness permit information to work. Journal of Forestry 72: 622-626.

Little, Silas and John J. Mohr. 1979. Reestablishing understory plants in overused wooded areas of Maryland State Parks. USDA, Forest Service, Northeastern Forest Experiment Station. Research Paper NE-431. Upper Darby, PA. 9 pp.

Lucas, Robert C. 1979. Perceptions of non-motorized recreational impacts: A review of research findings. In: Ittner, Ruth; Potter, Dale R.; Agee, James K.; Anschell, Susan, eds. Recreational Impact on
Wildlands: Conference Proceedings; Seattle, WA. R-6-001-1979: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station and USD1 National Park Service: 24-31.

Lucas, Robert C. 1990. How Wilderness Visitors Choose Entry Points and Campsites. Research Paper INT-428. Ogden, UT: USDA Forest Service, Intermountain Research Station. 12p.

Lucas, Robert C. 1982. Recreation regulations-When are they needed? Journal of Forestry 80(3): 148-151.

Manning, Robert E., William Valliere, James J. Bacon, Alan Graefe, Gerard Kyle and Rita Hennessy. 2000. Use and users of the Appalachian Trail: A source book. USD1, National Park Service, Appalachian National Scenic Trail, Harpers Ferry, WV.

Marion, Jeffrey L. 1995. Capabilities and management utility of recreation impact monitoring programs. Environmental Management 19(5): 763-771.

Marion, Jeffrey L.; Cole, David N. 1996. Spatial and temporal variation in soil and vegetation impacts on campsites. Ecological Applications 6(2): 520-530.

Marion, Jeffrey L. and Tracy Farrell. 2002. Management practices that concentrate visitor activities: Camping impact management at Isle Royale National Park, USA. Journal of Environmental Management 66(2): 201-212.

Marion, Jeffrey L. and Robert D. Proudman. 1999. Management options for minimizing camping impacts along the Appalachian Trail. The Register 23(2):12-15.

Marion, Jeffrey L. and Yu-Fai Leung. 1997. An assessment of campsite conditions in Great Smoky Mountains National Park. U.S. Department of the Interior, National Park Service, Great Smoky Mountains National Park, Gatlinburg, TN, Research/Resources Management Report. 127 pp.

Marion, Jeffrey L. and Toivo Sober. 1987. Environmental impact management in the Boundary Waters Canoe Area Wilderness. Northern Journal of Applied Forestry 4(1):7-10.

Marion, Jeffrey L., Joseph W. Roggenbuck, and Robert E. Manning. 1993. Problems and practices in backcountry recreation management: A survey of National Park Service Managers. USD1, National Park Service, Natural Resources Rpt. NPS/NRVT/NRR-93/12, 63 p.

McEwen, Douglas; Cole, David N.; Simon, Mark. 1996. Campsite Impacts in Four Wildernesses in the South-Central United States. Research Paper INT-RP-490. Ogden, UT: USDA Forest Service, Intermountain Research Station. 12p.

McGivney, Annette. 1998. Leave No Trace: A Guide to the New Wilderness Etiquette. The Mountaineers: Seattle, WA. 190 pp.

National Park Service. 1981. Appalachian Trail Comprehensive Plan. USD1, National Park Service, U.S. Forest Service. 1993. George Washington National Forest Plan. USDA, Forest Service, George Washington National Forest, Roanoke, VA.

National Park Service. 1993. Backcountry Management Plan. USD1, National Park Service, Great Smoky Mountains National Park, Gatlinburg, TN.

National Park Service 1997a. A Summary of the Visitor Experience and Resource Protection (VERP) Framework. Publication No. NPS D-12l4. Denver, CO: NPS Denver Service Center. 35p.

National Park Service 1997b. The Visitor Experience and Resource Protection (VERP) Framework: A Handbook for Planners and Managers. Publication No. NPS D-1215. Denver, CO: NPS Denver Service Center. l03p.

National Park Service. 1998. Backcountry and Wilderness Management Plan. USD1, National Park Service, Shenandoah National Park, Luray, VA.

National Park Service. 1999. Reference Manual 41: Wilderness preservation and management. USD1, National Park Service, Washington, DC.

National Park Service. 2001. Management Policies. USD1, National Park Service, Washington, DC.

Olds, Douglas. 1992. Disturbed site restoration: An introduction to principles and techniques. Student Conservation Association. (Draft). Arlington, VA. 429 pp.

Proudman, Robert. 1989. Checklist for the location, construction and maintenance of campsites and shelters on the Appalachian Trail. Appalachian Trail Conference, Harpers Ferry, WV.

Roggenbuck, Joseph W.; Williams, Daniel R.; Watson, Alan E. 1993. Defining acceptable conditions in wilderness. Environmental Management 17(2): 187-197.

Shelby, Bo; Shindler, Bruce 1992. Interest group standards for ecological impacts at wilderness campsites. Leisure Sciences 14(1): 17-27.

Stankey, George H.; Cole, David N.; Lucas, Robert C. and others. 1985. The Limit of Acceptable Change
(LAC) System for Wilderness Planning. General Technical Report INT-176. Ogden, UT: USDA Forest Service, Intermountain Research Station. 37p.

Stewart, William P. 1989. Fixed itinerary systems in backcountry management. Journal of Environmental Management 29: 163-171.

U.S. Forest Service. 1980. ROS users guide. USDA, Forest Service, Washington, DC.

U.S. Forest Service. 1990. Title 2300-90-2 - Recreation, wilderness, and related resource management. USDA, Forest Service, Washington, DC.

U.S. Forest Service. 2000. Minimum requirement decision guide. USDA, Forest Service, Arthur Carhart National Wilderness Training Center, Missoula, MT.

Williams, Peter B.; Marion, Jeffrey L. 1995. Assessing Campsite Conditions for Limits of Acceptable Change Management in Shenandoah National Park. Technical Rpt. NPS/MARSHEN/NRTR-95/071. Blacksburg,VA: USD1 National Biological Service, Virginia Tech Cooperative Park Studies Unit. l38p.

APPENDIX 1: CAMPING MANAGEMENT CASE STUDIES

From: Marion, Jeffrey L. 2003. Camping Impact Management on the Appalachian National Scenic Trail. Appalachian Trail Conference, Harpers Ferry, WV. 109pp.

Cloud Pond Shelter, ME

Background

The case study team (members listed at end of document) visited the Cloud Pond Shelter in central Maine on October 5, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

Cloud Pond shelter (2,409 ft elevation) is located on Barren Mountain near the Katahdin Iron Works in Northern Maine. The shelter is located on NPS land and the Maine Appalachian Trail Club is the maintainer. The shelter is situated on a high ridge overlooking and about 100 yards from the shores of Cloud Pond. The shelter is somewhat typical of many in the "100-mile wilderness" though somewhat more popular due to the adjacent pond. Compared to other portions of the A.T. use at the shelter is low, predominantly by long-distance hikers as the area is quite remote. Shelter capacity is about six with up to 12 visitors on high-use weekends. A fire site and pit toilet complete the facilities at this site.

Description of Problems

Principal resource impacts include campsite proliferation and expansion in an area along the access trail just out-of-sight of the shelter. Although this overflow camping area has expanded over the last decade, it remains of modest size and is constrained from much further expansion due to the sloping and rocky terrain. The camping area is split into two adjacent sections which are bisected by the shelter access trail. However, they are separated and out-of-sight from the shelter and are a reasonable distance from the lakeshore.

The pit toilet is another principal problem. The existing pit is full and the extremely rocky soils hinder the digging of a replacement pit. Human waste has been removed in 5-gallon buckets to prolong the pit's useful life. Decomposition is slow due to the cool temperatures.

Previous Management Actions

Little has been done to manage the site since the lean-to was built. Occasional moving of the privy has been the only maintenance required over the last few years, though with increasing use this has become more and more frequent. MATC members reported that the overflow camping areas have expanded over the years, but no concrete action designed to curb this has taken place.

Recommendations

Case study members generally did not perceive the impacts at this location to be particularly pronounced or significant. Rather, this shelter is likely typical of many other shelters along the A.T. Current thinking is that overflow camping in the vicinity of shelters is probably necessary. Shelters are destinations for campers but are often filled during weekends or popular seasons. If campsites are not

provided visitors will often create them, often on the side of the trail or in fragile rather than resistant locations. Furthermore, the water supplies adjacent to shelters are often the highest quality and most dependable sources along the A.T.

The challenge is to manage overflow camping to avoid or minimize resource and social impacts. The principal deficiency of the current overflow camping at this shelter is the close proximity of the two camping areas to the shelter access trail and to each other. On the positive side, they are separated from the shelter and the pond shore and the steep rocky terrain will continue to constrain their further growth. Scouting could be conducted to locate another campsite or two that are further from the trail and preferably 200 feet from the pond and the shelter. Signs and improved tent pads, combined with closure signs and rehabilitation work on the existing sites might effectively shift use to the new sites. Refer to information in Appendix 2 for additional guidance if this action is adopted.

The pit toilet is perhaps a larger dilemma. The site is not sufficiently popular to warrant a composting toilet or caretaker. A pit toilet seems the most appropriate facility, though experimentation with red worms or some commercial products that accelerate decomposition might be in order. Additional effort in locating areas with less rock and digging deeper pits, possibly with the aid of explosives, is recommended.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Natural Resource Recreation
Rita Hennessy, NPS Appalachian Trail
JT Horn, ATC, New England Regional Office
Mark Simpson, Bruce Grant, Caleb Simpson, Dana Hall, Maine Appalachian Trail Club.

Bigelow Col, ME

Background

The case study team (members listed at end of document) visited the Avery Memorial Campsite at Bigelow Col in northwestern Maine on October 6, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance for managing camping to minimize resource impacts and enhance camping experiences.

Bigelow Col (3,900 ft) is located on the saddle of Bigelow Mountain between West and Avery Peaks within the Bigelow Preserve, managed by the Maine Bureau of Parks and Lands. The camping area is managed by the Maine Appalachian Trail Club. Bigelow Preserve is a very popular hiking destination and one of the several areas in the state where you can hike and camp at high elevations. Visitation consists of heavy day and overnight use. The Preserve received approximately 5,700 trail users in 1993, most of which is day use. Overnight visitation statistics from nearby Horns Pond reveal an average of 13 visitors/night during the summer season in 1998 which is thought to be somewhat higher than that received at Bigelow Col. Visitation increased threefold from the early 90's to 1996 but has leveled off since then. Increasing use by large groups is also an issue.

The Bigelow Col camping site is located in a dense spruce forest with very limited understory situated upon thin rocky soils. Facilities include a pit toilet and two tent platforms and three small tenting areas, including one on the site of a former lean-to. The area's camping capacity is approximately 20 to 30 visitors. A Fire Warden's cabin and storage shed is located nearby. It is occasionally used by volunteer weekend caretakers. Ropes strung between trees currently provide borders to contain trampling damage along some trails and campsites. Campfires are prohibited to protect the spruce forest and limit trampling disturbance.

Description of Problems

The primary management concern is resource protection, particularly in light of the fragile high elevation spruce forest within which the site is located. General management policies have been to limit camping at such high elevation sites to protect vegetation that is both rare and slow to recover.

Principal resource impacts include the trampling of vegetation on campsites and informal trails, improper human waste disposal, and wildlife obtaining human food. Rope borders have been only partially effective in containing trampling disturbance. Many informal trails have been developed and the area lacks a management regular presence to address potential problems like the proliferation and expansion of campsites. Repeating a situation that exists at other popular shelters and campsites along the A.T. in Maine, a new pit toilet was installed in 1995 has already filled. Various commercial products have been unsuccessful in speeding decomposition rates, which are retarded by the cool temperatures. Problems with flies and bad odor have caused some visitors to go out in the woods but rocky soils limit effective cat-hole digging, so surface deposition is common. Finally, improper food storage and dish cleaning practices has led to the attraction of animals to the site, especially red squirrels and birds.
Principal social impacts include crowding and lack of solitude caused by the close proximity of the A.T.

and by limited spacing between sites. All campsites and tent platforms are close to and within sight of the A.T. and each other, diminishing the potential for privacy for both hikers and campers. The limited spacing between sites also enhances the potential for conflict among groups of campers sharing the site.

Previous Management Actions

The construction of tent platforms and rope borders around parts of some campsites and trails have been the principal management response for limiting the creation and expansion of campsites. However, visitors continue to camp occasionally in areas not intended for such use. Restoration and revegetation work has been conducted to speed recovery in these areas. This work has largely consisted of dragging branches onto newly impacted areas. This work has been only partly effective in restoring these areas and preventing their further site deterioration. The pit toilet has not solved the human waste problem as it fills quickly. Bad odors and flies have led some visitors to move to the adjacent woods. A sump pit filled with rocks and a wooden frame containing a filtering screen are provided at one site along with a sign describing it's proper use. However, squirrels and birds still exhibit attraction behavior indicating that they continue to obtain human food.

Since 1992, MATC has hired seasonal caretakers to provide full-time presence during the summer use-season at the Horns Pond Campsite approximately three miles west (south on the A.T.) of Bigelow Cal. These personnel, MATC's group-outreach coordinator, as well as volunteer caretakers visit Bigelow Col to perform maintenance, however, when use is heavy, their priority for providing caretaker coverage has been Horns Pond. An auxiliary campsite was recently added at Moose Falls on the Firewarden's Trail.

Recommendations

Case study members were somewhat split over the issue of whether camping should be continued at Bigelow Col. Reference to the Bigelow Preserve Management Plan reveals that "the overriding management consideration in the Preserve will be to maintain the overall natural character and public uses of the Preserve as they existed in 1976 when the Bigelow Act was passed." Resource protection, particularly in the high elevation zone, is the primary management goal. Three alternate camping locations exist if the site were closed to overnight visitation: Horns Pond (3.0 mi W or S on A.T.), Safford Notch (2.0 mi N on A.T.), and Moose Falls site (0.9 mile S on the Firewarden's Trail). The difficulty in maintaining a usable pit toilet in the rocky soils, operating a composting toilet in the absence of a caretaker and cool temperatures also justify site closure.

Alternately, management of the site and of the nearby Moose Falls site could be enhanced to mitigate current problems. Because it is at a lower elevation, the Moose Falls site could accommodate greater visitation, particularly by organized groups, to alleviate pressure on Bigelow Col. To make the Moose Falls site more attractive to campers, alternative camping areas somewhat closer to and on the contour with the spring should be investigated. Site design and construction practices such as those described in Appendix 2 can be used to develop expansion-resistant campsites with spacing that promotes solitude. Actions for the existing sites include development of a site access trail higher on the slope with short spurs to each campsite, separation of existing sites (100+ ft), and improvement of 2-3 individual tent pads at each site. Campfires might also be permitted at this lower elevation site to make them more attractive to campers. If permitted, small steel fire rings should be installed and firmly anchored to contain fire impacts. Trailhead signs, maps, encouraging one-way hiking on the A.T./Firewarden's loop to reduce contact-intervals, and advance contacts with groups through MATC's already established

group-outreach program could be employed to encourage visitors to shift their use to this site.

The fragile vegetation, extremely rocky soils, and problems with site proliferation and expansion at Bigelow Col provide justification for limiting camping to tent platforms. Prohibiting camping on ground sites, even though enforcement is limited to caretakers, should reduce ground disturbance to more acceptable levels. Another tent platform or reinstallation of a small lean-to should be considered if ground sites are to be eliminated. Site capacity should be based largely on pit toilet capacity, or perhaps maintained at existing levels (approximately 10-12 visitors/night), unless, of course, the MATC and other clubs cooperating on R&D improvements to high-elevation sanitation problems succeed with developing new systems. Visitors, particularly groups, should be encouraged to use the Moose Falls-, Safford Brook- and Horns Pond Sites and informed that camping is restricted to a limited number of tent platforms. Should they arrive to find the platforms full, they should be prepared to travel on to the next camping area. The practicality of achieving this compliance without daily caretakers should be carefully evaluated by the club and state land managers.

A centrally located sign should orient visitors to the area and to camping policies. The A.T. or tent platforms should be relocated to allow greater spacing between the tent platforms and from the trail. The arrangement of facilities and their linkage through a constructed access trail system should pro-actively avoid the formation of visitor-created trails and enhance visitor solitude (see Appendix 2). Ideally, if such an improved site design succeeds in limiting unplanned cross traffic, rocks and logs should eventually be used instead of ropes to line trails and intended use areas. At Avery, fires should continue to be prohibited.

The pit toilet should be moved and additional measures taken to reduce problems with flies and odors. Effective management of a composting toilet likely would require a caretaker but site capacity does not warrant this at Bigelow Col. Installation of a Mouldering Toilet design might be investigated. Educational messages about proper food storage, dish cleaning practices, location of the sump, and concerns about wildlife impacts should be included on the central sign.

Case Study Members

Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Natural Resource Recreation
Mark Simpson, Chris Wolfe, Mark Sario, Dick Fecteau, Heather Merczak, Caleb Simpson, MATC
Rita Hennessy, NPS Appalachian Trail Park Office
Bob Proudman, J.T. Horn, ATC
Steve Spencer, Maine Bureau of Parks and Lands
Charlie Jacoby, Acadia NP
Jeff Strout, Bangor Daily News

Full Goose Shelter, NH

Background

The case study team (members listed at end of document) visited the Full Goose shelter in western Maine on October 8, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

Full Goose shelter (2,900 ft elevation) is located in the Mahoosuc Mountains. The shelter is on land owned by the Maine Bureau of Parks and Lands and managed by the Appalachian Mountain Club. This section of trail is relatively popular among backpackers of the region; day-use is limited. Increasing numbers of organized groups use this section of trail, particularly camps, Outward Bound, and college groups. Shelter capacity is 14 visitors but tent platforms (3 single, 1 double) and several campsites can accommodate up to 20 additional visitors. Facilities also include a composting toilet and related bins and trays that are maintained by a roving caretaker. Due to the limitations of the terrain (top of a steep sided hill less than one-acre in extent), the facilities are located in close, within 30 feet of one another, with the tent platforms placed behind the shelter and the campsites below the spring just behind the platforms.

Due to the popularity of this section of trail the shelter reaches capacity quite frequently during summer weekends. Use increased substantially during the early to mid-1990's, but has leveled off in the late 1990's.

Description of Problems

Few resource impacts are evident due to the intensive management work by AMC. The club has applied its traditional solutions to the Full Goose site, which rely heavily on the use of facilities (large shelter, tent platforms and a composting toilet) and site definition ("scree" walls and revegetation areas). This strategy has had mixed results at Full Goose. The resource damage associated with visitor use is rather confined, but this may come at a cost of the visitor's experience. The limited resource damage is largely due to the sloping terrain and the intensive facility development, both of which concentrate visitor traffic and constrain expansion of the campsites. The composting toilet is well managed, with good visitor compliance in its use. Improper food storage has led to the attraction of various animals to the area and poor dish cleaning practices and litter are also recurring problems. Campfires are allowed, but the fire pit is managed to keep fires small which has kept tree damage minimal.

Social impacts were identified as a more significant issue. Some team members were concerned about the high potential for visitor crowding and conflict. A shelter capacity of 14 translates to six or more groups sharing the shelter, each with their own stove and conversations. Immediately behind the shelter the tent platforms were located in such close proximity to one another that conversations could easily be overheard, with all sites in full view of each other. Shelter users also have to walk between the tent platforms and near the campsites to access water. Finally, the tight clustering of up to 35 visitors,

particularly when accessing the spring and toilet, creates a greater potential for crowding and conflict than any developed campground, where such numbers would be spread apart with considerably more space.

Previous Management Actions

The use of facilities has effectively resolved most resource impacts at this heavily used site. Visitor activities are concentrated on wooden shelter and platform surfaces arranged in a tight cluster near the toilet and spring. Work has also been done to build "scree walls" to help define the trails and access points for the area. These low rock walls are only partially effective in preventing wandering and vegetation loss inside the tight cluster of development. A combination of the scree walls, revegetation signs and the sloping terrain have been effective in limiting the expansion of the campsite outside of the developed cluster. Installation of the composting toilet has also resolved human waste impacts and the roving caretaker program effectively manages both the toilet and site use.

Discussion

Management actions at the Full Goose shelter raised some interesting discussions among case study members. Two issues emerged: 1) the importance of solitude and privacy to the social experience for A.T. hikers, and 2) the appropriateness of a facility-intensive management approach.

Surveys of backcountry and wilderness visitors have consistently shown solitude to be an important element of high quality recreational experiences. Surveys also show that while visitors expect and accept seeing large numbers of others at access points and attraction features, even along popular trails, they are most concerned about finding solitude at their campsite. Are A.T. visitors any different? Club members in other states have frequently shared their observations about some A.T. visitors who purposefully avoid shelters and common camping areas to find solitude in less-visited areas. Managers need to be aware that limitations on available camping areas due to terrain, water, and camping regulations can make finding solitude while camping a difficult objective to achieve. Furthermore, some campers who desire solitude may lack the knowledge or skills necessary to locate a remote or pristine site or to camp on such a site while limiting resource impacts.

The high capacity and density of camping facilities at the Full Goose shelter almost guarantee that crowding and conflict will occur at medium to high use levels. One case study member had camped at the shelter when it was at capacity and related how comical it was to pump water at the spring with members of a half-dozen other groups. Lines forming at the outhouse door and multiple conversations amid the roar of four or more cooking stoves in the shelter also come to mind. Loud groups and snoring undoubtedly keep campers awake at night or awaken them early the next morning. Conflicts between different groups, such as Scout troops, church groups, college students, friends, families and couples sharing the shelter or camping on adjacent tent platforms also undoubtedly occur.

Upon reflection, we ask whether such social problems could be avoided without sacrificing the success achieved in resource protection. To an extent some trade-offs must be made. Enhancing the spacing between camping facilities will increase the length and disturbance associated with access trails but should not change the footprint of the individual sites. Some of us also question the appropriateness of larger shelters, preferring well-spaced multiple smaller shelters or tent platforms and campsites. Total capacity at the site is also part of the issue. Regardless of the spatial arrangement of sites and facilities,

crowding will occur at the water source and outhouse if site capacity is too high. Discussions need to define what levels of crowding can be tolerated at these locations for the desired social experiences to be provided.   Some potential solutions are to select water sources with multiple access points (e.g., streams or ponds), use pipes to create two water sources from a single spring, and build multiple toilets. Developing nearby additional sites, and manipulating Full Goose's site capacities represent other solutions.

