

ABSTRACT

CLARK, AMANDA BROWNING. Exploring Relationships between Management Actions and the Visitor Experience to Reduce Off-Trail Hiking in the Potomac Gorge, Maryland. (Under the direction of Dr. Yu-Fai Leung).

The number of people recreating on America's natural trails is increasing, posing a challenge for management to lessen the impact of depreciative behaviors on natural resources. The problem of off-trail hiking is of particular concern along the Billy Goat Trail in the C&O Canal National Historic Park in Maryland, where repeated off-trail hiking occurs in an area with over 50 species of rare plants despite the past efforts of park management to deter the offenders. Scientists from North Carolina State University and Virginia Tech implemented a National Park Service funded program of research in 2007 to evaluate the efficacy of four treatments designed to discourage off-trail hiking. Treatment efficacy was evaluated through a visitor survey and direct observation of visitor behavior. This thesis reports results from two studies that analyzed data from the visitor survey.

The first study focused on participants of the control survey to understand visitors' experience use history (EUH) on the trail in relation to place attachment, reported behaviors, and attitudes toward management. Participants were divided into four EUH categories (beginner, local, visitor, veteran) for comparison with other characteristics. Veterans had the most experience and rated place identity items the highest, while locals had significant experience only at the Billy Goat Trail and rated place dependence items higher than the other groups. Over 70% of the entire control group admitted hiking off the official trail intentionally, while only 45.2% of "locals" left the trail intentionally. There was no significant difference across EUH groups regarding attitudes toward management actions, although as a whole the group favored indirect management actions like educational signs

and brushing. Segmenting visitors into categories based on experience proved a useful way for managers to understand who might be more or less amenable to proposed management actions.

The second study examined the additive treatments to evaluate the best option in terms of reducing off-trail hiking and maintaining a quality visitor experience. While personal contact with a trail steward was most effective in reducing off-trail hiking, it was only perceived as an acceptable action and a positive experience when experienced directly. Treatments involving brushing the trail, and applying restoration and fencing were second most effective, yet perceived as both more positive and acceptable by visitors who experienced them during the study. Examining variations of effects on the visitor experience, brushing (including an educational sign at the trailhead and “no hiking” signs at informal trails) is recommended as the optimal solution.

By understanding the study populations through these two assessments, managers can gain increased clarity about the users and their potential responses to management changes to implement an optimal solution for visitors and the Bear Island ecosystem. Several management considerations are addressed at the end of this thesis, and suggestions are made as to the future successful management of the trail and interpretation of visitor survey data.

Exploring Relationships between Management Actions and the Visitor Experience to
Reduce Off-Trail Hiking in the Potomac Gorge, Maryland

by
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DEDICATION

This thesis is dedicated to my loving husband John for his patience and support during the past two years of classes and research, and for braving several sweltering weekends in 2007 to help collect survey data. Also to my parents, Jim and Lynn Strandquist, for their constant encouragement to pursue what I enjoy and for the many adventures of my childhood that made me truly love the outdoors.

BIOGRAPHY

Amanda was born on February 5, 1982 in Maryland, where she spent her entire life until college exploring the pre-housing boom countryside. She earned a B.S. in Environmental Studies from Elon University in 2004. During her years at Elon, Amanda spent many hours promoting fitness and the outdoor program for Elon's Campus Recreation center. She participated in and led several outdoor adventure trips and spent ample time in the pottery studio perfecting her skills. During the fall of 2002, Amanda ventured to Kenya with the School for Field Studies and spent a semester learning about the importance of tourism and conservation in the African wilderness. This soon prompted a greater interest in the human aspect of resource management and subsequent interests in ecotourism and the role of outdoor recreation as parts of the human experience.

After graduating, she spent two years working in conservation for the Association for Zoos and Aquariums before deciding to pursue a degree in outdoor recreation management. After receiving her Master's degree, Amanda hopes to work with community-based organizations to encourage physical activity and increased exposure to nature among children and adults. She also plans to continue following her other "hobbies" of pastel art, running, and surfing.

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CHAPTER 1: Introduction

Problem Statement

Use of trails for recreation is a popular activity in the United States. Over 76 million American hikers went on an average of 11 outings in 2005 (Leisure Trends Group, 2006). While these numbers have remained constant for the past few years, 32% of hikers now also participate in trail running. Participation in trail running continues to increase with 40.4 million Americans over age 16 involved in the activity. Individuals went on an average of 33 outings in 2005 (Leisure Trends Group, 2006). Conversely, visitation to U.S. National Parks has declined over the past 20 years (Pergams & Zaradic, 2008), a statistic that may indicate use levels are moving away from wilderness areas and into frontcountry parks managed by other entities. These numbers demonstrate the popular active outdoor lifestyle that requires the use of trails, one that is likely to grow for years to come. While trail-based recreation has many benefits and participation in hiking and trail running is continually encouraged, growth in these activities places stress on vital recreation resources. In particular, areas designated as National Parks must follow a 1916 mandate that states these places must be passed on to future generations in an “unimpaired condition” (NPS, 2006). Striking a balance between resource protection and recreation provision is a conflict continually faced by park managers.

While many parks establish regulations for recreational use, even minor rule violations such as off-trail hiking are a growing management concern. These actions destroy delicate habitat, degrade visitor experiences, and account for a significant proportion of annual repair costs (Johnson, Rugh, Vande Kamp, & Swearingen, 1994). Informal trail use is of particular concern for managers of the Chesapeake & Ohio (C&O) Canal National

Historical Park and The Nature Conservancy, who co-own and manage Bear Island and the Billy Goat Trail in Maryland. The frequency of off-trail hiking on this island that also supports numerous rare plant communities and species is one of the most salient problems reported by park management. Despite the efforts the Potomac Appalachian Trail Club (PATC) volunteers, previous attempts at closing informal (visitor-created) trails by brushing, posting signage at trail entrances, and volunteer contact with visitors have been unsuccessful in substantially reducing the amount of off-trail hiking. PATC observations showed that trail users included both runners and hikers, and that some individuals continue to use and restore the informal trails despite efforts to close them.

Following development of the Potomac Gorge Site Conservation Plan in 2001 (Allen & Flack, 2001), a collaborative project was initiated between scientists at Virginia Tech, North Carolina State University, and park management to identify resource impacts associated with on- and off- trail hiking. This larger ongoing study (2007-2009) is assessing the integrity of the Bear Island ecosystem and recreation provisions. Included in the comprehensive study are a GPS inventory of all formal and informal trails, trail condition monitoring using the problem and point assessment methods (Leung & Marion, 1999), and the treatments to informal trails assessed by a visitor survey and direct observation. The data collected for this study were obtained during the visitor survey portion as part of the larger ecological assessment.

Visitor statistics obtained for the C&O Canal National Historic Park in 2003 indicated that 71% of visitors had been to the park at least twice and that 73% of visitors were from the Maryland/Virginia/Washington DC area (Meldrum, Littlejohn, Gramann, &

Hollenhorst, 2004). Due to the high number of local and repeat visitors, it appeared that past experience and attachment to a trail might affect the success of management for the Billy Goat Trail. Previous research demonstrates that frequent and long-term users are less likely to favor current management (Schreyer, Lime, & Williams, 1984). These individuals are characterized by the experience use history (EUH) framework as veterans and locals, both of which are frequent users of a given recreation resource. Within the context of place attachment, Bricker (1998) found that while individuals with greater place dependence exhibit greater support for trail management, individuals scoring higher on place identity show less support for management practices (Bricker, 1998). These findings indicate that resistance to current management practice might be associated with individuals at certain levels of place attachment and past use experience and should be further investigated along the Billy Goat Trail.

In addition, past research into the effectiveness of various interventions to deter depreciative behaviors concluded that using multiple techniques is most effective (Littlefair, 2003; Vande Kamp, Johnson, & Swearingen, 1994). A recent study at Acadia National Park demonstrated that low fencing and signs located near informal trails were most effective (Bradford & McIntyre, 2007; Park, Manning, Marion, Lawson, & Jacobi, 2008) and a study at Mt. Rainier that showed the presence of a uniformed employee in combination with rope barriers was most effective in deterring informal trail use (Rochefort & Gibbons, 1992). Due to the effectiveness of multiple techniques in past research, this study implemented a control followed by four additive treatments to test the efficacy of various management actions. This pragmatic approach is not only more useful in testing realistic management

actions that will achieve desired results, but will add to the academic knowledge base regarding multiple management techniques on a frontcountry trail.

Study Objectives

The purpose of this research was to provide the National Park Service and The Nature Conservancy with data that describe who is using the Billy Goat Trail, characteristics of visitors who hike off-trail, effectiveness of various treatments, and their potential effect on visitor satisfaction. Since certain elements of this research are theoretical and others practical, the outcomes of this study are presented in two separate papers with unique objectives. Two specific objectives for this thesis are (1) To use the control group as a baseline for understanding the relationship between past experience on the Billy Goat Trail and level of place attachment, attitudes and opinions of management actions, and self-reported behaviors to help inform management planning, and (2) To assess management actions that effectively reduce off-trail hiking on the Billy Goat Trail and maintain opportunities for a quality visitor experience.

Thesis Overview

The second chapter of this thesis was written as a technical article aimed at an academic audience and examines the effect of Experience Use History (EUH) against place attachment, self-reported behaviors, and attitudes toward management. EUH is a common measure that categorizes individuals based on their frequency and length of time using the Billy Goat Trail and similar trails in comparison to trails at other locations (Hammit, Backlund, & Bixler, 2004). EUH is treated as an independent variable and examined in

relationship to place attachment, visitor attitudes, and behaviors to lend insight regarding depreciative users. This paper will also add to the literature on visitor behavior and deterring off-trail hiking on a frontcountry trail.

The third chapter was written for a managerial audience and addresses the more practical interpretation of visitor responses to the applied treatments. It primarily examines how a study such as this can promote management decisions that follow the dual mandate faced by many parks: protecting the resource while ensuring an enjoyable experience for visitors. The effectiveness of management actions and impact on visitor experience are examined as treatments become progressively stricter and more informative. These results will inform park management about what actions are most appropriate to achieve their desired reduction in off-trail hiking and desired recreation opportunities for the park.

Chapter four summarizes research findings and provides some universal management recommendations gleaned from the preceding chapters.

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CHAPTER 2: Linking experience use history with place attachment, self-reported behaviors and management preferences about off-trail hiking

Abstract

As participation in trail recreation continues to increase, off-trail hiking is becoming a greater problem for park managers. This is of particular concern at the C&O Canal National Historic Park in Maryland, where over 50 threatened plant species are located in a prime off-trail hiking zone along the Billy Goat Trail (BGT). While off-trail hiking is common, little is known about what visitor characteristics might prompt visitors to ignore management actions designed to deter such depreciative behavior. Data were obtained from a control group about experience use history (EUH) and place attachment, self-reported behaviors, and attitudes toward management actions. Participants were divided into four EUH categories: beginner, local, visitor, veteran. Veterans had the most experience and rated place identity items the highest. Locals had significant experience only on the BGT, and rated place dependence items highest. Over 70% of surveyed hikers admitted hiking off the official trail intentionally, while only 45% of “locals” left the trail intentionally. There was no significant difference across EUH groups on attitudes toward management actions, although as a whole the group favored indirect management actions like educational signs and brushing. In conclusion, segmenting visitors into EUH categories is a useful method for understanding characteristics that make certain groups more accepting of future management actions.

Keywords: place attachment, experience use history (EUH), off-trail hiking, visitor survey, visitor management

Introduction

The use of trails for outdoor recreation activities is popular in the United States. According to the most recent outdoor recreation participation study, 76 million Americans reported hiking and 40.4 million reported participating in trail running (Leisure Trends Group, 2006). A *Roper/Starch* poll reported similar findings, showing that the top ten outdoor recreation activities Americans participate in include walking, running/jogging, and hiking (Outdoor Recreation in America, 2004).

Simultaneously, minor depreciative behaviors such as off-trail hiking are a growing management concern in parks because they destroy delicate habitat, degrade visitor experiences, and account for a significant proportion of annual repair costs (Johnson, Rugh, Vande Kamp, & Swearingen, 1994; Lynn, 2003). Minimizing the use of informal (visitor-created) trails is of particular concern on the Billy Goat Trail (BGT), located within the Potomac Gorge in Maryland, where a high frequency of off-trail hiking occurs in an area reported as having “incompatible recreation uses and park infrastructure” in the recent Potomac Gorge Site Conservation Plan (Alan & Flack, 2001). Despite the efforts of Potomac Appalachian Trail Club (PATC) volunteers who maintain the BGT, previous attempts at brushing informal trails, posting signage at trail entrances, and volunteer contact with visitors have been unsuccessful in reducing the amount of off-trail hiking.

Numerous studies have assessed the usefulness of educational messages to reduce depreciative actions in park settings (Littlefair, 2003; Park et al., 2008). Building on earlier studies, recent research found interpretive messages (Duncan & Martin, 2002), an attribution message (Bradford & McIntyre, 2007) or an injunctive-proscriptive sign (“Please don’t go

off established paths and trails, in order to protect the Sequoias and natural vegetation in this park”) (Winter, 2005) are often most effective. Other studies found that the presence of a uniformed employee is as effective as signage in deterring depreciative behavior (Widner & Roggenbuck, 2000; Ward & Roggenbuck, 2003; Swearingen & Johnson, 1995). Using multiple techniques such as low fencing and signs near informal trails also yields high compliance rates as demonstrated in a recent study at Acadia National Park (Park et al., 2008).

