

**Minimizing Visitor Impacts to Protected Lands: An Examination of
Site Management and Visitor Education Methods**

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Thesis submitted to the faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of
Master of Science
in
Forestry

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April 30, 2004
Blacksburg, Virginia

Keywords: Recreation management, visitor impacts, low-impact camping

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(ABSTRACT)

This thesis contains two studies that explore different methods of visitor management in recreation. The management strategies studied here are both relatively indirect approaches intended to minimize the environmental and social impacts that visitors cause in protected areas. The Annapolis Rocks study focuses on visitors' evaluations of a site management strategy that shifted camping from a flat, open area to constructed side-hill campsites. A visitor questionnaire was administered before and after the treatment to determine visitors' ratings of importance and satisfaction for various campsite attributes. We found some evidence of visitor displacement but concluded that the site management strategy supported the intentions of the managers. The Leave No Trace study evaluates the effectiveness of the Trainer courses in improving the knowledge, ethics, and behavior of the participants and encouraging them to teach others in the community. This study employed pre-course, post-course, and follow-up questionnaires to evaluate the participants' short-term and long-term gains from the course. Trainer course participants showed significant short-term and long-term gains from the course, with a slight decline in the total gain four months after the course. The participants showed improvements in low-impact behaviors, suggesting that education is an effective visitor management strategy. These studies demonstrate that managers can be successful at controlling visitor impacts without relying on stringent regulations and enforcement.

ACKNOWLEDGEMENTS

I would like to thank my major professor, Dr. Jeff Marion for the advice and support over the past two years, as well as my committee members, Dr. Steve McMullin and Dr. Joe Roggenbuck for their incredibly helpful constructive criticism. Thanks to Jay Wright and Amy Sternheim, 2003 caretakers at Annapolis Rocks, who made this study possible and survived a lot of nagging from me. Also thanks to the Appalachian Trail Conference Mid-Atlantic Regional Office, the Potomac Appalachian Trail Club, and the Maryland Department of Natural Resources, all who made the Annapolis Rocks project possible, and provided background information and review comments. Thanks to the staff of the Leave No Trace Center for Outdoor Ethics, who helped me contact course instructors and who also offered constructive reviews of the questionnaires and the report on the study. Also, a personal thanks to my roommate Christine, and my kitties Bear and Chablis for helping me maintain sanity, and finally to Brian for your unending love and support.

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CHAPTER I:

Introduction to the Research

Americans are drawn to the outdoors for many reasons. We flock to the backcountry to escape from our daily routines, appreciate nature, find solitude, study ecology, and enjoy time with friends and family. Unfortunately, our use of natural areas incurs a cost to the environment and to other visitors. Human use of natural areas causes damage to ecological and social conditions. Although some degradation is unavoidable, much of the damage can be prevented by proper management. Managers of protected areas must evaluate the costs and benefits of various management strategies to protect the natural resources and the visitors' experience.

The following studies employ social science methods to explore campers' relationships with the outdoors. The Annapolis Rocks study addresses visitors' opinions of a new designated camping area relative to the preexisting area. The Leave No Trace (LNT) study examines the effectiveness of the LNT Trainer courses in knowledge gain and retention, changes in ethics, changes in behavior, and teaching others. Both site management and environmental education are light-handed strategies employed to reduce impacts in natural areas. Subtle yet effective management strategies are important to protect the environment and preserve a high quality experience for outdoor visitors. If these methods are effective in changing visitor behavior without detracting from the experience, they have great potential for application and success in other recreation areas.

Major Themes

Recreational Resource Impacts and Visitor Perceptions

Ecological impacts to natural areas vary greatly, from severe ecological degradation and serious health hazards, to aesthetic considerations. Ecological impacts attributed to recreation include tree damage, soil exposure, soil erosion, vegetation loss, litter, human waste, and wildlife disturbance (Leung & Marion, 2000). These impacts are the result of the interplay among topography, vegetation, climate, patterns of visitor use, and the certain visitor characteristics. Topography, elevation, and climate affect the soil and vegetation types, and erosion potential in an area. Vegetation characteristics such as fragility (resistance and resilience) and density affect the amount of impact an area can

sustain (Cole, 1995; Marion & Cole, 1996). Some families or species of plant life may be more susceptible to damage than others. Patterns of visitor use include the amount of use, spatial distribution throughout an area, and degree of concentration of activities in a localized area (such as a campsite) (Hammit & Cole, 1998; Cole, 1992). Understanding these patterns is important when planning facilities such as campsites and trails. Other visitor characteristics may affect impacts. These include party size, type of user, mode of travel, and user behavior (Hammit & Cole, 1998). Larger parties and those traveling with pack animals tend to have greater impacts than smaller groups and backpackers. The behavior of visitors, especially the extent to which they adopt low-impact practices, can have a substantial effect on the amount of impact they cause.

One difficulty for managers is the disparity between their own perceptions of impacts and the visitors' perceptions. Marion and Lime (1986) suggested that visitors do not notice ecological deterioration as much as managers due to a lack of training in the biological sciences, or low expectations from their adaptation to deteriorated conditions. Moderate impacts may make campsites more recognizable or more desirable to visitors (Heberlein & Dunwiddie, 1979; Shelby, Vaske, & Harris, 1988; White, Hall & Farrell, 2001). Knudson and Curry (1981) found that visitors tended to rate their present campsite highly, even when the site was in poor condition. Although visitors are generally satisfied with conditions while on site, some studies suggest that they can be more critical of impacts when given a visual or verbal comparison of conditions. Martin, McCool and Lucas (1989) compared visitors' evaluations of campsite conditions with managers' evaluations, using artistic representations of impacts. They found that the visitors had more restrictive standards for fire rings and tree damage, while managers were more sensitive to bare ground. Shelby and Shindler (1992) found that managers and Sierra Club members were more sensitive to impacts than other users. When making decisions about natural areas, managers should be aware that their perceptions frequently differ from visitors' perceptions.

Social Impacts

Social impacts include crowding and conflict. Crowding occurs when too many users visit the same recreation area or visitor attraction at the same time. Crowding may cause campsite sharing, visitor displacement, unsanitary conditions, and natural resource degradation. Crowding may also interfere with the experience of visitors who are seeking solitude. Conflict refers to problems created by interactions with other groups or a perceived difference of goals. These disagreements can negatively impact the experience of one or both parties.

Crowding has been studied in a variety of ways. Some methods use evaluations from visitors' actual experience, while others ask visitors to compare several possible management scenarios. Not surprisingly, there is a positive relationship between the number of encounters visitors experience, and their perception of crowding (Vaske & Donnelly, 2002). There are also negative (although weak) relationships between the number of encounters and experience quality, and perceived crowding and experience quality (Stewart & Cole, 2001). The level of solitude/privacy—another indicator of crowding—showed a consistent and a strong negative relationship with number of encounters, and positive relationship with experience quality (Stewart & Cole, 2001). Twenty percent of respondents to an onsite survey at Arches National Park suggested that there were "too many people in the park" and many respondents expressed concern over inappropriate behaviors, particularly walking off designated trails (Manning, Lime, & Hof, 1996). Knudson and Curry (1981) examined the spacing of campsites and found that most campers tended to prefer spacing between campsite centers that was greater than 40 feet and less than 65 feet; however, privacy and spacing did not affect most campers' satisfaction with their experience. Lawson and Manning (2003) reported that 9% of campers in Isle Royale National Park shared campsites each night during the months of July and August. Although a fixed itinerary system or construction of additional campsites would reduce campsite sharing to less than 1%, visitors preferred the status quo or a permit quota, which would keep campsite sharing at 5% or more (Lawson & Manning, 2003). Although visitors may indicate a preference for fewer encounters and greater solitude, high numbers of encounters and campsite sharing do not

strongly affect experience quality, and visitors are generally unwilling to sacrifice flexible itineraries and other freedoms in order to promote greater solitude.

Recreation conflict is a common topic among leisure researchers. Researchers suggest that interpersonal conflicts are caused by goal interference: a recreationist's desired experience is negatively affected by another visitor. A second type of conflict is related to social values. Conflict with social values stems from the beliefs and values that a person or group has about the acceptability of a certain behavior, whether or not the individual or group has witnessed the behavior (Vaske, Donnelly, Wittman, & Laidlaw, 1995). Conflict can occur when individuals (or groups) are engaged in the same activity (in-group) or in different activities (out-group) (Carothers, Vaske, & Donnelly, 2001; Vaske, Carothers, Donnelly, & Baird, 2000). The conflict may be based on several different factors: activity style, resource specificity, mode of experience, and lifestyle tolerance (Jacob & Shreyer, 1980). Many "specialized" recreationists place special or symbolic meaning on their activity. When this activity is negatively impacted by another person or group, the quality of this meaningful experience is damaged. Some experiences are resource specific, either due to the importance of a particular setting for the activity (e.g., backpacking for solitude, whitewater canoeing, studying bald eagles), or due to an individual's attachment to place (Gibbons & Ruddell, 1995). When a resource-specific activity is disturbed by one that is not resource-specific (e.g. large horse-packing groups in a wilderness), the resource-specific visitor may be negatively affected. The mode of experience, or the degree of focus on the activity can also vary and create conflict. A rock climber may be disturbed by loud hikers in the vicinity of the climbing site. Finally, a perceived difference in lifestyle can affect a visitor's experience. For example, the dress, language, and behavior of snowboarders creates a stereotype that is generally perceived as different and unpleasant to skiers (Vaske et al., 2000). These types of interpersonal conflict may be mutual between the two parties, but they are frequently one-sided, with one group perceiving the conflict while the other group is unaffected.

Management Strategies

A number of strategies are used to guide appropriate visitor behavior. Management strategies tend to fall on a continuum from direct to indirect approaches (McCool & Christensen, 1996). Regulations, permit systems, physical barriers, and fixed itineraries are generally categorized as direct, while subtle site alterations, interpretive signs, and educational programs are considered indirect. Direct methods tend to restrict the visitors' choices, while indirect methods guide the visitor to make the appropriate choice without mandating a certain course of action. Visitors tend to prefer indirect management strategies, and these approaches generally promote the "unconfined" nature of the recreation experience (McCool & Christensen, 1996). The most effective solutions to management problems combine indirect and direct strategies (Vander Stoep & Roggenbuck, 1996).

Managers use many different approaches to guide visitors. The spatial distribution of recreational use—and the regulations sometimes needed to promote these strategies—help minimize environmental and social impacts. Spatial strategies include segregation, containment, dispersal, and configuration (Leung & Marion, 1999). Spatial segregation relies on zoning, buffers, or closures, which require regulations and their enforcement. Spatial containment is also somewhat heavy-handed, forcing visitors to remain in designated areas. Spatial dispersal relies on regulations and education to encourage visitors to scatter their use, and spatial configuration minimizes regulations, providing visitors with facilities such as established trails and campsites that they are likely to use rather than traveling off-trail.

Education is a common method of indirect management. Using onsite methods, managers can educate their visitors in a variety of ways—from personal contact to written materials and interpretive signs. Signs, posters, and brochures may be used to educate visitors, with messages informing them of certain regulations, threatening a sanction, making an ethical plea, or suggesting a certain appropriate behavior (Widner & Roggenbuck, 2000; Martin, 1992; Johnson & Swearingen, 1992). Park staff may also provide interpretive programs or personal contact at popular attractions or trailheads. Carter (2001) suggests that managers should utilize multiple communication techniques, present a context that will provide a positive experience for the visitor, and emphasize

one's ability to choose a particular behavior. The most important aspects to consider when developing an educational program are the visitor characteristics, behavior, and informational needs, the cost-effectiveness of the plan, and getting information to visitors early in the planning stages of their outdoor excursions (Roggenbuck & Ham, 1986). Educating visitors gives them realistic expectations of the site they will be visiting and may reduce environmental and social impacts.

Many visitors only experience brief, onsite educational encounters, but others explore environmental issues more thoroughly through environmental education (EE) programs. EE programs range from in-school curricula and educational camps (Zint, Kraemer, Northway, & Lim, 2002), to adult workshops (Westphal & Halverson, 1985-6) and outdoor skills courses (Hammit, Freimund, Watson, Brod, & Monz, 2003). In the Tbilisi Conference of 1977, the following objectives were identified for environmental education: awareness, sensitivity, attitudes, skills, and participation (Hungerford & Volk, 1990). A great variety of EE programs have been developed in pursuit of these goals. Although some scientists have questioned the effectiveness of EE, there is significant evidence that EE can improve environmental behavior (Zelenzy, 1999). The effectiveness of EE programs depends on many factors, including the setting (Zint et al., 2002), duration of involvement (Bogner, 1998; Metzger & McEwen, 1999) affective component (Pooley & O'Connor, 2000), and discussion of practical actions (Culen & Volk, 2000).

The two studies presented in this thesis evaluate two types of management strategies. The Annapolis Rocks (AR) paper evaluates visitors' acceptance of a new campsite design and the accompanying designated site policy. Direct actions included site closure, use limits (number of visitors per night), party size limits, and campfire and alcohol bans. Indirect actions included interpretive signs, educational interventions, and site selection and development. These actions were proposed when ecological and social conditions had reached unacceptable levels at the camping area. Tree damage, soil impacts, and unsanitary conditions were prevalent throughout the camping area. The area was frequently crowded and most of the existing campsites did not provide any privacy or solitude. Large, disruptive groups conflicted with families and backpackers who sought a peaceful weekend. The Leave No Trace (LNT) study evaluates a two-day adult environmental education program. Although LNT courses are primarily taught at one

backcountry location, many of the themes and ideas may be applied to any outdoor experience, regardless of region, terrain, or level of development. The LNT Master and Trainer courses were created to promote responsible outdoor behavior that would minimize visitors' impacts on the natural environment and on the experience of other visitors. The major focus of the study presented in this thesis was the retention of material from the Trainer course. Skills and ideas retained four months after the course are likely to have lasting effects on the participants' outdoor behavior. These two studies offer perspectives on two different management techniques. They will enhance our understanding of visitor perceptions, and compliance with management actions. Although there is no universal management solution to correct the problems at natural areas, these studies investigate strategies that have the potential to effectively minimize the impacts caused by recreational use in many different locations.

Value for the Research Community

These research projects have great value for the scientific community. They help us to understand visitors' preferences and behaviors in actual recreation settings and therefore provide new insight into the effectiveness of different management strategies. The Annapolis Rocks study provides a unique perspective from visitors both before and after management interventions. It allows a comparison of the preferences of the populations of visitors pre- and post-treatment. While several studies have documented the effectiveness of designated campsites and of side-hill construction in reducing the extent of ecological damage, few have evaluated these interventions from the social perspective. This study gives managers insight into visitors' perceptions of impacts, perceptions of social conditions, and the usefulness of the site design. It helps managers and scientists to see the social effects of their actions in addition to the ecological effects. The Leave No Trace study provides an evaluation of the absorption and retention of the LNT messages. The LNT courses have been taught for many years, but their effects were largely unknown. There was little documentation of the participants' use of LNT following the Master and Trainer courses. This study provides insight into the extent that LNT Trainers retain and use the information and skills taught during their course.

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CHAPTER II:
**Visitor Evaluations of Management Actions at a Highly Impacted Appalachian
Trail Camping Area**

ABSTRACT

Protected area management involves balancing environmental and social objectives. This is particularly difficult in high-use/high-impact recreation areas, because resource protection objectives may require substantial site management or visitor regulation. This study examined the visitors' reactions to both of these types of actions at Annapolis Rocks, MD, a popular Appalachian Trail camping area. We surveyed visitors before and after implementation of camping policies that included shifting camping to designated campsites and a campfire prohibition. Survey results reveal that visitors were more satisfied with all social and environmental indicators after the changes were enacted. An Importance-Performance analysis also determined that management actions improved conditions for factors of greatest concern to campers prior to the changes. Post-treatment visitors were least satisfied with factors related to reduced freedom and inherent characteristics of the design of constructed campsites. Although there was evidence of visitor displacement, the camping changes met management goals by protecting the camping area's natural resources and improving social conditions.

Introduction

Management of backcountry recreation areas involves a balance of actions taken to meet environmental and social objectives. Decisions made to protect the resource should also consider the consequences for visitors. This study examines visitors' evaluations of environmental, social, and management conditions at a popular high-impact camping area. It provides a comparison of visitors' evaluations before and after the implementation of an impact containment strategy with constructed designated campsites.

From October 1999 to March 2001, several scientists, land managers, Appalachian Trail Conference (ATC) staff, and trail club volunteers visited high-use/high-impact camping areas and shelters along the 2,160-mile Appalachian Trail (AT). Of the 17 sites visited, Annapolis Rocks (AR) in western Maryland was deemed one of the two areas with the greatest extent and severity of impacts to soil, trees, and ground vegetation (Marion 2002). Problems with camping-related crowding and conflicts were also cited and targeted as a management concern. Managers decided to move camping from visitor-created sites in a flat, highly impacted, heavily used area to an area farther from the cliffs, where camping was confined to well spaced constructed sites arranged along a common access trail. These sites were constructed using cut-and-fill methods to create a relatively flat bench in sloping terrain. Previous research has shown that this spatial containment of camping to constructed side-hill campsites can be effective in containing the expansion of camping impacts (Leung and Marion 1999). If management efforts are effective in keeping visitors from camping in the preexisting area and encouraging revegetation in this area, these new sites will greatly reduce the extent of camping impacts at AR.

While such site management actions may control and contain ecological impacts, their effects on the visitors' experiences are not well known. Visitors may not perceive ecological impacts the same as managers, and they may not feel that the changes are justified. Since managers typically must protect the resource but also preserve a high quality experience for visitors, they need to have a flexible management strategy that will evaluate their success and permit necessary modifications. The study described here is an integral part of such an adaptive process. Adaptive management relies on scientific data

and monitoring, frequently accompanied by stakeholder involvement, to inform management decisions. This study uses a variation of Importance-Performance analysis to assist managers in focusing on those aspects of the camping experience that need the most attention. This research evaluates visitors' opinions of the camping changes at Annapolis Rocks to inform managers of the acceptability of their actions and to offer suggestions that will improve the visitors' experience.

Our primary research objective was to determine the differences in visitor satisfaction with resource and social conditions before and after the management changes were implemented. We used ecological monitoring data to provide a context for the visitors' satisfaction scores. A secondary objective was to examine an importance-satisfaction matrix to derive timely guidance for managers. This was focused on determining whether changes to the camping area corrected the issues that were most salient to visitors.

Literature Review

Recreational Impacts

Recreational impacts include tree damage, soil exposure, soil erosion, vegetation loss, litter, human waste, and wildlife disturbance (Leung and Marion 2000). Impacts to campsites and trails are caused by a variety of factors. Scientists have begun to examine the numerous visitor and site characteristics that affect the amount and severity of camping impacts. The magnitude of these impacts depends on visitor factors such as amount of use, behavior, and outdoor experience, but research has shown that the quantity of use does not have as much of an effect as was previously assumed (Leung and Marion 2000). Hammitt and Cole (1998) identified party size, type of user, user behavior, mode of travel, and use distribution as primary factors influencing the amount of impact. Cole (1992) employed amount of use, vegetation fragility, vegetation density, and degree to which activities are concentrated spatially, to model and predict impacts to campsites. He found that amount of use, vegetation fragility, and vegetation density were all significant factors in campsite impacts, and the curvilinear relationship between amount of use and impact is explained by the increasing concentration of activities with increased use. Marion and Cole (1996) examined the spatial and temporal variation of

impacts to vegetation and soil on campsites. They found that some grasses and sedges demonstrated significant resistance and resilience to tramping, while broad-leafed forbs were damaged more easily and were less likely to recover quickly.

Combining Recreation Ecology and Social Science

Recreation impacts are a result of the interaction between ecological site characteristics and visitor behaviors. Studies limited to resource conditions may be insufficient for understanding and correcting problems. However, recreation ecology and social science research together can be powerful tools for management decision-making. In order to prevent further resource damage, managers need to understand the underlying causes of damaging behaviors. Damage may result from visitors' careless, unskilled, uninformed, unavoidable, or illegal actions (Hendee and Dawson 2002). Once the cause of the damage is identified, managers can choose the most appropriate strategies to correct the problem. Social science helps to identify human tendencies in behavior, conditions and variables that influence behavior, and critical factors involved in personal decision-making (Vander Stoep and Roggenbuck 1996). By understanding human behavior and the motives that underlie it, managers can identify actions that will likely be most effective in preventing future resource damage.

Management Strategies

A number of different strategies are used to guide appropriate visitor behavior. Management strategies are generally categorized as direct or indirect, although the amount of enforcement and the degree of subtlety of the actions can vary greatly. Direct management approaches, such as use limits, barriers, and campsite assignments, can be very effective but are often intrusive and unnatural to the visitor experience. Indirect measures, such as interpretive signs, educational programs, and subtle site alterations are less intrusive but rely on visitors making the appropriate choices. Visitors tend to prefer indirect management strategies, and these approaches generally promote the "unconfined" nature of the recreation as described by the Wilderness Act of 1964 (McCool and Christensen 1996). The best solutions to management problems tend to combine indirect and direct strategies (Vander Stoep and Roggenbuck 1996).

This study examines visitors' reactions to management actions and addresses the efficacy of these actions during the first season following their implementation. Managers implemented direct and indirect actions at Annapolis Rocks in an effort to improve both resource and social conditions. Direct actions included site closure, use limits (number of visitors per night), party size limits, and campfire and alcohol bans. Indirect actions included interpretive signs, educational interventions, and selection and development of campsites in an area that will likely resist campsite expansion (Leung and Marion 2000). This study concentrates on the efficacy and acceptability of a designated campsite policy and the constructed campsites.

Site Management Techniques

A number of site management strategies have been employed to reduce impacts in camping areas. Areas that receive high levels of use may benefit from a containment strategy, where campsites or camping areas are designated. Marion and Leung (1998) studied camping areas in Great Smoky Mountains National Park and found that one of the most significant factors leading to campsite expansion and proliferation was the location of the designated areas. Campsites in flat terrain, near water or other desirable resources, experienced the greatest areal extent of impacts. The authors suggested a containment strategy that considers site selection criteria when choosing new areas for designated campsites. Site selection criteria should include vegetation resistance to trampling, low erosion potential, and topographic features that restrict campsite expansion and proliferation (Marion and Leung 1998).

According to Cole (1992), activity concentration interacts with many other impact variables such as amount of use and vegetation fragility. If campers concentrate their activities in a small area, total vegetation loss for a campsite will be minimized. However, Hall (2001) cautions wide implementation of designated site camping strategies. She studied the changes to campsites following implementation of a designated site policy in the Mount Jefferson and Three Sisters Wildernesses. Although the policy appeared to reduce the rate of site proliferation, many illegal sites were used and the bare core areas of these sites expanded. In Isle Royale National Park, a designated site policy employing constructed side-hill campsites significantly reduced the

areal extent of impacts (Marion and Farrell 2002). These side-hill sites consisted of slightly out-sloped tent pads cut into a steeper hill to limit expansion and concentrate activity on the pad. Managers should consider the amount of use an area receives when planning the quantity of constructed, resistant campsites so that visitors do not create new, less resistant sites.