The second issue that should be considered is the appropriateness of a facility-intensive management approach. Facilities are generally viewed as being decreasingly appropriate across the continuum from developed, to backcountry, to wilderness environments. Other common principles are that backcountry and wilderness managers should use the minimum tool available, avoid artificiality (or the appearance of same), and favor resource protection over visitor convenience in selecting facilities. Some members of the case study team found the large and extensive facilities at the Full Goose shelter to be out-of-character with the primitive natural environment of the area. In particular, the large size of the shelter structure, the numerous tent platforms, and the large toilet and its two large stainless steel composting bins and mesh drying racks were somewhat artificial and obtrusive.

A smaller, more traditional shelter, or two smaller shelters separated by 100 feet, would be visually less obtrusive or massive in appearance. Furthermore, the use of tent platforms was not required to protect high elevation vegetation and although the ground was rocky, sufficient soil and flat or sloping terrain existed in the area to create campsites through cut-and-fill techniques (see Appendix 2). The simpler approach of creating good tent pads with rock and soil is more permanent, less expensive, and more visually appealing than the construction and maintenance of dimensional lumber platforms. Finally, the composting toilet, although no doubt necessary at this location, could be relocated somewhat further away from the shelter with more care taken to shield or camouflage its supporting facilities from the view of visitors such as masking or painting the bright stainless steel bins, burying PVC pipe, and building natural screens.

These concerns about the lack of solitude and the probability of encountering social conflict have some basis in anecdotes from the public, but the on-site caretakers and AMC management get few formal complaints about Full Goose. Given the high use of the site and the density of the developed area one may wonder if displacement of those who are seeking solitude is occurring, or if there is a different level of acceptance of the crowding at the shelters in the Mahoosuc range. The nature of the Trail in this area as being on the ridge top with limited water and dense vegetation and steep slopes also makes dispersed camping more difficult in this particular area perhaps making the public more tolerant of lack of solitude. As local managers make decisions about the site, they may choose to engage in some social science research to sample people's acceptance of the densely clustered facilities and people. The Manning study (1999) should be checked regarding this question.

These discussions are included not so much as a critique of past management decisions at the Full Goose shelter as an opportunity to stimulate current discussions regarding the development of future trail-wide camping management guidance. AMC might consider the long-range implications at this and the other major Mahoosuc sites, and prepare a long-term develop plan for enhancing the designed opportunities for experientially more solitude at campsites (increase number and frequency). Readers are encouraged to consider and debate these issues and decide if the actions taken at this shelter would be appropriate at other shelters in other regions.

Recommendations

A number of actions could be taken to alleviate some of the social concerns at this site. The existing tent platforms could be moved to alternate locations that allow greater spacing from the shelter and each other. Alternately, tent platforms could be removed and replaced with constructed soil tent pads in sloping terrain (App. 1). Elimination of tent camping near the spring and at other adjacent non-designated locations would reduce the camping capacity to alleviate some crowding. This may require a more regular caretaker presence or the development of some additional overnight opportunities between Carlo Col and Speck Pond, the adjacent designated sites, respectively north and south. The eventual replacement of the large shelter with one or more smaller, well-separated structures should also be considered. For example, an ideal overnight site may be possible at the head of the Notch Trail where both water and soils appear adequate for preparation of a low-development campsite to reduce peak loads at Full Goose.

Painting the composting bins brown and planting native evergreen shrubs to provide a visual screen are also actions that might be considered to reduce the visual obtrusiveness of the composting toilet facilities.

Educational materials and contacts by the caretaker might also be enhanced to address the issues of inappropriate food storage, feeding of wildlife, and dishwashing practices.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Natural Resource Recreation
Rita Hennessy, NPS Appalachian Trail Park Office
JT Horn, ATC, New England Regional Office
"Hawk" Metheny, AMC White Mountain Trails Program

Stratton Pond, VT

Background

The case study team (members listed at end of document) visited the Stratton Pond area in southern Vermont on July 19, 2000 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

Stratton Pond (2,550 ft) is on land within the Green Mountain National Forest and along trail maintained by the Green Mountain Club (GMC). The highly scenic 46-acre pond is located nearly four miles from the nearest public road and is a destination for both day and overnight visitors, each comprising about 50% of the total visitation. With about 1,200 visitors/year, Stratton Pond is the most highly visited area along the A.T. and Long Trail (LT) in Vermont. The area is particularly popular for weekend camping, with 20 to 40 visitors/night in the warmer months and up to 60 to 75 visitors/night on peak use weekends. Approximately 20% of the overnight use is by visitors in larger organized groups. Visitation was nearly twice as high in the 1970s, dropping considerably in the 1980s and with modest growth currently.

A management plan for the area was prepared by the Green Mountain Club in September 1997. The plan called for further separation of camping areas from the pond shoreline (>200 ft) to protect water quality and shoreline vegetation. The removal of existing shoreline shelters and relocation to a new shelter were recommended. Separation of different user types (long-distance hikers, overnighters, and organized groups) and the selection of improved tent camping areas was also addressed.

Description of Problems

Camping currently occurs in four locations at Stratton Pond:
1) Stratton Pond shelter (completed fall 1999) - no tent camping here,
2) Vondell shelter and at five campsites up the hill behind the shelter (Vondell was since removed).
3) Stratton View tenting area - several campsites and potential sites arrayed along an old woods road,
4) North Shore tenting area - 3 tent platforms and tent camping on the ground.

Resource conditions are generally good, primarily due to previous and ongoing management efforts (described in the following section). With the exception of the Vondell shelter, which will be removed this year, all camping occurs more than 200 feet from the pond. The pond shoreline vegetation is significantly disturbed in only one location, at the Willis Ross cabin clearing, where concentrated day-time traffic has converted the herbaceous groundcover to grasses and sedges (cabin burned 25 years ago). Trails around the pond remain close to the water's edge but trail improvements appear to be effectively resolving shoreline vegetation and water quality protection concerns. There was little evidence of problems with campsite proliferation or expansion or serious soil erosion. Some camping areas are larger than necessary but resource disturbance is fairly localized within the four camping areas (i.e. off-site impacts are minimal). Principal impacts include exposed soil, groundcover vegetation loss, tree damage,

fire scars, and litter. Toilet facilities include a composting toilet at the Stratton shelter and pit toilets at the three tent camping areas but high use necessitates their relocation every 1-2 years. The management of human waste remains a principal concern.

Social issues are also not a significant problem as the camping is dispersed among the four areas. Problems with crowding/conflict could occur within any of the four areas as the shelter capacity is 20 and individual campsites are not well-separated. One concern that was voiced was the deterioration of social experiences associated with removing camping from the shoreline of the lake to more distant areas that lacked views of the pond.

Previous Management Actions

The GMC has staffed the area with a caretaker beginning in the early 1970s in response to the areas high visitation. This individual is currently on duty from Memorial Day to Columbus Day and camps on a tent platform in a central location. Duties include directing campers to appropriate sites, general management and maintenance of the trails and campsites in the area (including operation of the composting toilet), visitor contact, education, and enforcement activities, and collection of fees ($5/person/night).

A number of previous visitor impact management actions have been directed at protecting the natural resources near Stratton Pond. Trail relocations and maintenance work, including installation of puncheon and stepping stones, have improved the protection of shoreline vegetation and pond water quality. Use and deterioration of a peninsula extending into the lake has been substantially reduced by the blockage of visitor-created trails. All camping structures (Bigelow, Statton View, and Vondell shelters and the Willis Ross cabin) have or will soon be removed with camping relocated to areas more than 200 feet from the pond. Old shelter locations have been successfully closed to further use (with the exception of Willis Ross) through restoration efforts, signs, and the caretaker presence. The Bigelow and Stratton View shelter sites have been fully colonized by herbaceous ground cover. The caretaker program has been effective in limiting impacts to trails and campsites through maintenance work and visitor information, education, and enforcement work. The caretaker's presence effectively prevents problems with campsite proliferation and illegal camping along the shoreline. Site facilities, such as the shelters, tent platforms, and trails, concentrate visitor activity onto prepared resistant surfaces and toilets have resolved problems with improper human waste disposal. Finally, campfire-related impacts have been minimized by prohibiting fires at the new shelter and restricting them to one fire ring at each of the three tenting areas.

Social conditions have been protected by distributing the camping across four, widely dispersed, camping areas, although the proximity of visitors within each area remains a concern.

Recommendations

Previous management actions and unimplemented actions within the Stratton Pond Management Plan have or can effectively resolve most of the visitor impact management concerns viewed by the case study members. However, our review did yield some additional comments and recommendations for each camping area:

Stratton Pond shelter - A good location removed from the pond. Discussions focused on its large size

(capacity =20) and concerns about forcing different visitor groups to camp in close quarters (crowding), noise levels (conflict), and the more decidedly large (2-story) and developed nature of the shelter (covered cooking area). Trail-wide discussions and debate regarding these shelter design trends should be initiated to develop a consensus on their appropriateness. Given the history of separate camping locations around the lake and the size of the shelter it would probably be best not to co-locate campsites in the vicinity of the shelter. A single campfire ring (<2 ft dia.) could be installed at the shelter, as firewood is plentiful. Several GMC members expressed concerns about losing the site's pristine qualities if a campfire site was constructed but consideration should also be given to the many visitors who really desire campfire experiences and safety issues during wet and cold weather.

Vondell tent camping area - Following shelter removal the area should be signed to prevent use and rehabilitated if possible with randomly placed clumps of transplanted native vegetation, including a few small trees and shrubs. Do this in the early spring to jumpstart vegetative recovery - watering may still be necessary in the summer if it's particularly dry. Do not seed to grass as this will retard colonization by native herbs (see Appendix 2 for additional site closure practices). The tenting areas occur in sloping terrain that is ideal for the kind of side-hill constructed campsites described in Appendix 2. They could continue to be used to accommodate increased demand on peak use weekends or could be further developed for continuous camping. The ease of digging additional pit toilets, in comparison to alternative camping areas, or of maintaining a composting toilet may determine the desirability of this area for continued use.

If developed for continuous camping, the site layout should be carefully planned to anticipate traffic patterns and separate individual or grouped tent sites. Further guidance for planning and constructing side-hill campsites is provided in Appendix 2.

Stratton View tenting area - The terrain here is not as sloping as Vondell but side-hill campsites could still be effective in most areas. GMC staff noted that it's easier to dig pit toilets in this area. The old roadbed might be used as the central access trail to individual campsites, arrayed 30 or more feet away upslope and downslope from the roadbed. The location of the water source and privy should also be taken into account during site design work. Campfires could be located at a single site or at individual sites, particularly if the area is to be dedicated to group camping as it is currently. Typical group sizes should be considered when designing how many tentsites should be clustered at each campsite. Campsites should be well-separated from each other (perhaps >200 ft) to preserve the social experience of group campers.

North Shore tenting area - This area has flatter terrain and wetter soils that make it somewhat less desirable for intensive camping. The existing tent platforms do concentrate use but they have not successfully limited ground disturbance within the surrounding area. This may be due to overflow camping on ground sites when platform use capacities are exceeded. There is also disturbance associated with the area's single fire ring. The use of tent platforms was also questioned. In backcountry settings the use of developed facilities are generally limited to those absolutely essential to accommodate recreational use while protecting natural resources or visitor safety. The Stratton Pond area has sufficient soil in all areas to support tent camping on the ground - tent platforms might be best reserved for those places where rocky terrain prevents tenting directly on the ground.

If camping in this area is continued there are some actions that could reduce resource impacts. An improved access trail to the area and to individual campsites is needed. Existing and any additional

campsites should be well-separated, preferably out-of-sight from one another. The platforms could be moved to sites that are less hospitable to off-platform activities (until they wear out and can be replaced by ground sites). Embedded logs or rocks can be used to visually define improved tent pads in flatter terrain. Site ruination practices (Appendix 2) may also be necessary to discourage use in adjacent flat areas.   A small steel fire ring could be installed and firmly anchored to encourage small fires.

Stratton Pond area - Alternative camping locations in sloping terrain might also be searched for in areas near the best springs and/or with the most suitable soils for pit toilets. A 12-18% slope is ideal for side-hill constructed campsites. The area appears to be quite resilient and moving camping areas is an appropriate practice when use is shifted from a more fragile to a more resistant site. Moving camping areas also permits the use of improved site configurations and access trails. Site configurations such as those shown in Appendix 2 limit resource degradation by concentrating use and constraining travel patterns.

The social experience is also improved by providing greater separation between visitor groups and heavily trafficked trails and use areas. This separation improves privacy and solitude, preserves the natural quiet, and enhances visitor interaction with the natural environment. A final social issue concerns the consequence of moving camping away from the more scenic lakeshore areas. While this was a valid resource protection action, it does reduce opportunities for visitors to experience the scenic pond vistas they hiked in to see. Some efforts might be expended to either locate or create (through selected tree thinning) a scenic vista of the pond, possibly on a rock outcropping overlooking the lake. A well-designed trail could be constructed up to this vista to provide low-impact access.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Dept. of Forestry, Recreation Resources Mgmt.
J.T. Horn, ATC, New England Region
Pete Irvine, USFS AT Coordinator, Harpers Ferry
Brian Fitzgerald, ATC Vice Chair and TLC Comm. Chair
USFS, Green Mtn. NF - Dennis Roy (District Ranger), Tom Paquette (Trails Spec.), Ken Norton
        (Wilderness Spec.), Eric Kohler (SCA Intern)
Green Mtn. Club - Marty Lawthers (President, ATC EIO Comm. Chair), Chris Mazdzer (Marty's son),
        Pete Richardson (Trail & Land Mgt. Comm. Chair), Steve Crowe (Trail & Shelter Section Chair,
        ATC BOM), Dave Hardy (Dir. Field Programs), Val Stori (Field Supervisor, S VT), Pete
        Ketchum (Field Supervisor, N VT), Todd ? (Caretaker at Stratton Pond)

Goddard Shelter, VT

Background

The case study team (members listed at end of document) visited Goddard Shelter in southern Vermont on July 20, 2000 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

Goddard Shelter is located on Glastenbury Mountain within the Green Mountain National Forest and along trail maintained by the Green Mountain Club (GMC). The area was acquired by the U.S. Forest Service approximately twenty years ago and the GMC and ATC have advocated for a wilderness designation. The shelter is about 15 years old and has a capacity of 12-15. A ridge-runner was added for this area this year and stays at the shelter three nights/week; no fees are charged for camping. The shelter's location is quite remote, requiring a fairly demanding 10-mile hike. Regardless, visitation has recently increased sharply in response to publicity about a 20-mile hiking loop that includes Glastenbury Mountain and Goddard shelter. Weekend visitor use currently frequently numbers in the teens with a maximum of 22 campers on one night. Day use and group use is minimal due to the longer and more demanding hike into the area.

Description of Problems

Problems with the creation of new and expanded campsites have occurred in response to the increased visitation. In particular, camping was occurring in a flat area immediately upslope and adjacent to the spring and in the shelter clearing. Ground disturbance in this area could drain directly to the spring and degrade water quality. Another resource concern is the development of gully erosion in the shelter clearing from water running down the A.T, which runs through the clearing, and from the shelter roof. Human waste management is a final concern, the rocky soils make digging a deep pit difficult and the privy has had to be moved annually due to the increased use.

Social issues are not a significant problem though the ridge-runner reports that most visitors actively seek out solitude, often camping outside of the shelter and remaining on their sites rather than congregating. Some speculated that this also may be a factor of the biting insects which are notoriously bad, causing people to prefer tent camping rather than the open air shelter. Given this preference for tenting, regardless of the reason, the current campsites are located too close to each other to provide solitude when all are occupied.

Previous Management Actions

The new shelter expanded camping capacity but many visitors are apparently opting to tent camp to obtain greater privacy. The ridge-runner has largely eliminated camping in the area adjacent to the spring through signs and her presence. Camping has been shifted to two new sites in the woods on the opposite side of the shelter.

Recommendations

Erosional problems in the shelter clearing can be resolved by installing tread drainage features on the A.T. before it enters the clearing to remove water. Resloping or a French drain to capture shelter roof water can also direct it around the opposite side of the shelter, out of the high traffic areas. Rock steps, ice-berged rocks, and the addition of soil and seeding will likely be needed to restore the eroded area and direct traffic to prevent its reoccurrence. The affected area could be roped off for a few months to accelerate recovery.

There was discussion about relocating the A.T. and the West Ridge trails so that the shelter is accessed by a spur trail. This option was favored by the group but needs to be planned carefully. Reroutes should account for and not interfere with the selection of the best campsites and privy locations.

Closure of the camping area above the spring can be enhanced by ice-berging some rocks to permanently ruin potential tenting sites.

The new campsites are located approximately 80 feet from the shelter in sloping terrain that is ideal for side-hill constructed campsites. A camping area design with an access trail on the contour and campsites arrayed above and below the trail is recommended. The campsites should be out-of-site from the shelter and each other, preferably, or at least set apart some minimum distance (e.g., 75 ft) to provide privacy. This is particularly relevant if the area is designated as wilderness due to the legal mandate for providing solitude. Camping capacity should address average high use rather than peak use.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Dept. of Forestry, Recreation Resources Mgmt.
J.T. Horn, ATC, New England Region
Pete Irvine, USFS AT Coordinator, Harpers Ferry
Brian Fitzgerald, ATC Vice Chair and TLC Comm. Chair
USFS, Green Mtn. NF - Dennis Roy (District Ranger), Ken Norton (Wilderness Spec.), Doug Reeves (Trail Spec.)
Green Mtn. Club - Pete Richardson (Trail & Land Mgt. Comm. Chair), Ben Rose (Executive Director), Dave Hardy (Dir. Field Programs), Val Stori (Field Supervisor, S VT), Kate Fish (Ridge-runner, Glastenbury Mtn.)

Bear Rock Falls, MA

Background

The case study team (members listed at end of document) visited the Bear Rock Falls designated camping area in western Massachusetts on March, 18, 2001, to identify and evaluate camping impact and visitor safety considerations. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Bear Rock Falls camping area (elevation 1,600 ft) is located on lands owned by the Commonwealth of Massachusetts within the Mt. Washington State Forest. The Massachusetts A.T. Committee of the Appalachian Mountain Club (AMC) and the Massachusetts Department of Environmental Management maintains this section of the A.T. This area has been popular with hikers and campers since the 1960's and was made a formal camping area with the addition of three camping platforms in the late 1980's. This action was taken to relieve heavy camping pressures from the Sages Ravine Campsite, located 1.3 miles to the south in Connecticut. Sages Ravine is the most heavily visited camping area along this stretch of trail, with 920 campers in 2000. The Bear Rock Falls campsite is the second most heavily visited area, with 581 campers in 2000 (a conservative estimate based on incomplete data). Estimates place average weekday visitation at around 10 campers/night and weekend use at 20/night.

The camping area is located within a mature hemlock forest between the A.T. and Bear Rock Falls Stream. Within 100 feet of the camping area, the creek spills over a waterfall. This feature serves as an attraction for area visitors. The waterfall is not fully visible from the top and there is no easy or safe route down to the bottom. Visitors are also attracted to a nearby scenic overlook, which at one point coincides with the waterfall. Most visitors likely use the stream as their water source, though its source is a nearby small lake surrounded by homes on septic systems. A spring is located a few hundred yards south on the A.T. and signs on the site notify visitors of its presence. An outhouse is located across the A.T. from the campsite.

Description of Problems

The primary management concern at this site is visitor safety and related liability issues associated with the camping area's proximity to the cliff top. Two serious injuries and one fatality have resulted from visitor use in the area over the last six years. One of these incidents was associated with camping. To promote visitor safety, staff from the State Department of Environmental Management have decided to move the designated campsite away from the cliff edge.

Primary resource impact concerns include heavy use and impact by campers in the vicinity of the tent platforms, and vegetation trampling and erosion of soil throughout the area. Much of this use and impact occurs on the banks of the stream, which runs through the middle of this area. The parallel arrangement and close proximity (<150 ft) of the camping platforms to the A.T. has also led to the development of numerous site access trails into the hemlock grove. Fire-related impacts are also a prominent concern, including the proliferation of fire sites and blackened rocks from a fire built against and under a large

overhanging boulder. Related impacts include tree damage, cut trees, social trails, and the lack of small woody material in the surrounding area. A decision has been made to discourage campfires effective in 2001 to alleviate campfire-related impacts and to implement a ban on fires in 2002.

Social issues, such as visitor crowding and noise, are also a concern due to the increasing use of the area, particularly by larger organized groups.

Previous Management Actions

The installation of the three small tenting platforms has contributed to the protection of the area by concentrating visitor camping activities. However, these are frequently full on weekends and numerous impacted ground tenting areas, with high inter-site visibility, have also been created. The sloping topography and limited flat terrain have effectively limited the number of these sites and their total area of disturbance. The area is also signed at both end along the A.T. to communicate to visitors the site layout and appropriate camping locations.

The AMC staffs a Caretaker at the Sages Ravine campsite during the summer months who hikes to the Bear Rock Falls campsite in the mornings or at dusk to contact campers and record visitation. Every other weekend a Ridge-runner stays at Bear Rock Falls campsite for one night. These staff help to ensure that visitors camp in designated areas, warn of the dangers associated with the adjacent cliffs, and fulfill a general visitor contact and information function.

Recommendations

Recommendations for alternative management actions at Bear Rock Falls campsite focus on four issues: 1) visitor safety, 2) site closure and rehabilitation, 3) selection and development of an alternative camping area, and 4) A.T. relocation.

Visitor Safety - There are many cliffs along the A.T. and in backcountry settings visitors are expected to take appropriate precautions without the notification of agency warning signs or protective fences. Reviews of case law reveal that land management agencies have little liability for accidents in such unimproved settings. However, given the history of serious accidents at Bear Rock Falls, state managers have concluded that designated camping should be moved and that day use should be discouraged. A formal facility such as a designated overnight campsite does attract visitors to this potentially hazardous cliff-top environment where visitors have ample time for exploration and related accidents. The case study members concur with this decision, though it was noted that day-use visitation will likely remain high in the area.