While these studies and others explore the effectiveness of management options, few studies have considered why interventions to reduce depreciative behaviors may not be working (Ward & Roggenbuck, 2003). In particular, the need to explore what characteristics might cause visitors to be more or less amenable to certain actions, particularly at a resource like the Billy Goat Trail where traditional management actions have not yielded the desired outcomes. Several authors suggest further exploration of how place attachment (Warzecha & Lime, 2001) and Experience Use History (EUH) (McFarlane, Boxall, & Watson, 1998) can help characterize reactions to management, therefore informing management planning. Visitor survey research on the Billy Goat Trail examined such visitor characteristics in the context of a larger study with the overall goal to reduce off-trail hiking and the proliferation of informal trails. Specifically, this paper examines the relationship between past experience on the Billy Goat Trail and level of place attachment, attitudes and opinions of management actions, and self-reported behaviors to help inform park management decision making.

Related Research

In the context of outdoor recreation, a person's attachment to and past experience of a specific resource are powerful constructs that can provide insight to visitor preferences and behaviors. When examined in relation to users' tendencies to hike off-trail, recognizing attributes of these users provides insight about why depreciative behavior occurs.

Understanding the level of place attachment and past experience of such users is likely to aid in implementing effective management strategies and actions.

Experience Use History

The concept of experience use history (EUH) is an important aspect of resource use, as it "represents the type, amount, and diversity of information available to the individual through previous participation" (Schreyer, Lime, & Williams, 1984, p. 35). The idea of using past experience to understand users stems from Bryan's (1977) concept of specialization. Specialization uses a composite of behavioral and affective factors to understand progression in an activity from novice, to established, to specialized users (Bryan, 1977). There is some disagreement as to whether past experience should be measured individually or as a component of specialization. Both methods have been used with varying success, but Scott & Shafer (2001) recently concluded that past experience should not be considered a comprehensive measure of specialization because it does not adequately capture the desire or success of increasing skills and knowledge. Hammitt, Backlund & Bixler (2004) used an indexed measure of EUH and concluded that dividing users into meaningful subgroups to evaluate other constructs was empirically useful. For the purposes of this study,

EUH was investigated solely for its relationship to place attachment and management preferences and was not used or intended as a measure of specialization.

As a separate measure, the concept of EUH as past on-site experience can reveal relationships to behavior, individual interpretations of recreation, and psychological rewards (Schreyer et al., 1984). EUH has been used to explain relationships involving place attachment (Bricker & Kerksetter, 2000), opinions of management (Hammit & McDonald, 1983; Schreyer et al., 1984), motivations (Williams et al., 1990), perceptions of crowding (Arnberger & Brandenburg, 2007), and site choice (McFarlane et al., 1998).

Past on-site experience has primarily been measured using a combination of frequency and total experience with the study resource and the resource in general (Hammit & McDonald 1983; Hammit et al., 2004). One study of EUH operationalized the concept by asking frequency of use, self-perception of experience, and need of a map (Arnberger & Brandenburg, 2007). In one of the more detailed studies, eight questions were used to determine EUH groups through factor analysis (McFarlane et al., 1998). However, past studies usually generate EUH categories using an additive index (Arnberger & Brandenburg, 2007; Hammit & McDonald, 1983, Hammit et al., 2004). Using this information, visitors are categorized as beginners, visitors, locals, and veterans (Hammit et al., 2004), and occasionally as novices and collectors (Williams, Schreyer, & Knopf, 1990; Schreyer et al., 1984) or local residents, regional visitors, and distant visitors (Arnberger & Brandenburg, 2007).

Past on-site experience has also been investigated in relationship to management preferences. Aside from gaining better definitions of the EUH concept, this practical approach attempts to provide managers with information to aid in resource management.

Kuentzel and McDonald (1992) examined past experience as a separate dimension of specialization and related it to management preferences of Ocoee River users. Users with more past experience wanted to open the Upper Ocoee for recreational use, but were opposed to limiting commercial use, private use, or put-in times. Another perspective of the relationship with management is demonstrated by a study of urban natural areas, where people with more environmental experience from using parks in the past had a significantly different attitude toward management practices (Ryan, 2005).

Similar research focuses on anglers and relates measures of past experience via the specialization framework to attitudes toward management. Oh and Ditton (2006) demonstrate the usefulness of understanding visitor attitudes toward management in relation to their level of specialization. While this is a more complete measure of activity participation than EUH, the study demonstrated that segmenting users based on their participation in an activity can lead to useful management conclusions such as that the most specialized anglers preferred the most relaxed rules (Oh & Ditton, 2006). In a similar study of anglers, level of support for management regulations was largely affected by how participants perceived regulation changes would alter the experience (Wilde & Ditton, 1999 in Oh & Ditton, 2006).

Few studies look at the relationship between past use and visitor behavior. One European national park study found that visitors categorized as “locals” because their use rates were highest had a higher rate of displacement and changing their use behavior in response to crowding (Arnberger & Brandenberg, 2007). A separate study of a Canadian wilderness area found a relationship between past experience and site choice behavior. As visitors gained more experience at the park, they chose more difficult locations for their

activity (McFarlane et al., 1998). This study used a comparison similar to that used by Schreyer et al. (1984) when they compared EUH levels with self-reported behaviors for river recreationists. The BGT study found differences among EUH groups when looking at their behavior for length of trips taken, outfitted vs. non-outfitted trips, and type of craft chosen. The research supports understanding attitudes toward the potential management action and resulting behaviors when contemplating changes in management of a resource in order to achieve greater visitor satisfaction.

Place Attachment

Place attachment has been repeatedly shown to relate to experience use history and past experience, thereby giving insight into visitor behaviors (Bricker & Kerstetter, 2000; Moore & Graefe, 1994; Williams et al., 1992). While experience use history provides a more practical set of independent variables through which to investigate attitudes toward management, place attachment allows for a more theoretical approach. Place attachment is just one form of place-based recreation research that is sometimes considered under the broader concept of sense of place or human interpretations of a setting (Jorgenson & Stedman, 2001). Some research includes place attachment as a dimension of sense of place (Jorgenson & Stedman, 2001). Other research emphasizes this difference by criticizing past research for measuring only the strength of attachment to a place and not the meanings humans give to a place, when a combination of the two will yield the most useful information (Davenport & Anderson, 2005). Nonetheless, recent place-based research has adopted means to both measure attachment and conceptualize place meanings in an effort to understand visitor responses to management.

The idea of place attachment was originally conceptualized by Tuan (1974) as a bond that forms between people and places. This idea later evolved into a measure of the extent to which people identify with specific locations and was conceptualized as functional and emotional meanings and attachments (Williams & Roggenbuck, 1989). These meanings then evolved into the traditional dimensions of place dependence and place identity as supported by numerous studies (Jorgensen & Stedman, 2001; Moore & Graefe, 1994; Williams & Vaske, 2003). Place dependence is often defined as a functional association, recognizing a place's importance for supporting a desired activity (Schreyer, Jacob, & White 1981; Williams & Roggenbuck, 1989). Place identity is a part of self identity, characterized by emotional attachment to a place with symbolic meaning (Williams & Roggenbuck, 1989; Proshansky, Fabian, & Kaminoff, 1983; Vaske & Kobrin, 2001).

Also referred to as place bonding or sense of place, the concept of place attachment receives increasing attention in the outdoor recreation field for its role as a mediator or moderator, ability to differentiate among activities, and usefulness of its underlying dimensions in informing management. There are many ways in which place attachment and the underlying dimensions of place identity and place dependence can be used to understand related constructs, including its use as either a mediator or moderator. Vaske and Kobrin (2001) measured place dependence and place identity against environmentally responsible behaviors, revealing that place identity acts as a mediator. Yet another study evaluated the entire place attachment construct as a moderator of attitudes toward user fees (Kyle, Graefe, Manning, & Bacon, 2003). This construct is even described as a necessary step between experiencing an environment and producing pro-environmental attitudes and behaviors (Ryan, 2005).

The majority of place attachment research on recreation and leisure has studied whitewater recreationists, anglers, and wilderness areas, while only a few have explored trail users. A study along the Appalachian Trail examined differences in place attachment and activity involvement between day hikers, overnight hikers, section hikers, and through hikers (Kyle et al., 2003). They found that as users rated a hike more important or pleasurable their dependence on the trail increased. A study on rail trail users conducted by Moore and Graefe (1994) found that the users exhibiting greater attachment were the most frequent users and lived closest to the trail. More recently, visitor attachment to an entire park was compared with attachment to a trail inside the park (Moore & Scott, 2003). Results showed that personal commitment to an activity and frequency of use were positively related to attachment to the trail.

While place identity and place dependence are frequently used dimensions of the place attachment construct, several studies have examined the existence of additional dimensions. In a study on place crowding, the dimension of “social bonding” was added to account for the role of social relationships and experiences (Kyle, Graefe, Manning, & Bacon, 2004). Other dimensions tested in previous research include place belongingness, rootedness, and sense of place (Moore & Graefe, 1994) and the dimension of lifestyle (Bricker & Kirksetter, 2000).

A recent study measured the EUH of trout anglers to test the extent to which the resulting index differentiated between five dimensions of a newly proposed place attachment scale (Hammitt et al., 2004; Hammitt, Backlund, & Bixler, 2006). Hammitt et al (2004, 2006) contend that while place attachment has traditionally been conceptualized using place identity and place dependence, there are a variety of interactions during recreation

experiences that might warrant additional dimensions. Basing their model on research in recreation and other disciplines, the study tested three additional dimensions of place attachment: familiarity, belongingness, and rootedness. These dimensions were conceptualized as additions to the two standard dimensions of place dependence and place identity. Familiarity is characterized by greater knowledge of a locale, often associated with pleasant experiences. Hammitt et al (2004) reference the work of Roberts (1996) in stating that familiarity is a process that aids in the development of a sense of place for resource locations, which can be further described as a “structural coupling” of humans to place. Belongingness is similar to identity, but focuses more on a social or spiritual connection to a place. Proshansky, Fabian, and Kaminoff (1983) first described place belongingness as a narrower concept of place identity that involves a social bond and development of skills in a new environment. Milligan (1998) also emphasizes the social aspect of attachment, concluding that “virtually every aspect of social life is in some sense concerned with spatial attachments” (p. 28). Rootedness to a place is often characterized by some form of long-term use. In a study of Jackson Hole residents, those who lived there the longest expressed strong commitment to their town and feelings of being “rooted” (Smaldone, Harris, & Sanyal, 2005). Taking these new dimensions into consideration, Hammitt et al (2004) tested the model on trout anglers at the Chattooga River and found support for the five-dimension model of place attachment.

Research on the relationship between place attachment and attitudes toward management as well as self-reported behaviors has not been widely applied to resource management, but several studies address the benefits this knowledge can provide. Studies of place attachment lend insights into the relationships between users and recreation places,

allowing management to provide more satisfying opportunities (Moore & Graefe, 1994). Place-based recreation research can also help expand from the traditional approach of managing for activities through the Recreation Opportunity Spectrum (ROS) to incorporating emotional concerns and needs of attached users (Eisenhauer, Krannich, & Blahna, 2000). Such insights are primarily gained by exploring behaviors and attitudes that result from varying levels of attachment. Bricker (1998) found that while individuals with greater place dependence exhibit greater support for trail management, individuals scoring higher on place identity show less support for management practices. Another study showed that as individuals developed a sense of place identity with a resource, they showed increasingly responsible environmental behavior in daily activities and at the specific location (Vaske & Kobrin, 2001). Warzecha and Lime (2001) studied attitudes of Green and Colorado River users toward potential management actions, finding that those with higher place identity were most supportive of prohibiting motorized rafts and less supportive of campsite reservations and fixed itineraries. These findings indicate that resistance to current management practice may be associated with individuals exhibiting certain levels of place attachment.

A limited number of studies investigated the relationship between place attachment and behaviors. Stedman (2002) concluded that in relation to environmental issues, people with a greater attachment and lower satisfaction were most willing to act against environmental changes. When looking at the behavioral aspect of displacement, a study of Norwegian residents showed that those with greater attachment to a given location were less likely to leave because of environmental changes (Kaltenborn, 1998). Behaviors have also been examined with respect to behavioral commitment to a given activity at a paved

suburban trail. Individuals with greater behavioral commitment had lower attachment or commitment to the park and the trail, leading to the authors' conclusion that these individuals might instead form stronger bonds with people than places (Moore & Scott, 2003).

Other studies on resource management conclude that the concept of "place" is the result of a complex interaction between people and a particular resource (Cheng, Kruger, & Daniels, 2003). Visitors to three urban natural areas in Michigan demonstrated attachment to specific physical features of certain parks, indicating that amenities within the same park are not necessarily substitutable (Ryan, 2005). Similarly, Cheng et al (2003) concluded that resources occur in meaning-filled places and are not generalizable across locations, therefore managers should look at people-place relationships not just use of the particular resource. Responses to hypothetical environmental changes in the Arctic produced similar patterns where residents with a stronger sense of place were the least likely to displace (Kaltenborn, 1998). A conclusion by Stedman (2003) points out the importance of understanding whether physical changes to a location affect attachment or if degradation can occur without a significant effect on users. Some studies have found support for the latter, concluding that visitors are likely to continue using certain resources despite negative changes (Ryan, 2005).