Visitor Perceptions

One of the obstacles to the achievement of management goals may be the visitors' limited perceptions of resource impacts. While visitors may agree that "damaged trees" and "trampled vegetation" are undesirable, they may not notice the presence of these features in their campsites. They may also consider some impacts—such as bare soil—positive attributes for a campsite. In the Mt. Jefferson Wilderness, 65% of visitors interviewed perceived existing vegetation impacts, 51% mentioned existing soil impacts, and 53% noticed existing tree damage in their campsites. While these impacts were attributed to human actions, some were considered positive attributes of a campsite, or at least "to be expected" (Farrell and others 2001). Campers at Island Lake, in the Bridger Wilderness of Wyoming, tended to choose campsites that were more worn, had more litter, and had less wood available than other sites (Heberlein and Dunwiddie 1979). Marion and Lime (1986) suggested that visitors do not notice ecological deterioration as much as managers due to a lack of training in the biological sciences, or low expectations due to their adaptation to deteriorated conditions.

Another difficulty for managers is the diversity of expectations among the visitors. The definition of a quality outdoor experience varies widely, depending on the visitor's motivations, activity, past experience, and interests. There have been numerous methods employed to measure the quality of a wilderness experience, all of which have their advantages and disadvantages (Borrie and Birzell 2001). Shelby and others (1988) found that visitor norms for campsite and fire ring size within the same wilderness area varied depending upon the popularity of the camping area and its location. Shelby and Shindler (1992) found disagreements among various interest groups for acceptability of bare ground or fire rings in campsites. The diversity of protected area visitors contributes to diversity in their expectations for the experience. Managers are faced with the difficult

task of balancing ecological objectives with preferences from a diverse population of visitors.

Several studies have examined visitors' perceptions and opinions of resource conditions and management strategies. Knudson and Curry (1981) found that campers at an Indiana state park were not bothered by crowded conditions and did not perceive much of the damage at campsites. In contrast, Martin and others (1989) found that wilderness users tended to have more restrictive standards for tree damage and fire rings than managers. Although the exact difference between managers' and visitors' perceptions may vary, managers need to acknowledge that a difference exists. Since managers make the decisions that affect recreation areas, they should consider the recommendations of their visitors, their own knowledge and experience regarding resource impacts, and the agency's mission and the area's management goals.

Adaptive Environmental Assessment and Management

In an effort to integrate scientific resource management with stakeholder involvement, adaptive management is becoming a common strategy. McLain and Lee (1996) describe the process of Adaptive Environmental Assessment and Management (AEAM) as organizing people and decisions around systems modeling and hypothesis testing. Although adaptive management has a more restrictive definition, AEAM is commonly called adaptive management (Blumenthal and Jannink 2000). A true AEAM plan recognizes that management is a continual learning process where research and ongoing regulatory activities cannot be separated (Walters 1986). AEAM relies on systematic scientific data to suggest the best management strategies, and continual monitoring to evaluate the success of these strategies.

While adaptive management has some weaknesses, these should be precautionary rather than restrictive. Moir and Block (2001) stress the importance of information feedback, and Ewel (2001) emphasizes the importance of accepting uncertainty. There is hope for success in the application of AEAM to ecosystem management as long as managers understand that efficient monitoring is critical (Johnson 1999), conflict among stakeholders is inevitable and constructive (Lee 1999), and learning from experience and creating new hypotheses is part of the process (Wilhere 2002).

Adaptive management has many possible applications to studies of recreation. Chavez (2002) used an adaptive management strategy to choose appropriate renovations and monitor the visitors' use of the new facilities at a popular picnic area. Working with AEAM, managers must continually monitor conditions to determine the effectiveness of the management plan, and to make changes if necessary to protect the resource or to minimize social impacts.

Importance-Performance Analysis

For this study, we adapted Importance-Performance (I-P) analysis (Martilla and James 1977) to determine the relative importance of various campsite attributes and the visitors' satisfaction with them. Importance-Performance analysis is a technique originally developed for marketing. It has been used in the hospitality and tourism industry for many years (Oh 2001), and has also been applied to park and wilderness management. Mengak and others (1986) used Importance-Performance Analysis to evaluate a visitor center in the Great Smoky Mountains National Park. Importance-Performance studies can help managers to prioritize actions based on visitors' ratings of the importance of certain aspects of the recreation experience, and their satisfaction with these aspects. Introduced by Martilla and James (1977), I-P analysis uses measures of importance and performance, plotted in an "action grid" to identify the strengths and weakness of a service or company. The action grid is divided into four quadrants, usually using the mean or median of these measures as the crosshairs. The previous literature that utilized this technique placed performance on the *x*-axis and importance on the *y*-axis; however, we believe it is more appropriate to reverse the axes since importance is the independent variable and performance is dependent. The four quadrants help managers and marketers focus on improving customer relationships (Figure 2.1).

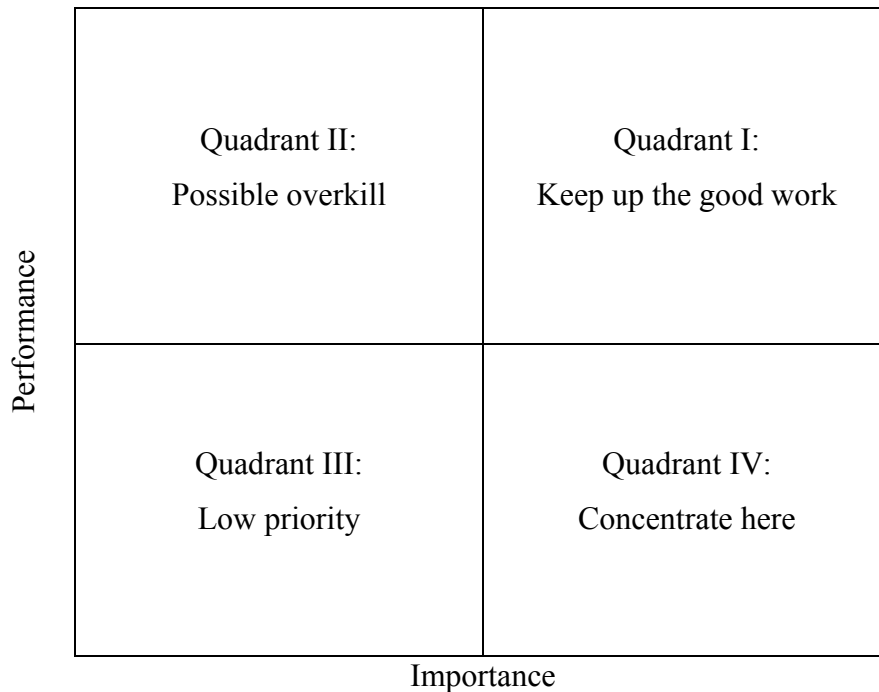


Figure 2.1. Quadrants of importance-performance action grid.

Although it can provide valuable insight, I-P analysis should be used with caution. Since many visitors are inherently satisfied by any recreational activity, and not trained to recognize impacts, they tend to rate conditions above the midpoint of the scale. For this reason, most I-P analyses compare the attributes to a measure of central tendency (mean or median) to evaluate the relative importance and performance of the attributes studied. The midpoint of the scale has been used in some studies (Oh 2001) but frequently places all indicators in the "Keep up the good work" quadrant. Although this placement may appear to be a positive assessment of management, it is not a very helpful tool for managers. The goal of many organizations is to strive for excellence; therefore, managers want to identify services whose performance falls below others. In the absence of defined indicators and standards, Importance-Performance analysis—using the means as the crosshairs—can be very valuable. It presents a graph that is easily interpreted to identify management priorities. In addition to using I-P analysis to clarify visitor evaluations, managers should also measure the physical parameters of resources to have a more objective assessment of resource conditions.

Study Area

Annapolis Rocks (AR), located in Greenbrier State Park in western Maryland, is a short side hike from the AT. Although geographically situated in Greenbrier State Park, AR is collaboratively managed by the South Mountain Recreation Area (Maryland Department of Natural Resources), the Potomac Appalachian Trail Club (PATC), and the Appalachian Trail Conference (ATC.). The area is popular with day users and weekend campers due to its close proximity to a major highway, spectacular sunsets, and challenging rock climbing routes. The unregulated, free camping is also an attractive feature for overnighers. The 2002 AT ridgerunner (a seasonal trail caretaker and educator) observed an average of nine people at AR on (non-holiday) weekdays and 24 people on weekends during the summer and fall.

From the time the state of Maryland acquired the land in the early 1990s, this site has been considered a problem area. Overuse and inappropriate use degraded the natural and social conditions. The area was frequented by novice campers and large groups, and there was clear evidence of large bonfires and live trees cut for firewood. Long distance hikers avoided the area because of its high use and negative reputation (McCorkle 2004). The state did not have the resources to tackle the problem, and the ATC and PATC were hesitant to accept responsibility for an area that was off the AT. This created a "hands off" approach to management for many years (Lutz 2004). Finally, the Maryland AT Management committee met to discuss a solution, working with scientists and the ATC.

In October 2002, the impacted areas at AR were carefully measured, totaling greater than 4000 m² of disturbance from 19 campsites. The disturbance was, however, not limited to areal measures. Multiple fire scars marred the ground and rocks in the campsites, and tree stumps and scarred bark demonstrated the lengths to which campers would go for a campfire (i.e., attempting to burn green wood or large logs). Careless and uninformed campers left beer bottles, cans, and other burned trash in the fire rings. Sanitation was also a concern; toilet paper "flowers" were evident in many locations throughout the area. According to the ridge runner, crowding was a concern on holiday weekends, and noise from large groups may have been disruptive to others seeking solitude in the outdoors. The managers wanted to protect the resource by allowing vegetation to grow back in the area, and modify the dispersal, quantity, and behavior of

visitors (McCorkle 2004). They also wanted to create a more primitive experience and protect the natural resources (Lutz 2004). To mitigate impacts and improve visitor safety, managers chose to move camping to smaller, more isolated campsites farther away from the cliffs. The decision to implement this change was made with little public involvement. The managers and trail club members decided the impacts were unacceptable and that corrective actions were needed.

As of May 23, 2003, visitors were required to camp in a new camping area. Eleven new campsites were created to accommodate one or two tents, and three group sites to accommodate three or more tents. All of these campsites were constructed with cut-and-fill methods to produce relatively flat benches large enough for tents that accommodate two or three persons. These "side-hill" campsites are surrounded by sloping terrain. The campsites were constructed at least 30 meters apart to minimize visual and auditory intrusion from other campers. Spur trails to the individual campsites branch from a single access trail that runs parallel and uphill from the cliffs, ending at a spring (see Figure 2.1 for camping area diagram). Moldering (above-ground composting) privies were installed at both ends of the camping area. All preexisting campsites were closed to allow natural recovery. The closures were identified by signs posted on string or plastic fencing surrounding the preexisting sites.

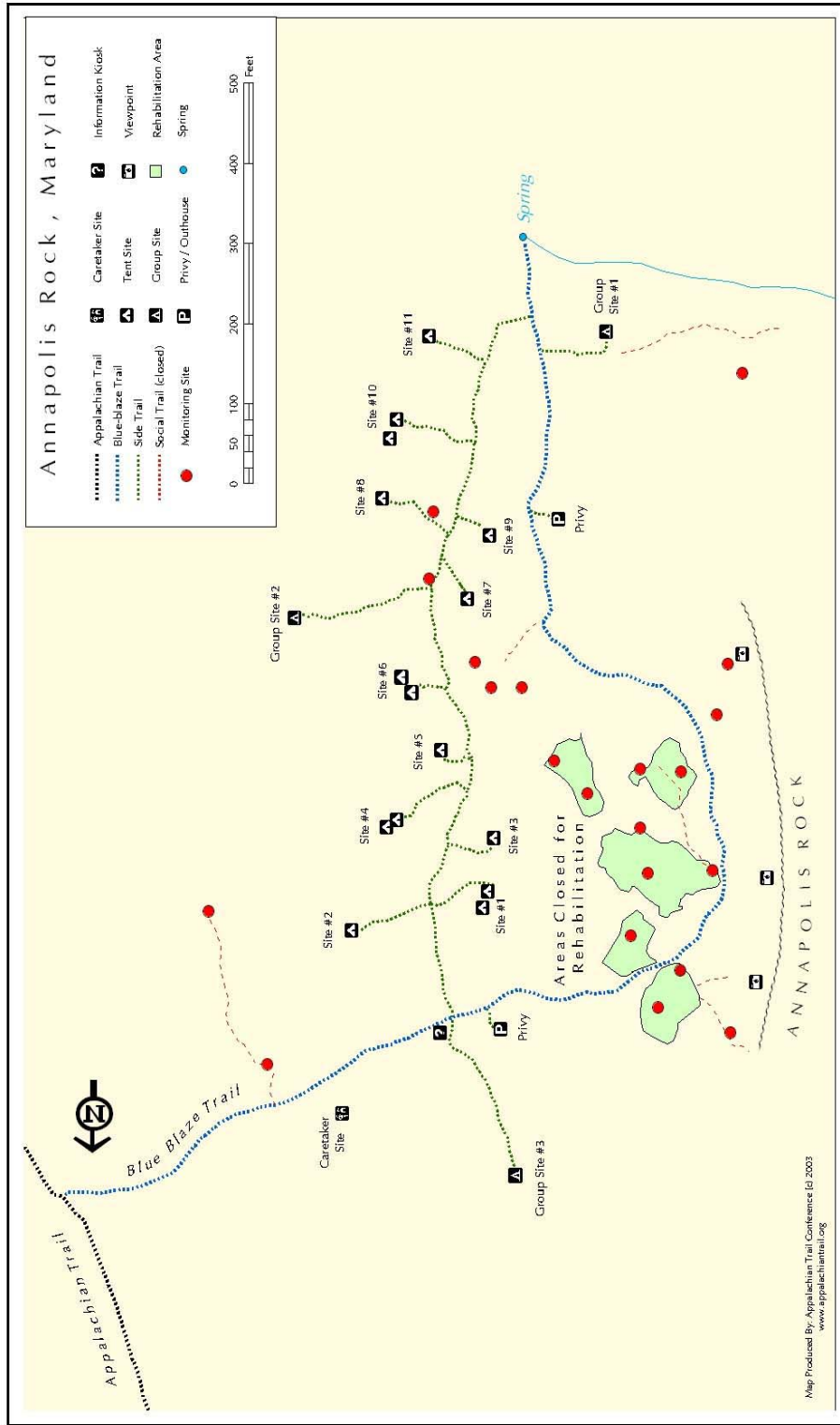


Figure 2.2. Campsite layout at Annapolis Rocks. The outlined polygons and solid dots indicate preexisting campsites. Constructed campsites are denoted by tent symbol.

Managers also limited group sizes to 10 and total overnight visitation to 75 (first-come, first-served basis), and imposed prohibitions on campfires and alcoholic beverages. Group size and use limits were adopted to match use to the capacity of the newly constructed sites, addressing site proliferation and expansion concerns. The campfire ban addresses previous management problems, including fire site proliferation, depletion of firewood, severe damage to live trees, and trampling disturbance from firewood gathering. Alcohol was prohibited to reduce noisy, rowdy behavior, and trash left at the campsites. Two ridgerunners alternated caretaker duty at AR. Their primary duties were to educate and inform visitors about the new policies and to care for the site. They had no law enforcement responsibilities, and the area was not patrolled regularly by Maryland State Park law enforcement rangers. A caretaker was stationed at the site seven days per week from May to October 2003. Articles, news releases, and an AR brochure were used to inform the public. Several weeks before the policy changes, kiosks with information on the changes, and educational materials about Leave No Trace camping practices were installed along the AT and the AR access trail.

Although the public was not consulted for initial planning, this situation is well suited for a type of adaptive management strategy. The survey reported here provides a formal opportunity for public input regarding the design of the campsites and the current policies. Cole's (1992) findings regarding wilderness campsite impacts provides a scientific basis for the side-hill design of campsites, encouraging activity concentration and limiting the areal extent of camping disturbance. Resource and social conditions should be monitored for several years to ensure that visitor expectations and management goals are compatible. If this campsite design meets resource protection goals without degrading the visitors' experience, the design may be more widely applied along the AT or in other areas.

Social Research at Annapolis Rocks

Since Annapolis Rocks has been a popular camping spot for a long time, campers were expected to have strong opinions about the changes. This research is an attempt to capture the impressions of campers regarding the preexisting and new campsites. A

principal study question was: Are visitors more satisfied with physical and social conditions at the new campsites than those at the previous campsites? For this reason, we asked visitors to rate their satisfaction with various aspects of the camping environment. A pre- to post-treatment comparison was used to determine if visitors were more or less satisfied with the camping area following the changes. Since some aspects of the camping environment may not be as important as others, we also asked visitors to rate the importance of each factor. We used these ratings in a modified Importance-Performance analysis to provide guidance for management decisions. Physical site measurements of campsite conditions were also conducted on the preexisting and new campsites to provide an initial assessment of resource impacts. This research provides managers with a "check-up" regarding the efficacy and acceptability of their actions, and guidance for future decisions.

We expected that visitors would be satisfied with the social conditions—increased privacy and spacing. We also expected an improvement in the containment of ecological impacts, increasing satisfaction with ecological indicators. However, dissatisfaction was expected with utility indicators, such as reduced freedom in site choice and the small size of the new sites. While some visitors would appreciate the changes, those with greater AR experience might dislike any departure from the traditional camping area, and large groups might be displaced or dislike dividing their group among smaller separate sites.

Methods

Ecological Assessment

In October 2002, campsite impacts were assessed for the preexisting camping area, using methods described by Marion (1995), to establish baseline measurements. Campsites were identified by the presence of bare ground, trampled vegetation, or pulverized organic matter. Wire flags were placed along campsite boundaries to approximate their shapes, and galvanized nails with numbered tags were buried at permanent reference points. The distance and azimuth from the reference point to each wire flag was recorded to calculate site areas. Damaged trees, stumps and other resource impacts were also assessed within campsite boundaries (Marion 1995). Constructed campsites were assessed with the same procedures prior to their use and measured again in the fall of

2003, after the summer use season. The boundaries of these sites were identified by the cut-and-fill surface, as well as adjacent areas that were likely used for cooking or sitting. These measurements are a part of an ongoing assessment of environmental impacts and recovery at Annapolis Rocks.

Social Assessment: Research Design

The social assessment employed onsite questionnaires distributed to campers before and after the management actions were implemented. This is a separate pre-post samples design using a nonequivalent group of AR campers. A census of campers age 16 and older was sought by visiting all occupied campsites and requesting each eligible person to complete a survey the morning of their stay at AR. The surveys were collected personally or dropped in a return box along the trail leading from AR to the AT.

Survey Instrument

A pre-treatment version of the questionnaire was administered for 5 weeks to campers on the preexisting campsites, and a post-treatment version was administered for 22 weeks to campers on the newly constructed campsites.

Satisfaction. The questionnaire contained 22 items related to camping conditions, for which visitors ranked their satisfaction on a scale from one (highly dissatisfied) to five (highly satisfied). This section also contained an item to indicate overall satisfaction.

Preference. For each of the satisfaction items, we also asked respondents to circle their preference for the condition of the item, for example, "Less," "Same," or "More."

Importance. Another section contained the same items to be rated for importance from one (not important) to five (very important).

Direct Comparison. The post-treatment survey contained an additional section, comparing the new sites and policies with the old sites, only to be completed if the respondent had experience under the previous camping policies. These items asked campers to indicate their agreement with various statements on a scale from one (strongly disagree) to five (strongly agree).

Additional questions addressed demographic variables, past outdoor experience in general, and camping experience at Annapolis Rocks. Space for written comments was also provided.

For the pre-treatment survey, 57 questionnaires were returned for a 68% response rate. For the post-treatment survey, 174 questionnaires were returned for a 55% response rate. Three individuals declined to receive a pre-treatment survey, and seven individuals declined a post-treatment survey. Upon consultation with a statistician, we determined that statistics were appropriate.

Analysis

Change in Satisfaction. We grouped the 22 satisfaction items into three categories: utility indicators, environmental indicators, and social indicators. For each of these items and an overall satisfaction item, we calculated mean satisfaction values and identified significant differences between the pre- and post-treatment evaluations.

Preferences. For the "Preference" section, we calculated the frequencies of the responses. Chi-square analysis was used to test for significant differences from a uniform distribution.

Direct Comparison. The "Direct Comparison" statements were ranked in descending order of the mean response.

Importance-Satisfaction. We created separate action grids for the pre- and post-treatment surveys, with importance on the *x*-axis and satisfaction on the *y*-axis, then plotted the mean values for each of the 22 items. We followed Oh's (2001) suggestion, placing the crosshairs at the overall mean because the mean and median were very close, and the data had a normal distribution.

Additional Analysis. We examined the effects of previous experience camping at AR on two items: "Restrictions on where I can camp" and "Freedom to choose a preferred campsite." Respondents were grouped based upon the distribution and gaps in the frequency of responses, and tested for significant differences using ANOVA and Fisher's Least Significant Difference.

Results

Ecological Conditions

Because resource protection was a major goal of management, a preliminary examination of environmental conditions is constructive and provides context for the visitors' satisfaction ratings. Moving camping to the new designated sites resulted in a reduction in the area of disturbance caused by camping. The previous camping area had over 4000 m² of disturbance among the 19 sites. After one season of use, the combined size of the 14 new sites (580 m²) represented an 85% reduction in the total area of camping disturbance (Table 2.1). Additionally, preexisting sites had 32 fire sites, 83 damaged trees, 14 trees with exposed roots, and 137 tree stumps. Evaluations of newly constructed sites prior to use revealed one fire site, 11 damaged trees, two trees with exposed roots, and five stumps; nearly all of these impacts are attributable to conversion of two preexisting sites to group use sites. The first season of use contributed one additional damaged tree, with all other factors unchanged. After one season of closure, the preexisting sites showed substantial recovery. Although damaged trees could not be corrected, grasses and moss covered most of the area, making previous fire rings and campsite boundaries largely unnoticeable. Readers are cautioned, however, that both group size and total visitation declined at AR following implementation of the new policies. Though complete data are unavailable for pre-treatment use, partial data from ridgerunners suggest a 30% reduction in visitation on weekdays and 57% on weekends.

Table 2.1. Size comparison of campsites.