Placement of a cliffside sign warning visitors of the dangers associated with the cliff was discussed. A permanent sign was not viewed as necessary once the existing camping area is moved. A temporary sign until the area is closed might be prudent. If this action is taken a letter should be written to the permanent state files that the sign was temporary in nature and would be removed following campsite relocation. A lawsuit at the Palisades State Park (N.Y.) went against the state because a warning sign that was repeatedly vandalized was not replaced. Legal advice on this issue should be sought.

Site Closure and Rehabilitation - Case study members stressed that closure of the Bear Rock Falls campsite will be a difficult and unpopular process. The area is visually attractive and has a long tradition

of heavy use that will be hard to reverse. Furthermore, the dense hemlock forest cover will greatly slow recolonization of the area by ground vegetation, which would be very sparse even in the absence of trampling disturbance.

The closure process should begin with notifications to the adjacent YMCA camp, trail-related organizations, organized groups who routinely use this section of the A.T., and general public information news releases. These notifications should provide the rationale for closure, including both safety reasons and resource protection concerns regarding environmental impacts within the hemlock grove. Development of the alternative camping area in the vicinity should also be noted. Over the long term, management efforts could also be made to remove the name Falls from all signs, maps, and printed literature. Named waterfalls often become a destination for hikers, and visitors are undoubtedly disappointed to discover that they are unable to clearly view the Bear Rock Falls. Attempts to climb on the rocks or climb down to gain a better view are clearly unsafe.

Following relocation of the existing tent platforms, tent site ruination work is recommended to discourage illegal tenting in the closed area. This work consists of digging in or "ice-berging" large rocks and scraping shallow depressions and mounding soil to create uneven surfaces in areas most likely to receive tent camping. An archaeological survey may be required prior to initiating such work. Large standing dead trees in the area should be felled or moved to the site to create physical barriers. The cutting of some live trees should also be considered. An advantage of cutting live trees would be increased sunlight penetration that would accelerate and sustain higher levels of ground vegetation growth. Hemlocks throughout this area are expected to die eventually from the hemlock woolly adelgid, currently progressing from the south. Substantial ground vegetation growth will not likely occur unless this stand succumbs to this invasive insect.

Trails leading to the area should be blocked where they first leave the A.T. with rocks, woody debris and possibly transplanted shrubs. Several signs reading "Area Closed for Recovery, Please Stay Out" should also be erected with anchors that prevent their easy removal. A supporting action is to erect string or rope around the area - a practice that is visually obtrusive but has been highly effective in other areas. Some group discussion focused on the appropriateness or inevitability of continued visitor access to the area, particularly the viewpoint. One option is to post the entire area with signs and attempt to close all of it to use. The lack of management presence and enforcement capabilities and the attraction of the viewpoint, falls, and prior popularity likely means that such closure will be ineffective. Even low amounts of continued trampling will prevent the recovery of ground vegetation. In recognition of this problem, another option would be to create a formal viewpoint access trail through the area to concentrate use on a single route. Such viewpoint access trails are a common practice along the A.T. One concern with this option is the potential for liability as the access trail could be construed as a facility designed to bring visitors to the dangerous cliff-face. Another option discussed was to leave only one unobstructed, lightly maintained access trail to the overlook. This issue was unresolved by the case study discussions.

Selection and Development of an Alternative Camping Area - Given the high use this site receives there was a strong consensus that an alternative camping area needs to be developed in the vicinity. A prior search by DEM, AMC and ATC staff had identified some prospective areas approximately 100 yards away on the opposite side of the A.T. The terrain in this area is sloping and has deciduous forest cover with nearly continuous patches of mountain laurel and understory trees. Such an area would readily permit a designed camping area with constructed access trails and side-hill constructed campsites to

concentrate camping activities and discourage campsite proliferation and expansion. Some concerns were voiced about the proximity of this area to the closed sites - both related to visitor safety and continued trampling pressures.

Searches for more distant alternative areas near the spring did locate a higher elevation slope with identical vegetation characteristics that would satisfy this concern. This area could be accessed by a trail directly from the spring, providing both a distance and elevation deterrent to campers who might explore or spend time at the closed area. Concerns with this site centered on the elevation gain involved in accessing the area and the potential need for a switchbacked trail. Further investigation when snow is absent from the area will be needed to evaluate and select from among the two potential locations based on ease of trail alignments and site construction. In both instances there are opportunities to develop separate group and individual campsites. Strategic placement of a single toilet facility accessible by all campsites is an important consideration for site planning. Documentation of the number of groups by group size on a sample of weekend nights this summer season would be useful for planning site capacity. Group campsites should include no more than four tent sites and individual campsites might include one or two tent sites. Additional campsites could be planned but not developed until their need is demonstrated.

A.T. Relocation - Case study members also discussed the potential for relocating the A.T. to remove it from a deep erosional trench and to provide further visual separation from the present camping area, overlook and waterfall. Land ownership patterns constrain a relocation of more than 20 to 40 feet unless permission is granted to move it onto a tract that has an NPS scenic easement. Further evaluations are required based on accurate boundary delineation in the area. The braided Bear Rock Falls stream bed may also serve as a constraint in the relocation process.

Case Study Members

J.T. Horn, ATC, New England Regional Office
Jody Bickel, ATC, New England Regional Office
Paul Adams, Massachusetts Department of Environmental Management
Rebecca Barnes, Massachusetts Department of Environmental Management
Ben VanOudenallen, Americorps
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Deno Contos, AMC Regional Trails Coordinator
Cosmo Catalano, AMC Massachusetts A.T. Committee
Peter Jensen, OpenSpace Management

Sunfish Pond, NJ

Background

The case study team (members listed at end of document) visited the Backpacker II site near Sunfish Pond in northwestern New Jersey on December 10, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Backpacker II camping area (1280 ft) is located high on the Kittatinny Ridge within the Worthington State Forest (NJ Div. of Parks and Forestry), 50 miles west of the populous Newark, NJ and New York City metropolitan areas. Depending on the trail taken, this site is a 3.5mile hike from the trailhead. The camping area is located a short hike from Sunfish Pond, a highly popular destination point for both day-use hikers and backpackers. Camping is not permitted around Sunfish Pond. The Appalachian Trail runs near this popular camping area but the majority of site use is by casual campers who hike up just to camp one night. The maintaining club for this section of the A.T. is the New York-New Jersey Trail Conference.

The Backpacker II site receives very high overnight visitation with up to 150 campers on popular weekends and 10-40 on weekdays. As many as 250 day hikers per day visit nearby Sunfish Pond but most do not visit this camping area. Substantial group camping occurs at the site (approximately 25-35% of all use), in part because of the many private camps located in the region and because of its easy access.

There are approximately 25 campsites at the designated Backpacker II site, though these are not individually designated or formally marked. Facilities include two pit toilets, four bear bag poles, and a steel food locker. Signs posted in the area inform visitors that alcohol and campfires are prohibited and to secure food from bears. A caretaker tent platform, food storage box, and picnic table are provided at one end of the camping area. The water supply is Sunfish Pond, a long 15-minute walk down a woods road.

Description of Problems

Resource impacts are remarkably limited given the exceptionally high overnight visitation this are receives. Though campsites are numerous most are of reasonable size and bare soil is limited to core use areas. The borders of some sites are ill defined and continuing site expansion and proliferation are management concerns. A large network of ill-defined visitor-created trails also runs throughout the area. Substantial tree loss from the gypsy moth caterpillar has resulted in the spread of trampling resistant grassy groundcover throughout the camping area. Rocky soils and gently sloped terrain also limit soil erosion. Illegal campfires are common in the off-season when the caretaker is not present - several campsites had fire pits. Tree damage is not extensive. Litter remains the most significant problem, particularly in the off-season. Bears frequently visit the site, even during daylight hours, and continue to obtain food from visitors on occasion. Other animals are also attracted to the are because of the availability of human food.

Social concerns are primarily related to noise and crowding. Some groups of sites are clustered with limited space between them. Many are in sight of each other though some campsites are more distant and provide opportunities for greater solitude. Most trails run right through campsites to access others. The large number of groups who use this are also create a higher potential for visitor conflict

Previous Management Actions

Of interest to other areas, there was formerly a Backpacker I campsite located only 1.5 miles up the trail. Heavy use by casual campers, many of whom were unable to find car campground sites, and by groups as a party site caused State Forest managers to close this site in 1994. Compliance has been good and those problems have not transferred to Backpacker II because of the greater distance and caretaker presence.

The caretaker program has been successful in addressing many resource and social impact problems, including illegal camping, partying, bears obtaining food, and campfire-related impacts. Caretakers are present on the site from Memorial Day to Labor Day and trail club members and State Forest staff make additional visits during the off-season. One issue discussed was whether it is appropriate for A.T. community should be involved with the intensive management of a site that receives predominantly casual camping use.

Facilities have also helped to resolve many problems. Improperly disposed human waste is rare due to the pit toilets - though they fill quickly and are moved nearly every year. Installation of a Clivus composting toilet is planned for next year. The bear bag poles and food locker have also enhanced the ability of visitors to safely store food and reduced tree damage and ground vegetation trampling associated with bear bag hanging activities.

Routine litter cleanup has also addressed this problem, though visitors continue to leave trash at the site, particularly in the off-season.

Recommendations

Case study team members discussed a number of actions that could enhance existing management efforts at this site. Campsite numbers do continue to increase in the area though it is unclear whether all sites are really needed. Caretakers could monitor site use, recording the number of groups by group size for a sample of high use and peak use weekends. They might also discuss to what extent noise and crowding are a problem in the area to determine if increased campsite spacing is needed. This data can be used to determine how many campsites are needed and whether current spacing is adequate. This might be followed by some campsite inventory work to evaluate the resource resistance and spacing of existing campsites. Less resistant campsites and/or those close to others might then be closed or replaced by new campsites selected in more preferable locations. Refer to Appendix 2 for further guidance.

Managers may also consider designating each "official" campsite by marking them with camping posts or signs. This will facilitate recovery on closed campsites and limit future campsite creation. From one to four tenting sites could also be improved and made visually obvious on each campsite to more clearly define intended use areas, shrink site size, and limit future expansion. Appendix 2 contains further guidance. Providing more than four tent pads on any single site should be avoided as this accommodates and may increase use by large groups. Groups with too many tents for a site should be instructed to split

their group to camp and cook separately. This should also reduce noise and rowdiness, which tend to magnify with increasing group size.

Site maps at either end of the camping area might be useful to orient visitors to the layout of campsites in the area. Campsites on the map could be color coded by number of tenting sites to facilitate the matching of group size to campsite size. A campsite access trail system originating at these signs might also be developed to reduce the number of informal trails that visitors have created. The strategic placement of logs, which are abundant in the area, along these trails and on some ill-defined campsite borders could also help to delineate intended use areas.

Some efforts have begun to encourage groups to camp in other locations, particularly at locations provided by the State Forest and within the adjacent Delaware Water Gap National Recreation Area. These could be strengthened by preparing some literature that the caretakers and ridge-runners can hand to group leaders.

Finally, the design of the bear bag poles could be improved. The existing design consists of 12 foot 2x8's bolted to trees about 12 to 15 feet up. These have hooks under them for hanging food bags; an aluminum pole is provided to lift and retrieve the bags. Metal sheeting has been nailed to each tree up to the poles to prevent bears from climbing them. This design involves considerable nailing to the trees, particularly given that the metal sheeting will need to be redone periodically as the trees grow in diameter. In other parks and forests managers have used thick aircraft cable stretched at a height of 15-20 feet between two trees approximately 30 feet apart. Smaller cables or ropes on pulleys hang down from this cable to allow visitors to attach and then hoist their food. These are kept at least 10 feet from the anchor trees, which are left unshielded.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Natural Resource Recreation
Paul DeCoste, NY/NJTC
Karen Lutz, ATC, Mid-Atlantic Office
John Wright, ATC, Mid-Atlantic Office
Glenn Scherer, NY/NJTC, ATC BOM
Helen Maurella, Superintendent, Worthington State Forest

Tom's Run Shelter, PA

Background

The case study team (members listed at end of document) visited the Tom's Run shelter on December 9, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Tom's Run shelter is located in the Michaux State Forest (PA Dept. of Conservation and Natural Resources), southeastern Pennsylvania, along trail maintained by the northern chapter of the Potomac Appalachian Trail Club. Two six-person shelters are present at this site, which is located within one mile of a road access. A blue blazed trail provides another one-mile access from the road to the shelters. The shelters are about 30 yards apart and 50 yards from a stream. This section of the trail has become very popular and is easily accessed from populous areas such as Baltimore and Washington and closer cities like Harrisburg. During typical high use periods approximately 20-30 visitors camp in or near the shelters with most visitors on shorter 2-3 day hikes. However, the shelter's close proximity to the road means that carry-in camping is quite common as well. Group and family use are common; club members cited scouts, church groups and other organized groups as the greatest source of resource and social impact. Overflow camping is unrestricted, much of it within 20 yards of the stream. Facilities include a pit toilet, picnic tables and a stone fire pit at each shelter. Forest is fairly open with limited understory consisting of some saplings and low blueberry shrubs. Terrain is gently sloped. Several campsites are on the shelter side of the stream, one is very large, one somewhat large. One large site is on the other side of the stream, close by, another upstream and three further away upstream.

Description of Problems

Given the number of visitors here there seem to be too many sites and too much area of disturbance. Use is likely rotating around to many sites, preventing recovery and causing a higher total area of disturbance than is necessary. Terrain and vegetation does not limit site proliferation or expansion, which are the primary problems at this shelter. Much of the camping currently occurs in front of and directly in sight of the shelters. The borders of three of the campsites are within 15 feet of the stream, though streambanks remain in largely natural conditions and erosion is not readily apparent.

Social problems, while not judged to be serious, include lack of privacy and noise. Several campsites are located immediately in front of one shelter, though a few trees and bushes provide some screening. Other campsites are located within sight of the shelters along the stream, and within sight of each other.

Previous Management Actions

Ridge-runners have patrolled this site for ten years during the summer season, educating campers in Leave No Trace techniques, and generally presenting a management presence. Club maintainers have maintained the shelters and privy, and keep the area clean by hauling out trash from the fire pits.

Recommendations

Terrain and vegetation does not limit site proliferation or expansion, which are the primary problems at this shelter. Much of the camping currently occurs in front of and directly in sight of the shelters. Try to move some campsites to the sides or up on the slopes behind the shelters and also away from the stream. They should be arranged with most of them along a campsite access trail that can be signed as such. Another solution would be to designate some campsites with camping posts and have a central sign that asks visitors to camp on these sites. The club could also install well-anchored steel fire rings. Posts could say camping within 20 feet. Embedded rocks could make a border in some areas (logs don't work as well in areas where fires are permitted). Make tentpads obvious by improving them and adding embedded log borders. Do site ruination work on non-selected sites and/or use signs to close them. Don't include picnic tables at campsites - these are more artificial and are less appropriate on primitive backcountry campsites. Site management actions should be limited to the minimum necessary to achieve resource protection objectives. For example, tent pads are created or improved to concentrate use on the same places, not as a convenience for visitors (though it is). Fire grates area provided to fix the fires in one spot, not to make it more convenient to sit pots on for cooking. Placing a centrally located sign informing visitors of camping locations, policies and LNT practices might be useful. The campsite access trail(s)could begin here. Make sure it's effective (see AMC/NPS sign manual).

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Natural Resource Recreation
Karen Lutz, ATC, Boiling Springs
John Wright, ATC, Boiling Springs
Steve Koeppen, PATC
Bill Jones, PATC
George Finney, PATC
Curtis Finney, PATC
Gary Zimmerman, Asst. District Forester, PA-DCNR
Mike Kusko, District Forester, PA-DCNR

Tumbling Run Shelter, PA

Background

The case study team (members listed at end of document) visited the Tumbling Run shelter on December 9, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Tumbling Run shelter is located in the Michaux State Forest (PA Dept. of Conservation and Natural Resources), southeastern Pennsylvania, along trail maintained by the northern chapter of the Potomac Appalachian Trail Club. Two six-person shelters are present at this site, which is located within a five-minute walk from road access. This section of the trail has become very popular and is easily accessed from populous areas such as Baltimore and Washington and closer cities like Harrisburg. During typical high use periods approximately 20-30 visitors camp in or near the shelters with most visitors on shorter 2-3 day hikes. However, the shelter's close proximity to the road means that carry-in camping is quite common as well. Group and family use are common, club members cited scouts, church groups and other organized groups as the greatest source of resource and social impact. Overflow camping has been successfully restricted largely to two areas, one in front of the shelters and another with three campsites located off the water access trail. Facilities include a pit toilet, a picnic table, and steel fire rings at each shelter and campsite.

Description of Problems

Resource impacts include tree damage, vegetation trampling, litter, and wildlife obtaining human food. Much of the tree damage was attributed to unsupervised organized youth group activity. Trash and poor food handling and dish cleaning practices were also cited as major problems. Intensive caretaking activity by local club members have successfully limited site proliferation and expansion problems, as well as many other resource and social impacts. The borders of three of the campsites are within 12 feet of the stream, though streambanks remain in largely natural conditions and erosion is not readily apparent.

Social problems, while not judged to be serious, include lack of privacy and noise. The largest campsite is located immediately in front of the shelter, though a few trees provide some screening. The other three formal campsites are located very close together but are out-of-sight from the shelter.

Previous Management Actions

Local club members have adopted this shelter and a great deal of caretaking and stewardship activity was evident. The shelters and campsites were in excellent condition and features such as steel fire rings and natural rock pavers underlying the picnic table enhance resource resistance. More importantly, club members have worked closely with State Forest staff in resolving a number of social problems, including partying, that were common at the site. A sign on the shelter access trail indicates that alcohol is prohibited. Routine weekend evening visits are made as necessary to deter party and other inappropriate

activities. Club members confront visitors and inform them of State Forest regulations, which prohibit alcohol, drugs, and require non-backpackers to obtain free camping permits. A sheet of paper with this and other information is provided to the individuals, who are asked to leave the site. Recording of license numbers and the threat to inform State Forest rangers is used for those not easily coerced. Frequent sign-ins on the shelter register also helps build a reputation for the shelter as one that is well-cared for.

Camping in the area has slowly been shifted to the two previously described areas. Occasional camping still occurs outside these areas by visitors looking for addition solitude but associated resource impact is negligible. The trash is routinely picked up and fire rings are kept neat and tidy. Through cooperation and support with the State Forest, five ridge-runners operate in the area during summer months. Their activity has also been very effective in resolving many camping-related problems.

Recommendations

Case study members were impressed by the highly effective program of caretaking and stewardship evident at this shelter. This activity has resolved many resource and social impact concerns and provides a successful model for other areas. Some resource and social problems were identified, however, resulting in some recommendations for further action. Concerns on the resource side were the close proximity of three campsites to the stream, permitting a high potential for water pollution during large rain events from campsite sheet erosion. Some gully erosion from shelter roof run-off across the shelter sites was also evident. Reports of poor food handling and clean-up practices also emphasized the need for improved visitor education. Development of an LNT poster and increased ridge-runner contacts with recommended practices may help to resolve these problems.

Social concerns included the location of a large camping area in front of the shelters, the close proximity of the two shelters (about 25 feet apart), and the close grouping of the stream-side campsites, the largest of which is bisected by the water access trail.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Natural Resource Recreation
Karen Lutz, ATC, Boiling Springs
John Wright, ATC, Boiling Springs
Steve Koeppen, PATC
Bill Jones, PATC
George Finney, PATC
Curtis Finney, PATC
Gary Zimmerman, Asst. District Forester, PA-DCNR
Mike Kusko, District Forester, PA-DCNR

Annapolis Rocks, MD

Background

The case study team (members listed at end of document) visited the Annapolis Rocks camping area in west central Maryland on December 8, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

Annapolis Rocks (1700-ft elev.) is located in Greenbrier State Park (MD Dept. of Natural Resources) about 10 miles southeast of Hagerstown, MD near the A.T. (about 0.2 miles via a side trail). The Potomac Appalachian Trail Club maintains this section of the A.T., the land at Annapolis Rocks is owned by the State Park. This popular day use and overnight destination area features some cliffs with an excellent scenic overlook that is a short 2-mile hike from Route 40. The cliffs are also very popular with rock climbers. The area is exceptionally popular as a camping spot, particularly by large groups. It is not uncommon to have up to 150 visitors and 30 or more tents on popular weekend nights. Use of the area is thought to be increasing at a slow but steady rate. There are currently a large number of campsites scattered throughout the area (no inventory has been conducted). No facilities or signs are present in the area. A reliable spring is located nearby, away from most campsites.

Description of Problems

Campsite proliferation and expansion are major problems in this area. Campsites are numerous and the total area of camping disturbance is exceptionally large. There is considerable vegetation loss but rocky soils and relatively flat terrain limit the potential for soil erosion. Campfires are permitted and fire sites are numerous, many are quite large and are filled with charcoal, pieces of broken glass and aluminum foil. Firewood in the area is exhausted and tree damage is widespread and common. Club members report that unknowledgeable visitors commonly cut and try to burn green wood. Litter and cleaning dishes directly in the spring are other significant recurring problems. There are also no toilets and the ground is rocky so improperly disposed human waste is another major problem in the area.

Social conditions are very poor on popular weekends. Many campsites are within sight of each other, though some are located in tall shrubs or further away. The large groups are quite noisy and crowding and conflict issues are a management concern. Some theft has occurred in the area. Accidents at the cliffs require frequent extractions of injured visitors, sometimes by helicopter.

Previous Management Actions

A well-established ridge-runner program has been in operation in the area for nearly a decade. Club members and State Park rangers also visit the site occasionally. Ridge-runner staff occasionally stay overnight, particularly on weekends. Educational efforts have been largely ineffective due to insufficient on-site presence and the large number of visitors here.