These findings all have implications for management and can potentially provide a new aspect to natural resource planning. Understanding attitudes and attachment has also been identified as important in creating a park management plan (Warzecha & Lime, 2001). Forest planning is cited as another field of resource management that has yet to widely incorporate the needs of attached users into planning (Mitchell, Force, Carol, & McLaughlin, 1993). The relationship between place attachment and management

preferences is one that warrants continued investigation and might best be pursued in multiple-use settings where there are current or potential conflicts with management.

Findings from previous studies indicate several gaps in the research that should be explored. While research on place attachment and experience use history is plentiful, there is still relatively little that focuses on trail use and even less that has occurred in frontcountry settings. Recent research has extensively investigated the roles of past experience and place attachment on attitudes toward proposed management changes, but little has been done to investigate the role these constructs play in a recurring resource management issue like off-trail hiking. Studies in recent years also recognize the importance of incorporating the needs of attached users and associated place meanings into natural resource management, but there is little evidence of actual application. The purpose of this study was to use visitors' experience use history to understand their level of place attachment, behaviors, and attitudes about potential management actions on the BGT. By understanding the relationship among place attachment, experience use history, behaviors, and management attitudes of visitors at a frontcountry park where off-trail hiking is a primary management concern, park officials will gain a better understanding of factors that might inhibit or facilitate proposed management actions. Specifically, this study examined responses to address the following questions:

- 1: What is the range of experience use history (EUH) and place attachment among BGT users?
- 2: What is the relationship between EUH and place attachment of BGT users?

3: What is the range of variation among behaviors and attitudes toward management acceptability?

4: What is the relationship between this range of variation and EUH?

Methods

Study Area

The Potomac Gorge is located in Maryland and is home to over 100 threatened, rare, or endangered species (The Nature Conservancy, 2005). Located immediately outside Washington, DC, it includes notable areas such as Great Falls and the C&O Canal, and offers a wide range of recreational activities including hiking, cycling, kayaking, rock climbing, and photography. The majority of visitors (64%) come to the park to walk, jog, or hike (Meldrum Littlejohn, Gramann, & Hollenhorst, 2004). The National Park Service recorded 2,809,968 visitors in 2007 (NPS, 2008), which reflects the popularity of the Potomac Gorge as a frontcountry recreation setting.

Located in the Potomac Gorge between the C&O Canal and the Potomac River is Bear Island, a 96 acre tract of land co-owned by the Nature Conservancy and the National Park Service. This island provides habitat for over 50 of Maryland's threatened, rare, and endangered species (The Nature Conservancy, 2005). Bear Island is traversed by the BGT section A, a 1.7 mile strenuous hike that is popular among visitors for its scenic views and challenging rock scrambles (Appendix 5). The trail is accessed at three points from the C&O Canal towpath: a north entrance near Great Falls, a south entrance near Angler's Inn, and a central "emergency exit" trail that bisects the BGT and is often used by visitors to create a

shorter loop hike. This popular trail cuts through the fragile ecosystem of Bear Island and receives heavy visitation in the Washington, DC metropolitan area, presenting unique management issues of interest in this study.

Data Collection

Questionnaires were administered across a randomized schedule on at least two weeknights (from 4:30pm to 7:30pm) and on two weekend days (from 10am to 6pm) during a control and each of four subsequent treatments. A control survey was given to establish a baseline for which to compare the four subsequent treatments. Only the control group was selected for analysis in this paper.

To ensure a representative sample of trail users was obtained, survey stations were randomly distributed across the north entrance, south entrance, and emergency entrance where the BGT intersects the C&O Canal towpath. Weekday survey administration was randomly conducted at either the north or south entrance and alternated for the subsequent weekday survey(s). Weekend survey administration was always conducted at the emergency entrance and at either the north or south entrance, alternating for subsequent weekend days.

Project staff and trained volunteers approached visitors exiting the trail and/or from the opposite direction along the C&O Canal towpath and asked them to fill out an eight-page onsite questionnaire (Appendix 1). If a group consisted of more than one person, the person with the most recent birthday (over age 18) was asked to complete the questionnaire. A total of 1,221 visitors completed the survey for a 66% overall response rate. This is comparable to similar on-site surveys that yielded response rates of 60% (Arnberger & Brandenburg,

2007) and 71.7% (Park, Manning, Marion, Lawson, & Jacobi, 2008). Sixteen questionnaires were later deleted from the sample because they were completed by ineligible respondents. Exploration of experience use history and place attachment in this study is only investigated for the control group (n=304) with the purpose of providing a useful baseline of visitor attitudes and behaviors prior to any subsequent management actions.

Measuring Experience Use History

Experience use history is commonly measured by questions comparing frequency of resource use and time using a particular resource (Hammitt et al., 2004, Hammitt & McDonald, 1983). The EUH measures used in this study were derived from those used by Hammitt et al., (2006) and were altered to fit the trail focus of this study.

Participants were asked the frequency of using the BGT in the past 12 months, the frequency of using any recreational trails in the past 12 months, the number of years since they first used the BGT, and the number of years since they first used any recreational trail. The frequency questions gave participants a choice of six mutually exclusive categories from which to choose one that best described their frequency of use in the past year. The mean number of trips within the chosen category was then used as that participant's frequency. For example, if they chose the category for "3-5 trips" their frequency for the EUH calculation would be four. Each participant's experience on the BGT was then calculated by adding the number of years to their frequency of use last year to obtain a single number. This number was then divided by the highest number (therefore greatest amount of experience), resulting in a ratio for each participant of their experience on the BGT. The same methods were followed to calculate experience on other recreational trails

as a group. The median was then found for BGT experience of all participants, and they were separated into those whose experience ratio was equal to or less than the median, and those who were higher. The same was done with the experience ratios for experience on other trails. Participants were segmented as beginners, locals, visitors, or veterans depending on their experience levels (Figure 1).

		Experience on the Billy Goat Trail	
		Low	High
Experience on Other Trails	Low	Beginner (Low, Low)	Locals (Low, High)
	High	Visitor (High, Low)	Veteran (High, High)

Figure 1. Experience Use History matrix

Limitations to this method of indexing users include the restricted ability of EUH to describe an individual’s experience with the activity. Past experience is often used as a component in examining specialization, but for the purposes of this study the utility of EUH was evaluated with respect to providing a management tool for categorizing visitors. A second limitation is the use of a mean frequency number based on a selected category. The participants who chose “21-50 times” and received a mean frequency number of 35.5 could have fallen in a different category on the EUH chart depending on their actual number of trips.

Measuring Place Attachment

The place attachment construct was measured using a reduced 15-item scale piloted by Hammitt and a group of researchers (C. Wynveen, personal communication, February 9,

2007). The reduced scale was the same as that pilot tested and was chosen for this study due to space constraints on the survey instrument. The scale included three questions from each of five dimensions of place attachment: familiarity, identity, dependence, rootedness, and belongingness (see Appendix 1). The full version of this new five dimension scale was proven successful in the 2004 study of trout anglers where further research was recommended on additional dimensions and the role of these and EUH in assessing visitor attitudes toward management (Hammit et al., 2004).

Measuring Attitudes and Behaviors

Questions on attitudes toward management were adapted from recent studies on off-trail hiking management actions (Park, Manning, Marion, Lawson & Jacobi, 2008). Ten items were asked on a five-point Likert-type scale to determine participants' levels of agreement on appropriateness of the management action. They included indirect and direct potential management actions, spanning the continuum from educational signs, to fencing, to a monetary fine (Appendix 1). Self-reported behaviors were measured on a dichotomous scale, where participants indicated whether they left the official trail for each of sixteen reasons.

Data Analysis

Statistical analyses were performed in SPSS version 16.0 and chosen with regards to the specific research question being asked. Missing data were treated as follows: in the ANOVA analyses they were treated "by analysis," factor analyses excluded missing cases listwise, and all descriptive analyses are reported as frequencies, automatically excluding

any missing data. Analysis of variance (ANOVA) was chosen to analyze statistical differences between the EUH groups on potential management actions, place attachment, and participant age. The control group meets the assumption that the sample is random across a normal population. Crosstabs and chi-square statistics were used to determine associations between EUH and education, gender, and self-reported behaviors. Factor analysis (principal-component extraction with a varimax rotation) was used to examine underlying inter-correlations among observed values for place attachment and for ratings of potential management actions. Due to the mutually exclusive group membership among EUH categories, discriminant analysis was also performed to determine whether place attachment and management attitudes could predict EUH group membership.

Results

The average age of the survey respondents (N=304) was 38 years old (standard dev. = 11.6) and evenly spread with respect to gender. Groups most frequently consisted of between 2-3 people and people spent a mean of 88 minutes on the trail (standard dev. = 40.5). Participants in the control group were also highly educated, with 87.9% of them reporting at least a four-year degree. In the following sections, results of the EUH categorization are presented first, followed by individual analyses of the dependent variables. An analysis with EUH after each dependent variable allows for the effects of each dependent variable to be recognized as the study addresses each of the research questions.

Experience Use History

Using the previously described methods, an EUH index of participants allowed for separation into four distinct categories. Figure 2 shows the breakdown of participants, where veterans and visitors each represent a quarter of all participants and beginners and locals represent 42% and 10% of all participants respectively. This variation in representation is likely due to the high number of first-time trail users, who all had an experience ratio of zero for the BGT and therefore loaded more participants into the beginner category. While locals only compose 10% of the control group, there were 31 individuals in this category, which is enough to compare statistically (Trochim, 2005).

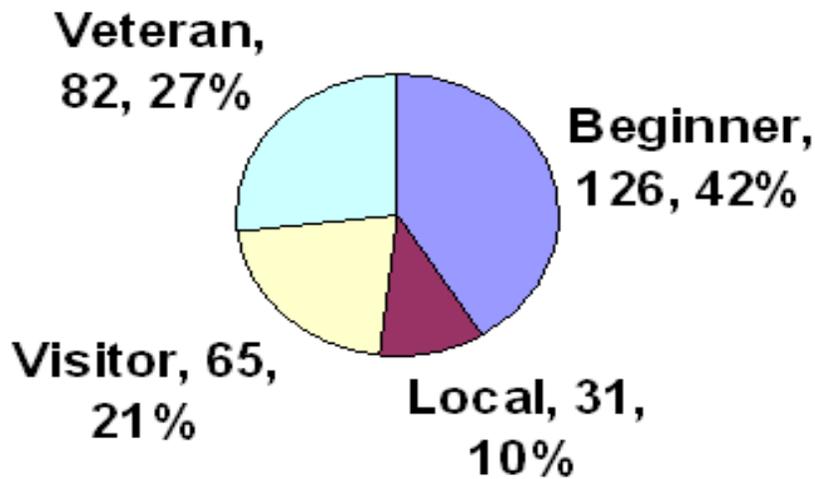


Figure 2. Frequency and Percentage of EUH Group Membership

An ANOVA between the EUH groups and participants' responses to frequency of hiking the trail and total years hiking revealed highly significant differences among groups. This result reinforces the success of using an additive index to segment EUH groups (Table 1).

Table 1. ANOVA of Frequency and Total Use among EUH groups

EUH Variables	Means				F	p
	Beginner	Local	Visitor	Veteran		
Years hiking the BGT ¹	2.37	13.26	2.57	20.12	168.9	.000
Years hiking other trails	9.63	15.84	29.75	31.43	100.7	.000
Times last year on the BGT	3.29	8.05	3.47	15.99	24.7	.000
Times last year on other trails	5.13	8.62	20.31	26.92	62.1	.000

¹ BGT = Billy Goat Trail

Visitor characteristics were also examined in reference to EUH categories. An ANOVA between EUH and participant age revealed that veterans had a significantly higher average age than any other group, and beginners were significantly younger than both visitors and veterans (Table 2). A chi-square analysis comparing EUH to gender and education levels did not reveal any significant difference (Table 3).

Table 2. ANOVA between EUH and Participant Age

	EUH Category			
	Beginner (n=124)	Visitor (n=62)	Local (n=30)	Veteran (n=81)
Mean Age¹	32.47 ^a	40.44 ^b	34.57 ^{ab}	46.02 ^c

¹ Means with dissimilar superscripts are significantly different (Scheffe $p \leq 0.05$)
 $F=31.47$, d.f. = 3, $p = .000$

Table 3. Comparison of EUH category with education level and gender

Education Level ($\chi^2=9.279$, d.f.=6, p=.159)	EUH Category			
	Beginner (n=122)	Visitor (n=65)	Local (n=30)	Veteran (n=80)
Less than 4-year degree	10.7%	4.6%	10.0%	13.8%
Bachelors degree	48.4	40.0	43.3	31.3
Advanced degree	40.9	55.4	46.7	55.0
Gender ($\chi^2=6.121$, d.f.=3, p=.106)	Beginner (n=123)	Visitor (n=65)	Local (n=30)	Veteran (n=82)
	Male	48.8%	44.6%	43.3%
Female	51.2	55.4	56.7	37.8

Place Attachment

A principal components factor analysis was performed on responses to the 15 place attachment items in the questionnaire. While this reduced item scale is representative of the full 26-item scale originally used, analyses using several different rotations revealed results similar to previous studies. The place attachment items used in this survey factored into only two dimensions with a total of 62.46% variance explained. The results from the varimax rotation are reported in Table 4. Interestingly, items that were representative of the same dimensions in the original instrument factored together into a dimension in this analysis. The first dimension is titled place dependence, and includes the three items that were borrowed from the place dependence dimension and the three items that were borrowed from the rootedness dimension of the full scale. The second dimension is titled place identity and includes the three items labeled place identity, belongingness, and familiarity that were borrowed from the original full length scale. Reliability tests using Cronbach’s alpha revealed high internal consistency among responses within each

dimension. In addition, factor loadings for each dimension were generally high, indicating little ambiguity.