Site Characteristics	Preexisting sites (before closure)	Designated sites, as constructed	Designated sites, post use (1 season)
Area Total (m ²)	4004	535	580
Mean area per site (m ²)	211	38	41
Number of sites	19	14	14

Visitor Satisfaction

Visitors were generally satisfied with all camping indicators, both before and after the changes were enacted. Mean satisfaction scores for all indicators were above the neutral

value of three (Table 2.2). Post-treatment visitor satisfaction ratings increased significantly for 14 of the 23 items. All environmental and social indicators showed significant increases, with the largest increases in social indicators, particularly i) Number of people camped near me (.93), j) Privacy of my campsite (1.04), and k) Noise from other groups (.94). All environmental indicators also showed increases in satisfaction, particularly g) Naturalness of the area near my campsite (.47). For the utility indicators, only one item showed a significant change, q) Freedom to choose a preferred campsite (-.28). Respondents' overall satisfaction with their campsite had a mean of 4.19 both before and after the treatment, higher than the mean values for most of the individual indicators (Table 2.2, item w).

Table 2.2. Mean satisfaction with campsite indicators before and after treatment.¹

Utility indicators	Pre	Post	Difference
a) Number of campsites available	3.96	4.11	0.15
b) Size of my campsite	3.98	3.83	-0.15
p) Ability to camp near members of my group	4.15	3.95	-0.20
q) Freedom to choose a preferred campsite	4.17	3.88	-0.28*
r) Restrictions on where I can camp	3.65	3.40	-0.25
s) Distance from my campsite to the spring	3.87	4.07	0.21
u) Slope of the tenting surfaces	3.91	3.89	-0.02
v) Smoothness of the tenting surfaces	3.75	3.70	-0.06
Environmental Indicators			
c) Amount of bare soil on my campsite	3.27	3.60	0.33*
d) Condition of trees on my campsite	3.76	4.17	0.41**
e) Amount of ground vegetation cover near my campsite	3.44	3.83	0.39**
f) Naturalness of my campsite	3.63	3.94	0.32*
g) Naturalness of the area near my campsite	3.71	4.18	0.47**
h) Attractiveness of my campsite	3.75	4.06	0.31*
Social Indicators			
i) Number of people camped near me	3.31	4.23	0.93**
j) Privacy of my campsite	3.26	4.30	1.04**
k) Noise from other groups	3.27	4.21	0.94**
l) Interactions with other groups	3.63	4.05	0.42**
m) Behavior of other groups	3.46	4.09	0.62**
n) Number of day users near my campsite	3.49	3.96	0.47**
o) Security of my belongings at my campsite	3.81	4.23	0.42**
t) Distance from my campsite to other sites	3.68	3.98	0.30*
w) Overall impression of my campsite	4.19	4.19	0.00

¹Indicator scores are based on a scale of 1 (highly dissatisfied) to 5 (highly satisfied). *p<.05, **p<.01 based on independent t-tests

These ratings give us an idea of the visitors' satisfaction, but they do not express their preferences. In addition to satisfaction ratings, we asked visitors to indicate their preferred condition for each camping indicator. For 19 pre-treatment items and all 22 post-treatment items, "Same" was the most frequent response. Chi-square analysis showed significant differences from a uniform distribution for all items except the pre-treatment measure of "Amount of bare soil on my campsite." For this item, 16 campers each chose "Less" and "Same," and 9 campers chose "More." Table 2.3 demonstrates the

frequencies of the responses for each of the 22 indicators. Although the most frequent response for most items was "Same," some items had a large number of visitors preferring a change from the status quo. Before the treatment, many visitors preferred more ground vegetation near the campsite, a more natural area near the campsite, more privacy, and better behavior from other groups. A majority of pre-treatment visitors preferred fewer people camped nearby and less noise. After the treatment, many respondents indicated a preference for larger campsites with a smoother surface for their tents.

Table 2.3. Frequency of responses for camping indicators and significance based on chi-square test.¹

Indicator	Pre-treatment				Post-treatment			
	Response frequency		p-value	Response frequency		p-value	Response frequency	
	Less*	More*		Less*	More		Less*	More
a) Number of campsites available ^a	9	31	4	.000	6	101	23	.000
b) Size of my campsite ^b	4	33	4	.000	1	71	59	.000
c) Amount of bare soil on my campsite	16	16	9	.303	23	68	35	.000
d) Condition of trees on my campsite ^c	0	30	6	.000	0	96	21	.000
e) Amount of ground vegetation cover near my campsite	1	27	14	.000	6	87	28	.000
f) Naturalness of my campsite	0	30	9	.000	0	87	38	.000
g) Naturalness of the area near my campsite	1	25	13	.000	1	95	29	.000
h) Attractiveness of my campsite	0	28	8	.000	0	89	28	.000
i) Number of people camped near me	27	15	1	.000	19	99	2	.000
j) Privacy of my campsite	3	20	15	.002	1	98	18	.000
k) Noise from other groups	23	19	1	.000	19	95	1	.000
l) Interactions with other groups	7	30	2	.000	10	92	11	.000
m) Behavior of other groups ^c	1	23	16	.000	0	102	8	.000
n) Number of day users near my campsite	7	30	1	.000	10	92	2	.000
o) Security of my belongings at my campsite ^d	1	31	5	.000	0	95	15	.000
p) Ability to camp near members of my group	0	32	4	.000	4	80	24	.000
q) Freedom to choose a preferred campsite	0	33	5	.000	0	78	31	.000
r) Restrictions on where I can camp ^a	6	27	4	.000	29	77	8	.000
s) Distance from my campsite to the spring ^e	1	35	1	.000	17	93	1	.000
t) Distance from my campsite to other sites ^e	0	31	6	.000	5	90	14	.000
u) Slope of the tenting surfaces	8	25	2	.000	36	75	6	.000
v) Smoothness of the tenting surfaces	0	30	6	.000	6	66	39	.000

¹ Respondents were asked to circle their preference for each item. Number of responses for each item was less than total number of respondents. Total respondents for pre: 57; post: 174

*Deviations from this wording are indicated: ^aFewer/Same/More, ^bSmaller/Same/Larger, ^cWorse/Same/Better, ^dLower/Same/Higher, and ^eCloser/Same/Farther.

Although the high mean values for indicators show that visitors were satisfied and that all factors were somewhat important, the importance-satisfaction matrix provides a useful graphical portrayal of the relative satisfaction and importance of each indicator. For the pre-treatment survey (Figure 2.3), five factors fell into the high importance, low (relative) satisfaction category. These are: j) Privacy of my campsite, k) Noise from other groups, l) Interactions with other groups, m) Behavior of other groups, and f) Naturalness of my campsite. This quadrant is labeled the "Concentrate here" category, since managers should strive to improve visitors' satisfaction with the more important items.

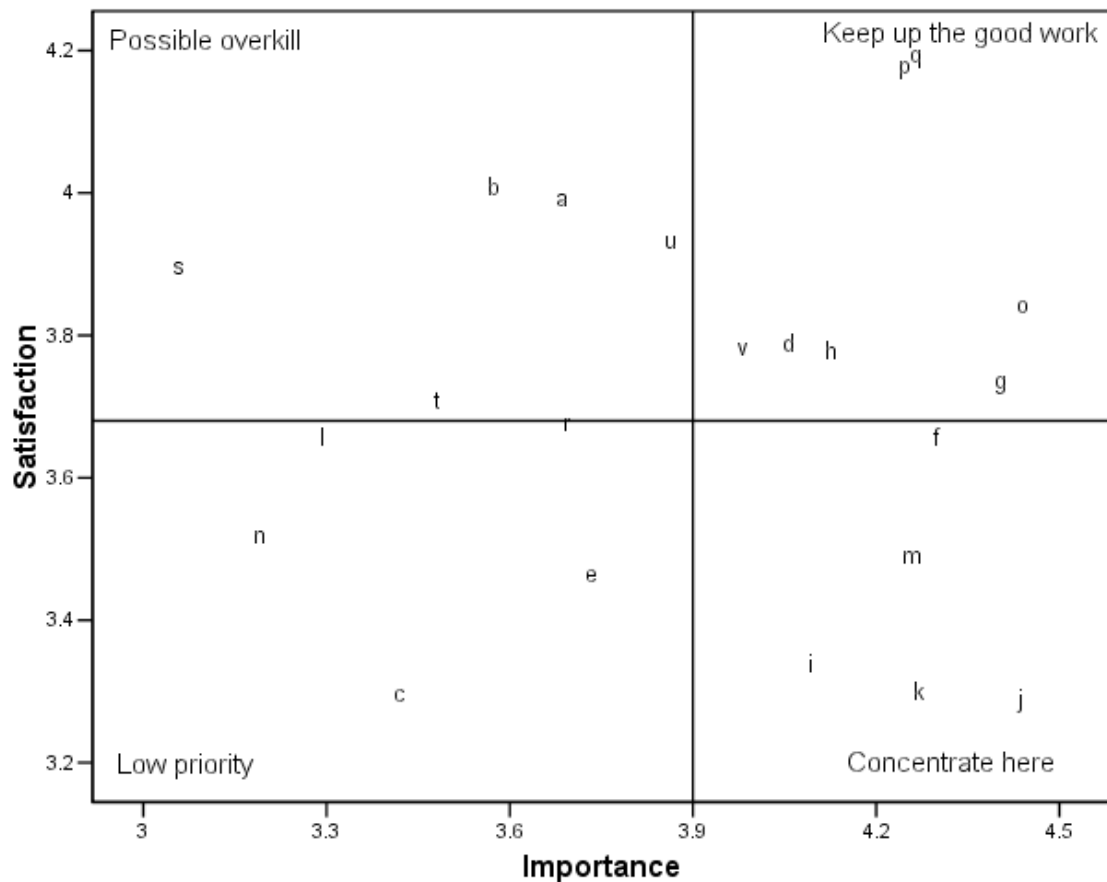


Figure 2.3. Importance-satisfaction analysis of camping indicators before treatment. Crosshairs are placed at the mean value for all indicators. Refer to Table 2.3 for legend.

Figure 2.4 shows the importance-satisfaction matrix for the post-treatment survey. The mean satisfaction has shifted more than 0.2, indicating greater satisfaction with the

indicators, on average. The importance axis is roughly the same as before the treatment but has shifted upward slightly. Of the five indicators that fell into the "Concentrate here" category before the change, only one indicator, f) Naturalness of my campsite, is still present in this quadrant. Even though this indicator falls into the quadrant, a mean satisfaction score above 3.9 is still very close to the "Satisfied" rating of four. The four other indicators that fall into the high importance, low (relative) satisfaction for the post-treatment questionnaire are v) Smoothness of the tenting surface, q) Freedom to choose a preferred campsite, u) Slope of the tenting surfaces, and p) Ability to camp near members of my group.

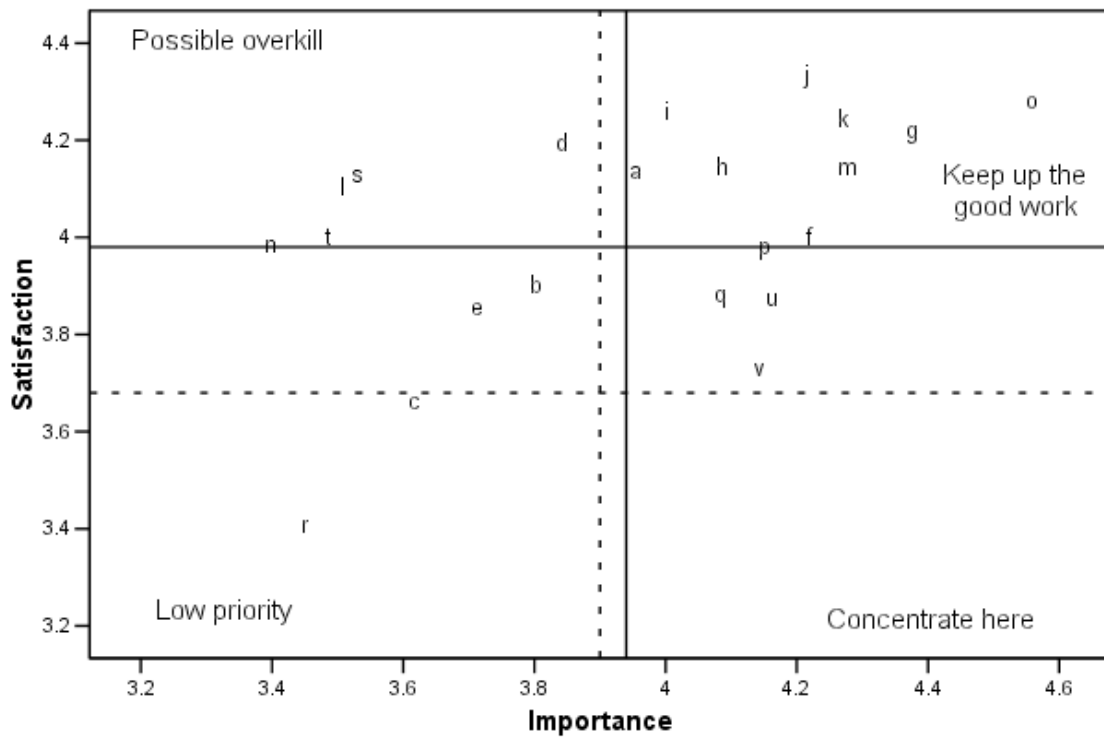


Figure 2.4. Importance-satisfaction analysis of camping indicators after treatment. Solid crosshairs are placed at the mean values for all post-treatment indicators; dashed crosshairs indicate means for pre-treatment conditions. Refer to Table 2.3 for legend.

For the post-treatment importance-satisfaction analysis, we omitted thru-hikers that camped at AR. Although their satisfaction ratings did not differ from the rest of the

population, their ratings of importance did. Thru-hikers are backpackers who attempt to hike the entire Appalachian Trail within one year. Since thru-hikers could not visit the area during the pre-treatment survey collection, (due to the time of year at which they pass through Maryland), their presence in the post-treatment population created some concerns about nonequivalent groups. We included thru-hikers in the t-test for differences in the pre and post-treatment satisfaction because there were no significant differences between thru-hikers and non-thru-hikers for these ratings; however, because they significantly differed in their importance ratings, we recalculated mean importance and satisfaction ratings without the thru-hikers for the importance-satisfaction grid in the post-treatment analysis.

For the post-treatment survey, we added a section to be completed only by those who had experience camping in the preexisting sites. When asked to respond to this statement: "I prefer camping at the current campsites rather than the former sites," 47% of visitors circled "No" and 39% said "Yes" (N = 57 visitors). We asked this subset of respondents to indicate their agreement with eight additional statements comparing the social and environmental conditions of the former and current camping areas (Table 2.4). They agreed that the former campsites had too much resource damage and the current sites had less damage, and that the current campsites provided more privacy. The respondents tended to disagree that the former campsites were unsafe, and they were more neutral regarding crowding and conflict issues.

Table 2.4. Previous campers' agreement with eight statements.¹

Item	Agreement
The current campsites have less resource damage than the former campsites.	4.0
The former campsites had too much resource damage.	3.9
The current campsites provide more privacy than the former campsites.	3.8
I prefer the current management of this area rather than the former management.	3.6
The current campsites are safer than the former campsites.	3.3
Crowding was a problem for me at the former campsites.	2.9
I enjoyed seeing and camping near other people at the former campsites.	2.8
The former campsites were unsafe.	2.3

¹Respondents were asked to rate their agreement with each statement from 1 (strongly disagree) to 5 (strongly agree).

The number of times individuals had previously camped at AR also had an effect on their satisfaction. Although there were no noticeable trends before the treatment, individuals with five or more nights of camping previously at AR were less satisfied (2.94) with the restrictions on the camping area than those with no previous experience (3.55) or one to four nights of previous experience (3.61). There was also a significant difference in satisfaction with "Freedom to choose a preferred campsite"; the satisfaction ratings for those with five or more nights of experience (3.52) were significantly different from those with one to four nights of experience (4.24).

Discussion

These findings support many of the goals of the management. Managers desired to protect the area's natural resources and enhance social conditions by shifting camping from large, flat highly impacted areas to well spaced campsites constructed in sloping terrain. This shift in camping resulted in a large reduction in the area used for camping. Although the size of the constructed campsites increased by 8% after one season of use, we believe the constructed sites were too small for typical backcountry use, and therefore some expansion was expected during this first season. Though overnight visitation has declined at AR, preliminary resource data suggest that the new design has the potential to meet resource protection objectives, and questionnaire results show significant improvement in satisfaction for most of the indicators.

Social conditions were a concern for overnight visitors to Annapolis Rocks prior to the management changes (Table 2.3 and Figure 2.3). Many respondents indicated a preference for a change in "Number of people camped near me," "Privacy of my campsite," "Noise from other groups," and "Behavior of other groups." Each of these factors also fell into the "Concentrate here" category of the importance-satisfaction matrix. Although the noise and behavior of other groups are not directly subject to management control, a requirement to use only appropriately designed designated campsites can minimize the effects of noisy and rude groups and reduce campers' perceptions of these problems. A requirement to use only designated campsites that were well spaced guarantees visitors a certain level of solitude and privacy, which may be important to some visitors. At AR a spacing of greater than 30 meters was selected based

on trials showing that a normal conversation could not be easily heard or interpreted at this distance. Increased spacing and screening between campsites is therefore an effective method for minimizing noise and interactions with other groups. Although the alcohol and fire prohibitions were not the focus of our study, the reduction in bonfires and rowdy behavior likely contributed to increased visitor satisfaction with the noise from, interactions with, and behavior of other visitors. The management changes increased visitor satisfaction for these social conditions (Table 2.2), which moved them from the "Concentrate here" quadrant of the importance-satisfaction matrix (Figure 2.3) to the "Keep up the good work" quadrant (Figure 2.4).

"Naturalness of my campsite" (f) appeared in the "Concentrate here" quadrant both before and after the treatment. Although this is a concern, there was an average improvement of .32 on the five-point scale, and it falls close to the mean satisfaction score on each matrix. Naturalness is a subjective concept, with different criteria for different respondents, and therefore may be a difficult factor to control with management actions. We also note that campsite construction created exposed soil surfaces on and immediately adjacent to the campsite (e.g., cut-and-fill slopes) that will require several years to regain organic matter, vegetation, and assume a more natural appearance.

The post-treatment importance-satisfaction grid identifies new priorities for management. Although five items fell into the "Concentrate here" quadrant, this reflects a change in the satisfaction of these items relative to the others, not necessarily a real change in visitors' satisfaction with the individual item. The average satisfaction ratings were 0.2 higher than pre-treatment, shifting the crosshair for satisfaction. If the ratings for these five items were compared to the pre-treatment means, they would all fall in the "Keep up the good work" quadrant, indicating that visitor satisfaction with these items is higher than pre-treatment but still low relative to other indicators. Those items that fell into the "Concentrate here" quadrant of the post-treatment importance satisfaction matrix (Figure 2.4) were utility indicators. Table 2.3 illustrates that many visitors preferred a smoother surface for their tents (item v), and this item also showed a slight drop in satisfaction (Table 2.2). "Ability to camp near members of my group" (p), and "Freedom to choose a preferred campsite" (q), appear in the "Concentrate here" quadrant of figure 2.4 and show some of the larger decreases in satisfaction. "Restrictions on where I can

camp" (r) also showed a drop in satisfaction, but its lower importance placed it in the "Low priority" quadrant. Many respondents also noted a preference for larger campsites (Table 2.3), and this item showed a drop in satisfaction. Items with larger reductions in satisfaction are all related to the general purpose of designated sites—to contain impacts to a smaller area. To some extent these may be unavoidable consequences of using designated campsites. Freedom of choice and ability to camp near group members are logically reduced when camping is changed from unregulated to designated site camping. Small decreases in satisfaction for "Slope of the tenting surface" and "Smoothness of the tenting surface" are characteristics of the construction. The sites need to have a slight outslope in order to drain properly, and the rocky soil made it difficult to create smooth tent pads on some sites. However, managers are planning to revisit the sites to enhance their drainage and smoothness, now that soils have compacted and settled.

Overall satisfaction highlights an interesting issue. This item received an average satisfaction rating of 4.19 both before and after the camping changes. Only four items had higher satisfaction than this, all from the post-treatment survey. This suggests that despite lower (but above neutral) satisfaction ratings for various individual characteristics of the campsite, the visitors are generally very satisfied with their campsites. This is not surprising, because visitors tend to rank their overall recreational experiences highly due to the inherent satisfaction derived from being at leisure rather than at work. In this case, the visitors may have been slightly less satisfied with certain elements of the campsite, but they likely rated the "Overall impression of my campsite" highly because they merely enjoyed having an adequate place to camp.

It is important to note that while these indicators support the goals of the managers, this is may be attributable to visitor displacement. One of the managers' goals was to reduce inappropriate behaviors (e.g., partying with alcohol and bonfires) and larger groups, which likely displaced these types of visitors. A caretaker reported that around 20% of potential AR campers moved elsewhere when informed that they could not have a campfire. Considering that other visitors may have been aware of the new regulations prior to planning their trips, or when they reached the bulletin board close to the start of the trail, the number of displaced visitors could be in the 30-40% range. Caretakers did see, but did not enforce, exceeded group size limits. Due to low visitation

for this first season for use, caretakers did not need to enforce the maximum camping capacity of 75 persons. Some of the lower use levels during this first season may also be attributable to an unusually rainy summer season.

Due to the nature of this experiment—surveying actual visitors to the site—the satisfaction and importance ratings examined by this study are from two separate populations. Although few demographic and experience variables showed differences between the two groups, the pre- and post-treatment populations may have been seeking different types of experiences based on their knowledge and expectations of the camping area. Table 2.5 demonstrates the similarities and differences in the populations. Age, education, and gender did not show significant differences. The pre-treatment population traveled a shorter distance to access the site and had more experience camping at the site than the post-treatment population. The pre-treatment group rarely camped at other locations along the Appalachian Trail. When thru-hikers were included in the post-treatment population, there was a significant difference in backpacking frequency, but this difference did not apply to the rest of the post-treatment population. Thru-hikers also greatly increased the average for number of nights camped elsewhere along the AT, but there was still a significant difference between the pre-treatment and post-treatment populations when thru-hikers were omitted.

Table 2.5. A comparison of the pre- and post-treatment populations.¹

Characteristic	Pre	Post, thru-hikers included	Post, thru-hikers excluded
Age ²	31.2 _a	31.6 _a	32.0 _a
Education (median) ³	College degree _a	College degree _a	Some college _a
Gender (male) ⁴	76% _a	64% _a	64% _a
Distance traveled from home (miles) (median) ³	51-100 _a	51-100 _b	51-100 _c
Nights previously camped at AR ²	3.3 _a	1.6 _b	1.6 _b
Nights camped at other locations along the AT during the current trip ²	.02 _a	11.6 _b	1.0 _c
Backpacking frequency (nights/year) ²	13.96 _a	22.35 _b	13.88 _a

¹Values shown are mean responses. Differing subscripts indicate significant differences.

²Significance determined by ANOVA.

³Significance determined by Kruskal-Wallis Test. For "Distance traveled from home," p=.018. although median responses are equal (pre<post, thru-hikers excluded<post, thru-hikers included).