The Maryland Appalachian Trail Management Committee developed a site plan for this area in 1995, including representation from the Potomac Appalachian Trail Club, state park staff, and the ATC. The plan was not implemented, due in part, to misunderstandings over legal issues and liability in the state Attorney General's office (they thought it was to be a type of commercial campground where fees were charged). Further discussion on this topic is included in the Recommendations section.

Recommendations

There was a consensus among case study members that this was the most highly impacted camping area seen to-date, from both resource and social impact perspectives. Case study members had many suggestions for addressing these problems. The earlier plan prepared for this site was reviewed and found to be quite good. This plan calls for development of tent pads in one clustered site in previously impacted areas near the main access trail but out-of-sight of the cliff overlook. Several more isolated campsites with well-defined access paths would also be constructed for those desiring more solitude. The main campsite would accommodate 40-50 visitors on hardened tent pads defined by timber placements. Two pit, composting, or sealed vault type toilets would also be constructed, along with an information kiosk. A wooden platform, picnic table and wall tent would also be constructed for a site caretaker.

Proposed regulations described in the plan call for prohibiting campfires and restricting camping to the prepared tent sites. When available tent sites are all occupied (first-come, first-served basis) visitors would be required to move on to another approved camping site - communicated through signs and visitor contacts. Alcoholic beverages would be prohibited and a pack-it-in, pack-it-out garbage policy would be enforced. A caretaker would be stationed at the site from late May to late September, with club members making periodic visit during the off-season.

Case study members have a few added suggestions regarding the plan's recommended actions. One important issue to address is whether the majority of tenting sites should be clustered together as proposed. Social conditions would be improved substantially by providing separate well-spaced campsites with up to four tent sites at each. This arrangement may somewhat discourage use by larger groups and at least forces them to split their group to camp on separate sites. Site management actions should not accommodate or promote further use by large groups. Existing campsites should be used where possible to reduce the number of sites that must be closed and rehabilitated. Additional guidance on plan implementation is provided in Appendix 2.

Greater efforts to reduce and relocate large group camping at this location are needed. This could be initiated through visitor contacts by state park staff and the caretaker, encouraging large groups to shift their use to other locations provided for this purpose. Alternately, large groups could be encouraged to split into smaller groups and to hike and camp separately.

A caretaker presence is viewed as essential to ensure compliance with the camping and campfire regulations and to improve low impact camping knowledge. Case study team members felt that very little could be done to resolve existing problems without a full-time caretaker presence.

A permit system to limit visitors was also discussed but is not recommended at this time. Operation of a permitting program is an expensive administrative and staffing burden that may not be needed. Problems associated with a similar high-use camping area at Sunfish Pond in New Jersey have been resolved with actions similar to those proposed above. Communication with managers of that area is recommended.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Natural Resource Recreation
Karen Lutz, ATC, Boiling Springs
John Wright, ATC, Boiling Springs
Thurston Griggs, Mountain Club of Maryland
Walt Smith, Potomac Appalachian Trail Club
Al Preston, Maryland DNR, South Mountain Recreation Area

Pine Knob Shelter, MD

Background

The case study team (members listed at end of document) visited the Pine Knob shelter in west central Maryland on December 8, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Pine Knob shelter (1400 ft elev.) is located on NPS land in Greenbrier State Park about 10 miles southeast of Hagerstown, MD. This shelter is about 1/2 mile from Route 40 along a heavily accessed section of the A.T. that passes Annapolis Rocks, a popular day-use and overnight camping destination. This section of the A.T. is maintained by the Potomac Appalachian Trail Club. The shelter receives heavy use because Park policy requires visitors to camp only at shelters or other designated camping areas. Use increased substantially about ten years ago and is increasing more slowly at present. Up to 50-80 visitors (7-20 tents) have been counted here during busy weekends. Many large groups use the area as well, particularly Boy Scouts. There is very little day-use here as most visitors are not aware of the shelter as they hike past it's access trail on their way to Annapolis Rocks.

In addition to the 8-person shelter and pit toilet, there are approximately 12-15 campsites in the area. The campsites have not been formally defined and there are no facilities. The water source is a spring that has been running more poorly lately.

Description of Problems

One campsite approximately 30 yards to the side of the shelter is quite large and appears to have formed by the merging of two or three smaller sites. The proliferation and expansion of campsites and fire sites are the principal resource problems, though trash, tree damage, and food storage and cleanup were also mentioned. However, there appears to be less resource damage than would be expected given the amount of use the area receives and that campfires are permitted.

A significant social issue that was discussed is repeated use of the site for partying due to it's proximity to the road. Noise is another frequent problem due to the close spacing of campsites to each other and the shelter.

Previous Management Actions

The club has been actively getting word out to groups, particularly the Boy Scouts, about limiting group size or using alternative sites. This has been somewhat effective. State Park Rangers try to visit the site on at least one weekend evening to reduce it's use as a party site. Club members also make frequent visits. This has also been helpful but has not resolved the problem. Trash inside the shelter was effectively reduced by extending the shelter floor out to the shelter opening, covering an entry pit that collected garbage.

Recommendations

Considerable discussion focused on the issue to who this area should be managed for. After some debate there was a consensus that camping by visitors who only hiked in from the road was appropriate, provided they were not there to party. However, given the high use this shelter receives it is recommended that managers should try to shift some of this type of use to other places in the park or region. Another somewhat controversial option is to remove the shelter on the basis that it is an attractive nuisance that is far too accessible to the types of individuals looking for a party site. Such an action was viewed by several case study members as justified due to its proximity to the road and difficulties in controlling the party type activities. Another option is to investigate alternative shelter locations further from the road with more dependable water sources.

If camping is continued at this location, managers may wish to consider a more structured layout of formally selected and/or constructed campsites. Two or three campsite access trails could branch out from the spring, each with shorter access trails leading to individual campsites. Individual campsites should be marked with camping posts or signs and two to four good tenting sites should be prepared at each campsite. See Appendix 2 for further guidance on determining the total number of campsites and campsite construction and layout to limit campsite expansion and enhance visitor privacy and solitude. Information on techniques for closing and rehabilitating pre-existing campsites is also provided.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Troy Hall, Virginia Tech, Natural Resource Recreation
Karen Lutz, ATC, Boiling Springs
John Wright, ATC, Boiling Springs
Thurston Griggs, Mountain Club of Maryland
Walt Smith, Potomac Appalachian Trail Club
Al Preston, Maryland DNR, South Mountain Recreation Area

Maupin Field Shelter, VA

Background

The case study team (members listed at end of document) visited the Maupin Field shelter in west central Virginia on November 11, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

Maupin Field shelter (3000 ft) is located 15 miles southeast of Waynesboro, VA. The shelter is on land managed by the George Washington National Forest along trail maintained by the Tidewater Appalachian Trail club. This section of the trail receives heavier use due to the development of a circuit hike that is popular with organized groups (Mau-Har Trail loop). The shelter also receives some casual camping use due to its proximity to the Blue Ridge Parkway. Current use is relatively stable. On typical high use weekends the shelter will fill (capacity = 10) with typically 20-30 visitors in nearby campsites. Some tent camping occurs in areas to the front of the shelter with several more campsites in a small meadow located approximately 100 yards up the shelter access trail. A pit toilet is also provided.

Description of Problems

Resource impacts are not particularly substantial as none of the campsites are large. A significant loss of trees in the area due to the gypsy moth caterpillar has opened the overstory and grassy vegetation now limits the exposure of soil on many campsites. According to club members, the grasses, shrubs, and some tree regeneration have successfully colonized large areas that were formerly bare, eroding soil. Some tree damage is evident, other impacts include litter and wildlife obtaining food.

Social issues are of somewhat greater concern as the campsites are located close together in the two separate clusters. The camping in front of the shelter is mostly within view, though some vegetative screening reduces visibility.

Previous Management Actions

Previous management has included construction and maintenance of the trail, shelter, and pit toilet, removal of litter, and some education through visitor contacts by club members.

Recommendations

The case study members did not see significant problems here that require immediate management action. However, visitation may grow further and club members expressed interest in proactive management solutions. In that light, we recommend consideration of shifting camping away from the shelter to new locations, such as area further up the slope from the existing shelter. Campsites should be well-spaced and arrayed off a signed campsite access trail as described in greater detail in Appendix 2. Guidance on determining the number of campsites is also addressed in the Appendix. Further

separation and creation of discrete campsites and tenting sites in the second cluster of campsites might also be considered.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Bill Rogers, Tidewater Appalachian Trail Club
Bob Giffon, Tidewater Appalachian Trail Club
Pete Irvine, USFS-ATPO
Mike Dawson, Southwest and Central Virginia Regional Office, ATC
Teresa Martinez, Southwest and Central Virginia Regional Office, ATC
Morgan Sommerville, Deep South Regional Office, ATC
Ben Lawhon, Deep South Regional Office
Pat Egan, USFS, Pedlar /Glenwood Ranger District

Harper's Creek Shelter, VA

Background

The case study team (members listed at end of document) visited the Harper's Creek shelter in west central Virginia on November 12, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

Harper's Creek Shelter (1,900 ft) is located just below Three Ridges along the upper drainage of Harper's Creek, 1.4 miles east of Tyro, VA. The shelter is on land managed by the George Washington National Forest along trail maintained by the Tidewater Appalachian Trail Club. This section of the trail receives heavier use due to the development of a circuit hike that is popular with organized groups (Mau-Har Trail Loop). The shelter also receives some casual camping use due to its proximity to Route 56. Current use is relatively stable. On typical high use weekends the shelter will fill (capacity = 10) with typically 5-10 visitors in nearby campsites, 20 on a peak use weekend. There are four campsites on the opposite side of the creek along the shelter access trail and two small ones below the pit toilet on the shelter side.

Description of Problems

Resource impacts are not particularly substantial as the campsites are not large and are separated from the shelter and each other. One campsite is located close to the creek. Impacts include exposed soil, tree damage, litter and wildlife obtaining food. The area between the shelter and the creek is devoid of vegetation and vulnerable to soil erosion.

Social issues are also not a great concern as the campsites are reasonably well separated, though several are within sight of each other and the shelter due to the open forest vegetation. The potential for disturbance from noise is high because the sites and shelter are located on opposite sides of the drainage.

Previous Management Actions

Previous management has included construction and maintenance of the shelter and pit toilet, removal of litter, and some education through visitor contacts by club members. Beginning in 2000 a ridge-runner will begin operating in the area. The club is developing a map that lists the best group campsites in the region not directly on the A.T. in hopes of dispersing some of the group camping use. Southern National Forest agency planning also includes a regulation for a group size limit of ten persons.

Recommendations

The case study members did not see significant problems here that require immediate management action. However, overnight visitation is relatively high and may grow further and club members expressed an interest in proactive management solutions. Camping could be shifted to new locations away from the creek and out-of-sight of the shelter. Campsites should be arrayed off a signed campsite

access trail in sloping terrain to avoid future campsite expansion (see Appendix 2). Unfortunately, steep slopes behind the shelter and toilet likely prohibit use of these areas so locations more distant from the toilet would have to be used. Areas opposite the shelter and further into the woods or down the drainage closer to the A.T. offer the best opportunities. Relocation of the toilet to an intermediate position or construction of an additional toilet would likely be necessary. Appendix 2 contains additional guidance on determining camping capacity.

Discussion also focused on methods for reducing group use of the area. Campsites should have a maximum of four tenting sites to discourage continued use by large groups or to force larger groups to split up and camp separately. Alternately, group camping could be developed in other areas located further off the A.T. and education used to encourage larger groups to use only these camping areas. A strong recommendation was to have the ridge-runner, beginning in this area in 2000, collect information on shelter visitation, particularly the number and size of large groups.

A final issue discussed were methods to reduce food-related wildlife attraction to shelters. This is primarily an educational problem though a sump facility may help. First, visitors need to be made more aware that there is a problem with wildlife obtaining human food, even scraps (micro-garbage). The attraction of wildlife such as mice, rats, raccoons, skunks, possums, squirrels, and birds are relatively common at many shelters. Their consumption of human food and garbage is unnatural and threatens the safety of visitors, wildlife, and visitor property (packs!). LNT food-related handling and cleanup practices, including cooking and eating over plastic kitchen sheets (tablecloths), complete cleanup of spilled foods, carrying out all leftovers and trash, proper storage of food, and careful cleanup and filtration of dishwater, need to be more fully communicated to all A.T. hikers. Some experimentation with sump facilities at shelters may also prove helpful. Currently, many campers are pouring unfiltered dishwater into shelter fire pits or washing dishes in or near streams. Sumps with small signs regarding their appropriate use may help to reduce these problems.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Bill Rogers, Tidewater Appalachian Trail Club
Bob Giffon, Tidewater Appalachian Trail Club
Pete Irvine, USFS-ATPO
Mike Dawson, Southwest and Central Virginia Regional Office, ATC
Teresa Martinez, Southwest and Central Virginia Regional Office, ATC
Morgan Sommerville, Deep South Regional Office, ATC
Ben Lawhon, Deep South Regional Office
Pat Egan, USFS, Pedlar /Glenwood Ranger District

Priest Mountain Shelter, VA

Background

The case study team (members listed at end of document) visited the Priest Mountain Shelter in west central Virginia on November 11, 1999 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Priest Mountain shelter is located at approximately 3,500 feet on the shoulder of The Priest Mountain 5 miles norththeast of Montebello, VA. The shelter is on land managed by the George Washington National Forest along trail maintained by the Natural Bridge Appalachian Trail Club. A popular destination that includes the Priest Mountain sustains a high level of visitation at the shelter. Group use, particularly Boy Scouts, is also common. The shelter is within 1 mile of a road so some casual camping use occurs. Use patterns have been relatively stable for the last ten years. On typical high use weekends the shelter will fill (capacity = 10) and there will be 5-6 groups camped in the vicinity. The shelter, which is located close to a spring, has a picnic table and pit toilet. Approximately six campsites are arrayed down the slope in front of the shelter and another grouping of approximately four campsites is located along the A.T. on a ridge above the shelter.

Description of Problems

Resource impacts are primarily associated with the campsites and include campsite proliferation and expansion, exposed soil, limited soil erosion, tree damage, litter, and wildlife obtaining food. Improper human waste disposal is also an issue for the A.T. ridge campsites because of their distance from the shelter toilet. The area between the shelter and the spring is devoid of vegetation and some erosion is occurring. Club members noted that trash is a particularly significant problem for A.T. shelters that are closer to roads, such as this one. Trash is generally correlated with amount of use by casual walk-in campers.

Social issues are also a concern. One campsite is located immediately in front of the shelter and club members noted that many shelter users would prefer not to see campsites so close. The shelter overflow campsites are arrayed in a linear fashion down the slope from the shelter - many are quite close to one another but some tall shrubs still provide limited visual screening. The ridge campsites are located close to and within view of the A.T., diminishing hiking solitude for trail users. These campsites are arranged in a tight cluster with considerable flat terrain available for expansion or new site development. Some sites appear to be growing together and most have fire sites. Club members noted that visitors appear to actively search out sites that are separated from other groups (even when unoccupied sites are available next to occupied sites). Above moderate use levels visitors would be unable to find solitude on existing sites. In addition, the water access trail passes directly in front of the shelter, which diminishes solitude for shelter users. Some instances of conflict were also discussed; potential conflicting groups include large vs. small groups, organized vs. unorganized groups, and long-distance hikers vs. weekenders. In particular, large groups occasionally camp at the shelter and dominate it's use.

Previous Management Actions

Previous management has included construction and maintenance of the shelter and pit toilet, removal of litter, and some education through visitor contacts by club members. Beginning in 2000 a ridge-runner will operate in the area. Some active management to close trail-side bootleg campsites in fragile vegetation has been ongoing but is only partially effective. The club is also developing a map that lists the best group campsites in the region not directly on the A.T. in hopes of dispersing some of the group camping use. Southern National Forest agency planning also includes a regulation for a group size limit of ten persons.

Recommendations

The highest priority is to eliminate the trail-side campsites along the A.T. Recommended campsite closure practices are described in Appendix 2. Camping capacity could be enhanced closer to the shelter, perhaps along a campsite access trail placed on the slope behind the toilet. The campsites located below the shelter could be evaluated to select those with the highest resistance and most privacy. The campsite closest to the shelter and less preferable sites close to resistant sites should be closed and rehabilitated. Additional new site locations in this area might also be investigated. Tenting site improvement work and some method of signing sites (see Appendix 2) will also encourage visitor use of the preferred sites. Construction and signing of two formal campsite access trails is also recommended to facilitate the finding and use of intended campsites. Refer to discussion in Appendix 2 regarding determination of overall site capacity.

The shelter location is too close to the spring and should be relocated when appropriate. A new location might be evaluated at present so that campsite development work, if implemented, will not conflict. In the interim it might be possible to construct an obvious water access trail for campsite users around the back of the shelter. A large felled tree or low rock wall might be used to partially block the current water access in front of the shelter. Another possibility is the use of an enclosed catchment and pipes to provide an additional or alternate water access location downslope from the spring.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Bill Rogers, Tidewater Appalachian Trail Club
Bill Foot, Natural Bridge Appalachian Trail Club
Sharon Ripley, Natural Bridge Appalachian Trail Club
Pete Irvine, USFS-ATPO
Mike Dawson, Southwest and Central Virginia Regional Office, ATC
Teresa Martinez, Southwest and Central Virginia Regional Office, ATC
Morgan Sommerville, Deep South Regional Office, ATC
Ben Lawhon, Deep South Regional Office
Pat Egan, USFS, Pedlar /Glenwood Ranger District

Slaughter Gap, GA

Background

The case study team (members listed at end of document) visited Slaughter Gap in northeastern Georgia on March 31, 2000 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Slaughter Gap camping area (3,900 ft) is located approximately 3 miles from Neels Gap (Rt. 129) on land within the Chattahoochee National Forest and along trail maintained by the Georgia Appalachian Trail Club (GATC). This section of the trail receives very high levels of day use due to the attraction of Blood Mountain, the highest mountain along the AT in Georgia and one with large bedrock outcroppings to permit outstanding views. Slaughter Gap is the closest good camping area in the vicinity of Blood Mountain and it has water and lies at the intersection of several trails. The area receives heavy camping use year round and use levels have increased steadily over time. Slaughter Gap is particularly popular with large groups as there is a considerable amount of flat space.

Description of Problems

Resource impacts are relatively substantial. The camping occurs in a large flat area of the gap with additional camping occurring on a somewhat higher bench. The largest area could be up to 10,000 square feet in size. Most of the camping areas have lost both vegetation and organic litter cover, in spite of the recovery that should have occurred during the fall, winter, and early spring seasons. Camping activities occur throughout the area, there are no topographic features or other constraints that define individual campsites or limit campsite expansion. Some sheet erosion has occurred but the predominantly flatter terrain prevents serious erosion. Tree damage is also common. There is no toilet in the area and improperly disposed human waste is a problem in the area surrounding the gap. Trash left behind by campers is also common.

Social issues such as crowding and conflicts between visitor groups are also a concern as most camping occurs in one large central area. There are no well-defined separate campsites within this area.

Previous Management Actions

A ridge-runner program was started in about 1995 (March to October) and Forest Service staff also used to patrol the area but funding cuts have reduced or eliminated these.

Recommendations

Case study members viewed the extremely large size of the camping disturbance in the gap and the crowded social conditions as unacceptable. A number of actions are recommended to avoid and minimize these existing conditions. The gap itself should be closed to camping. The group discussed how the placement of a sign explaining the cultural and historic significance of the gap regarding the Indian battle fought here, might mitigate illegal camping. However, the area is Wilderness which may preclude such signage, at least at the site.

Case study members mentioned the fact of many trail junctions within or near Slaughter Gap which cause confusion among hikers. Discussion revealed that a good sketch map showing all existing junctions, and some design analysis of alternate relocation scenarios will reduce confusion and extraneous trail sections. Astute trail design could bring visitors into those portions of the gap that have been prepared for camping while hopefully removing them from the areas of greatest existing impact at the center or floor of the gap, which will recover if left undisturbed.

Two campsite access trails could then be constructed along both sides of the gap with shorter access trails leading down to individual campsites, each with 2-3 sidehill-constructed tentpads. These should be spaced at least 100 feet apart. Campsites should be located in areas with slopes of 10-20%. If the existing fire ban is ever lifted, small steel fire rings could be firmly anchored at each campsite to help delineate its use for campers. Information in Appendix A provides guidance for determining the number of campsites needed.

Following some discussion it was recommended that club members construct the first one or two campsites as examples and then recruit scout troops or other organizations who use the area to construct the remainder, under agency and club supervision. This work would make ideal Eagle Scout projects. Some short relocations of formal trails in the area may be necessary to provide room for the campsites and to improve circulation patterns. Given the intensive camping visitation this area receives a toilet facility is also warranted. A temporary caretaker or enhanced ridge-runner presence is recommended during the first season of new site use to redirect visitors to the new campsites.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Morgan Sommerville, ATC, Deep South Region
Pete Irvine, USFS, Harpers Ferry
Eddi Minche, Marianne Skeen, Darleen Jarman, Carole Perry, Herb Daniel, GATC

Blood Mountain Shelter, GA

Background

The case study team (members listed at end of document) visited the Blood Mountain shelter in northeastern Georgia on March 31, 2000 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Blood Mountain Shelter (4,458 ft) is located 2.2-miles from Neels Gap (Rt. 129) on land within the Chattahoochee National Forest and along trail maintained by the Georgia Appalachian Trail Club (GATC). The shelter is made of natural stone and was constructed by the Civilian Conservation Corps in the 1930's. This section of the trail receives very high levels of day use due to the attraction of Blood Mountain, the highest mountain along the AT in Georgia and one with large bedrock outcroppings to permit outstanding views. A 1994 visitor use study revealed that day use comprises up to 75% of total use. Many visitors aren't even aware they are on the AT. This high visitation has occurred for several decades and is gradually increasing. Visitation is year round with up to 200 people making the hike on busy weekends.

Relatively few thru-hikers use the shelter or camp on top of the mountain so the shelter fills only on high use weekends (15 people) with up to 15-20 people in trail-side campsites or in a camping area near the shelter. Camping is not regulated so visitors are free to camp anywhere. The area was designated wilderness in 1991 and the USFS used a LAC framework to develop a wilderness plan for the area. An inventory and condition assessment of campsites was done 5-6 years ago.