Potential reasons for why these place attachment items did not factor into five dimensions as in the original study include the limitations of reduced scale, sample size, and characteristics of the sample population. By using a reduced 15-item scale, respondents might have missed key items that described their attachment, the inter-correlations of which could not be observed with the reduced scale. The reduced sample size of the control group might not provide enough responses to adequately discern five dimensions. Alternately, the population in this study is primarily walkers, runners, and hikers instead of anglers as used in the original study, which may trigger different responses to attachment (Hammitt et al., 2004).

Table 4. Factor analysis of place attachment items

Factored Dimension (Items)	Item Mean	Factor Loading
Place Dependence (Cronbach's alpha = .87, eigenvalue = 1.88, 24.65% of variance explained)		
I get more pleasure out of hiking/running on the Billy Goat Trail than from hiking/running on other trails	3.51	.671
I would not substitute any other area for the hiking/running I do at the Billy Goat Trail	3.06	.590
Hiking/running on the Billy Goat Trail is more important to me than hiking/running on any other trail	2.55	.756
I consider only the Billy Goat Trail when I go hiking/running	2.37	.781
I rarely ever hike/run at any place other than the Billy Goat Trail	2.31	.785
The Billy Goat Trail is the only place I desire to hike/run	2.12	.808
Place Identity (Cronbach's alpha = .94, eigenvalue = 7.49, 37.81% of variance explained; total variance explained = 62.46%)		
I am very attached to the Billy Goat Trail	3.83	.744
I have many memories of hiking/running at the Billy Goat Trail	3.66	.744
When I am at the Billy Goat Trail I feel I am part of it	3.55	.777
I feel like I belong at the Billy Goat Trail	3.43	.829
I feel connected to the Billy Goat Trail	3.39	.868
I identify strongly with the Billy Goat Trail	3.27	.828
I feel like the Billy Goat Trail is a part of me	3.22	.868
I could draw a rough map of the Billy Goat Trail	3.08	.713
I know the Billy Goat Trail like the back of my hand	2.80	.771

Means based on responses 1-5, where 1=strongly disagree to 5=strongly agree

The Relationship between Past Experience and Place Attachment

An ANOVA performed between the four EUH groups and place identity and place dependence revealed that EUH groups differ significantly in their ratings of place identity ($F = 27.9, p \leq .01$) and place dependence ($F = 17.0, p \leq .01$) items. A Scheffé test further revealed that with regard to place identity, veterans and locals rated items significantly higher than beginners and visitors (Table 5). A Scheffé test on place dependence revealed that visitors exhibit significantly less dependence on the BGT than any of the other groups,

perhaps because of their higher use of other recreational trails. Locals have the highest mean dependence score, demonstrating their reliance on the BGT for chosen activities.

Table 5. Results of an ANOVA between EUH and Place Attachment

Place Attachment Dimension Variables	Experience Use History				F	p
	Beginner (n=126)	Local (n=31)	Visitor (n=65)	Veteran (n=82)		
Place Identity	3.01 ^a	3.69 ^b	2.93 ^a	4.03 ^b	27.9	.000
Place Dependence	2.62 ^b	3.03 ^b	2.11 ^a	2.99 ^b	17.0	.000

¹ Means with dissimilar superscripts are significantly different (Scheffe $p \leq 0.05$)

Self-Reported Behaviors

Participants were asked whether they went off the official trail for a variety of reasons. The results are displayed in Table 6. The most commonly reported reasons for leaving the official trail were to get to an area of interest, to move past others, to use an existing unmarked trail, and to explore. To make the intentional behavior of users easier to compare with visitors' EUH, behaviors were reduced to a dichotomous variable (Table 7). Those who indicated they did not leave the official trail or only left the trail accidentally were placed in one category, and visitors who indicated one or more reasons for leaving the official trail were placed in the other category. An overwhelming 70.1% of control group participants reported leaving the official trail for one or more reasons, further supporting the need to better characterize visitors.

Table 6. Frequency of reasons for hiking off the official trail

Reason for hiking off-trail	Frequency	Percent
To get to a scenic vista or area of interest	138	45.4
To move past others on the trail	121	39.8
Because there was an unmarked trail that already existed	120	39.5
To explore	107	35.2
Accidentally because the trail was poorly marked	102	33.6
To get around a difficult part of the trail	90	29.6
To get away from crowds on the trail	90	29.6
To get around poor trail conditions	89	29.3
To take a picture	68	22.4
To get to a rock climbing spot	52	17.1
To get to a picnic spot	42	13.8
To view wildlife/birds	40	13.2
To view wildflowers	30	9.9
To take a route you always use	28	9.2
To get to a fishing spot	9	3.0
Bathroom break	6	2.0
Miscellaneous	4	1.3
To swim/cliff jump	2	0.7
To relax, meditate, or read	1	0.3

Table 7. Visitors Grouped by Intent to leave the official trail

Visitors went off-trail...	Frequency	Percent
Not at all or accidentally	86	28.3%
Intentionally	213	70.1%

Past Experience and Self-Reported Behaviors

A chi-square test revealed a significant association between EUH category and the dichotomous measure of self-reported behaviors ($\chi^2 = 11.832$, d.f. = 3, $p = 0.008$). While over 70% of participants in the beginner, visitor, and veteran groups intentionally hiked off the official trail, less than half of participants in the “local” category intentionally hiked off-trail.

Table 8. The influence of EUH on self-reported behaviors

Visitors left the trail...	EUH Category			
	Beginner (n=126)	Local (n=31)	Visitor (n=65)	Veteran (n=82)
Not at all or accidentally	23.0%	54.8%	27.7%	26.8%
Intentionally	73.0	45.2	72.3	73.2

$\chi^2 = 11.832$, d.f. = 3, $p = .008$

Attitudes toward Management

Participants were asked to rate the acceptability of potential management actions. The most acceptable items appeared to reflect indirect management in the form of either educational signs or restoration of trails (Table 9). Direct management actions such as trail stewards, increased ranger presence, and monetary fines were viewed as least acceptable. A factor analysis supported these results that participants had similar opinions of certain groups of potential management actions. Items relating to educational signs and brushing loaded on the first factor (hereafter termed indirect management actions) and items relating to increased ranger or trail steward presence, monetary fines, and even rules prohibiting off-trail hiking loaded on the second factor (hereafter termed direct management actions). A Cronbach’s alpha reliability test revealed high reliability at .84 for indirect management actions and .83 for direct management actions (Table 9)

Table 9. Acceptability of potential management actions.

Factored Potential Management Actions	Mean ¹	Factor Loading
Indirect Management Actions (Cronbach's alpha = .84, eigenvalue = 4.75, 32.75% of variance)		
Educational signs along the trail about the damage that can be caused by walking off-trail on rare plants	4.24	.818
Restoration of unofficial, non-blazed trails to an undisturbed state	4.14	.723
Signs directing visitors to remain on the official paint-blazed trails	4.10	.816
"No Hiking" signs posted at unofficial, non-blazed trails	3.85	.723
Blocking unofficial trails with brush and logs	3.82	.626
Improve trail conditions (eliminate mud, downed trees, etc.) ²	3.70	N/A
Direct Management Actions (Cronbach's alpha = .83, eigenvalue = 1.34, 28.23% of variance, 60.98% of total variance explained)		
Rules prohibiting visitors from hiking off of the official paint-blazed trails	3.62	.576
Volunteer trail stewards asking visitors to stay on official paint-blazed trails	3.39	.850
Increased ranger presence along trails	3.31	.838
A monetary fine for visitors who walk off the official paint-blazed trails	2.54	.764

¹Reported by mean rating on 1-5 scale, where 1= Unacceptable and 5 = Acceptable

²This item was dropped from factor analysis results because of equal loading on both factors.

Past Experience and Attitudes toward Management

EUH level was compared with ratings of acceptability for the various management actions using ANOVA. Only trail restoration triggered significantly different responses among EUH groups. It was a weak difference since post hoc tests did not reveal any statistically significant results (Table 10). The lack of significance across groups might be

attributed to the control group, where regardless of experience on the BGT none of the visitors had experienced the listed management actions and viewed them all as potential future actions. This finding also establishes a baseline for understanding the reaction of various visitor groups to future management. A given action will elicit similar feelings of acceptance from all groups, allowing management to implement practices as needed without discriminating against any group of visitors. In addition to the ANOVA, a discriminant analysis was performed to determine if responses to the potential management actions could distinguish between EUH groups. The discriminant analysis did not yield any statistically significant results. Visitor responses to potential management actions were not significant predictors of EUH group membership.

Table 10. ANOVA examining impact of EUH category on attitudes toward management

Potential Management Action	Beginner	Local	Visitor	Veteran	F	p
Educational signs along the trail about the damage that can be caused by walking off-trail on rare plants	4.20	4.16	4.38	4.22	.694	.556
Signs directing visitors to remain on the official paint-blazed trails	4.10	4.06	4.29	3.96	1.56	.199
"No Hiking" signs posted at unofficial, non-blazed trails	3.76	3.81	4.08	3.80	1.21	.307
Blocking unofficial trails with brush and logs	3.68	3.94	3.93	3.87	.854	.466
Restoration of unofficial, non-blazed trails to an undisturbed state	3.98	4.03	4.30	4.30	2.76	.043
Rules prohibiting visitors from hiking off of the official paint-blazed trails	3.55	3.68	3.83	3.54	.955	.414
A monetary fine for visitors who walk off the official paint-blazed trails	2.51	2.58	2.66	2.49	.269	.847
Increased ranger presence along trails	3.27	3.20	3.63	3.17	2.15	.094
Volunteer trail stewards asking visitors to stay on official paint-blazed trails	3.31	3.45	3.69	3.24	2.00	.114
Improve trail conditions (eliminate mud, downed trees, etc.)	3.63	3.71	3.95	3.60	1.60	.191

¹ Item in bold indicates a difference between means at the $p \leq 0.05$ level. Post hoc tests did not reveal significant differences between specific EUH groups for this item.

Discussion and Conclusions

The examination of EUH in relation to place attachment, visitor attitudes, and behaviors demonstrates that it is a useful concept in understanding visitors to the BGT. The first research question sought to determine the range of experience use history among BGT users. The four categories of beginner, local, visitor, and veteran adequately describe four distinct groups of users based on their experience at the BGT and elsewhere. Regarding characteristics of EUH groups, at an average age of 46, veterans were significantly older than participants in any other group, while gender and education remained consistent.

The second research question addressed a comparison between EUH and place attachment. Place attachment items did not factor into the predicted five dimensions. Instead, the items fell into the traditional dimensions of place identity and place dependence. When EUH groups' place attachment ratings were compared, veterans and locals rated place identity items significantly higher than beginners and visitors, and visitors rated place dependence items significantly lower than any other group. This finding is supported by past research, suggesting that the emotional dimension of place identity forms over time after frequent contact with a place (Moore & Graefe, 1994), particularly at local resources that lend themselves to repeated use (Vaske & Kobrin, 2001). Time and repeat visitation are two things afforded to the significantly older veterans who use the BGT. This link between place identity and more past experience is also noted by Brooks, Wallace, & Williams (2006) for its contribution to the place relationship. People make return trips, become more familiar with the place, grow in their relationship with the place, and experience symbolic benchmarks (Brooks, Wallace, & Williams, 2006).

The visitors who exhibit lower place dependence are likely fulfilling their trail recreation needs at other locations and therefore do not have a functional need for the trail. While not significant, the locals ranked place dependence items highest and likely have a greater functional attachment to the trail because they reported low use of other resources and this is one of their few outlets for trail-based recreation. These associations are important to bear in mind when examining favorability of potential management practices. People ranking higher on place identity are more likely to favor preservation of the resource (Vaske & Kobrin, 2001) but show less support for management practices (Bricker, 1998) or increased recreation restrictions (Warzecha & Lime, 2001).

Bearing in mind the relationships between EUH and place attachment, management decisions need to incorporate the needs of current users. The veterans who have a greater emotional attachment to an area and locals who are dependent on the resource will likely have differing opinions on management from other groups of stakeholders. In accordance with past studies, more attached users might also be more aware of issues and should therefore be identified as stakeholder groups and be more involved in management discussions (Smaldone et al., 2005).

The next objective of this study was to determine the range of variation among behaviors and attitudes toward management acceptability. In the control group, 70.1% of participants hiked off-trail intentionally. Items measuring attitudes toward management practices were subjected to a factor analysis and grouped into indirect and direct management actions. The overall results showed higher acceptability ratings for indirect management actions (educational signs, brushing) and lower acceptability ratings for direct management actions (increased ranger patrols, monetary fines). This is in accordance with

the study at Cadillac Mountain in Acadia National Park where participants also rated indirect management actions as more acceptable than direct management actions (Park et al., 2008). While the favorability of indirect management among visitors appears to be a recurring trend, other studies suggest that the impact of direct management such as personal contact can be mitigated by educational messages, resulting in increased acceptance (Swearingen & Johnson, 1995).

The final research question investigated the relationship between EUH and behaviors and attitudes toward management. When compared with reported off-trail hiking behaviors, only 45.2% of locals intentionally hiked off-trail compared with nearly 73% of the other EUH groups. Locals also indicated a greater dependence on the resource than any other group, suggesting they are more willing to follow the rules either to preserve what for them is a limited commodity or because they are more familiar with the current park policies. This finding might also reflect a heightened sensitivity to changes in the resource, as reflected in a study at the Danube flood plains where “locals” had the highest incidence of reported crowding and displacement (Arnberger & Brandenburg, 2007). Management implications from this finding focus on target populations for future actions. Since those individuals who use only the BGT appear to have the lowest incidence of intentional off-trail hiking behavior, future actions might direct attention toward visitors who lack a sense of dependence and are more familiar with other recreational trails, or beginners who are new to trail use altogether.