⁴Significance determined by chi-square test.

In order to have a same-population comparison of the previous and current sites, we included a section on the post-treatment survey that directly compared the two arrangements. For these items, visitors who had experienced both pre- and post-treatment conditions seemed to appreciate the changes based on ecological and privacy arguments, but they were somewhat neutral to most social changes. They did not have strong opinions regarding crowding and conflict at the previous sites. A greater number of the respondents did not prefer camping at the current sites to the previous sites; however, agreement with the statement "I prefer the current management of this area rather than the former management" received a slightly positive mean rating of 3.6. Visitors with five or more nights of previous experience at AR were less satisfied with the new restrictions and reduced freedom than those with less experience at the site. Outdoor visitors may dislike any sort of change to a favorite location, and therefore have a less positive assessment of the new area. Through informal conversations with campers, we learned that some visitors appreciated the changes to protect the resource and minimize crowding and conflict, while others did not see a reason for the changes, and were disappointed that they could no longer use a favorite camping spot. Some of the disappointed visitors may not return to Annapolis Rocks in the future, increasing the amount of displacement caused by the changes.

Conclusions

The designated campsites were a success in many ways—assuming full recovery of the preexisting sites, the new sites substantially reduced the area used for camping, and they corrected some of the visitors' concerns. The new campsite design also supported the management goals by creating a more private and primitive camping experience for the visitors.

The side-hill campsites contained environmental impacts to a smaller area and increased spacing between groups, reducing noise and increasing privacy. The design minimized problems from large groups by placing them in group sites farther away from individual sites, or by splitting large groups among several small sites. The alcohol and campfire bans may also have helped to reduce large groups.

Visitor satisfaction with the campsites increased for all environmental and social indicators. Before concluding that visitors were more satisfied with the new management, we should consider the changes in the population of visitors. There is substantial evidence that visitors were displaced once they learned of the changes, and that some may not return to the area in the future now that they have experienced the new area and regulations. While affecting "appropriate behavior" (Lutz, 2004) and attracting appropriate campers and hikers (Graf, 2004) were management goals, the appropriateness of displacing other visitors is arguable given the lack of clearly defined goals or statements of desired social and resource conditions for the area. Rather than changing the behavior of the current visitors, managers may have displaced a relatively substantial percentage of former visitors.

Since we were unable obtain a census of visitors, we used statistics to describe the population. This method may bias the results. Our results assume that the non-respondents have similar opinions to those who responded; however, this is uncertain. For this reason, our results may be considered somewhat exploratory.

Overall, these changes suggest some degree of success for this management strategy. Although one year of monitoring is insufficient evidence of ecological improvements, this site design has great potential to contain camping impacts. The larger gain of this project was to improve social conditions at the site. The managers created a more primitive experience for their visitors by increasing the spatial separation of campsites to minimize visual and auditory impacts from other campers. The campfire and alcohol prohibitions also likely contributed to the reduction in noise and conflict, and promotion of solitude and primitive camping.

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CHAPTER III:
Communicating Leave No Trace Ethics and Practices:
Efficacy of Two-Day Trainer Courses

EXECUTIVE SUMMARY

The overuse and misuse of public lands has resulted in many ecological impacts. Many of these impacts may be avoided or minimized through adoption of low-impact camping and hiking skills. Although "no trace" messages have been promoted in public lands since the 1970s (Marion & Reid, 2001), few studies have documented the reception and effectiveness of these messages. The Leave No Trace Center for Outdoor Ethics supports two-day Trainer courses that teach Leave No Trace (LNT) skills and ethics to outdoor professionals, groups, and interested individuals. This study examined the change in knowledge, ethics, and behavior of LNT Trainer course participants. The respondents were a convenience sample of participants in Trainer courses offered from April through August 2003. Trainer course instructors administered pre-course and post-course questionnaires to their participants, and we contacted participants individually with a follow-up questionnaire four months after completion of their course. Scores for each of the knowledge, ethics, and behavior sections increased immediately following the course, and decreased slightly over the four months following the course. Overall, more than half of the knowledge and behavior items, and half of the ethics items, showed significant improvements from pre-course measures to the follow-up. Age, reported LNT experience, and backpacking experience affected the participants' pre-course knowledge and behavior scores. Younger, less experienced respondents also showed a greater improvement in behavior following the course. Trainer course participants also shared their LNT skills and ethics with others both formally and informally. The LNT Trainer course was successful in increasing participants' knowledge, ethics, and behavior, which they then shared with others. Since the low-impact skills taught in the LNT curriculum are supported by scientific research, LNT educational programs have the potential to effectively minimize the environmental impacts caused by outdoor recreationists. Research implications for improving LNT training and instruction are described.

Introduction

As outdoor recreation grows in popularity, public lands begin to suffer from overuse and inappropriate use. Outdoor visitors engage in an increasingly diverse array of recreational activities that can degrade both natural environments and the quality of experiences for other visitors. Although some impacts are unavoidable, many can be mitigated through the use of low-impact techniques. The U.S. LNT program has been recognized internationally for providing advice regarding the most appropriate low-impact skills and ethics for outdoor activities. Guided by the Leave No Trace Center for Outdoor Ethics, and with the participation of numerous governmental, commercial and non-profit partners, the LNT program has developed educational courses and literature to encourage adoption of low-impact ethics and practices for non-motorized outdoor recreationists. The LNT course curriculum is supported by scientific studies of visitor impacts, but few studies have documented the degree to which LNT practitioners gain, retain, or apply the knowledge, ethics, and practices that are promoted. This study evaluates the efficacy of the two-day LNT Trainer course, developed and authorized by the Center for Outdoor Ethics.

This study addresses the following research questions about the LNT Trainer course. Do course participants gain greater knowledge of LNT practices, improve their environmental ethics, and improve their low-impact behavior? Are improvements short-term or are they retained four months after the course? To what extent do participants teach others what they have learned? Study objectives sought to evaluate short- and long-term improvements in knowledge, ethics, and low-impact behavior, and the extent to which LNT instruction was provided to others. We also sought to learn the strengths and weaknesses in LNT Trainer courses to gauge their effectiveness and to suggest improvements.

Literature Review

Recreation Resource Impacts

The term recreation ecology describes "the study of ecological interrelationships between humans and the environment in recreation/tourism contexts" (Leung & Marion, 2000, p. 24). This field of study seeks to protect natural resources from recreation-related

degradation through an increased understanding of use/impact relationships and the influence of environmental and managerial factors. Recreational impacts include tree damage, soil exposure, soil erosion, vegetation loss, litter, human waste and wildlife disturbance (Leung & Marion, 2000). When severe, these impacts compromise management goals by degrading natural conditions and processes within protected lands and the quality of recreation experiences.

Impacts to campsites and trails are caused by a variety of factors. Scientists have begun to examine the numerous visitor and site characteristics that affect the amount and severity of resource impacts. The magnitude of impact varies depending on visitor factors such as amount and type of use, and visitor behavior, but the quantity of use is less important than was previously assumed (Leung & Marion, 2000). Hammitt and Cole (1998) identified party size, type of user, user behavior, mode of travel, and use distribution as the primary factors influencing the amount of impact. Cole (1995) examined the amount of impact on campsites used one night versus four nights and found that the campsites used four nights had less than twice the amount of impact as those used one night. Cole (1992) suggests that this effect is due to increased concentration of activities with increased use. This curvilinear use-impact relationship indicates that resource impacts can be minimized by either dispersing use widely (in very low use areas), or concentrating use on a limited number of high-use sites (Leung & Marion, 1999). Marion and Cole (1996) examined vegetation impacts and found that grasses and sedges demonstrated significant resistance and resilience to trampling, while forb-like vegetation was damaged more easily and recovered more slowly. These findings highlight the importance for altering visitor behavior, for example, by spatially concentrating trampling activities to resistant vegetation or surfaces to avoid or minimize resource impacts.

Combining Recreation Ecology and Social Science

Recreation impacts are a result of the interaction between ecological site characteristics and visitor behaviors. Studies limited to resource conditions may be insufficient for understanding and correcting problems. However, recreation ecology and social science research together can be powerful tools for creating low-impact education

programs. Educators and managers need to understand the underlying causes of damaging behaviors, as damage may result from visitors' careless, unskilled, uninformed, unavoidable, or illegal actions (Hendee & Dawson, 2002). Similarly, educators and managers need to understand how visitor behavior contributes to visitor crowding or conflict and how these relate to recreation satisfaction (Manning, 1999). Social science helps to identify human tendencies in behavior, conditions and variables that influence behavior, and critical factors involved in personal decision-making (Vander Stoep & Roggenbuck, 1996). By understanding human behavior, managers can implement actions, such as educational programs, that will be effective in encouraging behavioral practices that minimize resource and social impacts.

Environmental Education Programs

Environmental education is a method of indirect management that helps protect natural resources while promoting the "unconfined" nature of outdoor recreation (McCool & Christensen, 1996). Environmental education (EE) has become a popular tool to promote environmental awareness and behavior change. In the Tbilisi Conference of 1977, the following objectives were identified for environmental education: awareness, sensitivity, attitudes, skills, and participation (Hungerford & Volk, 1990). A great variety of EE programs have been developed in pursuit of these goals. Although some scientists have questioned the effectiveness of EE, there is significant evidence that EE can improve environmental behavior (Zelenzy, 1999). The effectiveness of EE programs depends on many factors, including the setting, duration of involvement, and discussion of practical actions.

Setting and Duration of Involvement

The LNT Trainer course usually lasts two days with a focus on participatory experiential learning in the field, sometimes with a limited classroom session. Zelenzy (1999) suggests that the most effective environmental interventions involve active participation. Zint, Kraemer, Northway, and Lim (2002) found that youth field trips were more effective in improving various indicators of the participants' environmentally responsible behavior than a similar curriculum offered in schools. This study also found

that longer programs produced a greater change in environmentally responsible behavior. Bogner (1998) surveyed students in a park-based outdoor ecology program and found that students in five-day programs improved in environmental behavior more than those in one-day programs. Metzger and McEwen (1999) found an increase in environmental sensitivity of 12-19 year-olds following the Environmental Ed-Ventures program, a five-day trip with planned EE activities and an immersion in the environment. These studies suggest that active participation, an outdoor setting, and a longer duration of involvement improve the students' environmental behavior.

Environmental Ethics

A consistent commitment to avoiding damaging behaviors may require a strong environmental ethic. Ethics are prescriptive concepts of the way the world ought to be (Harding, Borrie, & Cole, 2000). Environmental ethics define the moral norms between people and the environment, and explain humans' responsibilities towards the natural world (Des Jardins, 2001). Compliance with low-impact recommendations may reflect a type of environmental ethic rooted in an ethic of justice or of care (Harding, et al., 2000). By shaping an individual's ethics, educators seek to alter behavior on a voluntary basis, avoiding regulatory compulsion. The stated mission of the Center for Outdoor Ethics, "to promote and inspire responsible outdoor recreation through education, research and partnerships," (Leave No Trace Center for Outdoor Ethics [LNTCOE], 2003) embraces a philosophy that LNT education can lead to the development of an environmental ethic.

History and Efficacy of the Leave No Trace Program

Leave No Trace began in 1990 as an educational program offered by the Forest Service. It became a non-profit organization (Leave No Trace, Inc.) in 1994, and is now widely recognized throughout the United States and internationally (Marion & Reid, 2001). The phrase "leave no trace" has broad application, describing the concept of minimum impact camping and a set of outdoor ethics. For this reason, the organization was renamed the Leave No Trace Center for Outdoor Ethics. The Center for Outdoor Ethics develops and distributes a variety of educational materials in cooperation with organizations like the National Outdoor Leadership School (NOLS), government

agencies, and corporate sponsors. The LNT educational program is based on seven general principles:

1. Plan ahead and prepare.
2. Travel and camp on durable surfaces.
3. Dispose of waste properly
4. Leave what you find.
5. Minimize campfire impacts.
6. Respect wildlife.
7. Be considerate of other visitors.

The Center for Outdoor Ethics supports two courses—a two-day Trainer course and a more involved, weeklong Master course. These courses are taught by LNT Master Educators and sponsored by various agencies and organizations throughout the United States and Canada. The LNT Trainer course focuses on communicating LNT practices; the Master course adds greater depth of instruction, experiential practice, discussion of the rationale for LNT practices and environmental ethics, and experiential learning about communication techniques. LNT Masters and Trainers are encouraged to conduct public outreach and to train others.

Although few studies have directly evaluated the Leave No Trace program's effect on ecological conditions, scientists have documented the ecological benefits of low-impact practices and the efficacy of educational messages on producing low-impact behaviors. The theoretical basis for visitor education aimed at encouraging low-impact behaviors is reviewed by Roggenbuck (1992) and Reid and Marion (2002). They suggest that persuasive educational messages can be effective at promoting appropriate visitor behavior and reducing impacts. Overton (1991) used experimental camping techniques to demonstrate that low-impact camping was less damaging to *Vaccinium* and *Potentilla* species than traditional camping methods. Low-impact messages, particularly with ecological appeals, can be effective in reducing campfire use and lakeshore camping (Christensen & Cole, 2000), and in reducing littering and tree damage (Oliver, Roggenbuck and Watson, 1985). Despite the lack of studies that focus specifically on the LNT program, there is substantial evidence to support the benefits of low-impact camping practices.

Dowell and McCool (1985) studied the effectiveness of the USDA Forest Service's Leave No Trace program (a predecessor to the current program). They utilized a variety of presentation formats, and found that all formats improved Boy Scouts' scores for knowledge, attitudes, and behaviors. A study conducted by NOLS demonstrated increased environmental concern and a positive change in behavioral intentions following a NOLS course; a follow-up study showed deterioration in scores on theoretical constructs for responsible environmental behavior (subjective norms, concern for norms, knowledge, beliefs, locus of control, and personal responsibility) four months after the course's completion (Hammit, Freimund, Watson, Brod, & Monz, 2003). These studies demonstrate the potential for the success of a low-impact education program.

Methods

Research Design

This longitudinal study evaluated study participants at three times: immediately before the Trainer course (pre-course), immediately following the course (post-course), and four months after completion of the course (follow-up). We used a convenience sample of Trainer course participants. An e-mail describing the study was sent to all Leave No Trace Master Educators in the database at the Center for Outdoor Ethics (725 individuals). If one of these individuals was planning to offer a LNT Trainer course between April and August 2003, s/he could contact us for more information about the study. We also visited the LNT website for postings of course offerings, and contacted the course leader by e-mail or phone, asking if s/he could participate in the study. Master Educators who agreed to participate in the study were sent a packet containing instructions for survey distribution, a form requesting more details about the course and the instructors' experience, and the appropriate amount of pre- and post-course surveys. Students in the Trainer course were asked to participate, but participation in the study was not a requirement of the course. Survey respondents were also asked for contact information with the pre-course survey, and they were contacted individually for the four-month follow-up.

The sampling methods may limit the applicability of this study to the larger population of Trainer course participants. Although none of the course instructors we

contacted refused to participate, we were only able to communicate with those who publicized their courses on the LNT webpage or who contacted us for information on the study. There may have been other courses taught during the study period by instructors who neither advertised their courses nor contacted us for information on the study. Because we did not sample the total population of courses, we cannot legitimately extend our findings to all LNT Trainer courses.

Instrument

Pre-course survey. This survey evaluated the students' knowledge of Leave No Trace principles, ethical orientation towards the outdoors, and use of low-impact practices on a recent camping trip. This survey was administered at the site of the course, prior to the beginning of instruction (Table 3.1).

Post-course survey. This survey contained the knowledge and ethics sections and was administered onsite at the completion of coursework.

Follow-up survey. This survey contained the knowledge, ethics, and reported behavior (to be completed if respondents had taken an outdoor trip after their course) sections, and a section assessing the extent to which respondents had taught LNT practices to others. It was administered four months after course completion. Those participants who provided e-mail addresses with their original course surveys were directed to a web-based survey (but offered the option of a paper copy), while those who only gave postal addresses were sent a modified paper copy of the online survey with identical instructions, wording, and question/answer order.

Table 3.1. Components of each of the LNT questionnaires.

	Knowledge	Ethics	Behavior	Teaching others
Pre-course	√	√	√	
Post-course	√	√		
Follow-up	√	√	√	√

The knowledge, ethics, and behavior items selected for the questionnaire were composed from the most current teachings of the Center for Outdoor Ethics. They were

based on the information available in the Leave No Trace Skills and Ethics booklets, and topics covered during a Trainer course. The face validity of these items was established by sending the entire survey to be reviewed by Leave No Trace staff, state advocates, and agency partners. The knowledge section of the surveys was comprised of 25 items asking participants to identify the most acceptable LNT behavior or idea. The ethics section contained 16 Likert scale items asking the respondent to choose the level of agreement or disagreement with statements about ecological or LNT principles. Some of these items were reverse-coded. The behavior section asked respondents to choose one of three responses that most closely corresponded to their behavior on a recent camping trip. The "Teaching others" section documented how the participants have used informal contacts and conversations, written media, and backcountry or frontcountry presentations and workshops to teach LNT practices.

Analysis

Answers for the knowledge section were coded correct (1) or incorrect (0) to calculate scores for each respondent and the percent of respondents that answered each item correctly. When calculating the respondents' individual scores, skipped questions were counted as incorrect, except in certain circumstances. If it appeared that questions were unintentionally skipped (i.e., an entire page of eight questions was blank or the page was missing due to printing or photocopying errors), the score was based on the total correct for the remaining questions. All knowledge scores were standardized to a 100-point scale based on percent correct. For the ethics section, items were coded 1 (lowest agreement with LNT ethics) to 7 (highest agreement with LNT ethics). Those items that were reverse-coded for the questionnaires were corrected to conform to this scale. Behavior questions were coded 1 (least appropriate LNT behavior), 2, or 3 (most appropriate behavior). Analysis of "Teaching Others" is descriptive.

We used SPSS Version 12.0 for all analyses. Because the option of an online survey could create some differences in responses, the online and paper questionnaires were examined for significant differences. Fewer than 5% of the items showed significant differences, which was equivalent to the type II error rate; therefore, we treated the online and paper follow-up questionnaires as one group. Paired t-tests were

performed to test for significant differences in the scores for each item between pre/post, pre/follow-up, and post/follow-up. A paired samples t-test also tested for significant differences in the overall scores for the respondents for each comparison. We received a total of 166 pre-course, 156 post-course, and 112 follow-up surveys. The instructors reported 185 participants; therefore, 90% of course participants provided useable pre-course surveys. Based on the pre-course sample, we had a 94% response rate for the post-course survey, and a 67% response for the follow-up. Most follow-up questionnaires were received between four and six months following the course; however, all questionnaires were accepted as long as they were received before data analysis began (six months after the final course). If respondents did not complete a pre-course survey, we did not have their contact information to notify them of the follow-up, and could not use them for any paired comparisons; therefore, any post-course surveys not matched with pre-course surveys were eliminated from the analysis. Since paired comparisons were used for the analysis, we had 156 pre/post pairs, 106 post/follow-up pairs, and 110 pre/follow-up pairs.

The effects of age, education, and outdoor experience on the participants' scores for knowledge and behavior were also investigated. We examined the variables age, highest grade level completed, reported LNT expertise, backpacking frequency, and years of backpacking. The groupings were determined by using or combining categorization present on the questionnaire, or by examining the frequency distribution of responses to attain a relatively equal number of respondents in each category or to find distinct gaps in the responses (Table 3.2). We performed separate ANOVA and Tukey's HSD comparisons for the pre-course and follow-up surveys. These separate tests are more illustrative than testing the change scores because they minimize errors and provide a better explanation of the trends. The dependent variables were the participants' overall scores for each section (knowledge, ethics, and behavior), and categories described in table 3.2 were the independent variables. In order to have equivalent groups, we used only those respondents that completed both pre-course and follow-up questionnaires. We examined ANOVAs and HSD comparisons for each item in the pre-course and follow-up questionnaires.

Table 3.2. Analyses based on demographic variables and outdoor experience.

Variable	Categories chosen	Method for choosing categories
Age	14-20 21-30 31-50 51+	Equal distribution of respondents or noticeable gaps
Highest grade level completed	Elementary/some high school High school/some college Bachelor's degree/some graduate school Master's degree/Ph.D. or equivalent	Combined 8 categories present on questionnaire to create 4 categories
Reported LNT expertise	Novice Intermediate Advanced Expert	Categories present on questionnaire
Backpacking frequency (nights per year)	0 1-4 5-11 12+	Equal distribution of respondents
Backpacking experience (years)	0 1-3 4-9 10+	Equal distribution of respondents

Results

Knowledge

The mean score for the combined knowledge test items significantly improved by 11 points on a 100-point scale, from a mean pre-course score of 70 correct to a post-course score of 82 (Table 3.3). The slight 3-point drop from post-course to follow-up was also significant, but the long-term change, pre to follow-up, remained significant with an 8-point improvement. Of the 25 knowledge questions, 17 showed significant improvement pre to post, with the greatest improvements in, "When planning your food supply, you should... Re-pack dried or freeze-dried food into lightweight plastic bags,"

"What is the best procedure for traveling off-trail through a pristine area? Disperse over a wide area," and "What should you do with the ashes from your campfire? Scatter the ashes away from camp." (Table 3.3). There were no significant declines pre to post. Only one item showed significant decline post to follow-up: "While hiking, what should you do when you encounter horseback riders? Get off the trail on the downhill side." Thirteen items showed improvement pre to follow-up, with the same three items (as pre to post) showing the largest improvements. Several items did not show large improvements because course participants were already knowledgeable about that topic prior to the course. More than 90% of respondents answered five items correctly on the pre-course survey: "What should you do to avoid dangerous encounters with bears? Put your food and garbage in a bag and hang it," "When cooking, it is best to... Cook only what you need and pack out the wrappers," "When you are hiking on a trail with beautiful wildflowers, you should... Never pick even one flower," "When camping in popular or high-use areas... Concentrate use on existing trails and campsites," and "If campfires are permitted, how should you gather wood? Gather pieces of wood from the ground that can be easily broken." Several items began with low scores and did not show significant improvement pre to follow-up. These include "The primary argument for leaving a deer antler instead of keeping it as a souvenir is... To allow others to enjoy the object," and "When are wildlife least sensitive to disturbance from recreationists? In late summer." Two items began with low scores and showed significant improvement pre to follow-up; however, the improved scores were still below 50% correct across respondents: "For a group of twenty on a backcountry hike, it is best to... Camp in small groups on separate campsites, and do not hang out or eat together," and "When traveling through pristine or remote areas, an advisable LNT practice is to...Travel away from visitor-created trails."