Description of Problems

Resource impacts are not particularly substantial largely because camping use is not heavy and the topography constrains the size of campsites. The largest camping area (about 20x40 yards) is located near but almost out-of-sight of the shelter. Several groups could camp in this area but none of the tenting spots are particularly attractive due to sloping terrain. Impacts include exposed soil, tree damage, fire scars (in spite of the fire ban), litter, and improperly disposed human waste. There is a toilet but it is not currently signed or visible and some campers may not know that one is present. Regardless, the toilet fills quickly and must be moved every two-to-three years. Many bedrock surfaces and a fair amount of grassy ground cover make the mountaintop fairly resistant to camping impacts.

Social issues are also not a great concern as the campsites are reasonably well separated, though most of the trail-side campsites are very close to the trail and the camping area near the shelter offers little privacy when used by more than one group. Large groups rarely camp on the top of Blood Mountain due to lack of adequate camping space and water.

Previous Management Actions

A ridge-runner program was started in about 1995 (March to October) with some volunteer caretakers before that. Forest Service staff also used to patrol the trail but funding cuts have reduced or eliminated these. Historic problems with partying at the site and vandalism of shelter doors and window shutters were successfully addressed by removing these features and cementing up the shelter fireplace. The Forest Service has also issued a permanent campfire ban for the mountaintop to address problems with fire-related impacts at the shelter and campsites and because there is no water on the top of Blood Mountain for putting campfires out. The campfire ban also makes the area less attractive for use as a party site.

Recommendations

The case study members did not see significant problems here that require immediate management action. However, club members expressed an interest in proactive management solutions. Camping could be shifted to new locations away from the trail and shelter. For example, trail-side campsites could be replaced with impact-resistant campsites constructed in locations more than 100 feet from the trail. These could be clustered at least 100 feet apart in two's or three's arrayed off a short campsite access trail. A consistent method of signing such trails should be developed for the entire AT, such as a distinctly colored blaze or a short post cut at a 45-degree angle and routed with a campsite symbol (or both). Resistant locations include sloping terrain where sidehill construction methods can be used to create desirable expansion-resistant tentpads, durable grassy vegetation, and bedrock outcroppings where cooking activities might be encouraged.

Existing trail-side campsites can be closed by dragging large logs and rocks or by more active site ruination work such as "iceberging" rocks and shallow pitting and mounding on tenting sites to make them undesirable.

The existing camping area near the shelter could be converted to two campsites, each with two-to-three tentpads. Another camping access trail with two-to-three additional campsites could also be created elsewhere in the area to take advantage of the toilet. The toilet should be signed to promote its use, and possibly replaced with a moldering privy so it doesn't require re-excavation every two-to-three years.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Morgan Sommerville, ATC, Deep South Region
Pete Irvine, USFS, Harpers Ferry
Dave Kuykendall, Francis Mason, USFS, Chattahoochee National Forest
Eddi Minche, Marianne Skeen, Darleen Jarman, Carole Perry, Herb Daniel, GATC

Springer Mountain Shelter, GA

Background

The case study team (members listed at end of document) visited the Springer Mountain shelter in northeastern Georgia on April 1, 2000 to identify and evaluate camping impact problems. Management recommendations are offered for further discussion and consideration by local land managers and trail club members. This visit was part of a larger consulting effort aimed at improving our understanding of the social and resource impacts of camping along the A.T. and providing better guidance to affiliated clubs and land management agencies for managing camping to minimize resource impacts and enhance camping experiences.

The Springer Mountain Shelter (3,700 ft) is located on land within the Chattahoochee National Forest and along trail maintained by the Georgia Appalachian Trail Club (GATC). The two-story wooden shelter was built in 1993, when the shelter was moved away from the nearby spring. This section of the trail receives very high levels of day use due to the attraction of Springer Mountain, the southern terminus of the AT.

This shelter and the surrounding area receive fairly high camping use, particularly in the spring when 2000-2500 AT thru-hikers begin their treks by camping here. The shelter fills on high use weekends (15 people) with another 10 people in campsites near the shelter and up to 9 people at the top of Springer Mountain.

Description of Problems

Primary resource impact concerns include an expanding number of campsites in the immediate vicinity of the shelter and on top of Springer Mountain, and vegetation trampling and erosion of soil in front of the shelter. The shelter access trail currently drains a considerable amount of water straight into the area in front of the shelter, creating muddiness and erosion problems. Tree damage and fire site proliferations are also concerns.

Social issues do not appear significant except when large groups camp at the shelter, an increasingly common occurrence.

Previous Management Actions

A shelter caretaker program was started in 2000. This has been successful in guiding where camping occurs and managing other resource and social problems. For example, the caretaker erected some string to prohibit use in an area in front of the shelter that was showing increasing vegetation disturbance. The caretaker also guides where camping occurs, directing visitors to specific sites behind the shelter and in other areas on the mountain. This year, the new caretaker unofficially allowed camping on the top of Springer, limited to nine campers with one fire site.

The top of Springer used to be heavily impacted from both camping and heavy day use traffic. The AT was rerouted to direct traffic off the top to a large bedrock outcropping in 1993. This action, along with

the camping limitation, has successfully reduced the heavy mountaintop trampling, which presently has nearly 100% grass cover.

Recommendations

The plan for the area calls for moving all tent camping to the top of the ridge above the shelter, in the vicinity of the old heliport clearing. The case study members concurred with this direction. Current camping capacity is needed to accommodate up to 20 tents. Individual campsites could be constructed with improved, clearly defined tentpads around the existing clearing. This area would accommodate about four campsites with two-to-three tentpads each. This area would also make an ideal group camping site as occasional overflow camping could shift to the grassy central meadow with little permanent impact. Additional camping capacity is also needed and could be separated from this group area by arraying additional campsites off the ridgetop trail proceeding toward the top of Springer Mountain. This area also has a grassy groundcover that should be resistant to camping activities.   To protect the spring, no campsites should be constructed closer than about 300 feet. Construction of the tentpads should employ sidehill practices or use embedded logs to clearly define the intended tentpads on each campsite. Small round steel fire grates should also be permanently anchored on each campsite to keep fires small and built in only one spot.

Two water access trails should be carefully constructed from the two camping areas to the spring so that water and soil do not run into the spring or stream. A toilet facility might also be placed near these sites but on the opposite side of the ridge and clearly marked to avoid catholing on the slope above the spring. The shelter access trail should also be rerouted to prevent the current water drainage problems, muddiness, and erosion. This trail should also have a formal signed intersection with the campsite access trail so that visitors know of the campsites. Temporary camping closure signs will be needed in the current camping areas behind the shelter and on top of Springer Mountain to close these areas to future camping.

Case Study Members

Bob Proudman, ATC, Harpers Ferry
Jeff Marion, USGS, Virginia Tech Cooperative Park Studies Unit
Morgan Sommerville, ATC, Deep South Region
Pete Irvine, USFS, Harpers Ferry
Carolyn Hoffman, Becky Bruce, USFS, Chattahoochee NF
Eddi Minche, Marianne Skeen, Darleen Jarman, George Owen, Jim Schultz, Marion McLean, Bob Almand, Dudley Eggleston, Ginny Smith, Janet Jolly, Carole Perry, Herb Daniel, Jason Curry (caretaker), GATC

APPENDIX 2: CAMPING MANAGEMENT PRACTICES

From: Marion, Jeffrey L. 2003. Camping Impact Management on the Appalachian National Scenic Trail. Appalachian Trail Conference, Harpers Ferry, WV. 109pp.

Camping Management Practices[1]

Decision Making and Management Constraints

This new century will undoubtedly see a continuing escalation in visitation along the A.T. and a renewed focus on the management of associated recreation-related resource impacts. This Appendix is provided to review the range of potential management responses for preventing and minimizing camping-related resource and social impacts. It is intended to serve land management agency staff and A.T. club members (collectively referred to as "managers" in this Appendix) as a reference document to guide camping management planning, decision making, and fieldwork.

Camping management can be proactive or reactive. Proactive management anticipates a problem and seeks to minimize the likelihood of it occurring before its emergence. Reactive management responds to problems after they occur, often when unacceptable resource or social conditions have developed that are difficult or expensive to rectify. Professional management should always attempt to be proactive. Selecting and maintaining a resistant campsite is always better than reconstructing or relocating, closing and rehabilitating a poorly located site. The importance of supporting actions, evaluations of project success, and sustained management are also critical elements of successful camping management programs.

The identification and selection of effective management interventions requires knowledge of the impacts that are occurring, their underlying causes, and the role of various influential factors (e.g. environmental resistance). Hammitt and Cole (1998) and Leung and Marion (2000) review and summarize this knowledge and its implications for management decision making. Ideally, such knowledge should be integrated with current management expertise and monitoring data (if available) in a careful problem analysis prior to the identification and selection of management actions.

Decision frameworks such as Limits of Acceptable Change (LAC) (Stankey and others 1985) and Visitor Experience and Resource Protection (VERP) (NPS 1997a; NPS 1997b) can also be applied to provide formal decision processes to guide and evaluate the success of management decision making. These decision making frameworks transform management goals into prescriptive objectives that are implemented and evaluated with standards defining the limits of acceptable resource and social conditions. Monitoring permits periodic comparisons of conditions to standards. If standards are exceeded, a problem analysis evaluates causal factors to aid in selecting appropriate and effective management intervention(s). These models provide dynamic decision processes; future monitoring evaluates the success of implemented actions, so managers can select and implement additional actions if unacceptable conditions persist.

Informal decision making may also benefit from the guidance provided by these frameworks. For example, what are the management objectives for the area according to land management agencies, the ATC and local clubs and interests? What are the current conditions within the area and how do these differ from the desired future conditions? What criteria will be used to select new management strategies and actions? What do visitors want and how will proposed actions affect them? Management decisions

---

[1] Sections of this Appendix were taken or adapted from Leung and Marion, 2000.

must always strike a balance between protecting resources and providing for appropriate recreational opportunities. Successful management requires a thorough understanding and consideration of the diverse array of factors that control and influence that balance.

There are also a number of management constraints that must be considered during the selection of management actions. These include funding and personnel constraints, and policy limitations imposed by Congressional laws or agency and organizational guidance. As discussed in the Recommendations Chapter, federal management planning guidelines link the type and number of visitor facilities to land zoning classifications. The presence of facilities and the materials used to construct them generally vary across land management zones ranging from frontcountry, to backcountry, to wilderness. More latitude in the use and construction of facilities is permitted in frontcountry settings in contrast to wilderness, where an unmodified and undisturbed natural environment assumes a greater prominence.

The Wilderness Act (P.L. 88-577) defines wilderness as "undeveloped" lands "without permanent improvements" which "has outstanding opportunities for solitude or a primitive and unconfined type of recreation," and where "the imprint of man's work is substantially unnoticeable." Furthermore, it states that "except as necessary to meet minimum requirements for the administration of the area ... there shall be no ... structure or installation." In light of this mandate, managing agencies have generally adopted what has become known as the minimum tool rule to guide their wilderness management actions (Hendee and others 1990). This rule directs managers to apply only the minimum tools, equipment, device, force, regulations or practice that will accomplish the desired result.

This guidance is frequently interpreted as a need to first select and attempt indirect management actions, such as Leave No Trace educational practices or improved trail and site design and maintenance before more direct controls such as limitation of use or regulations. However, if indirect methods fail to resolve resource protection problems, managers must be prepared to apply more restrictive measures. It has been argued that managers must not hesitate to employ direct controls, even as initial actions, when long-term or irreversible resource degradation is occurring (Dustin and McAvoy 1982).

Decisions about the use of site hardening and facility development actions in wilderness are particularly difficult. A constructed and maintained trail is a permanent wilderness facility designed both to facilitate wilderness travel and protect resources. Such facilities can involve vegetation disturbance, soil excavation and deposition, and the potential disruption of surface water movement. However, a properly managed trail system limits the areal extent and severity of recreation impacts by concentrating traffic on resistant tread surfaces. The absence of formal trails in popular locations would lead to a proliferation of poorly located and heavily impacted visitor-created trails. Similarly, although less common in wilderness, designated campsites can be located, constructed and maintained to substantially reduce the areal extent and severity of camping impacts. The Wilderness Act clearly permits managers to employ such facilities, although their use must be justified as the minimum means for managing sustainable visitation.

Management Strategies and Tactics

Recreation impact management problems may be addressed through an array of management strategies and tactics. Strategies are broad approaches that address underlying causes of problems. Tactics are the means used to implement a strategy, often involving one or more specific management actions. To illustrate, consider the problem of excessive campfire-related impacts. Following a careful problem

analysis, an educational strategy is identified as the most appropriate first course of action. A tactic might be to develop a Leave No Trace program for the area to communicate low impact campfire and firewood collection practices. Specific actions might include distribution of the brochure at trailheads and by ridge-runners and club staff in the field.

The most common management strategies and tactics, which are presented and briefly reviewed in this section, are described in more detail in Anderson et al. (1998), Brown et al. (1987), Cole (1989), Cole et al. (1987), Hammitt and Cole (1987), Hendee et al. (1990). Readers are encouraged to access these references for more detailed information.

The most recent review by Anderson et al. (1998), employs a handbook approach with worksheets to guide managers through the process of defining unacceptable resource and social impacts and identifying and selecting from a range of strategies and tactics. Visitor use problems and alternative solutions are evaluated through a five-stage decision process: (1) problem awareness, (2) problem specification, (3) strategy and tactic selection, (4) plan implementation, and (5) monitoring. The manual also includes descriptions of 25 management tactics organized into five categories: (1) site management, (2) rationing and allocation, (3) regulations, (4) deterrence and enforcement, and (5) visitor education. Management tactic descriptions include information on their potential costs to visitors and managers, their effectiveness, and references for further information.

A comprehensive problem-oriented review of wilderness management strategies and tactics (Table 6) is provided by Cole et al. (1987), including information on their advantages and disadvantages, costs to visitors and management, effectiveness, and references for further information. Applicable strategies and tactics are highlighted for a set of common management problems, including: (1) trail deterioration, (2) campsite deterioration, (3) litter, (4) crowding and visitor conflict, (5) packstock impact, (6) human waste, (6) wildlife and fishery impacts, (7) water pollution. These management problems are also described, including information on potential causes relevant to the selection of strategies and tactics.

Management interventions seek to avoid or minimize recreation impacts by manipulating either use-related or environmental factors. Use-related factors, particularly the redistribution or limitation of visitor use, have received more research and management attention. However, research has increasingly demonstrated the importance of environmental factors, such as focusing use in environmentally resistant locations or increasing resource resistance through the use of facilities like trails and campsites (Cole, chapter 16, in Hendee et al. 1990; Leung and Marion 2000; Marion and Farrell 2002). The modification of user behavior through educational and regulatory actions is another increasingly applied strategy.

Use-Related Factors
Managers can control or influence amount of use, density of use, type of use, and user behavior. The type of visitor action contributing to the management problem is often an important consideration (Cole 1990a). For example, impacts from visitors knowingly engaging in illegal actions require a law enforcement response. Careless, unskilled or uninformed actions are often most appropriately addressed through visitor contacts and educational responses (Lucas 1982). Unavoidable impacts are commonly reduced by relocating visitation to resistant surfaces or by limiting use.

Table 6. Strategies and tactics for managing camping-related resource and social impacts.

I. REDUCE USE OF PROBLEM AREAS
a) Inform potential visitors of the disadvantages of problem areas and/or advantages of alternative areas
b) Discourage or prohibit camping in problem areas
c) Limit number of campers in problem areas
d) Encourage or require a length-of-stay limit in problem areas
e) Make access to problem areas more difficult and/or improve access to alternative areas
f) Eliminate facilities or attractions in problem areas and/or improve facilities or attractions in alternative areas

II. MODIFY THE LOCATION OF USE WITHIN PROBLEM AREAS
a) Discourage or prohibit camping on certain campsites and/or locations
b) Encourage or permit camping only on certain campsites and/or locations
c) Locate campsites on durable surfaces
d) Concentrate use on campsites through facility design and/or information
e) Separate campers from each other and trails

III. MODIFY THE TIMING OF USE
a) Encourage use outside of peak use periods
b) Discourage or prohibit use when impact potential is high

IV. MODIFY TYPE OF USE AND VISITOR BEHAVIOR
a) Teach *Leave No Trace* camping practices
b) Discourage or prohibit campfires, axes, or saws
c) Encourage or require certain behavior, skills and/or equipment
d) Encourage or require a group size limit
e) Discourage or prohibit pets

V. MODIFY VISITOR EXPECTATIONS
a) Inform visitors about appropriate uses
b) Inform visitors about negative resource or social conditions they may encounter

VI. INCREASE THE RESISTANCE OF THE RESOURCE
a) Create or strengthen campsites
b) Shield the site from impact

VII. MAINTAIN OR REHABILITATE THE RESOURCE
a) Maintain campsites
b) Close and rehabilitate unnecessary or impacted campsites

Adapted from Cole et al., 1987.

Amount of Use. Amount of use is perhaps the most studied use-related factor. Earlier studies have consistently found a nonlinear asymptotic relationship between amount of use and amount of impact (Cole 1987b). Most forms of camping impact occur rapidly with initial and low levels of use (up to 10 nights/year), then begin to level off as near-maximum impact levels are reached at moderate to high use levels. This use-impact relationship has been corroborated by recent trampling studies for most impact parameters with a few exceptions (such as exposure of mineral soil) (Cole 1987; Cole 1993; Kuss and Hall 1991).

The curvilinear use-impact relationship reduces the potential effectiveness of use limitation for addressing recreation impacts (Strategies I & II, Table 6). Substantial use reductions would be necessary to achieve even modest improvements in resource condition on heavily impacted trails and campsites. Use reductions can lead to pronounced improvements at lower use levels, where use and impact are more strongly related (although slow recovery rates prevent rapid improvements) (Cole 1995). Use reductions during peak use weekends (Strategy III) can also be very effective in preventing the establishment of new campsites. Peak use is often dramatically higher than normal use, so visitors frequently create new campsites during peak periods that are kept from recovering by subsequent occasional use during the rest of the year. Use reductions during peak periods reduces the number of campsites needed and the total area of camping disturbance. For example, visitors could be encouraged to avoid the A.T., or at least popular sections, during peak use weekends. Tactics for rationing use are reviewed in Anderson and others (1998) and Cole and others (1987).

Density of Use. How much visitation is concentrated spatially affects both the areal extent and severity of resource impacts (Marion and Cole 1996). Educational programs and regulations may be used to shape visitation density, generally through one of two strategies: visitor dispersal, which spreads use sufficiently to avoid or minimize long-term impacts, and visitor containment, which concentrates use to limit the areal extent of impact (Cole 1992; Leung and Marion 1999). Containment, as evidenced by the development and maintenance of formal trail systems, has a long tradition of use in wilderness. Its application to camping management is less common, but a variety of options are now in use (Marion, et al. 1993). In contrast, dispersal is rarely applied to reduce hiking impacts except for remote low-use areas. Its application to camping management is more common, although many factors thwart the success of this strategy.

When camping is unregulated, visitors are free to choose any existing campsite or create new ones. This policy can result in many poorly located campsites (Cole 1993a; Leung and Marion 2000b; McEwen et al. 1996). For example, wilderness campsites in the Jefferson National Forest of Virginia were frequently located on trampling-susceptible herbaceous groundcover in areas that readily permit site expansion and proliferation (Leung and Marion, 2000). Campsites were also located close to trails and other campsites, enhancing the potential for visitor conflicts and reducing solitude for both campers and hikers.

A successful application of dispersal and containment strategies can reduce camping impacts. Consider three campsites that receive intermediate amounts of use (10-20 nights/year) under an unregulated camping policy (Figure 2). Aggregate resource impact for these sites would be three times the "a" amount of impact. Under the purest form of dispersed camping, these sites would be closed and their use distributed across 45 pristine sites, each receiving only one night of use/year. Most vegetation types can sustain such light camping with no permanent impact visible the following year. More resistant surfaces, like grassy groundcover, sand, gravel and rock, can accommodate many more nights of use

without permanent impact. The low camping densities under a dispersal strategy also resolve problems with crowding and conflicts.

In contrast, a containment strategy could be implemented by closing two of the three original sites and distributing their use to the third. Due to the curvilinear use-impact relationship, impact on this third site would increase only marginally, from "a" to "b" (Figure 2). Aggregate impact would decline substantially, from three sites with an "a" level of

Figure 2. A generalized use-impact curve illustrating the intended locations of typical or average campsites under dispersed and containment strategies.

impact to one site with a "b" level of impact. Application of this strategy was largely responsible for a 50 percent reduction in the total area of disturbance from river camping at Delaware Water Gap National Recreation Area (Marion 1995). Furthermore, in addition to favoring resistant sites, site selection criteria emphasized the closure of sites within dense clusters, addressing crowding and conflict problems by maximizing intersite distances.
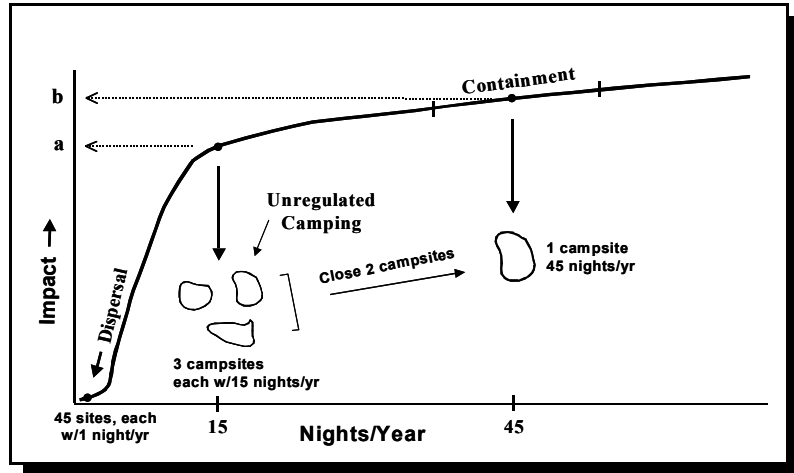
While these strategies may seem straightforward, additional issues often complicate their implementation. Achieving the level of camping dispersal necessary to prevent impacts has proven exceptionally difficult. In most vegetation types more than a few nights of camping will quickly create lasting impacts -- that is, permanent campsites (Cole 1995). Mountainous topography, dense vegetation, and availability of water frequently limit the number of potential camping locations, and few of these contain resistant surfaces (Williams and Marion 1995). Furthermore, most visitors prefer camping on established sites close to trails, water and popular features (Lucas 1990). Generally, a dispersed camping strategy will be effective only in areas that receive low levels of use, have numerous potential camping locations that are resistant and/or resilient, and where visitors are willing to learn and apply LNT camping practices (Leung and Marion 1999). See the following publications for more in-depth reviews of LNT practices: Cole 1989; Cole and Benedict 1983; Hampton and Cole 1995; http://www.LNT.org, and McGivney 1998.