While control group participants ranked indirect management actions as more acceptable than direct management actions, there was no significant difference between ratings for each management practice and EUH group. This differs from other studies,

where people with more environmental experience from using parks in the past had a significantly different attitude toward management practices (Ryan, 2005). Despite the lack of significance, this finding indicates that management will not favor any one group of users by implementing a given management action. When interpreted in combination with the frequency of intentional off-trail hiking, park management can consider focusing a variety of efforts on those not familiar with the BGT and Bear Island ecosystem without worry of hindering the recreation of frequent local users.

There are several limitations and strengths to this study that warrant mentioning. EUH categories were computed from the number of years using a resource and the median frequency from a selected category. Future studies should ask participants to estimate their frequency to obtain a more valid measure. This study also focused only on the control group due to the length of analysis necessary to compare all treatments. However, such comparison is necessary in the future to fully understand the range of reactions to management actions with respect to EUH and place attachment. Additional research on place attachment might also use the full 26-item scale when trying to identify more specific dimensions of bonding. Lastly, the potential interaction effects of EUH and place attachment were not examined, but leave room for further analysis. Strengths of the study include the large sample size, measures that exhibit high reliability, and the existence of new data and supporting conclusions on frontcountry trail users. This examination of EUH and place attachment has excellent external validity with the potential for application to many frontcountry trails. Future applications of these results should take into consideration that the BGT has been in use since the early 1900s, perhaps causing some users to have considerably more years hiking here than other comparable, yet younger trails.

In conclusion, EUH is a useful construct for segmenting users to better understand characteristics of visitor groups, which could play a vital role in the success or failure of management actions. By understanding the relationship of EUH to place attachment, user behavior, and attitudes, more effective management techniques can be implemented to decrease non-compliant behavior. Using these tools to examine the control group provides a good baseline by which to understand reactions to future management practices. The results of this study will also add to the knowledge base of trail research and inform other frontcountry parks that face similar issues of non-compliance. Future research should continue to look at these items in relation to trail use to paint a more comprehensive picture of visitors and visitor behavior.

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CHAPTER 3: A comparative assessment of management actions to reduce off-trail hiking in the Potomac Gorge

Executive Summary

As off-trail hiking and other depreciative behaviors pressure park management for innovative solutions, managers must take care to abide by NPS mandates and other regulations that require the preservation of both ecological integrity and an enjoyable visitor experience. This study examines strategies of effectively reducing off-trail hiking on the Billy Goat Trail in the C&O Canal National Historic Park while maintaining high quality visitor experiences. A visitor survey gathered information on self-reported behaviors and visitor opinions of potential management actions across a control and four subsequent additive treatments. While personal contact with a trail steward was most effective in reducing off-trail hiking, it was only perceived as an acceptable action and a positive experience when experienced directly. Treatments involving brushing the trail, and applying restoration and fencing were second most effective, yet perceived as both more positive and acceptable by visitors who experienced them during the study and those who saw them as potential future management actions. In many cases, participants in the brushing treatment rated potential actions slightly more positive or acceptable than those in the restoration/fencing treatment. In conclusion, personal contact with visitors is the best option only if it can be implemented correctly and contact made with the majority of visitors. Logistical limitations to this option makes brushing (including educational sign at the trailhead and “no hiking” signs at informal trails) the most attractive solution both in terms of feasibility, effectiveness, and positive visitor experiences.

Keywords: off-trail hiking, visitor experience, Billy Goat Trail, additive treatments

Introduction

Areas managed by the National Park Service (NPS) are subject to a dual mandate set forth by the 1916 Organic Act, which states that the purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations... (NPS, 2006, p.10).

This dual purpose often leaves managers of parks at all levels struggling to maintain ecological integrity while ensuring the enjoyment of recreationists. Management actions are often implemented without considering the empirical evidence of how they might add to or detract from the experiences sought by visitors.

The Billy Goat Trail (BGT), located within the C&O Canal National Historic Park in Maryland, is at the center of such a struggle. Management is charged with finding the best solution for protecting numerous rare plants in a location where off-trail hiking abounds and previous attempts at reducing off-trail hiking were unsuccessful. The park partnered with researchers to find the most effective way of reducing off-trail hiking by collecting empirical data on optimal combinations of management actions. A visitor survey administered across a control and four additive treatments identified area use, beliefs and attitudes about management, perceived acceptability of management practices, and self-reported behaviors.

Related Research

There is a large body of literature on depreciative behaviors and methods of deterring off-trail hiking. Empirical studies evolved from focusing on single methods of deterring unwanted behaviors to combining multiple techniques and achieving greater success. The following review of past research demonstrates this progression and supports methodologies like the current study that further refine previous research by using additive techniques.

Depreciative visitor actions destroy delicate habitat, degrade visitor experiences, and account for a significant proportion of annual repair costs (Johnson, Rugh, Vande Kamp, & Swearingen, 1994; Lynn, 2003). One of the most prominent depreciative behaviors is off-trail hiking, an action that results in the formation of visitor-created informal trails. A study by Thurston and Reader (2001) measured the effects of repeated off-trail hiking in undisturbed areas, showing an 81% mean loss of vegetation density in the center zone of the new linear informal trail, and a 71% decline in the species present. The mean soil exposure also increased by 23% in these areas. Research also demonstrates that the quality of a visitor's experience is likely to decrease if degradation to a trail is present (Lynn, 2003). Understanding and minimizing the ecological disturbance caused by off-trail hiking is important to maintaining both the environmental and social aspects of the recreation experience.

Informal trail proliferation is very common and in some parks is responsible for many of the damaged areas. A study in Mount Rainier National Park on the impacts of informal trail use identified 913 degraded sites and attributed 89% of them to the presence of informal trails (Rochefort & Gibbons, 1992). Some areas appear to be more prone to off-trail hiking because many visitors who wander off the official trail are taking a shorter route

to a site of interest (Keirle & Stephens, 2004). Regardless of an area's susceptibility to off-trail hiking, this form of depreciative behavior causes hundreds of thousands of dollars in damage each year (Christensen & Clark, 1983). In an effort to reduce the damage caused by informal trail use, educational and site management techniques can be evaluated and tested for their effectiveness.

Educational Efficacy

Several studies on educational efficacy demonstrate effective methods of reducing depreciative behavior and off-trail hiking through use of signage. Early studies in wilderness settings indicated that compared with appeal, humorous, symbolic, and hybrid messages, the most effective message was a sanction sign that threatened an unpleasant outcome (Johnson & Swearingen, 1992; Swearingen & Johnson, 1994). Despite the effectiveness of sanctions, recent concerns about degrading visitor experience through threatening messages led to the suggestion that interpretive messages were at least as effective as sanction messages in eliciting desired recreation behaviors (Duncan & Martin, 2002). Interpretive messages often use images, narratives, or analogies to demonstrate the effect of the undesirable behavior on the resource. Littlefair (2004) also established support for interpretive messages in Lamington National Park, finding that a complete interpretive program reduced shortcutting on a walking tour from 100% of participants to 7%.

Several studies examined off-trail hiking to demonstrate which wording techniques are most effective. Research indicates that an attribution message ("Your feet have trampled the vegetation on this island. Please stay on the main wood chipped trail") at St. Lawrence Islands National Park was more effective than a plea message (Bradford & McIntyre, 2007).

Winter (2005) recently found that an injunctive-proscriptive sign (“Please don't go off the established paths and trails, in order to protect the Sequoias and natural vegetation in this park”) was more effective than other types of messages in reducing off-trail hiking at Kings Canyon National Park. The location of signs in relation to off-trail hiking also has significant influence. Bradford and McIntyre (2007) found that while 88.3% of visitors left the main trail when no signs were present, this number was reduced to 86.5% when signs were placed at an information booth, and to 64.7% when signs were placed at the point where informal trails intersected the official trail.

Site Management

Site management techniques are another method of deterring off-trail hiking and include physical barriers or alterations in an attempt to reduce the behavior. One of the more commonly used methods involves brushing trails with nearby logs and clippings, but often results in removal and trampling by visitors as seen in one study at an easily accessible trail along the Blue Ridge Parkway (Johnson, Bratton, & Firth, 1988). This is likely the result of lack of education about rare plants, lack of signage, and a desire to explore.

While brushing alone seems to have limited efficacy, greater success is found using multiple methods. A recent study at Acadia National Park demonstrated that low fencing and signs located near informal trails were most effective (Park, Manning, Marion, Lawson, & Jacobi, 2008) and by a study at Mt. Rainier that showed the presence of a uniformed employee and rope barriers as being most effective (Rochefort & Gibbons, 1992). Many studies that implement multiple techniques demonstrate the utility of fencing in combination with either signage or the presence of a uniformed employee. Several studies also found the

presence of a uniformed employee to be as effective as educational signage in deterring depreciative behavior (Widner & Roggenbuck, 2000; Ward & Roggenbuck, 2003; Swearingen & Johnson, 1995).

Research on depreciative behaviors over the last 20 years consistently arrives at the conclusion that a combination of multiple methods is more effective than any single method. Less clear in the research is what combinations of techniques work best and how many must work in combination to achieve desired reductions in off-trail hiking. In addition, few studies address the potential impact of management techniques on the visitor experience. The BGT study implemented additive combinations of educational and site management techniques during a control and four subsequent treatments, during which a visitor survey asked visitor opinions and behaviors corresponding with the various treatments. This study addresses the following questions:

- 1) What is the most effective technique or combination of techniques to reduce off-trail hiking based on self-reported visitor behaviors?
- 2) What is the potential impact of the various management techniques on the visitor experience?
- 3) Taking these into consideration, what is the optimal combination of management techniques to reduce off-trail hiking while maintaining a quality visitor experience?

Methods

Study Area

The Potomac Gorge is located in Maryland and is home to over 100 threatened, rare, or endangered species (The Nature Conservancy, 2005). Located immediately outside

Washington, DC, it includes notable areas such as Great Falls and the C&O Canal, and offers a wide range of recreational activities including hiking, cycling, kayaking, rock climbing, and photography. The majority of visitors (64%) come to the park to walk, jog, or hike (Meldrum, Littlejohn, Gramann, & Hollenhorst, 2004). The National Park Service recorded 2,809,968 visitors in 2007 (NPS, 2008), which reflects the popularity of the Potomac Gorge as a front-country recreation setting. Located in the Potomac Gorge between the C&O Canal and the Potomac River is Bear Island, a 96 acre tract of land co-owned by The Nature Conservancy and the National Park Service. The island is home to over 50 of Maryland's threatened, rare, and endangered species (The Nature Conservancy, 2005). The fragile ecosystem of Bear Island is traversed by the BGT section A, a 1.7 mile strenuous hike that is popular among visitors for its scenic views and challenging rock scramble. This popular trail contends with both the fragile ecosystem of Bear Island and heavy visitation in the Washington, DC metropolitan area to present unique management issues of interest in this study.

Selection of Study Sites

The BGT is located on Bear Island, and is accessed by the C&O canal at one of three official access points (Appendix 5). There are parking lots within a half mile of both the North and South access points, so the majority of visitors enter at either the North or South, hike the 1.7 mile BGT, and return via the C&O canal tow path or visa versa. There is also an "emergency exit" trail located about half way through the 1.7 mile hike from which many visitors hike a half loop or use as a bail out when the main trail gets too difficult. In order to capture users going in all possible directions, surveys were administered at each of the three sites throughout the study.

Description of Treatments

Additive combinations of educational signs and site management techniques selected based on success in past research and discussion with park management were applied along the entire 1.7 mile stretch of the BGT section A (Table 11). Additive treatments were judged necessary for several reasons. Managers had previously applied single treatments (brushing or signs) and found them to be ineffective. Johnson et al. (1988) found that visitors quickly removed or created new paths around brushing materials used to close informal trails on the Blue Ridge Parkway, possibly due to the lack of signs explaining the existence of rare plants in the area and the purpose of the obstructing materials. Thus, educational messages can communicate the management problem and what change in visitor behavior is needed to resolve it, while site management actions can hide the existence of informal trails, enhance their recovery, or provide barriers to their use. To achieve maximum protection for rare plants growing near the BGT, a principal objective was to evaluate an additive set of actions that could achieve the lowest possible levels of off-trail hiking. Managers were unwilling to consider evaluating a regulation prohibiting off-trail hiking, though limited use of symbolic fencing was approved and used in this study.

Table 11. Summary of applied management actions.

Treatment Name	Management Actions Applied					
	Trailhead educational signage	Prompter signage at informal trailheads	Informal trail brushing	Symbolic fencing	Informal trail site restoration	Personal contact
Control	No	No	No	No	No	No
Signs	Yes	Yes	No	No	No	No
Brushing	Yes	Yes	Yes	No	No	No
Restoration & Fencing	Yes	Yes	Yes	Yes	Yes	No
Personal Contact	No	Yes	Yes	Yes	Yes	Yes

Prior to collecting survey data on a control group, the existing blue blazes along the trail were re-painted. Six informal trails leading to vista sites were formalized using a white blaze to ensure visitors could access views of the Potomac River without going on an informal trail. A control survey



Figure 3. No Hiking Sign

was conducted following the procedures previously described to establish a baseline for which to compare all subsequent treatments. Treatment one involved the placement of one large educational sign close to the trailhead about 40 feet beyond each of the three BGT trailheads (Figure 4). The messaging on these signs sought to communicate information on four topics: 1) that the area they would be hiking in contained 50 species of rare plants, 2) that hikers traveling off the formal trail had harmed these species and created miles of unofficial tracks which managers want to close, 3) a plea asking visitors to remain on the paint-blazed official trail, and 4) that even a few footsteps on the unofficial trails could prevent recovery of trampled vegetation.