Table 3.3. Knowledge test mean scores and score comparisons.¹

Question	Correct Answer	Score (%)			Change in score		
		Pre	Post	Follow-up	Pre-post	Post-follow-up	Pre-follow-up
Overall		70	82	79	11**	-3**	8**
The primary argument for leaving a deer antler instead of keeping it as a souvenir is...	To allow others to enjoy the object.	42	53	49	9**	-1	2
What should you do with the ashes from your campfire?	Scatter the ashes away from camp.	41	73	64	31**	-9	21**
What should you do to avoid dangerous encounters with bears?	Put your food and garbage in a bag and hang it.	99	99	97	0	-2	-2
Which of the following actions should be taken when breaking camp?	Brush off tents and ground tarps to avoid transporting non-native plant species.	77	86	87	7*	2	5
What is the best way to dispose of human waste (feces)?	Deposit human waste in a small hole.	87	95	92	8**	-4	4
When cooking, it is best to...	Cook only what you need and pack out the wrappers.	99	99	100	0	1	0
Which of the following actions does not demonstrate consideration for other visitors?	Camping in an open meadow.	80	92	94	10**	0	13**
How should dirty dishwater be disposed?	Strain out food particles and scatter the dishwater.	81	97	100	16**	0	15**
If you use an existing rock fire ring for your campfire, you should...	Leave the fire ring free of excess ashes, burned wood and trash.	83	87	87	5	-4	-1
When you are hiking on a trail with beautiful wildflowers, you should...	Never pick even one flower.	97	99	97	3*	-1	2
When planning your food supply, you should...	Re-pack dried or freeze-dried food into lightweight plastic bags.	71	92	95	23**	3	27**
When walking through an open gate on a trail, you should...	Leave the gate as you found it.	83	86	86	3	1	2
While hiking, what should you do when you encounter horseback riders?	Get off the trail on the downhill side.	48	82	66	31**	-18**	17**

Question	Correct Answer	Pre	Post	Follow-up	Pre-post	Post-follow-up	Pre-follow-up
For a group of twenty on a backcountry hike, it is best to...	Camp in small groups on separate campsites, and do not hang out or eat together.	31	47	44	16**	-8	12*
What is the best procedure for traveling off-trail through a pristine area?	Disperse over a wide area.	48	77	77	28**	3	26**
When camping in popular or high-use areas...	Concentrate use on existing trails and campsites.	93	93	94	-1	-1	2
When traveling through pristine or remote areas, an advisable LNT practice is to...	Travel away from visitor-created trails.	13	33	26	20**	-8	14**
Wildlife are least sensitive to disturbance from recreationists...	In late summer	43	54	45	11*	-8	1
When selecting a campsite, you should choose a site...	Away from lakes, streams, and trails.	74	89	86	15**	-5	7*
The best time to visit a popular backcountry or wilderness area is...	Any of the above: Late in the season; During the week rather than on weekends; Early in the season.	82	79	75	-4	-8	-6
Which of the following kinds of vegetation are the most likely to resist or recover from human trampling?	Grasses	63	82	77	19**	-7	14*
Of the learned responses that wildlife may exhibit around visitors, which is least desired?	Attraction	80	86	85	6	0	6
The only waste that is acceptable to leave in the backcountry is...	Human waste.	86	97	94	10**	-3	9**
What should you do when you see wildlife approaching your campsite?	Be quiet and try not to startle the animal.	61	65	66	5	1	10*
If campfires are permitted, how should you gather wood?	Gather pieces of wood from the ground that can be easily broken.	89	98	99	6*	1	10**

¹Mean scores are based on percent correct. Scores are based on mean for all respondents, whereas differences in scores are based on paired t-tests; * p<.05; ** p <.01

We also examined the data for trends related to age, education, and outdoor experience. We were particularly interested in changes from the pre-course survey to the follow-up. ANOVAs for the effect of age, education, LNT expertise, and number of years backpacking showed significant differences in the pre-course overall knowledge score. For each of these, respondents in the lower categories (younger, less education, less experience) tended to receive lower knowledge scores. For the follow-up tests, there were fewer significant differences, with ANOVA showing education and number of years backpacking as significant.

Ethics

The ethics section showed a similar pattern for overall mean scores. Ethics scores for the pre-course survey were fairly high—5.83 on a scale of one to seven—and improved significantly on the post-course survey (Table 3.4). The follow-up showed a significant decline from the post-course survey, but there was still a significant improvement pre- to follow-up. Twelve of sixteen items showed significant improvements pre to post, with the greatest increases for "It's OK to camp close to another group in the wilderness," "If I want a campfire and there isn't a fire ring present, I should gather some rocks and build one," and "Collecting a few interesting rocks or feathers as souvenirs of my outdoor visit is OK" (all reverse coded with "strongly disagree" as the most appropriate answer). Post to follow-up, five items showed significant declines ("If I want a campfire..." with the largest magnitude), and the ethics score for one item increased: "I should have a right to camp on public lands anywhere I want." Pre to follow-up showed eight items with significant increases, representing half of the items.

Table 3.4. Ethics mean scores and score comparisons.¹

Item	Score			Change in score		
	Pre	Post	Follow-up	Pre-post	Post-follow-up	Pre-follow-up
Overall	5.83	6.27	6.13	.43**	-.17**	.27**
It's best to leave a deer antler for others to find.	6.14	6.36	6.26	.21*	-.07	.17
I should have a right to camp on public lands any time I want.	5.10	5.42	6.04	.36*	.50**	.75**
I should have a right to camp on public lands anywhere I want.	5.87	6.11	6.00	.25*	-.27	-.21
Selecting an attractive place to camp is more important to me than finding a durable campsite.	5.81	6.23	6.15	.38**	-.03	.42**
It's OK to camp close to another group in the wilderness.	4.99	6.64	5.46	1.60**	-1.19**	.39*
If I want a campfire and there isn't a fire ring present, I should gather some rocks and build one.	5.04	6.04	5.96	.94**	-.11	.82**
It's OK to move up close to wildlife to get a good look.	5.75	6.21	6.30	.49**	.03	.51**
It's acceptable to feed wildlife human food.	6.70	6.87	6.79	.14	-.01	.11
The natural environment is very fragile and easily degraded by visitor use.	5.95	6.25	5.97	.28**	-.35*	.01
I should use low-impact camping and hiking practices or stay home.	6.01	6.12	5.81	.08	-.27	-.19
Outdoor visitors have a moral responsibility to avoid or minimize their impacts to natural environments.	6.36	6.84	6.69	.48**	-.12*	.32*
The native animals that live in parks and forests have a greater right to live undisturbed than my right to visit these places.	6.07	6.27	6.07	.19	-.24	.04
I would postpone a trip to my favorite area if I thought my visit would be harmful to wildlife at that time.	5.91	6.25	5.92	.37**	-.33**	.09
Collecting a few interesting rocks or feathers as souvenirs of my outdoor visit is OK.	5.23	6.29	6.05	1.00**	-.30**	.75**
Cutting a switchback is OK, especially when I am in a hurry.	6.35	6.64	6.73	.31**	.06	.28*
Public land managers should be able to limit visitation to protect park resources.	5.98	5.75	5.87	-.22	.07	-.23

¹Scores are based on a scale of 1 to 7, where 7 is the most appropriate response. Items in bold indicate "Strongly disagree" as the most appropriate response; for all others, "Strongly agree" was the most appropriate response. Differences in scores are based on paired t-tests; * p<.05; ** p<.01

Behavior

Reported behavior was assessed at two points in time—pre-course and follow-up. All mean scores for the items were above the middle response of 2, indicating that most

respondents chose the most appropriate or second-most appropriate behavior, even prior to the course (Table 3.5). The proximity of other groups to the respondent's campsite and dishwater disposal methods had the lowest initial scores. The overall mean score showed a significant improvement of 0.20 on a scale of one to three. Individual scores for seven of ten items also improved significantly. The items related to repackaging food and disposing of dishwater showed the greatest improvements. The items for which the respondents showed the most appropriate behavior after the course were hiking on established trails in popular areas, and packing out trash.

Table 3.5. Behavior mean scores and score comparisons.¹

Questions	Answers (from least appropriate to most appropriate)	Score		Change in score
		Pre	Follow-up	Pre- follow-up
Overall		2.49	2.72	.20**
Before leaving on my trip I:	1) Left my food in the original packaging. 2) Repackaged some of my food... 3) Repackaged most of my food ...	2.28	2.64	.39**
Before leaving on my trip, I:	1) Had no knowledge of my destination area's camping regulations or recommended practices. 2) Was somewhat aware... 3) Was well aware...	2.42	2.79	.28**
During my trip, I generally placed my tent on a spot with:	1) Forbs (erect-stemmed, broad-leaved plants) 2) Bare soil, rock, gravel or sand. 3) Grasses or sedges.	2.65	2.77	.12
When hiking through popular areas during my trip I:	1) Did not stay on designated or well-established trails. 2) Sometimes stayed... 3) Always stayed...	2.73	2.94	.14*
After washing dishes I:	1) Poured the dishwater onto the ground. 2) Scattered the dishwater away from camp. 3) Strained the dishwater to remove food particles and then scattered it away from camp.	2.26	2.57	.33**
I disposed of the trash and leftover food during my camping trip by:	1) Burning it in a campfire. 2) Burning some items and packing out others 3) Packing out all trash and leftovers.	2.72	2.91	.13*
From my trip I:	1) Kept several souvenirs that I found (e.g., rock, feather, piece of driftwood). 2) Kept one souvenir. 3) Didn't keep anything from the area I visited.	2.80	2.77	.02
During my trip I:	1) Built a campfire using wood that could not be broken by hand. 2) Built a campfire using downed wood that I could easily break by hand. 3) Never built a campfire.	2.28	2.42	.24**
During my trip I:	1) Took no precautions to keep wildlife (e.g., bears, raccoons, mice) from getting into my food. 2) Took a few precautions to protect my food but didn't hang it or use an animal-proof container. 3) Hung my food or placed it in a container specifically designed to protect it from wildlife	2.56	2.79	.14
On my trip I:	1) Camped where I could easily see and hear another group. 2) Camped where I could barely see and hear another group. 3) Camped where I could not see or hear another group.	2.25	2.58	.24*

¹ Scores are based on a scale of 1-3, where 3 is the most appropriate response. Differences in scores are based on paired t-tests; * p<.05; ** p<.01

We examined the effects of several demographic variables on reported behavior for the pre-course and follow-up questionnaires. The pre-course survey showed significant differences in behavior depending upon self-evaluated LNT expertise and backpacking experience. Those respondents indicating no backpacking experience and ranking themselves as LNT novices scored significantly lower on behavior than those with more experience. For the follow-up survey, no significant differences were found in reported behavior, although number of years backpacking had an ANOVA p-value of .056, with the 4-9 year group showing the highest scores for the Tukey's HSD comparison.

We examined Pearson correlations among the change in overall scores from pre to follow-up for the knowledge, ethics, and behavior sections and found a significant correlation of .419 ($p=.002$) for change in overall ethics score and change in overall behavior score. The correlations for change in knowledge to change in behavior, and change in knowledge to change in ethics, were not significant: .129 and .206, respectively.

Teaching Others

In the follow-up survey, we asked respondents to what extent they had taught LNT practices to others. Of the 112 respondents, only 6% did not teach LNT to others. Thirty percent taught LNT once or twice since the course, 24% taught LNT once or twice a month, and less than 20% each taught LNT "once a week," and "a few times a week." For 44% of those that shared their LNT skills, their teaching was part of a job or internship. Ninety-two percent of these respondents used informal contacts and conversations to teach LNT, 35% percent gave formal presentations in the frontcountry, and 25% percent gave formal LNT presentations in the backcountry. Respondents used a variety of media to convey LNT to others, most often posters or signs (31%), and pamphlets or brochures (40%). Apart from work responsibilities, 93% of respondents reported teaching LNT through informal contacts and conversations, most often to friends (74%) and family (66%). Ninety-one percent of respondents planned to teach LNT messages in the future.

Discussion

Test scores for the knowledge and ethics sections generally followed the expected pattern of significant improvement post-course, followed by a slight decline for the follow-up. Most of the follow-up scores were, however, significantly higher than the pre-course scores, suggesting positive long-term effects. Since a long-term adoption of low-impact skills and ethics will have a greater effect on reducing impacts than immediate short-term changes, the pre-course to follow-up change is the most important measure of course success. Significant improvements in pre-course to follow-up measures for overall knowledge, ethics, and behavior scores suggests that the LNT Trainer course is effective in conveying messages to its participants and aiding in retention of those messages. On the follow-up questionnaire, high overall scores of 79 (of a possible 100) on knowledge, 6.13 (of a possible 7.00) on ethics, and 2.73 (of a possible 3.0) on behavior, indicate that LNT Trainer course participants are likely to retain the low-impact skills and ethics that they learned from the course, and apply them to their outdoor pursuits.

Although overall scores suggest course success, individual items reveal the need for focusing attention on certain aspects of instruction, and possibly placing less emphasis on topics that are already known. In the knowledge section, significant improvements for 13 out of the 25 items, plus high scores for five other items suggests that the remaining seven items could be better addressed by the LNT Trainer courses. The items for which the follow-up survey showed the lowest score (regardless of significant improvement) require a more intensive focus in the Trainer course. Trainer course participants may not fully understand these issues, or they may not agree with the LNT perspective. The three items with noticeably low scores were "The primary argument for leaving a deer antler instead of keeping it as a souvenir is... To allow others to enjoy the object," " For a group of twenty on a backcountry hike, it is best to... Camp in small groups on separate campsites, and do not hang out or eat together," and "When are wildlife least sensitive to disturbance from recreationists? In late summer." Greater discussion or examination of case studies may help the participants to better understand these issues and the rationale for LNT recommendations. These items might also be poor measures; for example, "The primary argument for leaving a deer antler..." may have

been debated in some courses, certain wildlife may be sensitive to disturbance in late summer, and some participants may not agree to splitting a group among smaller campsites without socializing. Items with higher scores may require much less attention in the Trainer course. "What should you do to avoid dangerous encounters with bears? Put your food and garbage in a bag and hang it," "When cooking, it is best to... Cook only what you need and pack out the wrappers," and "When you are hiking on a trail with beautiful wildflowers, you should... Never pick even one flower" all had pre-course scores above 95% correct. Concentrating on these items in a LNT Trainer course may be unnecessary as participants are already sensitive to these situations.

All ethics items received high scores. All but one item had a score higher than 5.75 on a scale of one to seven. This item—receiving a mean score of 5.46—was "It's OK to camp close to another group in the wilderness." (For this item, "strongly disagree" was considered the most ethical answer.) Many respondents had limited experience with wilderness camping, and may be accustomed to backcountry or frontcountry areas with designated campsites. In such areas it may be difficult to find a site away from other groups.

The respondents' reported change in behavior, the most important effect of the LNT Trainer course, demonstrated the effectiveness of the course in promoting low-impact behaviors. All follow-up scores for behavior items were above 2.5 on a three-point scale, indicating that more than 50% of respondents chose the best behavior for each item. Those items with the lowest averages were related to camping close to other groups, disposing of dishwater, and campfire practices. We surmise that the issue of camping close to other groups was difficult for many respondents due to experience camping in areas with designated campsites, or where they had little control over site spacing. Lower scores for dishwater disposal may be due to lack of planning ahead and carrying a strainer, or camping with a group that did not consider it necessary to strain food particles. The most appropriate response for campfire practices was "I did not have a campfire." For many outdoor enthusiasts, a campfire may be an important element of a high quality experience. More than 50% of respondents did not have campfires on a trip following their Trainer course, and some respondents made campfires using small pieces of dead and downed wood. Another possible explanation for lower scores on these items

is the respondents' disagreement with the item. Perhaps some participants were not convinced by the arguments presented in their Trainer course, and chose to behave otherwise.

Although camping close to other groups may be unavoidable in certain situations, the issues of dishwater disposal and campfires may be improved in the Trainer course curriculum. If the deficiencies in dishwater disposal are caused by lack of preparation, this topic can be discussed in "Plan ahead and prepare" as well as "Dispose of waste properly." If campers do not understand or accept the reasons for straining dishwater, this topic can be emphasized in "Respect wildlife." Campfires are a difficult issue, probably due to traditional notions that a campfire is an integral part of a camping experience. The Trainer course could further emphasize alternatives to campfires (such as candle lanterns), teaching techniques, and the importance of resource protection to minimize people's felt need or desire for a campfire. For those campers that insist on the building a campfire, the course can teach low-impact fire building by using metal pans to contain the fire or by constructing the fire on mounded mineral soil.

When categorized by age, education, and experience, several relationships were revealed related to knowledge gain and reported behavior. For knowledge, the variables of age, education, LNT expertise, and backpacking experience had some effect on their pre-course scores, and less on the follow-up. This indicates that the younger, less educated, and less experienced respondents were less knowledgeable about LNT before the course, but the gap in knowledge between groups lessened after the course. For the pre-course survey, reported behavior showed significant differences between those with no backpacking or LNT experience, and those who had some experience. The ANOVA tests for these variables showed no significant differences in reported behavior for the follow-up, which suggests that groups with lower pre-course scores reduced the gap in use of appropriate behaviors.

The correlation between the (pre to follow-up) difference in ethics scores and difference in behavior scores may reflect an important step in the persuasion process. There was no correlation between difference in knowledge scores and difference in behavior, suggesting that information is not the most important tool in promoting appropriate behavior. While the items used in our questionnaire do not each directly

imply a particular ethic, they require thought about ethical concepts in order to choose an answer. Ethical appeals may be more important in promoting behavior change than factual information. This suggests that the LNT course should integrate more ethical appeals into the curriculum. An ethical thought process focuses on what a person "should" or "ought to" do (Harding et al., 2000). This process may be encouraged by targeting the central route to persuasion, which requires high involvement and increased processing of the subject matter (Petty & Cacioppo, 1984). A course such as the LNT Trainer course has great potential to involve the participants. Many course participants are already involved in outdoor careers or recreational pursuits and therefore highly interested in the subject. Many courses provide opportunities for the participants to be involved; many instructors require that each participant prepare a presentation on one of the Leave No Trace principles. An increase in role-playing, group discussions, and other high-involvement activities may help to increase the effectiveness of the Trainer course. Targeting the central route to persuasion may also help to convince those that are resistant to certain LNT tenets. By exploring the issues more deeply, instructors may be more effective in conveying the importance of LNT messages, and can overcome some resistance.

The LNT Trainer course was also successful in promoting LNT outreach activity. Ninety-two percent of course participants taught LNT to others in some way, and 91% planned to teach it in the future. The most common method of teaching was through informal contacts and conversations, although many respondents also gave formal presentations. Many respondents also produced written media, especially for work purposes. This demonstrates that Trainer course participants have used their training to reach out to the community, usually through informal means. Even if it was not part of their job, a majority of LNT Trainers took an active role in sharing their knowledge and skills with others.

There are several limitations of this study that merit recognition; these include the lack of a control group, the measurement of reported behavior, and social desirability bias. Events following the Trainer course may have affected the participants' knowledge of LNT practices, and subsequently, their test scores. Repetition of same questions on the tests may have created some improvement in scores due to improved testing skill and

familiarity with the questions. A control population would have helped evaluate the influence of these factors. This could be accomplished by varying the questionnaires sent to the instructors so that some received pre-course only, some post-course only, and some both pre- and post-course questionnaires. Although this does not allow random assignment to groups, it would be the most efficient and least confusing method for the course instructors.

While this study documents reported behavior, it did not assess actual behavior. Direct observation of participants on camping trips before and after the course was impossible given the number of subjects and their distribution throughout the United States and Canada. The use of reported rather than actual behavior was an unavoidable limitation of the research design.

Another consideration for interpreting some of these results is the social desirability bias. Although we emphasized that our study was conducted by Virginia Tech rather than the Center for Outdoor Ethics, some respondents may have felt pressured to provide the "right" answer rather than the truth on the ethics, behavior, and "Teaching others" sections. Respondents may have chosen the answer that they felt would be given a higher value rather than indicating how they truly felt or behaved. For this reason, there may be a slight bias towards higher scores and more positive behaviors.

Conclusions

This research demonstrated that the LNT Trainer courses successfully promoted short- and long-term improvements in the participants' understanding and adoption of LNT skills and ethics. Trainer course participants improved and retained their knowledge, ethics, and behavior following the course, and taught others what they had learned. Implications for improving the course by increasing or reducing focus on selected curriculum topics were described. The need for more emphasis on environmental ethics was also discussed. Some demographic variables had significant effects on behavior, with younger and less experienced participants showing greater improvements in use of low-impact behaviors than the rest of the respondents.

Participants' increased use of low-impact behaviors suggests that LNT education has the potential to reduce recreational impacts. If LNT Trainer course participants are

adopting low-impact behaviors that are supported by scientific studies, LNT courses are an effective method for minimizing environmental impacts from outdoor recreation. Although natural area managers generally do not have the opportunity to reach their visitors with a structured curriculum, they educate their visitors on site through environmental interpretation. Interpretive materials and staff-guided programs, particularly with ethical appeals, can reach many park visitors and minimize their impacts on the natural resources. While interpretive programs and materials will not be as effective as a two-day course, they may confront specific behaviors such as off-trail hiking and littering. Managers can also affect behaviors by targeting the central route to persuasion—providing interactive exhibits and activities that will help increase visitors' interest in the information and improve their information processing.

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CHAPTER IV:

Conclusions

These studies show that managers can be successful in preventing ecological and social impacts using relatively light-handed approaches. At Annapolis Rocks, there was some degree of visitor displacement; however, the extent of displacement was apparently acceptable to the management committee. The population of post-treatment visitors rated their camping experience higher than the pre-treatment visitors. The impacts that had degraded the previous camping area were largely unnoticeable in the new camping area. The design of the campsites improved social and ecological conditions, and the new regulations minimized the destructive behaviors. The Leave No Trace study showed that a two-day educational program is a successful tool for encouraging low-impact behaviors. The LNT Trainer courses enhanced the knowledge, ethics, and behavior of their participants for the long term. These new skills were utilized on backcountry trips, and they are likely to be used in the future. LNT Trainers will help minimize their impacts on the environment and teach others through personal example and outreach activities.

Although the strategies examined by this thesis may not be applicable in all situations, they provide potential solutions for managers to consider in other areas. The side-hill campsite design at Annapolis Rocks has been applied elsewhere successfully (Marion & Farrell, 2002). The study at Annapolis Rocks provides evidence of its social successes in addition to the documented environmental successes. This design may have wide application for similar areas across the AT—where managers want to eliminate noisy and destructive behaviors from groups who disrupt the desired backcountry atmosphere. The LNT study shows that education is an effective tool for promoting low-impact behavior. Trainer courses are already used by a number of organizations, from government agencies to scout groups. This study encourages these groups to implement this course or a similar program to teach their staff and membership about minimizing their impact on the environment.