Successful containment strategy requires concentrating camping activities on the smallest number of sites needed to accommodate the intended level of use (Leung and Marion 1999d). Reserved, designated site camping permits the smallest number of campsites and aggregate impact. However, fixed itineraries are difficult to follow and entail a substantial loss of visitor freedom (Stewart 1989). Restricting camping to designated sites (signed on the ground and marked on maps) without a reservation system allows greater flexibility. Visitor use surveys or direct observation can provide information for matching campsite numbers and locations to visitor use patterns, or entry point quotas can restrict use based on available campsite numbers (Lime and Buchman 1974). To avoid excessively large inventories of campsites, use surveys should be conducted during average high use periods rather than peak use periods. If limited to only a couple of peak use weekends, overflow camping in pristine areas will not likely result

in the establishment of new campsites. However, in comparison to areas with site reservation systems, somewhat larger numbers of campsites are necessary to avoid the "musical chairs" dilemma of too many visitor groups and too few campsites. For example, a system with fixed itineraries could achieve 100% occupancy rates during high use periods but a system with designated sites with unfixed itineraries would require occupancy rates around 70% to avoid the need for visitors to conduct extensive walking and searches for an open campsite.

An educational approach, asking visitors to camp only on informal well-established campsites (not signed or marked on maps), may also be used (Leung and Marion 1999). This less regimented "established site camping" option allows visitors greater latitude in seeking out informal campsites that meet their needs. Implemented at Shenandoah NP in 1999, this option targeted campsite proliferation problems which, in some areas of park, had resulted in occupancy rates as low as 10-20%. Managers applied site selection criteria to identify and concentrate future use on sites that were resistant and promoted solitude. Numerous poorly located sites were then closed, increasing site occupancy rates to the 50-70% range. Research and monitoring to gauge the effectiveness of this new strategy are nearing completion.

Often a combination of camping policies provide the most effective strategy (Leung and Marion 1999). The new backcountry camping management policies at Shenandoah NP provide an example (NPS 1998). The previously described established site camping option applies to the majority of the backcountry. Dispersed camping on pristine sites is permitted only when all available campsites are occupied. In high-use areas, such as at A.T. huts, visitors are required to camp on a limited number of marked designated campsites on a first-come, first-served basis. A few areas containing sensitive cultural and natural resources or that accommodate high day use are closed to camping. While more complex, such combined strategies offer substantial flexibility in balancing resource protection and recreation provision objectives.

Type of Use. Types of uses that result in greater or disproportionate impacts are often subject to special regulations or educational programs (Strategy IV). Use along the A.T. is relatively homogenous due to prohibitions on motorized, horse, and mechanical (mountain bike) uses. There are some differences in impacts between day and overnight use and between weekend vs. long-distance hikers but differential management of these groups related to reducing resource impacts at campsites and shelters is a largely unexplored topic. Targeting day use and weekend campers with introductory LNT information and practices focused on the predominant impacts or problems will often be the most effective action. Long distance hikers can be targeted with more comprehensive or "advanced" LNT information - these individuals are important because of their substantially greater number of camping nights and because they serve as role models during their numerous interactions with short-term A.T. hikers.

Large groups are perhaps the most important type of use that require special management attention. Organized commercial groups are often easier to target and manage than unorganized and/or non-commercial groups. Management of large groups was previously addressed in the Recommendations chapter under "Manage Large Groups," much of it is included here for easy reference.

Organized groups present A.T. managers with some unique opportunities. Most outdoor enthusiasts are introduced to the out-of-doors by some type of group-related outdoor program. The organizations that operate these largely novice and youth-oriented programs can be efficiently targeted, allowing cost-effective education of large numbers of public land visitors. Young, inexperienced visitors tend to be

more receptive to adopting Leave No Trace practices, providing an opportunity for instilling life-long LNT skills and ethics. Group leaders are receptive to educational literature and outreach efforts and are also skilled in teaching their members outdoor practices. An LNT pamphlet that specifically targets LNT practices for large groups has recently been developed (http://www.LNT.org).

Many agencies have established group size limits, particularly for wilderness, to address resource and social impact issues. However, few studies have examined the relationship between group sizes and resource or social impacts, nor is it expected that they could they provide specific guidance for selecting a meaningful size limit. Decisions about group size limits require subjective judgements and a limit of 10 is unlikely to be any more "correct" or "appropriate" than 6 or 14. There is no magic "best" number. Furthermore, while large groups create larger campsites than small groups, splitting them up may require more campsites and greater aggregate impact (Cole 1987b; Cole and Marion 1988). Matching group size with site size is therefore a significant management challenge.

To a large extent, resource and social impacts are primarily a function of visitor behavior rather than group size. Thus, the core land management challenge lies in encouraging all outdoor enthusiasts to learn and practice low impact skills, regardless of their group affiliation. An educational focus recognizes and avoids or reduces the significant visitor-related costs associated with group size regulations. The safety of group members, particularly in remote settings, may be compromised. Volunteer, non-profit and commercial organizations are also significantly disadvantaged by group size limits, which necessitate additional leadership. Smaller staff/participant ratios translate into higher costs for participants which reduces the economic viability of outdoor education programs or displaces them from public lands. A.T.-specific education efforts targeting organized groups have already been pioneered and implemented in the northern states.

Site management actions offer a final option to address large-group impacts. Group-use campsites have been designated in some areas and could be developed in others. Accommodating groups of up to 12 on carefully selected sites would likely involve less resource impact than splitting them up to camp on separate sites. Informal or formal reservation systems may be needed to facilitate site use by organized groups.

User Behavior. Many impacts are avoidable, often caused by uninformed or careless behavior (Lucas 1982). Education and regulations developed to modify visitor behaviors are effective methods for avoiding or minimizing resource and social impacts associated with overnight visitation (Strategy IV). Common avoidable camping-related resource impacts include littering, creating new campsites and trails, moving or building new fire sites, improper disposal of human and food waste, enlarging campsites, cutting or damaging trees, and feeding wildlife. Management efforts can also minimize unavoidable impacts, such as vegetation disturbance caused by foot traffic.

Generally visitor education should be given an opportunity to resolve problems before regulations are imposed, unless impacts are severe or long-term. An incremental management approach ensures that visitor freedoms are not unnecessarily restricted. For example, excessive tree damage related to firewood gathering might begin with LNT educational messages that encourage stove use over campfires. When campfires are desired they should be built small with dead and down wood that can be broken by hand. These messages might be conveyed on signs at trail heads and shelters, with LNT pamphlets or flyers, or through personal contacts by caretakers and club members. If subsequent evaluations reveal that the problem was not resolved an action such as prohibiting axes and saws might be added to the educational

program. The educational program might also be intensified by targeting groups known to be part of the problem. Finally, if these actions are ineffective campfires could be prohibited.

LNT camping practices have been developed to address every common camping management problem (Cole 1989b; Hampton and Cole 1995), along with alternative education techniques for conveying such practices to visitors (Doucette and Cole 1993). The list includes selection of resistant campsites away from streams, trails, shelters, and other occupied campsites, confining activities within core use areas to avoid enlarging sites, using stoves and low impact campfire practices, proper food storage and cleanup, proper human waste disposal, and practices to avoid impacts to wildlife and the recreational experiences for other visitors. These practices are taught in LNT training courses offered by a variety of organizations, including the National Outdoor Leadership School, the Appalachian Mountain Club, federal land management agencies, and the ATC. A variety of publications (1-800-332-4100) and a comprehensive web site (http://www.LNT.org) are also available.

Although more restrictive to visitor freedom and experiences, regulations offer another option for altering visitor behavior to reduce impacts (Lucas 1982). Examples include requirements on the location of camping, such as restricting camping to designated sites or prohibiting camping in certain areas or within a set distance from trails or streams. Axes, saws, or campfires may be prohibited or campfires may be restricted to designated fire rings. Proper food storage may be required and feeding wildlife may be prohibited. Interventions may employ both educational and regulatory responses. Finally, managers must consider their ability to enforce regulations. The remote nature of the trail environment and declining agency budgets make it difficult to enforce regulations along the A.T. While volunteers can remind visitors of regulations, they cannot and should not try to enforce them.

Environmental Factors and Site Management
Managers can also influence or control the locations where visitors camp (Strategy II) and manage the sites that they use (Strategies VI and VII). Both the areal extent and severity of camping impacts can be reduced through careful site selection, design, construction and maintenance. The location and spatial arrangement of campsites also determine the social conditions for visitors who use them.

Primitive campsites have rarely been planned and developed through careful evaluations of their expected ability to sustain use while preserving high quality natural conditions and social experiences. Most backcountry campsites, even those that have been formally designated, were originally visitor-selected and created. Examples abound in many backcountry areas of poorly located campsites that are severely degraded or offer little opportunity for solitude and natural quiet. However, scientific knowledge and managerial experience have provided improved information for selecting campsites able to sustain heavy recreational traffic with far less resource and social impact than most existing campsites. Improved site design, facilities, and maintenance also contribute substantially to the avoidance and minimization of impacts.

Site Selection. Flat, dry ground near water and the trail have been the traditional requirements for a good backcountry campsite. However, research and management experience have shown that these are often poor locations for low-impact campsites. Large flat stream benches, gaps, and ridge tops may offer many potential camping locations but they also offer little resistance to campsite proliferation and expansion and promote high-density camping that degrades visitor experiences (Figure 3). Campsite monitoring has revealed that large flat areas often support several times the number of campsites needed for typical high use periods, with some that merge to form mega-sites exceeding 4000 ft^2 in size.

Campsites developed near streams, ponds, and springs often experience sheet erosion that drains down water access trails to add turbidity and sediments to pristine water sources. Finally, camping along or near trails reduces the opportunity for solitude for both hikers and campers, whose experiences are degraded by seeing campsite after campsite and their close proximity to other visitors.

Knowledge of the environmental resistance and resilience of vegetation and soil types can also be applied to select the most durable campsites (Hammitt and Cole 1998). Management options include educating visitors to improve their site

Figure 3. Large barren area due to high-density camping at Slaughter Gap, Georgia.

selection, marking resistant sites to encourage their use and designating resistant sites. Topography and other environmental attributes such as rockiness and vegetation density can also be considered to select locations that minimize impact severity and area of disturbance.

Research has demonstrated considerable variability in the trampling resistance of different vegetative growth forms and plant communities (Cole 1987; Kuss 1986). Open forests and dry meadows support grassy ground cover that is substantially more resistant to damage from trampling than herbs growing under closed forest canopies. Grasses have flexible stems and leaves that are well-adapted to trampling pressures and they recover more quickly following damage. Other alternatives include durable non-vegetated surfaces, such as rock or gravel, or other locations where ground vegetation is minimal, such as dense shade. For example, campsites are less obvious when located under dense forest canopies that shade out most ground vegetation yet yield substantial organic matter to cushion heavy foot traffic. Avoid fragile vegetation, like ferns or tall broad-leafed herbs, and vegetation that recovers slowly, like high elevation plants or woody shrubs. Resistant plant communities and environments may be targeted for camping, while fragile communities may be avoided or identified for closures to camping.

Similarly, soils vary in their resistance to trampling degradation, as influenced by texture, organic content, and moisture. Dry, somewhat organic soils with a wide range of particle sizes (e.g., sandy-clay loams) are preferred. Smaller silt and clay particles promote soil cohesion while larger sand particles promote soil drainage. Soils with a narrow range of particle sizes, particularly those high in silt and fine sands, are most prone to erosion (Hammitt and Cole 1998). Erosion is accelerated by the absence of vegetation and organic litter, and slope is a critical determinant of erosion potential. Highly organic soils (peats and mucks) retain water long after rains, creating mud.

Knowledge of the relative resiliency (ability to recover) of different environments and vegetation types may also be used to direct camping to areas that will recover quickly after trampling disturbance. Resiliency varies among plant species but is also strongly related to environmental factors that influence plant growth, including soil properties (fertility, moisture, and texture) and length of growing season. Environmental resilience is a more important consideration in low-use areas where dispersed camping is promoted, than in higher-use areas where a concentration strategy is employed (Cole 1995). This is because campsite impact rates are far greater than recovery rates (Marion and Cole 1996). On higher-use campsites, visitor traffic is sufficient to permanently remove most vegetation cover. However, vegetation

and environments that are highly resilient can still help to restrict campsite sizes and disturbance in surrounding areas.

Information to promote the selection campsites that are resistant and protect solitude can be communicated to and applied by visitors. The *Leave No Trace* program provides information focusing on this issue through it's second principal: "Travel and Camp on Durable Surfaces". Site selection information can be communicated in maps and guidebooks, but also through LNT brochures and direct visitor contacts. Alternately, in areas where a containment strategy is used, resource and social selection criteria can be developed and applied by managers to evaluate either existing or new campsites.

Experimentation by backcountry managers in parks and forests has revealed that site selection is the single most important factor in developing a campsite that sustains heavy use while remaining small and in good condition. Camping management should begin with a thorough assessment of existing or proposed campsites to evaluate their potential for sustaining use while protecting the quality of resource and social conditions. An illustration of draft campsite selection procedures adapted for the A.T. are included in Table 7 and discussed below.

Table 7. Campsite selection criteria. Adapted from Shenandoah NP procedures (Williams and Marion 1995).

Points	Campsite Selection Criteria
	1. Campsite Location
2	Campsite is located greater than ½ mile from a road or permanent building (other than shelters); 50 yards from the A.T. or a shelter; and 30 yards from another campsite. (Record actual distances for each element)
1	Campsite is located out-of-sight (summertime) from the A.T.
1	Campsite is located out-of-sight (summertime) from shelters or other campsites.
1	Campsite is located >30 yards from any water source
	2. Expansion Potential
2	Poor expansion potential: Off-site areas are completely unsuitable for any expansion due to topography, rockiness, dense vegetation, and/or poor drainage.
1	Moderate expansion potential: Off-site areas moderately unsuitable for any expansion due to the factors listed above.
-1	Good expansion potential: Off-site areas are suitable for campsite expansion, features listed above provide no effective resistance to campsite expansion.
	3. Campsite Slope
2	Most campsite areas have gentle slopes (3-4%), or they can be easily created.
	4. Vegetation Groundcover
2	Ground vegetation around the campsite is predominantly grasses or sedges, as opposed to broad-leafed herbs, *or* off-site vegetation cover is very sparse (less than 20%).

Campsite location -- These criteria ensure adequate separation from developed areas, the A.T., shelters, campsites and water resources. Points are awarded to favor campsites that are adequately separated or preferably out-of-sight from the A.T., shelters and campsites to enhance the solitude of both hikers and campers. A separate criterion is included to ensure the protection of water resources.

Campsite expansion -- These criteria emphasize selection of sites that have inherent constraints on expansion potential due to steep or uneven topography, rockiness, dense vegetation, or poor drainage. The objective is to identify sites that are unable to expand under heavy use within areas that will also deter campsite proliferation.

Campsite slope -- This criterion favors sites with gentle 3-4% slopes that facilitate drainage yet minimize erosion potential. Flat or cupped sites will develop drainage problems and more steeply sloped sites are prone to soil erosion. While cut-and-fill work can create campsites in more steeply sloped terrain, this criterion favors selection of sites that can be used without such work.

Vegetation groundcover -- This criterion favors sites with impact-resistant vegetation or areas with sparse vegetation cover. The most resistant campsites are those under nearly open tree canopies that support grassy groundcover. Alternately, vegetation loss can be minimized by selecting sites under dense forest canopies, which often have less than 20 percent vegetative groundcover. Campsites in these areas have less vegetation cover to lose, are not visually obvious, and have thick organic layers and heavy litter production to minimize trampling disturbance.

Additional factors, such as proximity to potable water, visitor attractions, hazardous areas (e.g., cliffs), cultural sites, or rare, threatened and endangered species, should also be evaluated and considered. Area attractiveness for camping is also an important consideration - campsites established in areas with little appeal may go unused. Selection criteria should be periodically reviewed and modified, particularly as management experience or monitoring data reveals how different campsites stand up to intensive or long-term use.

Field reconnaissance surveys must be conducted during summer months and can be applied to identify and rank existing or potential campsite locations. As a general rule, twice the number of desired new site locations should be identified and rated to ensure the search is thorough and that the most highly rated sites are selected. A form that includes rating data and descriptive information about locational attributes and resource conditions (e.g., distance to water or A.T.) will aid the ranking and decision making process.

An important decision is whether camping should be continued on existing campsites or shifted to new sites. Existing sites should be used when possible when they score highly for the selection criteria (Figure 4). However, existing campsites frequently have one or more significant limitation, such as close proximity to the trail, water, or other sites and the shelter. Sometimes the closure of some sites and construction or maintenance work on others can

Figure 4. Natural topography constrains expansion on this campsite.

adequately address deficiencies to make them usable (see following sections). This option may be favored as the areas are already impacted and their effective closure may be difficult to achieve. Shifting use to new sites can alleviate deficiencies in existing campsites. This may allow the selection and/or construction of smaller sites that will resist expansion and greater separation of campsites to improve social conditions.

Site Design. Resource and social conditions on campsites can also be substantially influenced by site design considerations and construction techniques. Site design relates to both capacity (number of campers) and site configuration (arrangement of sites in relation to shelters, other sites, and topography).

Site Capacity – Camping capacity is dependent on a variety of factors, including desired resource and social conditions, local demand for camping, topography, availability of water, and environmental resistance. The process of determining camping capacity should begin with a review and consideration of management objectives and desired future condition statements (which often vary by land management zone). What level of overnight visitation is most appropriate for the area? Given the desired social conditions, how should overnight visitation be structured and arranged in relation to the A.T., shelters, and other campsites? What are the maximum capacities for specific campsite/shelter locations? All other considerations ought to be secondary to these strategic factors.

Objective evaluations of other factors are also essential, beginning with documentation of existing use within the area. This will normally require field surveys to record overnight visitation by location, groups and group size on a representative sample of typical high use weekends. For example, ridgerunners or club staff might hike the trail to check all camping areas during the evening or early morning hours on four to six good-weather weekends during the most popular season(s). Data on peak use weekends would also be useful but should not be used for capacity decisions because visitation is often substantially higher. Land managers generally agree that facility capacities should not be designed to accommodate peak use periods. Evaluations of this data in relation to the desired future conditions prescriptions will reveal the acceptability of current use levels and the ability to accommodate future growth. It is important to note that capacity decisions are inherently subjective, they cannot be derived from scientific research or objective formulas.

Due to the decentralized management of the A.T. and its numerous entry points, use rationing will likely be rare and the primary goal will generally be to accommodate increasing demand over time. While this may be the case, managers can still manipulate where overnight visitation occurs and how much will occur at any single location. Critical decisions include the acceptability of co-locating camping with shelters and the maximum number of campers permissible within a single area. Capacity guidance can and probably should be established for management zones to ensure consistent management decisions along the A.T. For example, maximum campers per single location might be set at 40 for a Frontcountry zone, 30 for a Backcountry zone, and 20 for a Wilderness zone. Planning for site capacities above 20 to 30 need to carefully consider options for avoiding bottlenecks at communal facilities such as water sources, toilets, and food storage devices. Water sources with multiple accesses and multiple toilets and food storage devices can alleviate crowding at these locations when larger capacities are planned. Severe limitations for any of these factors should initiate considerations for shifting overnight use to other locations.

Next, other factors should be examined to determine if the preferred level of camping use can or should be sustained within the area. Topography and the availability of dependable water are important

considerations. Flat ground need not be a limiting factor, however, as techniques described in the following section require sloping terrain. Terrain that naturally limits site expansion is preferred, as are more open forests that support substantial grass cover.

Additional guidance on site capacity decision making, particularly related to shelters, is provided by Leonard et al. (1981).

Site Configuration – In areas where a containment strategy is used, campsites may be configured singly, in small clusters, or in large groupings depending on desired conditions, campsite demand and availability of space. On individual sites, the area of camping disturbance can be minimized by identifying one to three tent sites that are close to one-another (Figure 5) and promoting their consistent use through site construction and maintenance practices (described in a following section).   The objective is to encourage all campers to consistently tent and cook on the same sites so that camping activities and disturbance are spatially concentrated (Leung and Marion 1999, Marion and Farrell 2002).
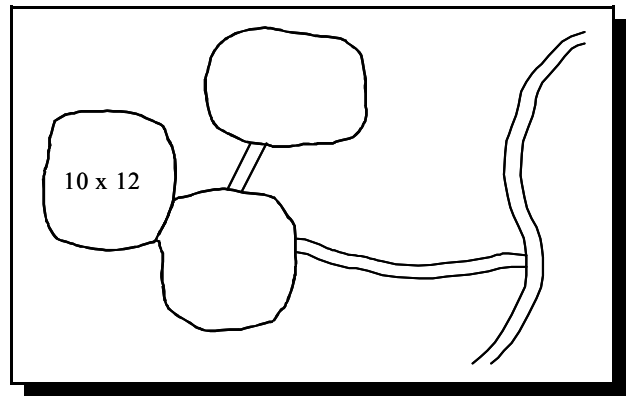

Figure 5. A campsite with three tent sites.