The text of this message was based on a careful review of previous studies that have tested alternate wording to discourage off-trail hiking. In particular, attribute theory was applied to compel visitors to personalize the problem and how a change in their personal behavior was needed to resolve it. For example, Bradford and McIntyre (2007) found that an attribution message: “Your feet have trampled the vegetation on this island. Please stay on the main wood chipped trail,” was more effective than a simple plea message. We also applied findings from Winter’s study (2005), that a sign with injunctive-proscriptive wording: “Please don’t go off the established paths and trails in order to protect the Sequoias and natural vegetation in this park,” was significantly more effective than descriptive-proscriptive, injunctive-prescriptive, and descriptive-prescriptive messages in

reducing off trail hiking at Kings Canyon National Park. The study sign resulting from these efforts was then reviewed by the NPS Harpers Ferry Center, which edited its design and color scheme to comply with NPS national sign standards. In addition to the three trailhead signs, staff mounted a 3”x 3” Vibram boot print prompter sign either on large sections of logs placed across the beginning of approximately 150 informal trails that branched off the BGT.



Figure 4. Trailhead Educational Sign

Treatment two maintained the educational signs at the trailheads and the boot print “no-hiking” signs, but added brushing consisting of leaves, rocks, and branches along the most visible portions of informal trails. This treatment was primarily designed to “hide” the initial portions of these trails, rather than to obstruct traffic, which might cause visitors to walk around the obstructions and cause additional trampling of rare plants. Treatment three retained the educational signs and brush work, adding a low rope fencing, an educational sign (worded: Restoration Area, Protect our Rare Plants, Please Stay Off and including the

boot print “no-hiking” symbol), and approximately 10-15 feet of Jute matting on the ground to simulate trail restorations at 12 selected high use informal trails. This “stewardship” treatment sought to convey that the NPS was working hard to restore areas damaged by prior off-trail foot traffic. The final treatment tested the efficacy of personal interaction with a PATC trail steward in official attire. The trailhead educational signs were covered up and the sign information was personally conveyed the trail stewards to visitors entering the trail (Appendix 6).

Data Collection

Questionnaires were administered across a randomized schedule on at least two weeknights (from 4:30pm to 7:30pm) and on two weekend days (from 10am to 6pm) during each treatment. Survey stations were randomly distributed across the north entrance, south entrance, and emergency entrance where the BGT intersects the C&O Canal towpath. Weeknight survey administration was randomly conducted at either the north or south entrance, and weekend survey administration was always conducted at the emergency entrance and at either the north or south entrance (Table 12).

Visitors exiting the trail and/or approaching from the opposite direction along the C&O Canal towpath were asked to fill out an eight-page onsite questionnaire. If a group consisted of more than one person, the person with the most recent birthday (over age 18) was asked to complete the questionnaire. A total of 1,221 visitors completed the survey for a 66.0% overall response rate. Sixteen questionnaires were later deleted from the sample because they were completed by ineligible respondents. A total of 1,205 surveys are used in the final analysis, the breakdown of which is displayed in Table 12.

Table 12. Response rates across treatments.

Treatment	Groups Contacted	Completed Surveys	Refusals	Response Rate
Control	477	304	173	63.7%
Signs	429	278	151	64.8%
Brushing	450	285	165	63.3%
Restoration & Fencing	221	170	51	76.9%
Personal Contact	249	168	81	67.5%
Overall	1826	1205	621	66.0%

Results

Out of the 1,205 participants, a slight majority were male (52.7%) and well-educated with 84.4% holding a four-year degree or higher. The mean participant age was 36, but this was the only demographic for which there was a significant difference in age among treatments causing concern that the visitors sampled under each treatment were not comparable. To account for this, an age weight variable was applied for all subsequent analyses to create the following representations of age groups in each treatment: 15% are age 18-24, 37% are age 25-34, 33% are age 35-49, and 15% are age 50-80. Regarding general trail use, the median group size was three people, the majority of visitors (54.1%) spent 1-2 hours on the trail, and 69.3% hiked the entire trail instead of cutting through at the emergency exit.

Self-reported reasons for hiking off-trail

The first objective was to determine what management techniques were most effective in deterring off-trail hiking. When asked whether they went off the official paint-blazed trail for the reasons listed, visitors generally reported a decrease in going off-trail for a given reason as the treatments built upon one another and became more restrictive.

Significant differences were found for all reasons except accidentally leaving the official trail (Table 13). Participants were then categorized based on their intent to go off-trail; whether they went off intentionally, accidentally, or not at all. The percent of individuals who cited at least one intentional reason for leaving the main trail decreased from 70.1% in the control to 43.6% in the final treatment (personal contact). Also of note are the treatments that added brushing and restoration/fencing, which both reduced intentional off-trail hiking rates to around 60% (Table 14).

Table 13. Associations between treatments and reasons why participants left the official trail (ordered by control)

Reason for hiking off-trail	Treatment ¹					χ^2	p
	Control (n=294)	Signs (n=257)	Brushing (n=275)	Restoration & Fencing (n=161)	Personal Contact (n=160)		
To get to a scenic vista or area of interest ²	46.6%	43.7%	34.3%	34.9%	16.4%	46.70	.000
To move past others on the trail ²	40.8	38.8	33.3	27.8	14.8	37.37	.000
Because there was an unmarked trail that already existed ²	39.6	32.2	25.7	24.2	18.0	29.22	.000
To explore ²	36.6	32.3	26.0	32.5	12.0	33.70	.000
Accidentally because the trail was poorly marked	34.5	35.1	29.4	26.3	28.7	5.959	.202
To get around a difficult part of the trail ²	31.3	28.1	22.3	19.3	16.5	17.89	.001
To get around poor trail conditions ²	30.7	27.3	22.8	21.4	12.4	21.12	.000
To get away from crowds on the trail ²	30.4	31.5	23.1	20.4	10.0	31.92	.000
To take a picture ²	22.4	25.5	24.0	19.9	8.8	19.27	.001
To get to a rock climbing spot ²	17.9	19.0	15.9	9.6	8.4	15.27	.004

¹ Refer to Table 3.1 for an explanation of management actions for each treatment.

² Indicates significance at $p \leq 0.05$.

Column totals might exceed 100% because respondents could choose more than one item.

Table 14. Association between treatments and self-reported behaviors

Visitors went off-trail...	Treatment ¹				
	Control (n=304)	Signs (n=278)	Brushing (n=285)	Restoration & Fencing (n=170)	Personal Contact (n=168)
Not at all	24.8%	24.6%	34.2%	37.8%	47.4%
Accidentally	4.0	3.9	4.0	2.6	9.0
Intentionally	71.1	71.5	61.7	59.7	43.6

¹ Refer to Table 3.1 for an explanation of management actions for each treatment.

Column totals may not equal 100% due to rounding.

$\chi^2 = 47.476$, d.f. = 8, $p = 0.000$

Effect of Treatments on Experience

Several questions asked participants to rate potential management actions to determine how these might affect the visitors' experiences at the trail. An ANOVA revealed that the enjoyment of participants in the personal contact treatment was less affected by trail closures than participants in the control and educational sign treatments (Table 15). Overall, participants in the brushing, restoration/fencing, and personal contact treatments experienced a smaller reduction in enjoyment due to this management action

Table 15. Participant response about whether closure of unofficial trails limited their enjoyment.

Agreement Level	Treatment ¹				
	Control (n=294)	Signs (n=255)	Brushing (n=271)	Restoration & Fencing (n=162)	Personal Contact (n=158)
Means ²	2.13 ^a	2.07 ^a	1.96 ^{ab}	1.94 ^{ab}	1.67 ^b

¹ Refer to Table 3.1 for an explanation of management actions for each treatment.

² Means with dissimilar superscripts are significantly different (Tukey $p \leq 0.05$)

Means based on a 5-point scale, from 1= Strongly Disagree to 5= Strongly Agree.

$F = 5.081$, $p = 0.000$

Participants were also asked to rate the positive or negative impact of management actions (Table 16). While all actions were rated as having a positive effect on the experience, paint blazes and boot print “no hiking” signs were rated the most positive. In almost all cases, as the treatments progressed and increased in restrictions, visitor perception of the management action became more positive. ANOVA revealed significant differences for the actions of the no hiking signs and trail stewards on the trail. In both cases, either the control or control and sign treatment participants rated the action less positively than participants in the personal contact treatment. When asked about trail stewards and paint blazes, participants in the restoration/fencing treatment viewed these as more negative than participants in the brushing treatment, although responses were still very similar for these two groups. When asked about the acceptability of potential management actions, similar trends show educational signs were the most acceptable action in most treatments (Table 17). Trail steward presence is the least acceptable action among all treatments and is significantly more acceptable in the personal contact treatment that directly experienced the trail steward interactions. The negative view of trail stewards might be due to unpleasant interactions with visitors in the past, as this was a rumor about the trail stewards commonly held by visitors who had experienced such interactions.

Table 16. Effect of potential management actions on the visitor experience across treatments.

	Treatment ¹					F	p
	Means ²						
Management Action	Control	Signs	Brushing	Restoration & Fencing	Personal Contact		
Educational signs near the trailhead	.83	.82	.89	.89	.92	.588	.671
Signs with rules near the trailhead	.80	.82	.84	.89	.96	1.23	.298
Boot print “No Hiking” signs	N/A	.82^a	.92^{ab}	1.01^{ab}	1.15^b	4.00	.008
Paint blazes on rocks and trees	1.78	1.37	1.43	1.4	1.51	1.20	.307
Using brush and logs to re-naturalize an area	N/A	N/A	.99	N/A	N/A	N/A	N/A
Trail stewards hiking the trail	.51^a	.53^a	.66^{ab}	.46^a	.96^b	6.07	.000

¹ Refer to Table 3.1 for an explanation of management actions for each treatment.

² Means with dissimilar superscripts are significantly different (Tukey $p \leq 0.05$)

Means based on a 5-point scale, from -2= very negative to 2= very positive.

Table 17. ANOVA on acceptability of management actions across treatments

Potential Management Action	Treatment ¹					F	p
	Means ²						
	Control	Signs	Brushing	Restoration & Fencing	Personal Contact		
Educational signs along the trail about the damage that can be caused by walking off-trail on rare plants	4.23	4.25	4.08	4.05	4.25	2.220	.065
Restoration of unofficial, non-blazed trails to an undisturbed state	4.10 ^a	4.24 ^{ab}	4.28 ^{ab}	4.21 ^{ab}	4.37 ^b	2.834	.024
Signs directing visitors to remain on the official paint-blazed trails	4.10	4.23	4.09	4.01	4.19	1.934	.103
Symbolic “No Hiking” prompter signs posted at unofficial, non-blazed trails	3.83 ^a	4.10 ^b	4.07 ^b	4.03 ^{ab}	4.21 ^b	4.647	.001
Blocking unofficial trails with brush and logs	3.79 ^a	4.13 ^b	4.22 ^b	4.00 ^{ab}	4.20 ^b	7.041	.000
Volunteer trail stewards asking visitors to stay on official paint-blazed trails	3.37 ^a	3.42 ^a	3.62 ^a	3.50 ^a	3.97 ^b	7.636	.000

¹ Refer to Table 3.1 for an explanation of management actions for each treatment.

² Means with dissimilar superscripts are significantly different (Tukey $p \leq 0.05$)

Reported by mean rating on 1-5 scale, where 1=Unacceptable and 5=Acceptable

Management Implications

The first research question aimed to determine the most effective technique or combination of techniques in reducing off-trail hiking at the BGT. By examining self reported behaviors, the greatest reduction in off-trail hiking resulted from the personal contact treatment (43.6% hiked off-trail). This result is similar to other studies where the most effective treatment was the presence of a uniformed employee in combination with a rope fence (Rochefort & Gibbons, 1992), or a combination of verbal appeals and educational signs (Littlefair, 2004). The next most successful treatments were the brushing and

restoration/fencing, both reducing the off-trail hiking rates to near 60%. The four most frequently cited reasons were getting to a scenic vista or area of interest, to move past others, because an unmarked trail already existed, and to explore, all of which were reduced significantly as the treatments progressed. Therefore, the most effective treatment to reduce off-trail hiking and was personal contact (the last treatment), followed by either brushing (second treatment) or restoration/fencing (third treatment) at informal trail junctions.

While implementing a larger system of volunteer trail stewards on the trail and increasing personal contact with visitors appears to be the most effective method to protect the rare plant communities from off-trail hiking, the impact of this and other management actions on the visitor experience are addressed to answer the second research question. The closure of informal trails limited the enjoyment of participants in the personal contact treatment the least. Participants in the personal contact treatment rated each management action as having a more positive impact on experience, followed closely by participants in the brushing treatment. While this bodes well for enhancing personal contact on the trail, interacting with trail stewards had the most negative effect for participants in every treatment except the personal contact treatment.