Future challenges

These studies highlight some future challenges for managers and scientists. Determining the needs and preferences of visitors is a constant task, as populations change over time and location. Managers may find that certain actions tend to attract or deter certain types of visitors, and these trade-offs should be considered carefully. Another challenge, particularly with education, is to reach new audiences. Outdoor skills courses have become very popular, but they tend to reach a limited audience—those already interested in the outdoors. Programs like Outward Bound and Eckerd Youth Alternatives help to reach disadvantaged populations, but these programs focus narrowly on urban youth. If programs such as these were expanded and targeted for adults as well as youth, they could reach a larger audience and strengthen the community. In-school environmental education programs should be expanded, and camp programs should offer more scholarships to reach more students, and foster a sense of environmental responsibility in young minds. Educating more adults and youth in scouting programs would also help reach a larger audience.

Research Opportunities

Throughout this process, I have learned from my mistakes and my successes. I have thought about possible improvements to these research projects, and ways to extend the major concepts. The urgency to begin some of these projects (given the time of year and management decisions) created some limitations that might have been avoided with more planning and preparation. For the Annapolis Rocks study, we worked with a management deadline, and had to prepare the questionnaires relatively quickly in order to capture the pre-treatment population. Logistical difficulties also prevented me from distributing the surveys myself and/or training the caretakers thoroughly for this task. If I had the opportunity (and funding) to complete a similar project, I would try to balance the pre- and post-treatment data collection periods using random selection of sampling days, and I would either complete the fieldwork myself or hire a charismatic research assistant whose sole duty was to distribute and collect the questionnaires properly. The biggest limitation of the Leave No Trace study was the lack of a control group to account for bias from repeated testing. Given the opportunity to work on a similar study, I would

randomly assign courses to receive pre-test only, post-test only, or both pre- and post-test. This would control repeated testing biases.

There are many opportunities for new research projects related to those presented in this thesis. The evaluation of success at Annapolis Rocks is just beginning. Although the previous camping area appears to be recovering, it should be monitored closely and evaluated again in the future. Once the fences are removed and caretaker absent, compliance with the closure will be more difficult to attain. Ecological monitoring should be a continuous process, at least every 5 years. This monitoring will lend itself to scientific inquiry as well as management guidance. The social study of visitors would also benefit from reevaluation in a few years. How will the population of visitors change in the next decade? Will the managers retain some of the pre-treatment users? Another inquiry could occur at different site with similar environmental and social impacts. At AR, the management enacted fire and alcohol bans, which seem to have had a significant influence on the change in the population of visitors. Managers at another site with similar problems could utilize this campsite design without changing the current regulations. This site would allow researchers to explore the effects of the campsite design alone, without the confounding regulations enacted at AR. Is the campsite design alone, with its spatial separation of sites, sufficient in alleviating conflicts caused by disruptive groups?

The efficacy of various environmental education programs has been studied frequently, including programs that follow course participants for years after the completion of their courses (Zint, Kraemer, Northway, & Lim, 2002; Bogner, 1998). The effectiveness of Leave No Trace messages have also been studied, mainly regarding onsite contacts methods (Cole, Hammond, & McCool, 1997; Oliver, Roggenbuck, & Watson, 1985). Future inquiries may be directed on the effects of LNT Trainer courses on participants' lives. Using a random sample (either system-wide or restricted to a limited geographic range) of previous course participants, a researcher could use qualitative methods to explore how LNT Trainers have (or have not) used Leave No Trace and taught it to others. This would be more informative than our quantitative evaluation of reported behavior four months after the course and descriptive assessment of teaching others.

The themes and discoveries of this thesis provide a variety of potential discussion and research topics. Natural area managers must constantly adapt to changing social, environmental, and legislative conditions. Ongoing applied research is necessary to help managers keep pace with the evolving challenges.

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**APPENDIX A:
ANNAPOLIS ROCKS QUESTIONNAIRES**

PRE-TREATMENT QUESTIONNAIRE

ANNAPOLIS ROCKS CAMPING SURVEY



**Cooperative Park Studies Unit
Virginia Tech, College of Natural Resources
Blacksburg, VA**

Dear Annapolis Rocks Campers,

The Cooperative Park Studies Unit at Virginia Tech University, with support of the Maryland Department of Natural Resources, Appalachian Trail Conference, and Potomac Appalachian Trail Club, is conducting this survey because we are interested in your opinions about camping at Annapolis Rocks. The survey asks about your level of satisfaction with certain aspects of the camping conditions and the importance of these aspects to your experience. Your ideas can help managers make better decisions in the future.

If possible, please fill out this survey before you leave the Annapolis Rocks camping area. It should take about 10 minutes to complete, and you can leave the completed survey with the caretaker or place it in the survey box located at the camping area entrance sign. If it is not possible to complete this survey during your visit, please take this booklet with you and ask the caretaker for a postage-paid, addressed envelope so that you may return it to us by mail.

We ask for your name, address, and e-mail address on a separate form so that: 1) we may contact you if we have not received a completed survey within a reasonable amount of time, and 2) so we can provide you with a copy of the survey results, if requested. This survey is confidential, and your name will not be associated with responses in any way, nor will it be used in reporting study results. We will not release your name to anyone.

We believe that this study can help us to better serve you. We would like to receive input from all campers to Annapolis Rocks so that we have the best representation of its overnight visitors. Study results will be available in the spring of 2004. If you would like to request a copy of our results or have questions about the survey, please contact Melissa Daniels at the address (preferably e-mail) provided below. Thank you for your time and your valuable input!

Sincerely,

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Camper Satisfaction at Annapolis Rocks

1. Please rate (circle the appropriate response to indicate) each of the following items based on your satisfaction during this trip to Annapolis Rocks AND your preferences for each item.

Items	Highly Dissatisfied	Dissatisfied	Neutral	Satisfied	Highly Satisfied	Would you prefer...		
						Fewer	Same	More
a) Number of campsites available	1	2	3	4	5	Fewer	Same	More
b) Size of my campsite	1	2	3	4	5	Smaller	Same	Larger
c) Amount of bare soil on my campsite	1	2	3	4	5	Less	Same	More
d) Condition of trees on my campsite	1	2	3	4	5	Worse	Same	Better
e) Amount of ground vegetation cover near my campsite	1	2	3	4	5	Less	Same	More
f) Naturalness of my campsite	1	2	3	4	5	Less	Same	More
g) Naturalness of the area near my campsite	1	2	3	4	5	Less	Same	More
h) Attractiveness of my campsite	1	2	3	4	5	Less	Same	More
i) Number of people camped near me	1	2	3	4	5	Less	Same	More
j) Privacy of my campsite	1	2	3	4	5	Less	Same	More
k) Noise from other groups	1	2	3	4	5	Less	Same	More
l) Interactions with other groups	1	2	3	4	5	Less	Same	More
m) Behavior of other groups	1	2	3	4	5	Worse	Same	Better
n) Number of day users near my campsite	1	2	3	4	5	Less	Same	More
o) Security of my belongings at my campsite	1	2	3	4	5	Lower	Same	Higher
p) Ability to camp near members of my group	1	2	3	4	5	Less	Same	More
q) Freedom to choose a preferred campsite	1	2	3	4	5	Less	Same	More
r) Restrictions on where I can camp	1	2	3	4	5	Fewer	Same	More
s) Distance from my campsite to the spring	1	2	3	4	5	Closer	Same	Farther
t) Distance from my campsite to other sites	1	2	3	4	5	Closer	Same	Farther
u) Slope of the tenting surfaces	1	2	3	4	5	Less	Same	More
v) Smoothness of the tenting surfaces	1	2	3	4	5	Less	Same	More
w) Overall impression of my campsite	1	2	3	4	5	--	--	--

Importance of Camping Conditions

2. Please rate the importance of each of the following items to your camping experience.

Items	Not Important	Slightly Important	Somewhat Important	Moderately Important	Very Important	No Opinion
a) Number of campsites available	1	2	3	4	5	N
b) Size of my campsite	1	2	3	4	5	N
c) Amount of bare soil on my campsite	1	2	3	4	5	N
d) Condition of trees on my campsite	1	2	3	4	5	N
e) Amount of ground vegetation cover near my campsite	1	2	3	4	5	N
f) Naturalness of my campsite	1	2	3	4	5	N
g) Naturalness of the area near my campsite	1	2	3	4	5	N
h) Attractiveness of my campsite	1	2	3	4	5	N
i) Number of people camped near me	1	2	3	4	5	N
j) Privacy of my campsite	1	2	3	4	5	N
k) Noise from other groups	1	2	3	4	5	N
l) Interactions with other groups	1	2	3	4	5	N
m) Behavior of other groups	1	2	3	4	5	N
n) Number of day users near my campsite	1	2	3	4	5	N
o) Security of my belongings at my campsite	1	2	3	4	5	N
p) Ability to camp near members of my group	1	2	3	4	5	N
q) Freedom to choose a preferred campsite	1	2	3	4	5	N
r) Restrictions on where I can camp	1	2	3	4	5	N
s) Distance from my campsite to the spring	1	2	3	4	5	N
t) Distance from my campsite to other sites	1	2	3	4	5	N
u) Slope of the tenting surfaces	1	2	3	4	5	N
v) Smoothness of the tenting surfaces	1	2	3	4	5	N

3. What is your opinion about the management of campfires at Annapolis Rocks? (Circle one)

- a) I think campfires should be prohibited.
- b) I think campfires should be limited to a few designated spots away from campsites.
- c) I think campfires should be permitted at all campsites.
- d) I don't have any strong opinions on this issue.

4. What is your opinion about the management of alcohol at Annapolis Rocks? (Circle one)

- a) I think alcohol should be prohibited.
- b) I think alcohol should be permitted only if consumed out of sight of other groups.
- c) I think alcohol use by persons of legal age should be permitted.
- d) I don't have any strong opinions on this issue.

5. How do you feel about the presence of the caretaker? (Circle all that apply.)

- a) It is nice to have a knowledgeable person at the camping area.
- b) I feel safer with a caretaker nearby.
- c) The area seems less like backcountry with a caretaker here.
- d) I felt like the caretaker is here to enforce regulations.
- e) I don't like the caretaker being here.
- f) I had a confrontation with the caretaker.
- g) I don't have any strong opinions on this issue.

6. Please rate the importance of each of the following items to your camping experience at Annapolis Rocks.

Items	Not Important	Slightly Important	Somewhat Important	Moderately Important	Very Important	No Opinion
a) Having a caretaker	1	2	3	4	5	N
b) Having a campfire	1	2	3	4	5	N
c) Having alcohol	1	2	3	4	5	N

Demographic Characteristics of Annapolis Rocks Campers

In order to make comparisons among the many types of visitors to Annapolis Rocks, we would like some general information about you and your group. Any personal information you provide will be kept confidential. Your personal information will not be identified with you in any report of study results.

8. What is your age? _____
9. What is your gender? M F
10. What is the highest level of education you have completed? (Mark one.)
- | | |
|------------------------|------------------------------------|
| a. Elementary school | e. Bachelor's degree or equivalent |
| b. Some high school | f. Some graduate school |
| c. High school diploma | g. Master's degree or equivalent |
| d. Some college | h. Ph.D., M.D. or equivalent |
11. About how many days per year do you participate in the following outdoor activities?
- | | |
|------------------|--------------------|
| Days per year | Days per year |
| Backpacking: [] | Day hiking: [] |
| Car camping: [] | Rock climbing: [] |
12. About how many years have you participated in the following outdoor activities?
- | | |
|------------------|--------------------|
| Years | Years |
| Backpacking: [] | Day hiking: [] |
| Car camping: [] | Rock climbing: [] |
13. Was this your first trip to Annapolis Rocks? Yes No
If yes, please skip to question 17. If no, continue with question 14.
14. How many times have you camped at Annapolis Rocks in the last 12 months? _____
15. When was your last camping trip to Annapolis Rocks? _____ (mo./yr.)
16. About how many times in your life have you camped at Annapolis Rocks?

17. How many people are in your group on **this camping trip**? _____
18. How many tents of each type did your group set up on your campsite?
- | | |
|----------------------------|--------------------------------|
| [] Solo (one-person) tent | [] 4-5 person tent |
| [] 2-3 person tent | [] Greater than 5-person tent |
19. **During this trip**, how many nights did you camp at Annapolis Rocks? _____

20. **During this trip**, how many nights did you camp at other locations along the Appalachian Trail? _____
21. How many other groups were camped within sight of your campsite at Annapolis Rocks on the busiest night of this trip? _____
22. Please estimate how far it was from your group's campsite to the next closest group's campsite:
- Less than 25 ft.
 - 26-75 ft.
 - 76-125 ft.
 - Greater than 125 ft.
23. How would you describe your group?
- Friends
 - Family
 - Organized group—scout or youth group
 - Organized group—summer camp
 - Organized group—college group
 - Organized group—Commercial (i.e., you paid an outfitter or trip organizer)
 - Other: _____
24. In which of the following activities did you participate while on this trip? (Check the activities in which you participated and write a "0" for those in which you did not.)
- | | |
|--|--------------------------------------|
| <input type="checkbox"/> Bird watching | <input type="checkbox"/> Hunting |
| <input type="checkbox"/> Rock climbing | <input type="checkbox"/> Photography |
| <input type="checkbox"/> Viewing scenery | <input type="checkbox"/> Other _____ |
25. Did you have a campfire?
- Yes
 - No
26. If yes, did you use this campfire to cook a meal?
- Yes
 - No
27. Did anyone in your group bring alcohol for consumption on this camping trip?
- Yes
 - No
28. Approximately how far do you live from Annapolis Rocks?
- Less than 25 miles
 - 25-50 miles
 - 51-100 miles
 - 101-300 miles
 - More than 300 miles

Thank you for your time!

Please use the back of this survey to provide your comments.

POST-TREATMENT QUESTIONNAIRE

ANNAPOLIS ROCKS CAMPING SURVEY



**Cooperative Park Studies Unit
Virginia Tech, College of Natural Resources
Blacksburg, VA**

Dear Annapolis Rocks Campers,

The Cooperative Park Studies Unit at Virginia Tech University, with support of the Maryland Department of Natural Resources, Appalachian Trail Conference, and Potomac Appalachian Trail Club, is conducting this survey because we are interested in your opinions about camping at Annapolis Rocks. The survey asks about your level of satisfaction with certain aspects of the camping conditions and the importance of these aspects to your experience. Your ideas can help managers make better decisions in the future.

If possible, please fill out this survey before you leave the Annapolis Rocks camping area. It should take about 15 minutes to complete, and you can leave the completed survey with the caretaker or place it in the survey box located at the camping area entrance sign. If it is not possible to complete this survey during your visit, please take this booklet with you and ask the caretaker for a postage-paid, addressed envelope so that you may return it to us by mail.

We ask for your name, address, and e-mail address on a separate form so that:

1) we may contact you if we have not received a completed survey within a reasonable amount of time, and 2) so we can provide you with a copy of the survey results, if requested. This survey is confidential, and your name will not be associated with responses in any way, nor will it be used in reporting study results. We will not release your name to anyone.

We believe that this study can help us to better serve you. We would like to receive input from all campers to Annapolis Rocks so that we have the best representation of its overnight visitors. Study results will be available in the spring of 2004. If you would like to request a copy of our results or have questions about the survey, please contact Melissa Daniels at the address (preferably e-mail) provided below. Thank you for your time and your valuable input!

Sincerely,

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Camper Satisfaction at Annapolis Rocks

1. Please rate (circle the appropriate responses to indicate) each of the following items based on your satisfaction during this trip to Annapolis Rocks AND your preferences for each item.

Items	Highly Dissatisfied	Dissatisfied	Neutral	Satisfied	Highly Satisfied	Would you prefer...		
						Fewer	Same	More
a) Number of campsites available	1	2	3	4	5	Fewer	Same	More
b) Size of my campsite	1	2	3	4	5	Smaller	Same	Larger
c) Amount of bare soil on my campsite	1	2	3	4	5	Less	Same	More
d) Condition of trees on my campsite	1	2	3	4	5	Worse	Same	Better
e) Amount of ground vegetation cover near my campsite	1	2	3	4	5	Less	Same	More
f) Naturalness of my campsite	1	2	3	4	5	Less	Same	More
g) Naturalness of the area near my campsite	1	2	3	4	5	Less	Same	More
h) Attractiveness of my campsite	1	2	3	4	5	Less	Same	More
i) Number of people camped near me	1	2	3	4	5	Less	Same	More
j) Privacy of my campsite	1	2	3	4	5	Less	Same	More
k) Noise from other groups	1	2	3	4	5	Less	Same	More
l) Interactions with other groups	1	2	3	4	5	Less	Same	More
m) Behavior of other groups	1	2	3	4	5	Worse	Same	Better
n) Number of day users near my campsite	1	2	3	4	5	Less	Same	More
o) Security of my belongings at my campsite	1	2	3	4	5	Lower	Same	Higher
p) Ability to camp near members of my group	1	2	3	4	5	Less	Same	More
q) Freedom to choose a preferred campsite	1	2	3	4	5	Less	Same	More
r) Restrictions on where I can camp	1	2	3	4	5	Fewer	Same	More
s) Distance from my campsite to the spring	1	2	3	4	5	Closer	Same	Farther
t) Distance from my campsite to other sites	1	2	3	4	5	Closer	Same	Farther
u) Slope of the tenting surfaces	1	2	3	4	5	Less	Same	More
v) Smoothness of the tenting surfaces	1	2	3	4	5	Less	Same	More
w) Overall impression of my campsite	1	2	3	4	5	--	--	--

Importance of Camping Conditions

2. Please rate the importance of each of the following items to your camping experience.

Items	Not Important	Of Little Importance	Somewhat Important	Important	Very Important	No Opinion
a) Number of campsites available	1	2	3	4	5	N
b) Size of my campsite	1	2	3	4	5	N
c) Amount of bare soil on my campsite	1	2	3	4	5	N
d) Condition of trees on my campsite	1	2	3	4	5	N
e) Amount of ground vegetation cover around my campsite	1	2	3	4	5	N
f) Naturalness of my campsite	1	2	3	4	5	N
g) Naturalness of the area around my campsite	1	2	3	4	5	N
h) Attractiveness of my campsite	1	2	3	4	5	N
i) Number of people camped near me	1	2	3	4	5	N
j) Privacy of my campsite	1	2	3	4	5	N
k) Noise from other groups	1	2	3	4	5	N
l) Interactions with other groups	1	2	3	4	5	N
m) Behavior of other groups	1	2	3	4	5	N
n) Number of day users near my campsite	1	2	3	4	5	N
o) Security of my belongings at my campsite	1	2	3	4	5	N
p) Ability to camp near members of my group	1	2	3	4	5	N
q) Freedom to choose a preferred campsite	1	2	3	4	5	N
r) Restrictions on where I can camp	1	2	3	4	5	N
s) Distance from my campsite to the spring	1	2	3	4	5	N
t) Distance from my campsite to other sites	1	2	3	4	5	N
u) Slope of the tenting surfaces	1	2	3	4	5	N
v) Smoothness of the tenting surfaces	1	2	3	4	5	N

3. What is your opinion about the management of campfires at Annapolis Rocks?

- a) I think campfires should be prohibited.
- b) I think campfires should be limited to a few designated spots away from campsites.
- c) I think campfires should be permitted at all campsites.
- d) I don't have any strong opinions on this issue.

4. What is your opinion about the management of alcohol at Annapolis Rocks?

- a) I think alcohol should be prohibited.
- b) I think alcohol should be permitted only if consumed out of sight of other groups.
- c) I think alcohol use by persons of legal age should be permitted.
- d) I don't have any strong opinions on this issue.

5. How do you feel about the presence of the caretaker? (Circle all that apply.)

- a) It is nice to have a knowledgeable person at the camping area.
- b) I feel safer with a caretaker nearby.
- c) The area seems less like backcountry with a caretaker here.
- d) I felt like that the caretaker is here to enforce regulations.
- e) I had a confrontation with the caretaker.
- f) I don't have any strong opinions on this issue.

6. Please rate the importance of each of the following items to your camping experience at Annapolis Rocks.

Items	Not Important	Of Little Importance	Somewhat Important	Important	Very Important	No Opinion
a) Having a caretaker	1	2	3	4	5	N
b) Having a campfire	1	2	3	4	5	N
c) Having alcohol	1	2	3	4	5	N

7. Answer this question only if you have camped at Annapolis Rocks prior to May 23, 2003.

We would like your opinion about the new campsites and management at Annapolis Rocks. Please circle your response to the following statements based on you experience with both the former and current camping areas.

I prefer camping at the current campsites rather than the former sites. Yes No

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	No opinion/ Don't know
a) The former campsites had too much resource damage.	1	2	3	4	5	N
b) The former campsites were unsafe.	1	2	3	4	5	N
c) Crowding was a problem for me at the former campsites.	1	2	3	4	5	N
d) The current campsites have less resource damage than the former campsites.	1	2	3	4	5	N
e) The current campsites are safer than the former campsites.	1	2	3	4	5	N
f) The current campsites provide more privacy than the former campsites.	1	2	3	4	5	N
g) I enjoyed seeing and camping near other people at the former campsites.	1	2	3	4	5	N
h) I prefer the current management of this area rather than the former management.	1	2	3	4	5	N

Demographic Characteristics of Annapolis Rocks Campers

In order to make comparisons among the many types of visitors to Annapolis Rocks, we would like some general information about you and your group. Any personal information you provide will be kept confidential. Your personal information will not be identified with you in any report of study results.

8. What is your age? _____ 9. What is your gender? M F
10. What is the highest level of education you have completed? (Mark one.)
- | | |
|------------------------|------------------------------------|
| a. Elementary school | e. Bachelor's degree or equivalent |
| b. Some high school | f. Some graduate school |
| c. High school diploma | g. Master's degree or equivalent |
| d. Some college | h. Ph.D., M.D. or equivalent |
11. About how many days per year do you participate in the following outdoor activities?
- | | |
|------------------------|---------------------------|
| Days per year | Days per year |
| Backpacking: [] | Day hiking: [] |
| Car camping: [] | Rock climbing: [] |
12. About how many years have you participated in the following outdoor activities?
- | | |
|------------------------|---------------------------|
| Years | Years |
| Backpacking: [] | Day hiking: [] |
| Car camping: [] | Rock climbing: [] |
13. Was this your first trip to Annapolis Rocks? Yes No
 If yes, please skip to question 17. If no, continue with question 14.
14. How many times have you camped at Annapolis Rocks in the last 12 months? _____
15. When was your last camping trip to Annapolis Rocks? _____ (mo./yr.)
16. About how many times in your life have you camped at Annapolis Rocks? _____
17. How many people are in your group on **this camping trip**? _____
18. How many tents of each type did your group set up on your campsite?
- | | |
|-------------------------------|-----------------------------------|
| [] Solo (one-person) tent | [] 4-5 person tent |
| [] 2-3 person tent | [] Greater than 5-person tent |
19. **During this trip**, how many nights did you camp at Annapolis Rocks? _____

20. **During this trip**, how many nights did you camp at other locations along the Appalachian Trail? _____
21. How many other groups were camped within sight of your campsite at Annapolis Rocks on the busiest night of this trip? _____
22. Please estimate how far it was from your group's campsite to the next closest group's campsite:
- Less than 25 ft.
 - 26-75 ft.
 - 76-125 ft.
 - Greater than 125 ft.
23. How would you describe your group?
- Friends
 - Family
 - Organized group—scout or youth group
 - Organized group—summer camp
 - Organized group—college group
 - Organized group—Commercial (i.e., you paid an outfitter or trip organizer)
 - Other: _____
24. In which of the following activities did you participate while on this trip? (Check the activities in which you participated and write a "0" for those in which you did not.)
- | | | | |
|--------------------------|-----------------|--------------------------|-------------|
| <input type="checkbox"/> | Bird watching | <input type="checkbox"/> | Hunting |
| <input type="checkbox"/> | Rock climbing | <input type="checkbox"/> | Photography |
| <input type="checkbox"/> | Viewing scenery | <input type="checkbox"/> | Other _____ |
25. Approximately how far do you live from Annapolis Rocks?
- Less than 25 miles
 - 25-50 miles
 - 51-100 miles
 - 101-300 miles
 - More than 300 miles

Thank you for your time!