Access trails should also be designed, constructed and marked to promote use of preferred or designated campsites and to avoid the development of numerous and poorly located visitor-created trails. Individual campsite access trails, generally 50-150 feet long, should branch off this trail when multiple campsites are provided, so that campers do not walk through or around the edge of other visitor's campsites when traveling to their own site. These trails could be marked with small camping symbol signs or paint blazes and should exit the park trail in a perpendicular fashion to discourage the creation of "short-cut" trails. Ideally, this unique symbol or blaze should be standardized for the entire A.T.

Careful thought should also be given to the spatial arrangement of campsites relative to resource features such as streams or water sources, other campsites, shelters or tent platforms, and communal facilities like toilets and food storage boxes or devices. This is particularly critical when larger numbers of overnight visitors are grouped within a single area. Travel patterns within the area should be anticipated so that intended use areas can be linked by a limited number of carefully designed and constructed trails rather than numerous visitor-created trails. Figure 6 illustrates some preferred arrangements; many other arrangements are possible. Where possible, a linear arrangement of sites and facilities promotes traffic along a single trail, protecting surrounding areas from trampling (Leornard et al. 1981). Spacing sites a minimum of 100 feet apart protects visitor privacy; conversational voices generally become unclear beyond this distance.

Site Construction. Much of the expertise gained in constructing and maintaining trails can be extended to campsites. For example, like side-hill trails, campsites can be constructed in sloping terrain (10-15% slopes) using standard cut-and-fill practices to create small benches for tenting and cooking areas (Figure 7). Rock, or less preferably, rot-resistant logs, should be used for cribbing to shore up fill material. Tent sites should be crowned or sloped to promote water drainage and free of rocks, stumps, and roots.
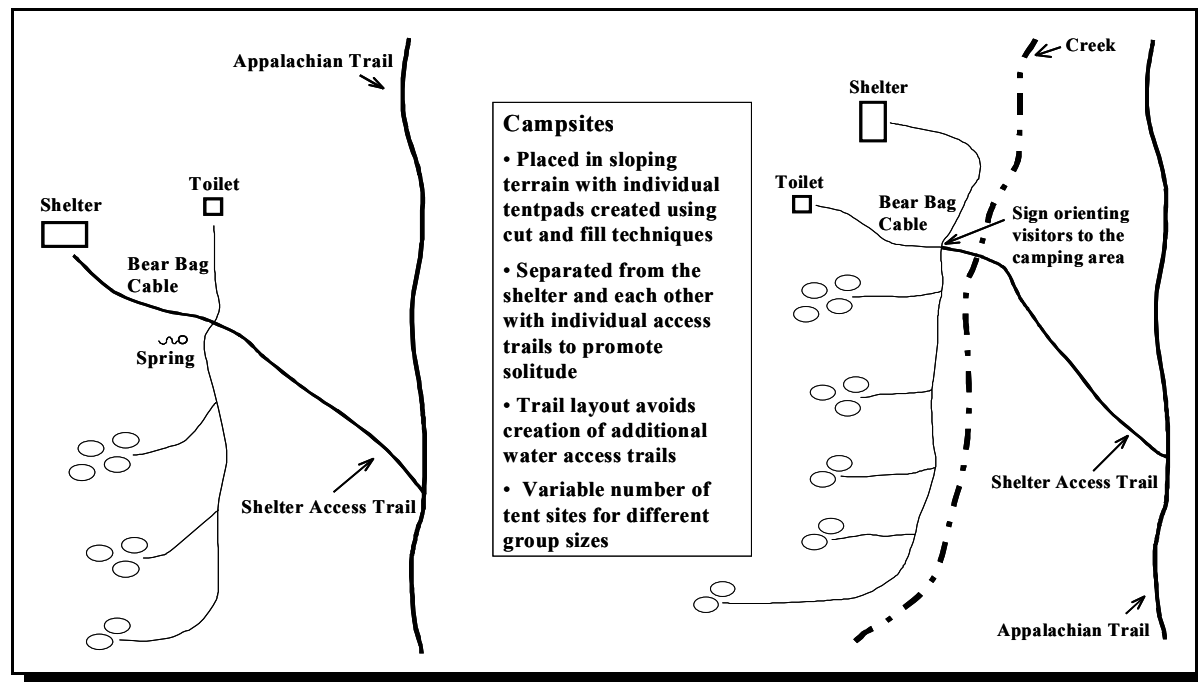
Campsites

• Placed in sloping terrain with individual tentpads created using cut and fill techniques

• Separated from the shelter and each other with individual access trails to promote solitude

• Trail layout avoids creation of additional water access trails

• Variable number of tent sites for different group sizes

Figure 6. Examples of preferred campsite/shelter site configurations that minimize resource impact and promote visitor solitude.

Scout the sloping terrain to look for spots that meet all the site selection criteria (preceding section) and that will minimize the amount of excavation. During excavation work it is best to remove all organic litter and soils to piles located along the contour on either side of the pad. Then find rock and build the stone cribbing along the downhill sides to contain fill material. Excavate uphill and fill in behind the cribbing, any rocks in the soil can be placed deep and filled over with mineral soil (at least five inches of soil to cover all rocks). Lower the slope of uphill excavations by digging further uphill

Figure 7. Cross sectional view of a side-hill constructed tent pad. Surface should be slightly crowned in all directions for water drainage.

- a steep slope will be prone to erosion and may not revegetate. Avoid making tent pads in precise geometric shapes (squares, rectangles, circles) due to their artificial appearance, uneven sinuous boundaries are preferable. The even, well-drained tent pad surface should be sufficient to promote consistent selection and use. Compact, smooth and gently crown or slope the fill material and dig a shallow drainage dip around the uphill side of the tent pad to collect and drain water. Finally, place the organic soil and litter on the cut slope uphill from the tent pad. This will naturalize the excavation work and promote natural recovery. Annual maintenance of tent pads to keep the surfaces even and well-drained will further promote their use and limit expansion and off-site impact.
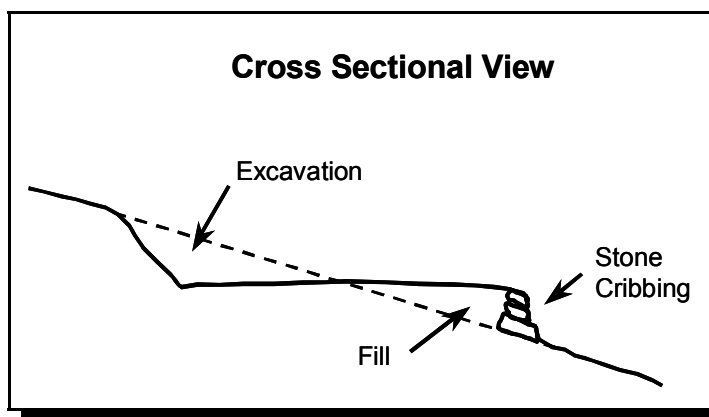
The number of tent sites should accommodate the typical range of group sizes for the area, generally one to three pads, up to five for group sites. A separate smaller pad can be created for cooking and a campfire ring in areas where they are permitted. Placement or a flat "stove/kitchen table rock" in the intended cooking area will help to attract kitchen activities to this location. Use of a large heavy rock will help discourage visitors from moving it around and disturbing different areas. Fire rings or grates can be anchored using a chain or aircraft cable down to a post-holed coffee can filled with cement. Fire rings no larger than two feet in diameter will encourage the building of smaller campfires using smaller-diameter wood.

At Isle Royale NP the construction of such "side-hill" campsites has yielded exceptionally small campsites in spite of their intensive visitation (Farrell and Marion 2002). Experience there has shown that visitors confine their activities to the flat intended use areas, resulting in sharp campsite boundaries and pristine vegetation in adjacent off-site areas. A principal advantage of side-hill campsites is that the topography, rather than educational messages or regulations, encourages campers to concentrate their activities on a limited number of "intended" use areas (Figure 8). Furthermore, placement of these sites away from

Figure 8. A constructed side-hill campsite at Springer Mountain, Georgia.

trails, shelters, and other campsites protects the quality of visitor experiences.

The area of disturbance will always be greater when camping must be accommodated in flat terrain but a number of site construction practices can help to define camping disturbance. Begin by applying the site selection criteria and site configuration recommendations to identify the approximate site locations. Look for specific site locations that have relatively few good tent sites, perhaps due soils with protruding roots (note that rocks can be removed or soil added to improve tent sites). The least intrusive technique is to construct campsite access trails to each intended campsite, identified by a camping sign or post. It may be necessary to line the access trails and campsites with rocks or logs, at least for the first year. Firmly anchored fire rings or grates have also been effective for marking campsites and concentrating visitor activities in flat terrain.

Another effective but more artificial technique for use in flat terrain is to construct slightly raised rock- and root-free tent pads. These can be made more visually obvious to attract use by lining their edges on two or three sides with embedded rocks or rot-resistant logs. Experience has shown that logs must be drilled so that rebar rods can be hammered through to anchor them (Figure 9). Nearby locations that could or have been used for tent sites should also be ruined (see site ruination practices in the Site Maintenance section). An effective regulatory approach is to erect 4x4 campsite posts engraved with the words "Camp within 5 yards" on each side. Most visitors will adhere to such regulations so that creation/ruination of tenting sites should be unnecessary.

Care should be taken to accomplish all site development and maintenance work in close cooperation with land management agency staff. Soil and vegetation disturbance often require environmental assessments and archaeological surveys and approvals, activities that can be expensive and time-consuming. In addition, construction work should strive to use native, rustic materials and be carefully blended to match natural conditions (Marion and Sober 1987). Avoidance of straight lines or perfect geometric shapes in marking campsite and tent site boundaries is one of the easiest ways to accomplish this. Using rock or short rot-resistant timbers rather than pressure-treated dimensional lumber is

Figure 9. Tent pad logs should be embedded and anchored with rebar or visitors may pull them out for firewood.

another. There is a fine line between making the intended use areas sufficiently obvious so visitors will consistently use them and artificial or visually obtrusive so that natural values are degraded. However, more artificial work may be justified in high use areas or on particularly troublesome sites.

Site Facilities. The installation of most facilities serving backcountry and wilderness campsites are justified on the basis of protecting natural resources or visitor safety, though most facilities also provide some kind of visitor convenience. For example, bridges along trails are built to safely transport trail users across deep or dangerous currents and to protect sensitive riparian areas from vegetation damage and soil erosion on steep slopes. Placement of small, firmly anchored steel fire rings can be used to identify preferred or legal campsites, spatially concentrate visitor activities to reduce site size and limit resource impacts by focusing fire-related activities at only one spot (Marion 1995). Pit toilets address problems with improperly disposed human waste, particularly on high-use campsites where the volume of waste poses a threat to human health.

The primary disadvantage of site facilities is the issue of their appropriateness in backcountry and wilderness settings. Facilities are artificial developments that can detract from the natural environment. U.S. federal land management planning guidelines link the type and number of visitor facilities to land zoning classifications. Facilities such as shelters, picnic tables, and toilets are appropriate and common in accessible frontcountry settings but are viewed as less appropriate or inconsistent with backcountry settings. NPS Management Policies (NPS, 2001, Section 8.2.2.4) state that backcountry facilities "will be limited to the minimum necessary to achieve a park's backcountry management objectives and to provide for the health and safety of park visitors."

The appropriateness of installing various facilities should be carefully considered, particularly in wilderness. The U.S. Wilderness Act defines wilderness as "undeveloped federal land retaining its primeval character and influence, without permanent improvements." Exemptions include essential administrative facilities and resource or visitor protection facilities. NPS wilderness management guidance (NPS 1999) directs managers to evaluate whether a facility: "is required to preserve wilderness character or values, not considerations of administrative convenience, economy of effect, or convenience to the public or park staff." Pre-existing shelters are generally permitted but picnic tables are specifically

disallowed. Federal wilderness management agencies have developed Minimum Requirement/Minimum Tool guidance (Arthur Carhart National Wilderness Training Center 2000) to assist managers in evaluating whether an action is the "minimum necessary requirement for the administration of the area..."

Guidance varies by agency and park or forest so local consultations with land managers regarding facility decisions in wilderness should be initiated early in the process. However, there are numerous precedents for facilities such as fire grates and pit toilets on wilderness campsites, justified as the minimum tool necessary to accomplish important resource protection objectives.

Even in backcountry settings the provision of facilities like picnic tables is a subject of some debate. Tables have traditionally been considered a visitor amenity or convenience facility. However, a study at Isle Royale NP found that backcountry and wilderness sites with picnic tables were significantly smaller and had less exposed soil than those lacking tables (Marion and Farrell 2002) (Figure 10). This was attributed to the activity concentration effect of tables, which attracts visitors to them and focuses trampling disturbance to their immediate vicinity.
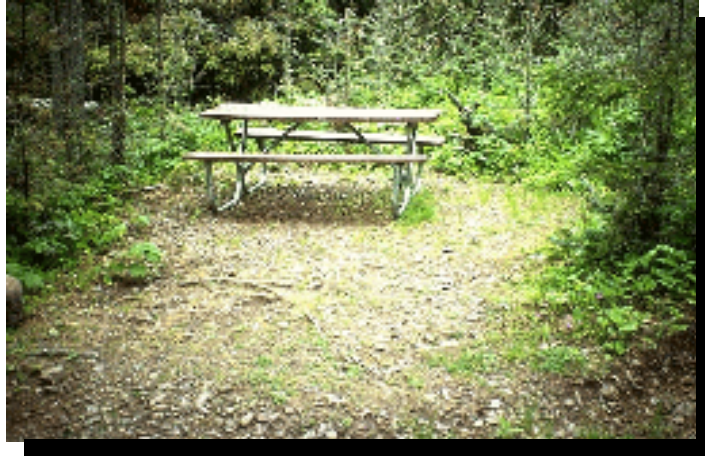

Figure 10. Picnic table on a campsite at Isle Royale NP.

The following sections on facilities and issues is offered to help decision makers evaluate the utility and acceptability of various facilities.

Campfire Rings/Grates - Campfires can be an essential element of a high quality camping experience for many visitors. Unfortunately, problems related to campfire use, including the development of multiple fire sites and large trash-and food-filled fire pits, mounds of charcoal and halfburned logs, tree damage and felled trees, off-site vegetation trampling and wood removal, and the threat of forest fires, have caused an increasing number of managers to prohibit campfires. Campfire rings or grates can help and could be tried along with educational efforts before campfire bans are considered. Many managers have had success in keeping campfires small and contained to a single location by firmly anchoring small steel fire rings or grates on campsites. Such facilities can also be used to identify preferred or designated campsites and have been shown to attract and concentrate visitor use to their vicinity, thereby minimizing site size and expansion. The trend is towards smaller fire rings, a six-inch tall 18 inch diameter ring is sized to encourage small, low-impact campfires that most effectively burn fuel that can be broken by hand (Great Smoky Mountain NP managers have a source for these). Anchoring the fire ring restricts campfires to a single permanent site. One easy anchoring method is to bolt a heavy chain to the fire ring (damage bolt threads to prevent removal), dig a hole as deep as possible and pour a gallon of cement in the bottom with the chain embedded. Large "ice-berged" rocks can be used to anchor rock fire rings.

Food Storage Devices - A fed bear is a dead bear. Unfortunately fed shelter mice do the opposite, they reproduce exponentially... The attraction of bears to campsites when they are successful in obtaining

food all too frequently ends with threats to human safety and the removal or shooting of the bear. Visitors to the backcountry are just that - we visit nature to see wild animals in their habitat. They should not have to pay any price for our recreational pursuits. Proper food storage, including smaller "micro-garbage," is key to preventing wildlife behavioral changes for a variety of wildlife species, including bears, skunks, squirrels, rats, mice, and birds. Tree damage and trampled vegetation associated with repeated bear bag hanging can be avoided through the provision of food storage hoisting cables, poles, or food lockers.

Cable systems can be installed with thick aircraft cable stretched between two trees spaced 30 feet apart at a height of 20 feet. Visitors can throw their own ropes over this to pull food bags up, taking care to hoist it at least 10 feet high and more than six feet from any tree. Alternately, pulleys and smaller cable or rope can also be installed for hoisting food, particularly in areas where visitors may not be carrying their own rope. Ground vegetation and organic litter under such cables will be quickly trampled and lost so it is important to locate such facilities in relatively flat terrain to prevent soil erosion. Contact Great Smoky Mountain NP for information on cable system construction.

Bear poles that resemble 15 foot tall coat racks with multiple arms and hooks for hanging food bags can also be effective. These should be sufficiently strong and anchored in cement for stability. A 10foot lifting pole with a hook on the end is provided for placing and retrieving food bags. The lifting pole should be secured to the bear pole with a six-foot length of chain or cable to prevent its loss. The capacity of this system is less than that of cable systems so more than one may need to be provided for larger capacity camping areas.

Food storage lockers are steel boxes with a hinged door and latch that bears cannot manipulate. Doors should also fit tightly to prevent access by mice. A common disadvantage of food lockers is that visitors leave trash and spilled food in them.

Toilets - Cat-holing is generally considered an effective human waste disposal practice only in areas where visitors are knowledgeable and overnight use is relatively low. Carry-out options are also increasingly possible due to the development of lightweight toilet kits that have been approved by the EPA for landfill disposal. Areas of concentrated overnight use generally require toilet facilities. The determination of when to place a toilet could be made based on monitoring the extent of improperly disposed human waste sites in the vicinity of shelters and camping areas. Low use shelters, particularly in wilderness, may not require toilets. A variety of pit toilet designs have been developed, ranging from simple fiberglass cone-shaped models that lack privacy walls to the more elaborate "Sweet Smelling Toilet" (SST) developed by the USFS. Simpler, more rustic models are cheaper and more appropriate in backcountry settings, though larger venting pipes and fly-proofing can be important features to ensure their consistent use by visitors. A variety of composting toilets have also been developed. Facilities such as stainless steel bin composting containers should be hidden from view by visitors and/or painted to make them less obtrusive. The new ATC "Backcountry Sanitation Manual" (ATC, Green Mountain Club 2002) is an authoritative source of information and guidance on toilets and their management.

Picnic Tables - Some managers question the necessity of picnic facilities at shelters, both as a visitor convenience facility that is considered inappropriate in backcountry and because they might attract greater day use to shelters. However, picnic tables are considered by many to be a traditional facility at shelters and they do concentrate resource disturbance associated with cooking and eating activities. If provided, they should only be placed at shelters, not on campsites. Their use in wilderness is disallowed by NPS management policies.

Shelters - The provision of shelters is a long and strong tradition for the A.T. Studies have shown that these structures concentrate visitor activities to the extent that areal measures of disturbance are substantially lower than for a similar number of visitors camping in tents. However, some managers question their necessity or appropriateness in backcountry and particularly in wilderness environments. They are artificial permanent structures; many use dimensional lumber and non-traditional roofing materials, a few are large and elaborate, and some even have modernistic circular concrete footers. A number of issues regarding use of shelters require considerable further debate and will not be addressed here: When shelters are replaced should larger capacity designs be used? Are multiple shelters at a site appropriate (instead of a single large shelter)? Should additional shelters be placed between existing shelters to increase camping capacity?

Tent Platforms - These are wood decks constructed from pressure-treated dimensional lumber. Such facilities have been built in flat terrain but are most useful in rugged rocky areas where smooth ground suitable for tenting cannot be found, or in areas of sensitive vegetation. Platforms do appear to be effective in concentrating camping activities and are cheaper to construct and maintain than shelters. Disadvantages include their high cost of materials and construction, maintenance requirements (painting, protruding nails, splintered wood), and artificial appearance. Erecting tents or tarps that require stakes is also problematic. In general, platforms should not be used in backcountry and wilderness environments where tent pads on soil can be located or constructed with cut and fill techniques or in flat terrain.

Spring Improvements - Trampling along the banks of springs and streams causes significant damage to vegetation and organic litter and can lead to muddiness, soil erosion, and contamination of drinking water sources. These impacts can be effectively minimized by installing some rock-work around the spring source and/or providing a pipe to speed the filling of water containers. While such a facility does protect the water source it is also artificial and could lead visitors to wrongly assume that the water is safe to use without purifying first. A general precaution when pipes are used is to ensure that educational information stress is provided clearly stating that water must be purified before use.

Site Maintenance. As discussed in the Density of Use section and Site Selection sections, some existing campsites that are poorly located for resource or social considerations should be closed and rehabilitated. The remaining campsites, including well-established visitor-created campsites, can benefit from routine maintenance, just as trails. This section describes maintenance practices that can be applied to keep campsites open and in good condition.

Much of the expertise gained in maintaining trails can be extended to maintaining campsites, although the appropriateness of such work in wilderness has been questioned (Cole 1990). Managers can perform maintenance work on campsites to reduce their size, protect visitor safety, minimize erosion, and address campfire-related impacts (Hammitt and Cole 1998; Marion and Sober 1987). Formal or informal site impact evaluations can reveal what problems require maintenance actions. For example, excessive site size may be addressed by subtly improving tenting locations in core use areas. If you maintain perfect tenting sites visitors will naturally choose and use them consistently (Figure 11). Where necessary, remove protruding rocks or redistribute soil to slightly crown tent pads and improve drainage or smooth over exposed roots (see Site Construction section for procedures).

Site ruination work on unnecessary, peripheral use areas can also be highly effective in concentrating activity and reducing site sizes. Ruin adjacent unnecessary tenting areas by ice-berging large rocks - this works best when rocks are buried at least three-quarters so that visitors cannot kick or pull them free

(Figure 12). Digging shallow soil scrapes and mounding the soil to create uneven terrain is an alternate practice. However, until the soil settles and compacts, visitors may kick it back into the depressions so this is a less effective technique. Brushing out alternative tent sites and use areas with felled trees, large logs, tree branches and organic litter should also be done to help close these areas but this action alone is rarely effective unless large materials are used.

Figure 11. The perfect tent site.

Hazardous trees can be a significant safety hazard, campers have been killed by falling limbs and trees. Hazardous trees should be identified and removed, often providing a good source of logs to line an expanding campsite's boundary. Check with land management agencies for current guidance on identifying hazardous trees (not just standing dead trees). Their removal is a legal liability issue for all shelters, tent platforms, and designated campsites.