Taking into consideration the visitor experience, personal contact with a trail steward appears to be the best solution *only* if it can be effectively integrated as a regular method of management and changed from a negative to a positive experience. Otherwise, it is perceived as one of the least acceptable management actions the park can take, and the logistics of implementing consistent personal contact may make it a tough solution. A second choice would be implementing a scenario similar to treatment two (“brushing”),

including trailhead education signs, “no hiking” signs at informal trails, and brushing of informal trails. This method was rated positively by the individuals who experienced that treatment and is considered one of the most acceptable management actions by participants in every group except the control. Another feasible option is the restoration/fencing treatment, which also included educational signs. Similar to the brushing treatment, it reduced off-trail hiking by approximately the same amount and also received approval by visitors.

While the additive combination with personal contact reduced off-trail hiking by almost 30%, this number is still quite high. With nearly half of all visitors using informal trails in the most stringent treatment, the park still risks damage to rare plant communities. To reduce this number further, the park might consider increasing the frequency of patrol by trail stewards, particularly at trailheads to personally convey the information contained on trailhead signs. Additional tread maintenance to eliminate muddy sections and the installation of rock or log trail borders in some areas could also help to contain traffic to the formal tread. Adding text to the symbolic “No Hiking” prompter signs could also increase their efficacy (e.g., Please Do Not Leave Trail). Finally, a regulation that prohibits off-trail hiking on the island could be considered, along with creation of some new official trails to overlooks, fishing locations, and rock climbing sites.

The third research question addressed in this study looks to both management efficacy and impacts on the visitor experience to find an optimal solution. Using trailhead education signs, “no hiking” signs at informal trails, and brushing of informal trails appears to be the best solution because it minimizes off-trail hiking while maximizing visitor enjoyment slightly more effectively than the restoration/fencing treatment. While past

research shows brushing may also pose logistical problems due to removal by visitors or creation of new paths around the brushed area (Johnson, Bratton, & Firth, 1988), in combination with educational and prompter signs it could yield successful outcomes. If brushing is unsuccessful at this park due to removal by visitors, implementing restoration/fencing designs at informal trail junctions is also an acceptable choice.

The additive design of this research study varied from a traditional experimental design in that each treatment did not test the efficacy of a new management technique, but of a combination of techniques. The greatest strength of this design was its ability to build on previous research that recommended using multiple management techniques to achieve the greatest reduction in off-trail hiking (Park et al., 2008). A weakness of this methodology is its inability to detect the added efficacy of individual techniques since each treatment uses multiple methods.

While the BGT is a prime example of meshing effective management actions with a quality visitor experience, several limitations and methodological evaluations of the study warrant mentioning. Empirical data from this study suggest some management techniques are more effective than others. Prior to any implementation, the park needs to decide what levels are feasible based on budget and staffing and which combination of treatments they wish to implement. While the increasing effectiveness of additive treatments suggests good internal validity, managers should keep in mind that reductions in off-trail hiking are due to a given combination of treatments, not necessarily to the addition of a single new management technique. In addition, the conclusions reached in this study rely entirely on self-reported behaviors. Since visitor cognition of whether they remained on the trail is not entirely accurate, this data should be supported by observations.

The additive methods used in this study also have implications for future research outside the Potomac Gorge. They proved successful by helping to determine the effects of adding subsequent treatments, providing data that allows management to see the effectiveness of each component and to determine what combination best meets their needs. Combinations of educational messaging and site management proved the most effective methods to deter off-trail hiking. These conclusions also have good external validity and are generalizable to other frontcountry trails with a few precautions. Namely, the relatively high rates of self-reported off-trail hiking on the BGT might be due to its unique layout. Despite clear blazing, several areas of the trail remain obscure because of large cleared areas or rock outcroppings, potentially leading visitors to believe they hiked off the official trail. Other parks with clear paths throughout may have more reliable data and a lower self-reported off-trail hiking frequency. Management considerations such as this are an important decision for other frontcountry parks and will likely play an important role in conserving our nation's parks while providing feasible solutions for increased visitation.

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CHAPTER 4: General Conclusions

The papers discussed in this thesis address two distinct objectives with the goal of providing an informative picture of uses and users of the BGT. The objectives were specifically (1) To use the control group as a baseline for understanding the relationship between past experience on the BGT and level of place attachment, attitudes and opinions of management actions, and self reported behaviors to help inform management planning and (2) To assess management actions that effectively reduce off-trail hiking on the BGT while maintaining a quality visitor experience.

Examination of EUH in relation to other visitor characteristics provided a greater understanding of visitors prior to the application of any treatments on the trail. This was important in establishing a baseline for management. In particular, analysis showed that while veterans are older and feel more of an emotional bond to the trail, locals are more functionally dependent on the trail as a resource and visitors are significantly less dependent on the trail than any other visitor group. Since locals were also the only group that reported less than 50% of members intentionally hiking off the trail, management might need to focus educational efforts toward the other three visitor groups. In addition, there was no significant difference among EUH groups regarding potential management actions, indicating that management can implement actions without worry of restricting certain user groups.

These user characteristics are important to consider when looking at the effectiveness of treatments in the second thesis paper. Decreases in intentional off-trail hiking were most pronounced during the personal contact treatment (rates reduced to 43.6%), although when

this option was raised as a potential management action it received the least support from all participant groups except those individuals who directly experienced the trail stewards. The alternative of brushing informal trails (including the presence of trailhead education signs and prompter signs) decreased off-trail hiking to 61.7% and was favored by visitors. The act of restoration/fencing all informal trails was also an effective and well-accepted option.

While the effect of subsequent treatments on various visitor groups needs to be tested, the non-significant results of attitudes toward management actions in the control group leads to the conclusion that implementation of educational signs and brushing will reduce off-trail hiking and maintain a quality experience for visitors. If management chooses to implement a personal contact scenario, there is an even greater need to evaluate the impact of this last treatment on various visitor groups since there appeared to be great variability in reactions to this form of direct management during the study. It is possible that resistance to more direct forms of management comes from a certain visitor group when the management action is implemented, and survey results should be further investigated to see if there is such a difference.

This study has several internal and external validity components that are worth mentioning. After examining the reductions to off-trail hiking as a result of additive treatment application, the study appears to have good internal validity. The reduction in off-trail hiking declines as expected as treatments become progressively more restrictive. This poses a caution for generalizability to other areas, in that similar frontcountry trail managers should remember that effects of treatments in this study were due to the combination of management techniques, not necessarily to the new technique that was added. When looking at comparisons of EUH and place attachment and the external validity of this paper,

such analyses are very relevant to other frontcountry trails. Other analyses of these constructs should be wary in comparing experience levels because of the potentially greater attachment and experience obtained by BGT users who may have used this classic trail for 50 years or more.

Additional analysis of the dataset is warranted to understand the accuracy of self-reported behaviors and extend the knowledge base of EUH and place attachment in trail settings. Examination of self-reported behaviors with observed off-trail hiking behavior should be a priority for further analysis. This will be most helpful for management by showing actual observed effectiveness of each treatment. It will also allow the park to gauge the number of correctly self-reported off-trail hiking incidents in the event that they want to conduct similar visitor surveys in the future. In conjunction with this analysis, self-reported intentional off-trail hiking might be re-examined after separating several additional reasons away from the “intentional” categories in each of these studies. While these papers described behaviors as either “intentional or unintentional” or “intentional, accidentally, and not at all,” other reasons such as “to move around a crowd” can be argued as less intentional than someone who goes off trail to explore. For this reason, closer examination of reasons for hiking off trail is warranted. EUH and place attachment variables in conjunction with visitor opinions of management as presented in the first thesis paper can be analyzed with respect to the four additive treatments of this study. This will enhance the understanding of these constructs along a frontcountry trail in the recreation literature and allow park managers to understand how the opinions of distinct visitor groups change in response to different management techniques.

In conclusion, the results presented in these papers along with additional analyses of visitor survey data will provide further research on frontcountry trails and aid park managers in choosing the best management techniques for deterring off-trail hiking. It is important to note that based on empirical evidence from the visitor survey, no treatment or combination of treatments reduced off-trail hiking to a level that will not cause damage to local ecosystems on Bear Island. While most reasons for intentionally leaving the official trail decreased in frequency as management actions became more restrictive, nearly 30% of participants still went off the trail accidentally in the personal contact treatment, an act that itself can cause significant resource damage. Park management needs to address these reported levels in terms of what is acceptable. Since the area is partially owned by the National Park Service, it is subject to the dual mandate of preserving the land for the future enjoyment of others. What level of impact due to off-trail hiking is too much? While this study did not ask the acceptability of limiting the number of people on the trail or any other methods of restrictive use, this might be one option for the park to consider. Above all else, management needs to consider the growing popularity of trail use in the Washington, DC metropolitan area by tourists and residents alike with respect to visitor survey data to determine what optimal management practice is optimal for the BGT.

APPENDICES

APPENDIX 1: BILLY GOAT TRAIL VISITOR SURVEY

OMB # 1024-0224
(NPS #07-023)
Expiration Date: 12/31/2007

Billy Goat Trail Visitor Survey

2007

Date: _____

Location: Angler's Inn Emergency Exit Great Falls Tavern

Time: _____AM/PM

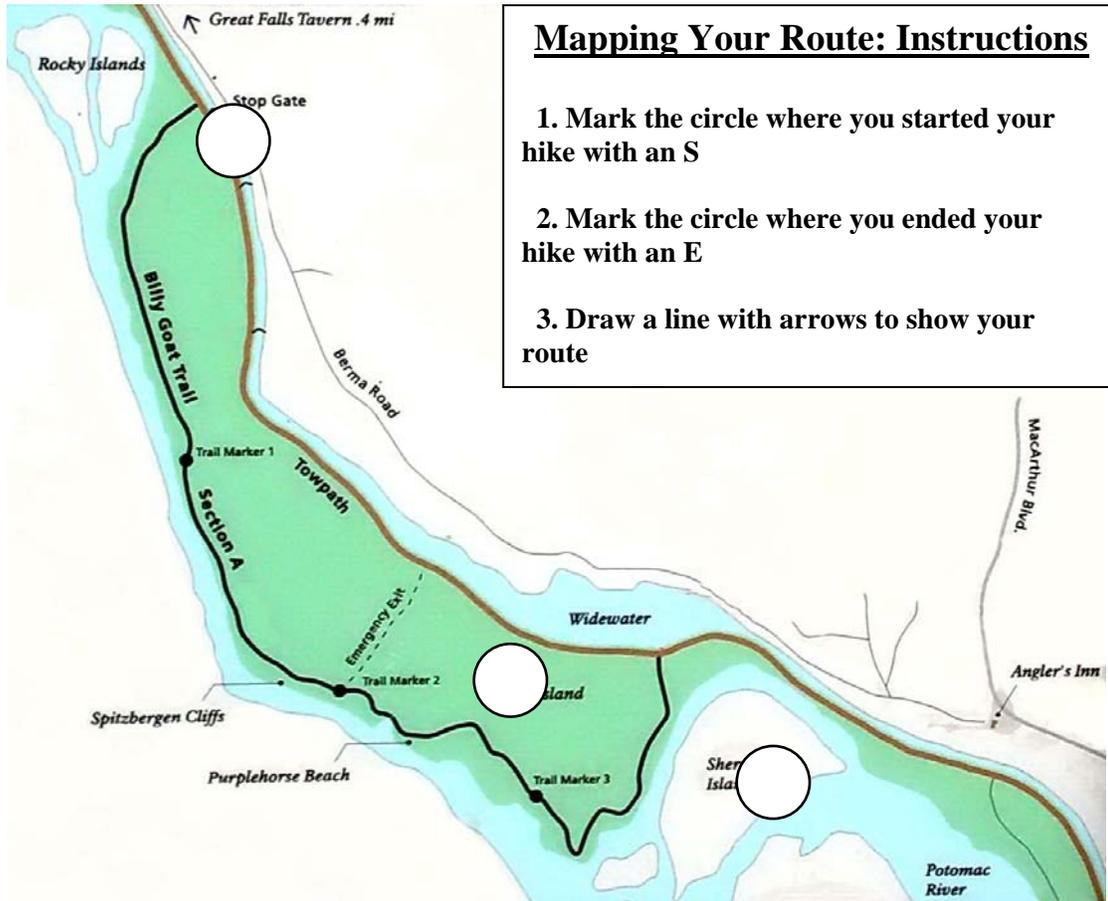
<p><i>For Researcher's Use Only</i></p> <p>Survey</p>
--

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Invent the Future

A. Trip Description

1. Please mark your hiking route on the map below (see the top right corner of the map for instructions):



2. Based on your best estimate how much time did you spend on your hike on the Billy Goat Trail TODAY (the route you indicated in the previous question)?

_____ minutes / hours (circle one)

Please answer all questions based on your visit TODAY to the Billy Goat Trail Section A on Bear Island. If part of your hike included the towpath, please consider only the Billy Goat Trail portion of your hike when answering the questions.

B. Trail Use

3. How many people are in your group TODAY (including yourself)? _____

4. Have you visited the Billy Goat Trail before? (Check one)

- Yes (Continue to Question 5)
- No (Go to Question 7)

Questions 5 & 6 refer to the BILLY GOAT TRAIL

5. To the best of your recollection, in what year did you first use the Billy Goat Trail?

Year: _____

6. Including this trip, about how many times did you run or hike on the Billy Goat Trail in the last 12 months? (Check one)

- 1-2 times
- 3-5 times
- 6-10 times
- 11-20 times
- 21-50 times
- More than 50 times

Questions 7 & 8 refer to ANY TRAIL IN A PARK SETTING

7. To the best of your recollection, in what year did you start hiking or running on trails in a park setting at ANY location?