Please use the back of this survey to provide your comments.

**APPENDIX B:
LEAVE NO TRACE STUDY MATERIALS**

INSTRUCTORS' INFORMATION



Dear Leave No Trace Trainer Course Instructors,

Thank you for agreeing to participate in this important effort. The enclosed information is part of a research study to examine the effectiveness of Leave No Trace Trainer courses. It is fully sanctioned by the Leave No Trace Center for Outdoor Ethics (formerly Leave No Trace, Inc.) and all supporting organizations. Our research objectives are to:



- 1) Evaluate the extent of LNT knowledge gained from taking the Trainer course and retained over a 4-month period.
- 2) Evaluate changes in LNT-related ethics caused by taking the Trainer course and changes over a 4-month period.
- 3) Document reported behavioral changes during outdoor visits over the 4-month period after the course (i.e., what LNT practices were adopted).
- 4) Document reported informal and formal LNT instruction given to others during the 4-month period after the course (i.e., quantify informal or formal LNT education provided).

Please distribute and collect pre- and post-course surveys and return them to us, along with a short Instructors' form. We will conduct the four-month follow-up survey ourselves.

Here's our specific guidance:

- 1) If possible, please do not provide any Leave No Trace literature like Skills & Ethics booklets to your participants prior to the course. All course-related instruction should take place after you've administered a pre-course survey (which evaluates their prior or baseline knowledge).
- 2) Pre-course survey – At the start of your course, please read aloud and distribute the enclosed letter to the participants. Please encourage your students to participate in the study, then distribute a “Pre-course” survey to each willing participant. The survey should take about 30 minutes; please allow enough time for the participants to complete it. As you collect the completed surveys please review each to ensure that all answers are clearly marked on *both sides* of each page and that the participants mail and e-mail addresses are clearly legible and complete. Please do not go over the survey or discuss answers to the questions.
- 3) Teach the Trainer course – During your course, please be familiar with all the topics covered on the survey quiz but teach your course as you normally would. The survey's quiz is designed to evaluate what we consider to be core Leave No Trace knowledge, most of which is addressed on the standard LNT hang tag. Answer all participants' questions during the course, even those that may have been prompted by taking the pre-test. Try not to make a big deal of these surveys or their involvement in this evaluation.
- 4) Post-course survey – At the conclusion of the course, please distribute the “Post-course” survey. Again, review all collected surveys for completeness and legibility and store the surveys in a safe place. Do not grade the surveys or go over them with the participants; however, you may answer any questions after all surveys have been collected. Remind the

participants that we will be contacting them via e-mail (if they listed a legible address) or regular mail in about four months with a follow-up survey.

5) Complete the “Instructors' Course Information Form” and return it along with the participants’ pre- and post-course surveys. Please send these to us in the addressed envelope provided (no postage is needed).

If you have any questions about this research or require clarification of your role please contact us using the information below. Thank you for your assistance with this exciting project and stay tuned to the LNT website for results by the summer of 2004!

Sincerely,

Jeff Marion
 Chairperson – LNT Education Review Committee
 Cooperative Park Studies Unit
 Virginia Tech/Forestry (0324)
 Blacksburg, VA 24061
 jmarion@vt.edu
 540-231-6603

Melissa Daniels
 Graduate Research Assistant
 Cooperative Park Studies Unit
 Virginia Tech/Forestry (0324)
 Blacksburg, VA 24061
 medaniel@vt.edu
 540-231-3596

ANSWERS Pre-course

1	A
2	D
3	A
4	A
5	C
6	A
7	B
8	B
9	A
10	D
11	D
12	C
13	C
14	C
15	D
16	B
17	D
18	D
19	D
20	A
21	A
22	D
23	B
24	A
25	C

ANSWERS Post-course

1	C
2	C
3	C
4	C
5	D
6	A
7	D
8	B
9	B
10	B
11	B
12	C
13	B
14	D
15	B
16	B
17	D
18	D
19	B
20	B
21	D
22	C
23	D
24	B
25	D

(Complete one per course)

1. Course Leader's name & affiliation: _____

E-mail address: _____

2. Co-Instructors' name & affiliation: _____

E-mail address: _____

3. Dates of course: _____ 4. Course location: _____
(area name, state)

5. Did this course include an overnight stay in the backcountry? Y / N

6. Primary mode of travel for this course: Hiking, Raft/Canoe, Horse,
Other _____

7. What is the predominant affiliation for participants (e.g., Boy Scouts, park seasonal staff, youth camp, or any combination)?

8. How many participants completed this course? _____

9. How much did each participant pay for this course? _____

10. **Course Leader:** In what year did you take the LNT Master Course? _____

11. How many times have you taught the LNT **Master** Course? _____

12. How many times have you taught the LNT **Trainer** Course? _____

13. How many times have you taught LNT Workshops or a shortened LNT course?

14. **Co-Instructor:** If you are an LNT Master, in what year did you take the Master course? _____

15. How many times have you taught the LNT **Master** Course? _____

16. How many times have you taught the LNT **Trainer** Course? _____

17. How many times have you taught LNT Workshops or a shortened LNT course?

Thank you for your participation in this study!

INTRODUCTORY LETTER AND PRE-COURSE QUESTIONNAIRE

Leave No Trace Trainer Course Participant,

Today you have an opportunity to participate in an important assessment of Leave No Trace training! In order to ensure the quality of training courses, we want to evaluate the skills and ethics learned and retained through the Leave No Trace program. Your participation in this study is strictly voluntary and will help the Leave No Trace Center for Outdoor Ethics continue to improve its communication of low-impact skills and ethics.



We would like you to complete a pre-course survey to assess your current knowledge of low-impact practices and a post-course survey to assess what you have learned. We ask for your name and address only so that we may contact you in about four months for a follow-up survey. Names and addresses will be kept in a separate file from your completed surveys and only used for contacting you for the follow-up. They will not be associated with any survey responses nor included in reporting of the results. If at any time you feel that you want to discontinue your participation in this study, you are free to do so.

Your participation in this study will allow the Leave No Trace Center for Outdoor Ethics to improve its educational training programs and encourage outdoor visitors to preserve the beauty of our nation's natural areas.

Sincerely,

Jeff Marion
Chairperson – LNT Education Review Committee
Cooperative Park Studies Unit
Virginia Tech/Forestry (0324)
Blacksburg, VA 24061
jmarion@vt.edu
540-231-6603

Melissa Daniels
Graduate Research Assistant
Cooperative Park Studies Unit
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Pre-Course Evaluation

Knowledge of Leave No Trace Principles

Please answer the following questions as they relate to the most appropriate Leave No Trace practices in a **backcountry** setting.

1. Which of the following actions does **not** demonstrate consideration for other visitors?
 - A. Camping in an open meadow.
 - B. Taking breaks off-trail
 - C. Selecting campsites out of sight and hearing of other campers.
 - D. Camping in small groups.
2. Which of the following kinds of vegetation are the most likely to resist or recover from human trampling?
 - A. Forbs (erect-stemmed, broad-leaved plants)
 - B. Tree seedlings
 - C. Mosses
 - D. Grasses
3. What is the best way to dispose of human waste (feces)?
 - A. Deposit human waste in a small hole
 - B. Dig a large, deep hole and have everyone use it.
 - C. Deposit human waste on the ground away from campsites.
 - D. Deposit human waste on the ground and cover it with rocks.
4. For a group of twenty on a backcountry hike, it is best to...
 - A. Camp in small groups on separate campsites, and do not hang out or eat together.
 - B. Have the whole group camp on one site.
 - C. Split up and camp on separate campsites, but designate routes to a central area to eat and socialize.
 - D. Take the whole group into a remote area where others won't see the impacts.
5. The primary argument for leaving a deer antler instead of keeping it as a souvenir is...
 - A. So scientists can learn about deer behavior.
 - B. To avoid disturbing fragile ecosystems.
 - C. To allow others to enjoy the object.
 - D. So that its nutrients can return to the soil.
6. When camping in **popular** or high-use areas...
 - A. Concentrate use on existing trails and campsites.
 - B. Scatter your activity beyond established campsites to permit their recovery.
 - C. Find a vegetated area to pitch your tent.
 - D. Disperse your group over a wide area.
7. How should dirty dishwater be disposed?
 - A. Use it to put out the campfire.
 - B. Strain out food particles and scatter the dishwater.
 - C. Pour it into a stream.
 - D. Throw it in the bushes away from the eating area.

8. Of the learned responses that wildlife may exhibit around visitors, which is least desired?
- A. Avoidance
 - B. Attraction
 - C. Indifference
 - D. Fear
9. When cooking, it is best to...
- A. Cook only what you need and pack out the wrappers.
 - B. Eat the leftovers and bury the wrappers.
 - C. Burn all your leftovers.
 - D. Eat leftovers the next day and burn the wrappers.
10. When you are hiking on a trail with beautiful wildflowers, you should...
- A. Walk away from the trail and take a flower no one can see.
 - B. Stay on the trail and take only one flower.
 - C. . Pick only dry, wilted flowers and leave the healthy plants alone.
 - D. Never pick even one flower
11. The best time to visit a popular backcountry or wilderness area is...
- A. Late in the season.
 - B. During the week rather than on weekends.
 - C. Early in the season.
 - D. Any of the above.
12. If campfires are permitted, how should you gather wood?
- A. Saw downed logs into manageable lengths.
 - B. Break dead branches from trees.
 - C. Gather pieces of wood from the ground that can be easily broken.
 - D. Saw dead limbs from a fallen tree.
13. When traveling through **pristine** or remote areas, an advisable LNT practice is to...
- A. Travel in large groups to ensure group safety.
 - B. Walk around mud puddles and downed trees.
 - C. Travel away from visitor-created trails.
 - D. Always use preexisting trails.
14. What should you do with the ashes from your campfire?
- A. Bury the ashes in the ground.
 - B. Throw the ashes into a fast moving stream.
 - C. Scatter the ashes away from camp.
 - D. Leave the ashes in the fire pit.
15. When selecting a campsite, you should choose a site...
- A. In an open area.
 - B. Close to a water source.
 - C. Near the trail.
 - D. Away from lakes, streams, and trails.

16. When planning your food supply, you should...
- A. Leave food in original packaging and put it in stuff sacks or plastic bags.
 - B. Re-pack dried or freeze-dried food into lightweight plastic bags.
 - C. Minimize smells by ensuring food is in airtight cans or bottles.
 - D. Take only fresh food.
17. If you use an existing rock fire ring for your campfire, you should...
- A. Collect extra firewood to leave for other visitors.
 - B. Dismantle the ring after you're finished.
 - C. Move rocks and logs close to the ring to sit on.
 - D. Leave the fire ring free of excess ashes, burned wood and trash.
18. What should you do to avoid dangerous encounters with bears?
- A. Keep all food in your tent at night.
 - B. Carry a firearm with you.
 - C. Bury your garbage and leftover food in the ground.
 - D. Put your food and garbage in a bag and hang it.
19. When walking through an open gate on a trail, you should...
- A. Head towards the closest ranger station to report the open gate.
 - B. Prop the gate open so it doesn't close accidentally.
 - C. Close the gate behind you.
 - D. Leave the gate as you found it.
20. The only waste that is acceptable to leave in the backcountry is...
- A. Human waste.
 - B. Toilet paper.
 - C. Orange peels.
 - D. Burned garbage.
21. Wildlife are **least** sensitive to disturbance from recreationists...
- A. In late summer.
 - B. When raising young.
 - C. In the winter.
 - D. During the nesting season.
22. What is the best procedure for traveling off-trail through a **pristine** area?
- A. Give everyone compass headings and a map with the route marked on it.
 - B. Have the group walk in single file.
 - C. Create trail markers out of natural materials so that everyone can follow the same route.
 - D. Disperse over a wide area.
23. While hiking, what should you do when you encounter horseback riders?
- A. Ask the horseback riders to yield.
 - B. Get off the trail on the downhill side.
 - C. Get off the trail on the uphill side.
 - D. Stay on the trail; you have the right-of-way.

24. Which of the following actions should be taken when breaking camp?
- A. Brush off tents and ground tarps to avoid transporting non-native plant species.
 - B. Leave any leftover wood you have cut for the next campers.
 - C. Leave any makeshift furniture you have created.
 - D. Rake your site to clear debris.
25. What should you do when you see wildlife approaching your campsite?
- A. Put food on the ground to feed the animal.
 - B. Make lots of noise to scare the animal away
 - C. Be quiet and try not to startle the animal.
 - D. Sneak up close to the animal to get a good look.

Leave No Trace Ethics

Please read each of the following statements and indicate your level of agreement.

Statement	Strongly disagree	Neutral	Strongly agree
1. I would postpone a trip to my favorite area if I thought my visit would be harmful to wildlife at that time.	1	2 3 4 5 6 7	
2. The natural environment is very fragile and easily degraded by visitor use.	1	2 3 4 5 6 7	
3. I should have a right to camp on public lands any time I want.	1	2 3 4 5 6 7	
4. It's OK to camp close to another group in the wilderness.	1	2 3 4 5 6 7	
5. It's best to leave a deer antler for others to find.	1	2 3 4 5 6 7	
6. Public land managers should be able to limit visitation to protect park resources.	1	2 3 4 5 6 7	
7. The native animals that live in parks and forests have a greater right to live undisturbed than my right to visit these places.	1	2 3 4 5 6 7	
8. It's acceptable to feed wildlife human food.	1	2 3 4 5 6 7	
9. It's OK to move up close to wildlife to get a good look.	1	2 3 4 5 6 7	
10. I should use low-impact camping and hiking practices or stay home.	1	2 3 4 5 6 7	
11. Cutting a switchback is OK, especially when I am in a hurry.	1	2 3 4 5 6 7	
12. I should have a right to camp on public lands anywhere I want.	1	2 3 4 5 6 7	
13. Outdoor visitors have a moral responsibility to avoid or minimize their impacts to natural environments.	1	2 3 4 5 6 7	
14. Selecting an attractive place to camp is more important to me than finding a durable campsite.	1	2 3 4 5 6 7	
15. Collecting a few interesting rocks or feathers as souvenirs of my outdoor visit is OK.	1	2 3 4 5 6 7	
16. If I want a campfire and there isn't a fire ring present, I should gather some rocks and build one.	1	2 3 4 5 6 7	

My Camping Practices

Think back to a recent “typical” backcountry camping trip and respond to the questions below in terms of that outing. Please describe your trip:

1. About how many months ago was this trip? _____
2. How many nights did you camp? _____
3. How would you describe your group?
 - a. Friends
 - b. Family
 - c. Organized group—scout or youth group
 - d. Organized group—summer camp
 - e. Organized group—college group
 - f. Organized group—Commercial (i.e., you paid an outfitter or trip organizer)
 - g. Other: _____
4. What was your mode of travel for this camping trip?
 - a. Hiking
 - b. Canoe or other watercraft
 - c. Horseback riding
 - d. Other _____

Describe your behavior on your recent camping trip:

*Please be truthful and select the response that most closely corresponds to your **actual behavior**. This is very important! We’ve provided space for comments if you would like to clarify what you did or explain why you did it.*

5. Before leaving on my trip I:
 - a) Left my food in the original packaging.
 - b) Repackaged most of my food to minimize the trash I would have to pack out.
 - c) Repackaged some of my food to minimize the trash I would have to pack out.Comments:
6. Before leaving on my trip, I:
 - a) Was well aware of the area’s camping regulations or recommended practices.
 - b) Was somewhat aware of the area’s camping regulations or recommended practices.
 - c) Had no knowledge of my destination area’s camping regulations or recommended practices.Comments:
7. During my trip, I generally placed my tent on a spot with:
 - a) Grasses or sedges.
 - b) Bare soil, rock, gravel or sand.
 - c) Forbs (erect-stemmed, broad-leaved plants).Comments:

8. When hiking through popular areas during my trip I:
- a) Sometimes stayed on designated or well-established trails.
 - b) Did not stay on designated or well-established trails.
 - c) Always stayed on designated or well-established trails.
- Comments:
9. After washing dishes I:
- a) Poured the dishwater onto the ground.
 - b) Strained the dishwater to remove food particles and then scattered it away from camp.
 - c) Scattered the dishwater away from camp.
- Comments:
10. I disposed of the trash and leftover food during my camping trip by:
- a) Burning some items and packing out others
 - b) Burning it in a campfire.
 - c) Packing out all trash and leftovers.
- Comments:
11. From my trip I:
- a) Kept several souvenirs that I found (e.g., rock, feather, piece of driftwood).
 - b) Kept one souvenir.
 - c) Didn't keep anything from the area I visited.
- Comments:
12. During my trip I:
- a) Built a campfire using downed wood that I could easily break by hand.
 - b) Never built a campfire.
 - c) Built a campfire using wood that could not be broken by hand.
- Comments:
13. During my trip I:
- a) Hung my food or placed it in a container specifically designed to protect it from wildlife.
 - b) Took no precautions to keep wildlife (e.g., bears, raccoons, mice) from getting into my food.
 - c) Took a few precautions to protect my food but didn't hang it or use an animal-proof container.
- Comments:
14. On my trip I:
- a) Camped where I could easily see and hear another group.
 - b) Camped where I could not see or hear another group.
 - c) Camped where I could barely see and hear another group.
- Comments:

Past Experience With Leave No Trace

1. How would you describe your current knowledge of minimum impact or leave no trace outdoor skills and practices?

Novice

Intermediate

Advanced

Expert

2. Have you ever had any official Leave No Trace training or workshops? Yes No

If yes, please describe each training event:

Year of most recent event: _____ Hours of instruction: _____

3. Have you had any other outdoor recreation minimum-impact training? Yes No

If yes, please describe the training you received and indicate the year of the most recent instance:

Formal training:

Informal training (e.g., from a friend):

Year of most recent training: _____ Hours of instruction: _____

4. Have you read any literature on low-impact camping and hiking practices? Yes No

If yes, please check which of the following you have read:

The 7 Leave No Trace principles

LNT brochure or hang-tag

LNT Skills & Ethics booklet (20-30 pgs)

LNT or minimum impact book

LNT video

Visited the LNT website

LNT article or paper

Other:

Demographic and Contact Information

1. Gender: M F

2. Age: _____ years

3. What is the highest level of education you have completed? (Mark one.)

- | | |
|------------------------|------------------------------------|
| a. Elementary school | e. Bachelor's degree or equivalent |
| b. Some high school | f. Some graduate school |
| c. High school diploma | g. Master's degree or equivalent |
| d. Some college | h. Ph.D., M.D. or equivalent |

4. About how many days per year do you participate in the following outdoor activities?

	Days per year		Days per year
Backpacking:	[]	Day hiking:	[]
Car camping:	[]	Horseback riding	[]
Rafting/canoeing/kayaking:	[]	Mountain biking:	[]

5. About how many years have you participated in the following outdoor activities?

	Years		Years
Backpacking:	[]	Day hiking:	[]
Car camping:	[]	Horseback riding:	[]
Rafting/canoeing/kayaking:	[]	Mountain biking:	[]

Please write legibly!

Name: _____

Please provide contact information for where you will be in **four months** or a permanent address.

Address: _____

Phone: _____ - _____ - _____ E-mail address: _____

POST-COURSE QUESTIONNAIRE

Post-Course Evaluation

Knowledge of Leave No Trace Principles

Name: _____ (We need your name to associate this survey with your previous surveys – we will not associate names with any survey responses.)

Please answer the following questions as they relate to the most appropriate Leave No Trace practices in a **backcountry** setting.

1. When cooking, it is best to...
 - A. Burn all your leftovers.
 - B. Eat the leftovers and bury the wrappers.
 - C. Cook only what you need and pack out the wrappers.
 - D. Eat leftovers the next day and burn the wrappers.
2. If campfires are permitted, how should you gather wood?
 - A. Break dead branches from trees.
 - B. Saw dead limbs from a fallen tree.
 - C. Gather pieces of wood from the ground that can be easily broken.
 - D. Saw downed logs into manageable lengths
3. When you are hiking on a trail with beautiful wildflowers, you should...
 - A. Stay on the trail and take only one flower.
 - B. Walk away from the trail and take a flower no one can see.
 - C. Never pick even one flower.
 - D. Pick only dry, wilted flowers and leave the healthy plants alone.
4. For a group of twenty on a backcountry hike, it is best to...
 - A. Have the whole group camp on one site.
 - B. Split up and camp on separate campsites, but designate routes to a central area to eat and socialize.
 - C. Camp in small groups on separate campsites, and do not hang out or eat together.
 - D. Take the whole group into a remote area where others won't see the impacts.
5. Which of the following kinds of vegetation are the most likely to resist or recover from human trampling?
 - A. Tree seedlings
 - B. Forbs (erect-stemmed, broad-leaved plants)
 - C. Mosses
 - D. Grasses
6. When traveling through **pristine** or remote areas, an advisable LNT practice is to...
 - A. Travel away from visitor-created trails.
 - B. Walk around mud puddles and downed trees.
 - C. Always use preexisting trails.
 - D. Travel in large groups to ensure group safety.