Examine how water drains across a campsite and look for evidence of erosion. Reshape the soil to disperse or shunt water to areas where erosion will not occur. In particular, make sure that

Figure 12. Club members ice-berging rocks to close this tent-site and shift use to adjacent constructed tent-pads near Maupin Field shelter, Virginia.

water is filtered through ground vegetation and organic litter before entering streams or other water resources. This requires a dispersed flow of water through at least 10 feet of undisturbed vegetation and litter. Well-placed rocks or a large log along the low side of a campsite and a redesigned water access trail that doesn't drain water can help protect riparian vegetation and allow it to filter campsite runoff.

The management of campfires can be a particularly vexing problem. Visitor surveys have shown that campfires can be an important element of a high quality camping experience, yet resource studies show that campfire wood collection and burning create significant damage to soils and vegetation (Cole and Dalle-Molle 1982). Due to the long-term nature of resource impacts where campfires are built, managers should select the best spot on a campsite and encourage use of only that spot. Some managers have followed a practice of removing all fire sites, even within areas where campfires are permitted. This practice encourages fire scars in multiple sites and should be avoided, except in remote areas where dispersed camping is encouraged. To the extent possible, managers should try to retain the same "fixed" fire site on each campsite and only dismantle new fire sites. Choose a good site that is not close to trees,

tree roots, or boulders and is away from the best tent sites (sparks will melt through tent fabrics). Making this spot the "permanent" fire site without using permanently anchored fire rings, grates, or ice-berged rocks will require reliance on field notes or site photographs. A strong educational message to visitors that encourages use of existing fire sites and discourages construction of new fire sites is critical.

Another important reason for keeping a fire site location fixed over time is that it attracts visitors to a common spot for camping activities and spatially concentrates use. Multiple fire sites create multiple locations of camping activities; different groups use different parts of a site, which grows larger over time. Breaking up all but the intended single fire site will effectively concentrate activity in the same place over time, reducing the area of camping disturbance.

A second fire site management issue is the use of rock rings, some managers have advocated the use of simple fire sites without rocks. Here are some advantages and disadvantages of using rock rings. Rocks shelter the fire from winds that may blow coals or sparks out of the fire, possibly when campers aren't looking. Rocks help to contain the fire, physically separating it from nearby flammable organic litter. Older agency literature recommended clearing to mineral soil a 10 foot circle around a campfire. This size of a cleared area is no longer advocated because of the soil disturbance involved so the risk of catching nearby leaves on fire is an important concern. Rocks also provide containment to charcoal and ash that might spread over the campsite from rain, wind, and foot traffic. Finally, rocks provide greater "permanency" to the fire site's location, the site is more "official" looking and less likely to be moved.

Some disadvantages are that visitors will "mine" surrounding areas for rocks, which provide habitat for aquatic organisms in water and for salamanders, reptiles, and insects on land. Visitors sometimes get carried away and build unnecessarily large rock rings. Rocks become permanently blackened by soot - an aesthetic eyesore for visitors. Wet rocks can explode from heat, a safety issue. Rocks make it difficult for managers or visitors to clean out the charcoal and ash. Rocks could provide campers with a false sense of security and be more likely to leave a fire burning unattended.

The maintenance of simple rock fire rings in commonly used camping areas is a preferred option. Rocks help to "designate" the intended fire site more effectively and permanently than just a fire scar, particularly after it has been cleaned of coals by visitors or managers. Permanency of the fire site is key to attracting camping activities to a common area - thus minimizing area of disturbance. Rocks also help to contain campfires from wind and organic debris. The chief difficulty lies in determining which areas should have fire rings and which shouldn't (those managed for dispersed use). The educational message for visitors is simple, however, avoid having a campfire or use only pre-existing fire sites. Never construct a new fire site (other than temporary mound fires) or add rocks to an existing one.

Managers can also modify environmental resistance to reduce camping impacts. The construction and use of campsites frequently opens forest canopies, allowing greater sunlight penetration that enhances the survival and spread of trampling-resistant (but shade intolerant) grasses, sedges and herbs (Figure 13). In some heavily used frontcountry areas it may be appropriate to thin forest canopies to promote the growth of native grasses, or to fertilize grasses to encourage expanded growth, particularly on eroding slopes. Seeding grasses, using locally obtained pure sources of native species in another option. Agricultural extension specialists can be contacted to locate companies in the region that provide weed-free sources of native grasses. Soil amendments, including a variety of organic materials, can be added to retain soil moisture and improve soil fertility. Although most commonly applied to restore closed campsites, these techniques can also be used on open campsites to close unnecessary areas and

reduce their size (Marion and Sober 1987). Gravel could also be placed in front of shelters or camping could be restricted to tent platforms. While use of these techniques may be common and acceptable in frontcountry settings, some are less appropriate in backcountry and inappropriate in wilderness.

Formal and well-placed visitor-created trails that access campsites, shelters, and water sources also require routine maintenance. The objective is to promote consistent traffic patterns within camping areas on well-designed and maintained footpaths and to close and rehabilitate unnecessary and poorly located routes (Figure 14). Many excellent trail maintenance manuals have been developed to guide this work (Birchard and Proudman 2000; Demrow and Salisbury 1998; Hesselbarth and Vachowski 1996; Hooper 1983). Active trail maintenance reduces impacts by providing a durable tread able to accommodate the intended traffic while minimizing problems with tread muddiness, erosion, widening and multiple tread development.

In areas where dispersed camping is practiced, routine maintenance consists of locating and removing all fire sites and renaturalizing site conditions to avoid

Figure 13. The forest canopy opening at this shelter in Great Smoky Mountains NP allows sufficient sunlight to support trampling resistant grasses that minimize soil exposure.

Figure 14. A visitor-created trail closed by logs and ice-berged rocks.

repeated use of the same sites. Refer to the Campsite Closure and Rehabilitation section for specific management practices. In these areas visitors should avoid building campfires or use LNT campfire practices, such as mound fires.

Site Closure and Rehabilitation. Camping closures represent a final resource protection strategy, generally most appropriate for protecting sensitive environments, rare flora and fauna or fragile historic sites (Cole 1990; Hammitt and Cole 1998). Camping closures around popular features such as waterfalls, cliffs, ponds and lakes may be appropriate to separate overnight campers from intensive day use. Closures of popular highly impacted campsites are often ineffective and inappropriate unless clearly marked alternatives are provided. Little recovery will occur unless all use is removed, and new campsites with greater aggregate impact are frequently created in nearby areas (Cole and Ranz 1983). Generally, closures of high-impact sites or areas are warranted only when use is shifted from impact-susceptible locations to impact-resistant locations, although social considerations (crowding, conflict or visitor safety) may also provide justification (Cole and Ranz 1983).

A common scenario is to shift camping from locations next to streams, trails, shelters or large flat areas to more carefully located sites selected to protect natural resources and visitor experiences. For example, a dense cluster of campsites next to a stream in front of a shelter might be shifted to newly constructed sites in sloping terrain arrayed along a campsite access trail. Successful closure of the old sites can be enhanced by making the new sites more attractive than the old (e.g., improved tent sites), clearly signing the access trail, conducting renaturalization and site ruination work on the old sites, and temporarily signing them as closed to use.

Site closure work can also follow an incremental or phased process. Phase 1 might include renaturalization by dragging woody debris and spreading organic litter across the site. A few larger rocks and partially rotted logs placed across tenting sites or felling large dead trees across the site are also helpful. The objective is to hide the site and make it appear natural. Several attempts at Phase i work are often necessary, be sure to check and redo such work immediately after busy or peak use weekends so that reused sites are quickly restored.

Phase 2 work involves placing a "No Camping" post or sign on sites that receive consistent repeat use. These signs should be relatively vandal-proof, such as a firmly anchored post with the words "No Camping" routed into the sides. Other alternatives include signs with messages like "Campsite Closed - Please allow this site to recover." Western land managers have had success in closing campsites by tying nylon string around them, wrapped around trees or temporary posts.

Phase 3 work consists of more active site ruination work and/or enforceable regulations. These generally require land management agency actions and approval so be sure to plan ahead and allow time for rule-making processes. Site ruination techniques are described in the Site Maintenance section. Vegetation transplanted from adjacent areas or native vegetation appropriate for the area may also be planted in a random fashion around the site, see Hanbey (1992) and Little and Mohr (1979) for guidance. Watering during dry spells is necessary to improve survival. Shrubs and tree seedlings or saplings will help to fill in the area, particularly after a few years growth. Phase 1 and 2 work should also be done to enhance the effectiveness of these more intensive actions. In addition, or as an alternative, enforceable regulations that prohibit camping at the closed sites and/or require camping at the alternative sites may also be enacted.

Effective site closures are often difficult to achieve so managers must be committed to many repeat visits and follow-up site work. The bulk of this work will occur during the first three years when the closed areas still resemble campsites and traditional use patterns must be altered. Occasional use may continue years after an effective closure so vigilance is necessary.

LITERATURE CITED

Anderson, Dorothy H.; Lime, David W.; Wang, Theresa L. 1998. Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers. TC-777. St. Paul, MN: University of Minnesota, Department of Forest Resources, Cooperative Park Studies Unit. l34p.

Appalachian Trail Conference. (Undated). Guidelines for sanitation, water supplies, and overnight facilities along the Appalachian Trail on National Forest lands. Appalachian Trail Conference, Report 16 by the Trail Facilities Task Group, Harpers Ferry, WV.

Appalachian Trail Conference. 1977. Appalachian Trail overnight use management principles. Appalachian Trail Conference, Use-Problem Work Committee, Harpers Ferry, WV.

Appalachian Trail Conference. 1997. Local Management Planning Guide. Appalachian Trail Conference, Harpers Ferry, WV.

Appalachian Trail Conference and Green Mountain Hiking Club. 2002. Backcountry sanitation manual. Appalachian Trail Conference, Harpers Ferry, WV.

Birchard, William and Proudman, Robert D. 1982. Appalachian Trail Fieldbook: A Self-Help Guide for Trail Maintainers. Appalachian Trail Conference, Harpers Ferry, WV.

Brown, Perry J.; McCool, Stephen F.; Manfredo, Michael J. 1987. Evolving concepts and tools for recreation user management in wilderness: A state-of-knowledge review. In: Lucas, Robert C., comp. Proceedings-National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; Fort Collins, CO. Gen Tech Rep INT-220. Ogden, UT: USDA Forest Service, Intermountain Research Station: 320-346.

Clark, Roger N. and Stankey, George H. 1979. The recreation opportunity spectrum: A framework for planning, management and research. USDA, Forest Service, Pacific Northwest Forest Experiment Station; General Technical Report PNW-98, Portland, OR.

Cole, David N. 1987. Research on soil and vegetation in wilderness: A state-of-knowledge review. In: Lucas, Robert C., comp. Proceedings-National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions; Fort Collins, CO. General Technical Report INT-220. Ogden, UT: USDA Forest Service, Intermountain Research Station: 13 5-177.

Cole, David N. 1989. Low-impact recreational practices for wilderness and backcountry. USDA, Forest Service, Intermountain Forest and Range Expt. Stn. General Technical Report INT-265. Ogden, UT. 131 pp.

Cole, David N. 1990. Ecological impacts of wilderness recreation and their management. In: Hendee, John C.; Stankey, George H., and Lucas, Robert C. Wilderness Management (2nd Ed.). Golden, CO: North American Press: 425-466.

Cole, David N. 1992. Modeling wilderness campsites: Factors that influence amount of impact. Environmental Management 16(2): 255-264.

Cole, David N. 1993. Trampling Effects on Mountain Vegetation in Washington, Colorado, New Hampshire, and North Carolina. Research Paper INT-464. Ogden, UT: USDA Forest Service, Intermountain Research Station. 56p.

Cole, David N. 1995. Disturbance of natural vegetation by camping: Experimental applications of low-level stress. Environmental Management 19(3): 405-4 16.

Cole, David N. and Jim Benedict. 1983. How to pick a campsite you can leave without a trace. Backpacker 11(5):40, 44, 87.

Cole, David N. and J. DalIe-Molle. 1982. Managing campfire impacts in backcountry. USDA Forest Service General Technical Report INT-135, 16 pp.

Cole, David N.; Marion, Jeffrey L. 1988. Recreation impacts in some riparian forests of the eastern United States. Environmental Management 12(1): 99-107.

Cole, David N., Margaret E. Petersen and Robert E. Lucas. 1987. Managing wilderness recreation use: Common problems and potential solutions. USDA, Forest Service, Intermountain Forest and Range Experiment Station. General Technical Report INT-230. Ogden, UT. 60 pp.

Cole, David N.; Ranz, Beth 1983. Temporary campsite closures in the Selway-Bitterroot Wilderness. Journal of Forestry 81(11): 729-732.

Cole, David N. and Edward G. S. Schreiner. 1981. Impacts of backcountry recreation: Site management and rehabilitation--An annotated bibliography. USDA, Forest Service, Intermountain Forest and Range Experiment Station. General Technical Report INT-121. Ogden, UT. 58 pp.

Cole, David N. and George H. Stankey. 1998. Historical development of Limits of Acceptable Change: Conceptual clarifications and possible extensions. In: McCool, S.F. and Cole, D.N. and others (Comps.), Proceedings: Limits of Acceptable Change and Related Planning Processes: Progress and Future Directions, pp. 5-9; May 20-22, 1997, Missoula, MT. Gen. Tech. Rpt. INT- GTR-371. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Demrow, Carl; Salisbury, David. 1998. The Complete Guide to Trail Building and Maintenance (3rd Ed.). Boston, MA: Appalachian Mountain Club Books. 256p.

Doucette, Joseph E.; Cole, David N. 1993. Wilderness Visitor Education: Information About Alternative Techniques. General Technical Report 1NT-295. Ogden, UT: USDA Forest Service, Intermountain Research Station. 37p.

Dustin, Daniel L.; McAvoy, Leo H. 1982. The decline and fall of quality recreation opportunities and environments? Environmental Ethics 4(1): 49-57.

Hammitt, William E. and David N. Cole. 1987. Wildland Recreation: Ecology and Management. John Wiley: New York, NY. 341 pp.

Hampton, Bruce and David N. Cole. 1995. Soft Paths: How to Enjoy the Wilderness Without Harming It. Stackpole Books: Mechanicsburg, PA. 222 pp.

Hanbey, Russell. 1992. On-site restoration methods for mountainous areas of the West. USDA, Forest Service, Intermountain Research Station. Missoula, MT. 40 pp.

Harmon, Will. 1994. Wild Country Companion: The Ultimate Guide to No-trace Outdoor Recreation and Wilderness Safety. Falcon Press: Helena, MT. 195 pp.

Hendee, John C., George H. Stankey and Robert C. Lucas. 1990. Wilderness Management. North American Press: Golden, CO. 546 pp.

Hesselbarth, Woody; Vachowski, Brian 1996. Trail Construction and Maintenance Notebook. 9623-2833-MTDC. Missoula, MT: USDA Forest Service, Technology and Development Program. 139p.

Hooper, Lennon 1983. NPS Trails Management Handbook. Denver, CO: USD1 National Park Service, Denver Service Center. 53p.

Kuss, Fred R. 1986b. A review, of major factors influencing plant responses to recreation impacts. Environmental Management 10(5): 637-650.

Kuss, Fred R.; Hall, Christine N. 1991. Ground flora trampling studies: Five years after closure. Environmental Management 15(5): 715-727.

Leave No Trace Skills & Ethics Series. Pamphlets, booklets, and other materials available from the Leave No Trace Center for Outdoor Ethics. Information is both generic and specific to different geographic regions, recreation environments, and uses. 1-800-332-4100 (http://www.LNT.org)

Leonard, R.E., E.L. Spencer and H.J. Plumley. 1981. Backcountry facilities: Design and maintenance. Appalachian Mountain Club, Boston, MA

Leung, Yu-Fai and Jeffrey L. Marion. 1999. Spatial strategies for managing visitor impacts in National Parks. Journal of Park and Recreation Administration 17(4): 20-38.

Leung, Yu-Fai and Jeffrey L. Marion. 2000. Recreation impacts and management in wilderness: A state-of-knowledge review. In: Cole, D.N. and others (eds.), Proceedings: Wilderness Science in a Time of Change; Vol 5: Wilderness ecosystems, threats, and management, pp. 23-48; May 23-27, 1999, Missoula, MT. Proceedings RMRS-P-15-Vol-5. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. (http://www.wilderness.net/pubs/science1999/volume5.htm)

Lime, David W.; Buchman, R. G. 1974. Putting wilderness permit information to work. Journal of Forestry 72: 622-626.

Little, Silas and John J. Mohr. 1979. Reestablishing understory plants in overused wooded areas of Maryland State Parks. USDA, Forest Service, Northeastern Forest Experiment Station. Research Paper NE-431. Upper Darby, PA. 9 pp.

Lucas, Robert C. 1979. Perceptions of non-motorized recreational impacts: A review of research findings. In: Ittner, Ruth; Potter, Dale R.; Agee, James K.; Anschell, Susan, eds. Recreational Impact on
Wildlands: Conference Proceedings; Seattle, WA. R-6-001-1979: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station and USD1 National Park Service: 24-31.

Lucas, Robert C. 1990. How Wilderness Visitors Choose Entry Points and Campsites. Research Paper INT-428. Ogden, UT: USDA Forest Service, Intermountain Research Station. 12p.

Lucas, Robert C. 1982. Recreation regulations-When are they needed? Journal of Forestry 80(3): 148-151.

Manning, Robert E., William Valliere, James J. Bacon, Alan Graefe, Gerard Kyle and Rita Hennessy. 2000. Use and users of the Appalachian Trail: A source book. USD1, National Park Service, Appalachian National Scenic Trail, Harpers Ferry, WV.

Marion, Jeffrey L. 1995. Capabilities and management utility of recreation impact monitoring programs. Environmental Management 19(5): 763-771.

Marion, Jeffrey L.; Cole, David N. 1996. Spatial and temporal variation in soil and vegetation impacts on campsites. Ecological Applications 6(2): 520-530.

Marion, Jeffrey L. and Tracy Farrell. 2002. Management practices that concentrate visitor activities: Camping impact management at Isle Royale National Park, USA. Journal of Environmental Management 66(2): 201-212.

Marion, Jeffrey L. and Robert D. Proudman. 1999. Management options for minimizing camping impacts along the Appalachian Trail. The Register 23(2):12-15.

Marion, Jeffrey L. and Yu-Fai Leung. 1997. An assessment of campsite conditions in Great Smoky Mountains National Park. U.S. Department of the Interior, National Park Service, Great Smoky Mountains National Park, Gatlinburg, TN, Research/Resources Management Report. 127 pp.

Marion, Jeffrey L. and Toivo Sober. 1987. Environmental impact management in the Boundary Waters Canoe Area Wilderness. Northern Journal of Applied Forestry 4(1):7-10.

Marion, Jeffrey L., Joseph W. Roggenbuck, and Robert E. Manning. 1993. Problems and practices in backcountry recreation management: A survey of National Park Service Managers. USD1, National Park Service, Natural Resources Rpt. NPS/NRVT/NRR-93/12, 63 p.

McEwen, Douglas; Cole, David N.; Simon, Mark. 1996. Campsite Impacts in Four Wildernesses in the South-Central United States. Research Paper INT-RP-490. Ogden, UT: USDA Forest Service, Intermountain Research Station. 12p.

McGivney, Annette. 1998. Leave No Trace: A Guide to the New Wilderness Etiquette. The Mountaineers: Seattle, WA. 190 pp.

National Park Service. 1981. Appalachian Trail Comprehensive Plan. USD1, National Park Service, U.S. Forest Service. 1993. George Washington National Forest Plan. USDA, Forest Service, George Washington National Forest, Roanoke, VA.

National Park Service. 1993. Backcountry Management Plan. USD1, National Park Service, Great Smoky Mountains National Park, Gatlinburg, TN.

National Park Service 1997a. A Summary of the Visitor Experience and Resource Protection (VERP) Framework. Publication No. NPS D-12l4. Denver, CO: NPS Denver Service Center. 35p.

National Park Service 1997b. The Visitor Experience and Resource Protection (VERP) Framework: A Handbook for Planners and Managers. Publication No. NPS D-1215. Denver, CO: NPS Denver Service Center. l03p.

National Park Service. 1998. Backcountry and Wilderness Management Plan. USD1, National Park Service, Shenandoah National Park, Luray, VA.

National Park Service. 1999. Reference Manual 41: Wilderness preservation and management. USD1, National Park Service, Washington, DC.

National Park Service. 2001. Management Policies. USD1, National Park Service, Washington, DC.

Olds, Douglas. 1992. Disturbed site restoration: An introduction to principles and techniques. Student Conservation Association. (Draft). Arlington, VA. 429 pp.

Proudman, Robert. 1989. Checklist for the location, construction and maintenance of campsites and shelters on the Appalachian Trail. Appalachian Trail Conference, Harpers Ferry, WV.

Roggenbuck, Joseph W.; Williams, Daniel R.; Watson, Alan E. 1993. Defining acceptable conditions in wilderness. Environmental Management 17(2): 187-197.

Shelby, Bo; Shindler, Bruce 1992. Interest group standards for ecological impacts at wilderness campsites. Leisure Sciences 14(1): 17-27.

Stankey, George H.; Cole, David N.; Lucas, Robert C. and others. 1985. The Limit of Acceptable Change
(LAC) System for Wilderness Planning. General Technical Report INT-176. Ogden, UT: USDA Forest Service, Intermountain Research Station. 37p.

Stewart, William P. 1989. Fixed itinerary systems in backcountry management. Journal of Environmental Management 29: 163-171.

U.S. Forest Service. 1980. ROS users guide. USDA, Forest Service, Washington, DC.

U.S. Forest Service. 1990. Title 2300-90-2 - Recreation, wilderness, and related resource management. USDA, Forest Service, Washington, DC.

U.S. Forest Service. 2000. Minimum requirement decision guide. USDA, Forest Service, Arthur Carhart National Wilderness Training Center, Missoula, MT.

Williams, Peter B.; Marion, Jeffrey L. 1995. Assessing Campsite Conditions for Limits of Acceptable Change Management in Shenandoah National Park. Technical Rpt. NPS/MARSHEN/NRTR-95/071. Blacksburg, VA: USD1 National Biological Service, Virginia Tech Cooperative Park Studies Unit. l38p.