7. The only waste that is acceptable to leave in the backcountry is...
- A. Orange peels.
 - B. Toilet paper.
 - C. Burned garbage.
 - D. Human waste.
8. While hiking, what should you do when you encounter horseback riders?
- A. Stay on the trail; you have the right-of-way.
 - B. Get off the trail on the downhill side.
 - C. Get off the trail on the uphill side.
 - D. Ask the horseback riders to yield.
9. When planning your food supply, you should...
- A. Minimize smells by ensuring food is in airtight cans or bottles.
 - B. Re-pack dried or freeze-dried food into lightweight plastic bags.
 - C. Leave food in original packaging and put it in stuff sacks or plastic bags.
 - D. Take only fresh food.
10. When walking through an open gate on a trail, you should...
- A. Close the gate behind you.
 - B. Leave the gate as you found it.
 - C. Prop the gate open so it doesn't close accidentally.
 - D. Head towards the closest ranger station to report the open gate.
11. Which of the following actions does **not** demonstrate consideration for other visitors?
- A. Selecting campsites out of sight and hearing of other campers.
 - B. Camping in an open meadow.
 - C. Camping in small groups.
 - D. Taking breaks off-trail.
12. Which of the following actions should be taken when breaking camp?
- A. Leave any leftover wood you have cut for the next campers.
 - B. Leave any makeshift furniture you have created.
 - C. Brush off tents and ground tarps to avoid transporting non-native plant species.
 - D. Rake your site to clear debris.
13. When camping in **popular** or high-use areas...
- A. Scatter your activity beyond established campsites to permit their recovery.
 - B. Concentrate use on existing trails and campsites.
 - C. Find a vegetated area to pitch your tent.
 - D. Disperse your group over a wide area.
14. When selecting a campsite, you should choose a site...
- A. Close to a water source.
 - B. Near the trail.
 - C. In an open area.
 - D. Away from lakes, streams, and trails.

15. The primary argument for leaving a deer antler instead of keeping it as a souvenir is...
- A. To avoid disturbing fragile ecosystems.
 - B. To allow others to enjoy the object.
 - C. So that its nutrients can return to the soil.
 - D. So scientists can learn about deer behavior.
16. How should dirty dishwater be disposed?
- A. Throw it in the bushes away from the eating area.
 - B. Strain out food particles and scatter the dishwater.
 - C. Pour it into a stream.
 - D. Use it to put out the campfire.
17. What is the best way to dispose of human waste (feces)?
- A. Dig a large, deep hole and have everyone use it.
 - B. Deposit human waste on the ground and cover it with rocks.
 - C. Deposit human waste on the ground away from campsites.
 - D. Deposit human waste in a small hole.
18. Wildlife are **least** sensitive to disturbance from recreationists...
- A. In the winter.
 - B. During the nesting season.
 - C. When raising young.
 - D. In late summer.
19. If you use an existing rock fire ring for your campfire, you should...
- A. Dismantle the ring after you're finished.
 - B. Leave the fire ring free of excess ashes, burned wood and trash.
 - C. Collect extra firewood to leave for other visitors.
 - D. Move rocks and logs close to the ring to sit on.
20. Of the learned responses that wildlife may exhibit around visitors, which is least desired?
- A. Fear
 - B. Attraction
 - C. Avoidance
 - D. Indifference
21. What should you do when you see wildlife approaching your campsite?
- A. Make lots of noise to scare the animal away.
 - B. Sneak up close to the animal to get a good look.
 - C. Put food on the ground to feed the animal.
 - D. Be quiet and try not to startle the animal.
22. What should you do with the ashes from your campfire?
- A. Bury the ashes in the ground.
 - B. Throw the ashes into a fast moving stream.
 - C. Scatter the ashes away from camp.
 - D. Leave the ashes in the fire pit.
23. The best time to visit a popular backcountry or wilderness area is...
- A. During the week rather than on weekends.

- B. Early in the season.
- C. Late in the season.
- D. Any of the above.

24. What should you do to avoid dangerous encounters with bears?

- A. Carry a firearm with you.
- B. Put your food and garbage in a bag and hang it.
- C. Bury your garbage and leftover food in the ground.
- D. Keep all food in your tent at night.

25. What is the best procedure for traveling off-trail through a **pristine** area?

- A. Have the group walk in single file.
- B. Create trail markers out of natural materials so that everyone can follow the same route.
- C. Give everyone compass headings and a map with the route marked on it.
- D. Disperse over a wide area.

Leave No Trace Ethics

Please read each of the following statements and indicate your level of agreement.

Statement	Strongly disagree	Neutral	Strongly agree
1. Cutting a switchback is OK, especially when I am in a hurry.	1 2 3 4 5 6 7		
2. It's OK to camp close to another group in the wilderness.	1 2 3 4 5 6 7		
3. Public land managers should be able to limit visitation to protect park resources.	1 2 3 4 5 6 7		
4. The native animals that live in parks and forests have a greater right to live undisturbed than my right to visit these places.	1 2 3 4 5 6 7		
5. I should have a right to camp on public lands any time I want.	1 2 3 4 5 6 7		
6. If I want a campfire and there isn't a fire ring present, I should gather some rocks and build one.	1 2 3 4 5 6 7		
7. Outdoor visitors have a moral responsibility to avoid or minimize their impacts to natural environments.	1 2 3 4 5 6 7		
8. I would postpone a trip to my favorite area if I thought my visit would be harmful to wildlife at that time.	1 2 3 4 5 6 7		
9. Selecting an attractive place to camp is more important to me than finding a durable campsite.	1 2 3 4 5 6 7		
10. I should have a right to camp on public lands anywhere I want.	1 2 3 4 5 6 7		
11. Collecting a few interesting rocks or feathers as souvenirs of my outdoor visit is OK.	1 2 3 4 5 6 7		
12. The natural environment is very fragile and easily degraded by visitor use.	1 2 3 4 5 6 7		
13. I should use low-impact camping and hiking practices or stay home.	1 2 3 4 5 6 7		
14. It's OK to move up close to wildlife to get a good look.	1 2 3 4 5 6 7		
15. It's best to leave a deer antler for others to find.	1 2 3 4 5 6 7		
16. It's acceptable to feed wildlife human food.	1 2 3 4 5 6 7		

FOLLOW-UP LETTER AND QUESTIONNAIRE



<DATE>

<NAME>

<ADDRESS>

<TOWN,STATE,ZIP>



Thank you for your participation in the Leave No Trace Trainer course evaluation. It has now been about 4 months since the completion of your course. The final component of our study is a follow-up to evaluate how Trainer course participants have retained and applied their knowledge of Leave No Trace skills and ethics. We also ask how you may have taught Leave No Trace to others.

The Leave No Trace Center for Outdoor Ethics is interested in knowing how you may have used your Leave No Trace skills since completing the course. Your input will help Leave No Trace to improve its curriculum and enhance its program.

Your answers to this survey and those completed during your course are completely confidential. Although a comparison will be made among these three surveys, the results will only be released as summaries. Your first two surveys have been assigned a 4-digit ID number. Your ID number is written at the top of the enclosed survey. Please take the time to complete the survey, and return it in the envelope provided. If you prefer to complete an on-line version of this survey, you may do so by visiting the website at <https://filebox.vt.edu/users/medaniel/Intweb.html>. Once we receive your completed survey, we will delete your name and address from the database.

Results will be available in the summer of 2004. If you would like to receive a paper copy of the results, please enclose a note with your survey or send a request to medaniel@vt.edu. We will then put your name and address on a mailing list, separate from the survey data. The results of the study will also be posted on the www.lnt.org website.

If you have any questions about the survey or this study, feel free to contact Melissa Daniels using the information below.

Thank you for your help with this important study.

Sincerely,

Jeff Marion
Chairperson – LNT Education Review Committee
Cooperative Park Studies Unit
Virginia Tech/Forestry (0324)
Blacksburg, VA 24061
jmarion@vt.edu
540-231-6603

Melissa Daniels
Graduate Research Assistant
Cooperative Park Studies Unit
Virginia Tech/Forestry (0324)
Blacksburg, VA 24061
medaniel@vt.edu
540-231-3596

(E-mail notice)

Dear <NAME>

Thank you for your participation in the Leave No Trace Trainer course evaluation. It has now been about 4 months since the completion of your course. The final component of our study is a follow-up to evaluate how Trainer course participants have retained and applied their knowledge of Leave No Trace skills and ethics. We also ask how you may have taught Leave No Trace to others.

The Leave No Trace Center for Outdoor Ethics is interested in knowing how you may have used your Leave No Trace skills since completing the course. Your input will help Leave No Trace to improve its curriculum and enhance its program.

Your answers to this survey and those completed during your course are completely confidential. Although a comparison will be made among these three surveys, the results will only be released as summaries. The responses from your first two surveys have been assigned a 4-digit ID number. Your ID number is <ID>. You may access the follow-up survey by clicking on the following link, or pasting into your browser: <https://filebox.vt.edu/users/medaniel/lntweb.html>. If you prefer to complete a paper version of this survey, please reply to this e-mail or contact Melissa Daniels at the address below. Once we receive your completed survey we will delete your name and address from the database.

Results will be available in the summer of 2004. If you would like to receive a paper copy of the results, please send a request to medaniel@vt.edu. We will then put your name and address on a mailing list, separate from the survey data. The results will also be posted on the www.lnt.org website.

If you have any questions about the survey or this study, feel free to contact Melissa Daniels at using the information below.

Thank you for your help with this important study.

Sincerely,

Jeff Marion
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Blacksburg, VA 24061
jmarion@vt.edu
540-231-6603

Melissa Daniels
Graduate Research Assistant
Cooperative Park Studies Unit
Virginia Tech/Forestry (0324)
Blacksburg, VA 24061
medaniel@vt.edu
540-231-3596

Follow-Up Evaluation Teaching Leave No Trace

ID Number: _____

We would like to get an idea of the extent to which you have taught Leave No Trace to others since you took your Trainer course. Think about all the possible ways you may have shared your LNT knowledge through your work or recreational activities. These are some typical ways to teach Leave No Trace:

- 1.) Informal contacts and conversation
- 2.) Written media
- 3.) Formal frontcountry presentations or workshops
- 4.) Formal backcountry presentations or workshops

1. How often were you able to teach others about Leave No Trace since completing your Trainer course? *If you believe that none of the above situations apply to you, then choose response "f" and skip to question 11.*

- a. Every day
- b. A few times a week
- c. At least once a week
- d. Once or twice a month
- e. One or two times since I completed the course.
- f. I did not teach Leave No Trace to others.

2. Was/Is teaching Leave No Trace a part of your job or internship?

- a. No → *Skip to question 7.*
- b. Yes → *Continue with question 3.*

Please answer the following questions **as they relate to the responsibilities of your job or internship**:

3. Have you taught Leave No Trace to others through informal conversations and contacts?

- a. No → *Skip to question 4.*
- b. Yes → *Please answer the following questions:*

i. About how many people did you teach in this informal way? _____

ii. Adding across all your Leave No Trace conversations and contacts, approximately how much total time did you spend teaching Leave No Trace? _____ hours

4. Did you use any of these written media to convey a Leave No Trace message? (Mark all that were used.)

- a. Park news article
- b. Poster/sign
- c. Pamphlet/Brochure
- d. Newspaper article
- e. I did not use written media to convey a Leave No Trace message.
- f. Other _____

If you answered *a, b, c, d, or f* above, do you know how many of each type of media were distributed?

- a. No
- b. Yes → About how many of each type of media were distributed?
 - Park news article _____
 - Poster/sign _____
 - Pamphlet/Brochure _____
 - Newspaper article _____
 - Other _____

5. Have you given formal Leave No Trace presentations or workshops in a frontcountry setting (e.g., classroom or car campground)?

- a. No → *Skip to question 6.*
- b. Yes → *Please answer the following:*
 - i. How many presentations or workshops did you give? _____
 - ii. About how long on average was each of your presentations? _____ hours
 - iii. In total, about how many people did you reach with these presentations? _____

6. Did you give formal Leave No Trace presentations or workshops in the backcountry (e.g., along trails or in campsites away from roads)?

- a. No → *Skip to question 7.*
- b. Yes → *Please answer the following:*
 - i. How many presentations or workshops did you give? _____
 - ii. About how long on average was each of your presentations? _____ hours
 - iii. In total, about how many people did you reach with these presentations? _____

Please answer the following questions **as they relate to what you have done to teach Leave No Trace away from your job or internship (e.g., volunteer work):**

7. Have you taught Leave No Trace to others through informal conversations and contacts?

- a. No → *Skip to question 8.*
- b. Yes → *Please answer the following questions:*
 - i. How would you describe the people you taught? (Mark all that apply.)
 - a. family
 - b. friends
 - c. co-workers
 - d. youth group
 - e. summer camp participants
 - f. park or forest visitors
 - g. people that I just met
 - h. Other _____
 - ii. About how many people did you teach in this informal way? _____

iii. Adding across all your conversations and contacts, approximately how much total time did you spend teaching Leave No Trace? _____ hours

8. Did you use any of these written media to convey a Leave No Trace message? (Mark all that were used.)

- a. Park news article
- b. Poster/sign
- c. Pamphlet/Brochure
- d. Newspaper article
- e. I did not use written media to convey a Leave No Trace message.
- f. Other _____

If you answered *a, b, c, d, or f* for question 8, do you know how many of each type of media were distributed?

- a. No
- b. Yes → About how many of each type of media were distributed?
 - Park news article _____
 - Poster/sign _____
 - Pamphlet/Brochure _____
 - Newspaper article _____
 - Other _____

9. Have you given formal Leave No Trace presentations or workshops in a frontcountry setting (e.g., classroom or car campground)?

- a. No → *Skip to question 10.*
- b. Yes → *Please answer the following:*

- i. How many presentations or workshops did you give? _____
- ii. About how long on average was each of your presentations? _____ hours
- iii. In total, about how many people did you reach with these presentations?

10. Did you give formal Leave No Trace presentations or workshops in the backcountry?

- a. No → *Skip to question 11.*
- b. Yes → *Please answer the following:*

- i. How many presentations or workshops did you give? _____
- ii. About how long on average was each of your presentations? _____ hours
- iii. In total, about how many people did you reach with these presentations?

11. Which of the following actions have you taken since completing the Leave No Trace Trainer course? (Mark all that apply.)

- a. Became a member of the Leave No Trace Center for Outdoor Ethics
 - b. Joined an environmental or conservation organization
- Which one? _____

- c. Joined an outdoor organization (like a hiking or canoeing club)
Which one? _____
- d. Co-instructed a Leave No Trace Trainer course
- e. Enrolled in a Leave No Trace Master course
- f. I have taken none of the above actions since completing my Leave No Trace Trainer course.

12. If you have not already done so, do you have plans to do any of the following within the next year? (Mark all that apply.)

- a. Become a member of the Leave No Trace Center for Outdoor Ethics
- b. Join an environmental or conservation organization
Which one? _____
- c. Join an outdoor organization (like a hiking or canoeing club)
Which one? _____
- d. Co-instruct a Leave No Trace Trainer course
- e. Enroll in a Leave No Trace Master course
- f. I plan to take none of the above actions in the next year.

13. Do you plan to teach Leave No Trace messages in the future?

- a. No
- b. Yes → *Please answer each of the following:*
 - i. Do you plan to do this while on the job or during non-work (e.g., volunteer) time?
 - a. On the job
 - b. During non-work time
 - c. Both on the job and during non-work time.
 - ii. How do you plan to do this? (Mark all that apply.)
 - a. informal contacts or conversation
 - b. written media
 - c. formal frontcountry presentations or workshops
 - d. formal backcountry presentations or workshops
 - e. Some other way: _____

Knowledge of Leave No Trace Principles

Please answer the following questions as they relate to the most appropriate Leave No Trace practices in a **backcountry** setting.

1. Of the learned responses that wildlife may exhibit around visitors, which is least desired?
 - A. Indifference
 - B. Fear
 - C. Avoidance
 - D. Attraction
2. For a group of twenty on a backcountry hike, it is best to...
 - A. Camp in small groups on separate campsites, and do not hang out or eat together.
 - B. Take the whole group into a remote area where others won't see the impacts.
 - C. Have the whole group camp on one site.
 - D. Split up and camp on separate campsites, but designate routes to a central area to eat and socialize.
3. The best time to visit a popular backcountry or wilderness area is...
 - A. Early in the season.
 - B. Late in the season.
 - C. During the week rather than on weekends.
 - D. Any of the above.
4. When cooking, it is best to...
 - A. Burn all your leftovers.
 - B. Eat the leftovers and bury the wrappers.
 - C. Cook only what you need and pack out the wrappers.
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5. When traveling through **pristine** or remote areas, an advisable LNT practice is to...
 - A. Travel away from visitor-created trails.
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 - C. Travel in large groups to ensure group safety.
 - D. Walk around mud puddles and downed trees.
6. What should you do to avoid dangerous encounters with bears?
 - A. Carry a firearm with you.
 - B. Put your food and garbage in a bag and hang it.
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8. When planning your food supply, you should...
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 - D. Take only fresh food.
9. Which of the following actions does **not** demonstrate consideration for other visitors?
- A. Camping in an open meadow.
 - B. Selecting campsites out of sight and hearing of other campers.
 - C. Taking breaks off-trail.
 - D. Camping in small groups.
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12. If you use an existing rock fire ring for your campfire, you should...
- A. Leave the fire ring free of excess ashes, burned wood and trash.
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 - B. Human waste.
 - C. Burned garbage.
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19. What should you do when you see wildlife approaching your campsite?
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 - B. Make lots of noise to scare the animal away.
 - C. Be quiet and try not to startle the animal.
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 - C. Near the trail.
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 - B. Bury the ashes in the ground.
 - C. Leave the ashes in the fire pit.
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24. What is the best procedure for traveling off-trail through a **pristine** area?
- A. Disperse over a wide area.
 - B. Create trail markers out of natural materials so that everyone can follow the same route.
 - C. Have the group walk in single file.
 - D. Give everyone compass headings and a map with the route marked on it.
25. If campfires are permitted, how should you gather wood?
- A. Saw downed logs into manageable lengths
 - B. Gather pieces of wood from the ground that can be easily broken.
 - C. Saw dead limbs from a fallen tree.
 - D. Break dead branches from trees.

Leave No Trace Ethics

Please read each of the following statements and indicate your level of agreement.

Statement	Strongly disagree	Neutral	Strongly agree
1. If I want a campfire and there isn't a fire ring present, I should gather some rocks and build one.	1	2 3 4	5 6 7
2. Public land managers should be able to limit visitation to protect park resources.	1	2 3 4	5 6 7
3. Collecting a few interesting rocks or feathers as souvenirs of my outdoor visit is OK.	1	2 3 4	5 6 7
4. I should use low-impact camping and hiking practices or stay home.	1	2 3 4	5 6 7
5. I should have a right to camp on public lands anywhere I want.	1	2 3 4	5 6 7
6. Cutting a switchback is OK, especially when I am in a hurry.	1	2 3 4	5 6 7
7. It's OK to move up close to wildlife to get a good look.	1	2 3 4	5 6 7
8. I would postpone a trip to my favorite area if I thought my visit would be harmful to wildlife at that time.	1	2 3 4	5 6 7
9. The natural environment is very fragile and easily degraded by visitor use.	1	2 3 4	5 6 7
10. It's OK to camp close to another group in the wilderness.	1	2 3 4	5 6 7
11. It's acceptable to feed wildlife human food.	1	2 3 4	5 6 7
12. The native animals that live in parks and forests have a greater right to live undisturbed than my right to visit these places.	1	2 3 4	5 6 7
13. Selecting an attractive place to camp is more important to me than finding a durable campsite.	1	2 3 4	5 6 7
14. I should have a right to camp on public lands any time I want.	1	2 3 4	5 6 7
15. Outdoor visitors have a moral responsibility to avoid or minimize their impacts to natural environments.	1	2 3 4	5 6 7
16. It's best to leave a deer antler for others to find.	1	2 3 4	5 6 7

My Camping Practices

Have you taken a backcountry camping trip since you completed your LNT Trainer course?

- a. No → *Skip to the "Final Comments" section of this survey.*
- b. Yes → *Please respond to the questions below in terms of that outing.*

1. About how many months ago was this trip? _____
2. How many nights did you camp? _____
3. How would you describe your group?
 - a. Friends
 - b. Family
 - c. Organized group—scout or youth group
 - d. Organized group—summer camp
 - e. Organized group—college group
 - f. Organized group—Commercial (i.e., you paid an outfitter or trip organizer)
 - g. Other: _____
4. What was your mode of travel for this camping trip?
 - a. Hiking
 - b. Canoe or other watercraft
 - c. Horseback riding
 - d. Other _____

Describe your behavior on your recent camping trip:

*Please be truthful and select the response that most closely corresponds to your **actual behavior**. This is very important! We've provided space for comments if you would like to clarify what you did or explain why you did it.*

5. During my trip I:
 - a) Built a campfire using downed wood that I could easily break by hand.
 - b) Built a campfire using wood that could not be broken by hand.
 - c) Never built a campfire.Comments: _____
6. Before leaving on my trip, I:
 - a) Was well aware of the area's camping regulations or recommended practices.
 - b) Was somewhat aware of the area's camping regulations or recommended practices.
 - c) Had no knowledge of my destination area's camping regulations or recommended practices.Comments: _____
7. From my trip I:
 - a) Didn't keep anything from the area I visited.
 - b) Kept one souvenir.
 - c) Kept several souvenirs that I found (e.g., rock, feather, piece of driftwood).Comments: _____

8. During my trip, I generally placed my tent on a spot with:
- Grasses or sedges.
 - Bare soil, rock, gravel or sand.
 - Forbs (erect-stemmed, broad-leaved plants).
- Comments:
9. Before leaving on my trip I:
- Left my food in the original packaging.
 - Repackaged some of my food to minimize the trash I would have to pack out.
 - Repackaged most of my food to minimize the trash I would have to pack out.
- Comments:
10. After washing dishes I:
- Poured the dishwater onto the ground.
 - Scattered the dishwater away from camp.
 - Strained the dishwater to remove food particles and then scattered it away from camp.
- Comments:
11. During my trip I:
- Took no precautions to keep wildlife (e.g., bears, raccoons, mice) from getting into my food.
 - Took a few precautions to protect my food but didn't hang it or use an animal-proof container.
 - Hung my food or placed it in a container specifically designed to protect it from wildlife.
- Comments:
12. I disposed of the trash and leftover food during my camping trip by:
- Burning it in a campfire.
 - Burning some items and packing out others
 - Packing out all trash and leftovers.
- Comments:
13. On my trip I:
- Camped where I could easily see and hear another group.
 - Camped where I could barely see and hear another group.
 - Camped where I could not see or hear another group.
- Comments:
14. When hiking through popular areas during my trip I:
- Did not stay on designated or well-established trails.
 - Sometimes stayed on designated or well-established trails.
 - Always stayed on designated or well-established trails.
- Comments:

Final Comments

Thank you for your help with this study. If you have any final comments about this study or your Leave No Trace Trainer course, please include a note with your completed survey.

VITA

Melissa Lynn Daniels was born May 7, 1979, in Annapolis, Maryland, and has always been fascinated by the outdoors. She reinforced her interest in nature by completing a Bachelor of Arts degree in Biology at St. Mary's College of Maryland in May 2001. Her interest in outdoor recreation was nurtured by several years of backpacking and canoeing adventures with the Girl Scouts and the Boy Scout Explorer program, as well as several summers working for the Boy Scouts at Philmont Scout Ranch in New Mexico. In the fall of 2002, Melissa enrolled in Department of Forestry at Virginia Tech to pursue a Master of Science degree. She completed this in May of 2004. Melissa's career interests include environmental interpretation, biological monitoring, and park management.