Year: _____

8. About how many times did you run or hike on ANY trail in a park setting in the last 12 months? (Check one)

- 1-2 times
- 3-5 times
- 6-10 times
- 11-20 times
- 21-50 times

C. Activities

9a. On your Billy Goat Trail hike TODAY, which of the following activities did you participate in? (Check all that apply)

- | | | |
|--|---|--|
| <input type="checkbox"/> Hiking/Walking | <input type="checkbox"/> Photography | <input type="checkbox"/> Viewing wildlife/birding |
| <input type="checkbox"/> Running/Jogging | <input type="checkbox"/> Exploring | <input type="checkbox"/> Visiting a favorite place |
| <input type="checkbox"/> Nature Study | <input type="checkbox"/> Viewing wildflowers | <input type="checkbox"/> Off-trail Bouldering |
| <input type="checkbox"/> Fishing | <input type="checkbox"/> Rock Climbing with ropes | <input type="checkbox"/> Other (please specify) |

9b. Of the recreational activities you checked, which one was your primary activity during your visit to the Billy Goat Trail TODAY? _____

D. Visitor Opinions

10. Please indicate to what extent you agree or disagree with each of the following statements about the importance of using the Billy Goat Trail for recreation to you personally. (Circle the appropriate number)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. I rarely ever hike/run at any place other than the Billy Goat Trail.	1	2	3	4	5
b. I get more pleasure out of hiking/running on the Billy Goat Trail than from hiking/running on other trails.	1	2	3	4	5
c. I am very attached to the Billy Goat Trail.	1	2	3	4	5
d. I would not substitute any other area for the hiking/running I do at the Billy Goat Trail.	1	2	3	4	5
e. I have many memories of hiking/running at the Billy Goat Trail.	1	2	3	4	5
f. I feel like the Billy Goat Trail is a part of me.	1	2	3	4	5
g. I feel like I belong at the Billy Goat Trail.	1	2	3	4	5
h. I could draw a rough map of the Billy Goat Trail.	1	2	3	4	5
i. When I am at the Billy Goat Trail I feel I am part of it.	1	2	3	4	5
j. I consider only the Billy Goat Trail when I go hiking/running.	1	2	3	4	5
k. I feel connected to the Billy Goat Trail.	1	2	3	4	5
l. I identify strongly with the Billy Goat Trail.	1	2	3	4	5
m. I know the Billy Goat Trail like the back of my hand.	1	2	3	4	5
n. Hiking/running on the Billy Goat Trail is more important to me than hiking/running on any other trail.	1	2	3	4	5
o. The Billy Goat Trail is the only place I desire to hike/run.	1	2	3	4	5

Park and Trail Management

11. Please indicate your beliefs regarding the ownership and management of the lands around the Billy Goat Trail.

a. Do you know who manages the lands around the Billy Goat Trail?

Yes (Please list the organization(s) and/or agency(s) here:

_____)

Don't know

b. The Billy Goat Trail is managed primarily for: (Check one)

Protection of natural & cultural resources

Recreation

Both recreation and protection of natural & cultural resources

Don't know

NOTE: There are many trails on Bear Island. The official trails designated by managers are blazed with blue or white paint. All other trails you may have seen on Bear Island were created by visitors. While they may look like official trails, managers call these trails "unofficial" or "visitor-created trails." In the remainder of the survey, "official" trails refer to designated trails and "unofficial" trails refer to visitor-created trails.

12. Please indicate the extent to which you agree or disagree with the following statements based on your visit to the Billy Goat Trail TODAY by circling a number.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. It is acceptable to walk off of the paint blazed trails, if visitors stay on the unofficial trails already created by other visitors.	1	2	3	4	5
b. Closures of unofficial trails limited my enjoyment.	1	2	3	4	5
c. The park provides clear indications about which trails should not be used.	1	2	3	4	5
d. Compared to other people I saw on this visit, I am causing less damage to the soils and vegetation along the Billy Goat Trail.	1	2	3	4	5
e. I feel a responsibility to help protect the special plants and ecosystems along the Billy Goat Trail.	1	2	3	4	5
f. The soils and plants along the Billy Goat Trail should be protected even if visitors are not allowed to explore off-trail.	1	2	3	4	5
g. I am willing to stay on the paint blazed trails to protect rare plants.	1	2	3	4	5
h. I feel responsible for the care of the Billy Goat Trail.	1	2	3	4	5
i. I am willing to give up hiking or running in some areas of Bear Island in order to protect rare plants.	1	2	3	4	5
j. There were official paint blazed trails leading to the places I wanted to visit.	1	2	3	4	5
k. The official paint blazed trails were well-marked.	1	2	3	4	5

13. Please indicate the extent to which you agree or disagree with the following statements based on your visit to the Billy Goat Trail TODAY by circling a number. If you are unsure about an item, circle Don't Know.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Don't Know
a. Even limited use of visitor-created trails can prevent their recovery.	1	2	3	4	5	DK
b. The continued use of unofficial visitor-created trails is a serious threat to rare plants along the Billy Goat Trail.	1	2	3	4	5	DK
c. Soils and plants along the Billy Goat Trail are very hardy and not easily damaged.	1	2	3	4	5	DK
d. Off-trail hiking on Bear Island can spread non-native weedy plants.	1	2	3	4	5	DK
e. There are many special and rare plants that live near the Billy Goat Trail.	1	2	3	4	5	DK
f. Visitors have created many miles of trails on Bear Island.	1	2	3	4	5	DK

14. Managers have many different tools they can use to maintain the trails on Bear Island. Please indicate how each of the following tools affected the quality of your hiking experience TODAY on the Billy Goat Trail by circling a number. If you did not notice an item listed, circle Didn't See.

	Didn't See	Very Negative	Negative	Neutral	Positive	Very Positive
Educational signs near the trailhead	DS	-2	-1	0	1	2
Signs with rules near the trailhead	DS	-2	-1	0	1	2
Boot-print "no hiking" signs	DS	-2	-1	0	1	2
Paint blazes on rocks and trees	DS	-2	-1	0	1	2
Brush and logs used to re-naturalize an area	DS	-2	-1	0	1	2
Trail stewards hiking the trail	DS	-2	-1	0	1	2

15. From the list below, please indicate which statement you think best reflects current park policy. (Check one)

- The park requires visitors to stay on the paint-blazed trails (i.e., off-trail hiking is prohibited).
- The park encourages visitors to stay on the paint-blazed trails.
- The park allows visitors to hike on any trail on Bear Island, whether it is paint-blazed or unmarked.
- The park allows visitors to hike anywhere on Bear Island.
- Don't know

16a. We are interested in learning why people sometimes leave the official paint-blazed trails on Bear Island. Each of the following is a potential reason why you might have walked off the official paint-blazed trails during your visit TODAY. For each item, please indicate whether or not you walked off the trail because of the reason listed.

Did you hike off an official paint-blazed trail	Circle One	
Accidentally because the trail was poorly marked?	Yes	No
Because there was an unmarked trail that already existed?	Yes	No
To get around a difficult part of the trail?	Yes	No
To take a picture?	Yes	No
To move past others on the trail?	Yes	No
To get around poor trail conditions (e.g. mud, downed trees, etc.)?	Yes	No
To get away from crowds on the trail?	Yes	No
To explore?	Yes	No
To take a route you always use?	Yes	No
To get to a picnic spot?	Yes	No
To get to a fishing spot?	Yes	No
To get to a rock climbing spot?	Yes	No
To get to a scenic vista or area of interest?	Yes	No
To view wildlife/birds?	Yes	No
To view wildflowers?	Yes	No

16b. Did you hike off an official paint-blazed trail for any other reason not listed above?

- No
- Yes → Please specify _____

- 17. You could've walked off the paint-blazed trails at one point today, but chosen not to do so at another point. Therefore, the following list suggests reasons why you chose not to walk off the official paint-blazed trails on your visit TODAY. Please indicate whether or not each item describes why you chose not to walk off of the paint-blazed trails.**

I chose <u>not</u> to hike off an official paint blazed trail because....	Circle One	
	Yes	No
Of the signs with "no hiking" symbols.	Yes	No
I was afraid I would be reprimanded or confronted by a trail steward.	Yes	No
I had no reason to hike off-trail.	Yes	No
It is not fair for me to walk off the paint-blazed trails when many other visitors don't.	Yes	No
I didn't want to step on and damage any rare plants by mistake.	Yes	No
I didn't want to cause any soil erosion or compaction.	Yes	No
I could see the park had tried to re-naturalize off-trail areas with brush and leaves.	Yes	No
Other (please specify):	Yes	No

- 18. There are many management actions the park could take to help prevent damage to soils and vegetation along the Billy Goat Trail and surrounding area of Bear Island. For each of the following potential management practices, please indicate how acceptable you think each action would be along the Billy Goat Trail.**

	Level of Acceptability (Circle one)				
	Unacceptable....			...Acceptable	
a. Educational signs along the trail about the damage that can be caused by walking off-trail on rare plants	1	2	3	4	5
b. Signs directing visitors to remain on the official paint-blazed trails	1	2	3	4	5
c. "No Hiking" signs posted at unofficial, non-blazed trails	1	2	3	4	5
d. Blocking unofficial trails with brush and logs	1	2	3	4	5
e. Restoration of unofficial, non-blazed trails to an undisturbed state	1	2	3	4	5
f. Rules prohibiting visitors from hiking off of the official paint-blazed trails	1	2	3	4	5
g. A monetary fine for visitors who walk off the official paint-blazed trails	1	2	3	4	5
h. Increased ranger presence along trails	1	2	3	4	5
i. Volunteer trail stewards asking visitors to stay on official paint-blazed trails	1	2	3	4	5
j. Improve trail conditions (eliminate mud, downed trees, etc.)	1	2	3	4	5

F. Background Information

19. In what year were you born? Year: _____

20. What is your gender? (Check one)

- Male
- Female

21. Do you live in the United States or are you here for an extended stay greater than 90 days? (Check one)

- Yes (What is your Zip code? _____)
- No (What country do you live in? _____)

22. What is the highest level of education you have completed? (Check one)

- | | | |
|---|--|---|
| <input type="checkbox"/> Elementary School | <input type="checkbox"/> Some college | <input type="checkbox"/> Associate's degree or equivalent |
| <input type="checkbox"/> Some high school | <input type="checkbox"/> Bachelor's degree or equivalent | <input type="checkbox"/> Master's degree or equivalent |
| <input type="checkbox"/> High school diploma equivalent | <input type="checkbox"/> Some graduate work | <input type="checkbox"/> PhD, M.D., or or equivalent |

Thank you for your help in completing this survey!

Please return the completed questionnaire to the survey administrator.

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. Permanent data will be anonymous. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

OMB# (1024-0224) NPS# 07-23

Expiration Date: 12/31/2007

Burden estimate statement: Public reporting for this form is estimated to average **15** minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to: Bill Justice, Chief of Interpretation, at 1850 Dual Highway, Suite 100, Hagerstown, MD 21740, Bill_Justice@nps.gov

APPENDIX 2: REFUSAL LOG

APPENDIX 3: RESULTS CONTACT SHEET

APPENDIX 4: SURVEY INSTRUCTIONS

Billy Goat Trail Visitor Survey 2007

Volunteer Administrator Instructions

Thank you for volunteering to help in this research study. Your time is greatly appreciated. Please review the following information if you will be involved with survey administration.

Greeting Participants

Greet visitor groups with the following script:

“Hello, my name is _____. I am conducting a survey for Virginia Tech and NC State University on your use and opinions of the Billy Goat Trail. Your participation in this survey is voluntary and all answers will be confidential. It will take between 10-15 minutes to complete. Would you be willing to participate?”

If “NO” then, “I understand, enjoy your visit.” Record their information on the Survey Refusal Log (See “Incomplete Surveys” below).

If “YES” then thank them. Ask which of the group had the most recent birthday and ask if this individual would please complete and return the questionnaire.

- **Complete question #1 with the participant.** We found that this question is confusing to participants. Please ask the participant where they began their hike and where they ended. Place an “S” in the circle where they started, an “E” in the circle where they ended, and draw an arrow to show direction (you’re following the instructions for question #1). Then hand over the questionnaire to be completed by the participant.
- Tell visitors they may sit where they want (but should remain near the survey station) to complete their surveys, but all surveys must be completed on site. Please encourage them to sit in the chairs we provide.
- Remind them that there is a **front and back** to the survey.
- Ask participants to pay particular attention to questions containing the bold word **TODAY**. In these instances, we are interested only in their experiences on today’s visit.
- Instruct them to drop their survey into the box on completion.
- **Please make sure that no one leaves the site with a survey.**
- Ask participants to address any questions to the surveyor. Common questions might include:
 - **Why are you doing this survey?** To collect information on trail use and visitor’s opinions on management. This information will be used to more efficiently manage recreational and ecological resources in the area.
 - **Will my answers be anonymous?** All information will be kept anonymous.
 - **Can I find out the results of the study?** Yes. Please leave your preferred contact information on our Results Contact sheet.

- **Will you be permanently closing the Billy Goat Trail?** No. Trail closures during this study are for research purposes only. Certain sections of trail might be improved in the future through rerouting or restoration.

Incomplete Surveys

- If a participant is willing to fill out a survey but does not have time to complete the questionnaire onsite, collect the incomplete questionnaire before the participant leaves the survey station.
- Thank individuals who are unwilling or unable to participate in the survey for their consideration. Record their information on the survey refusal log.

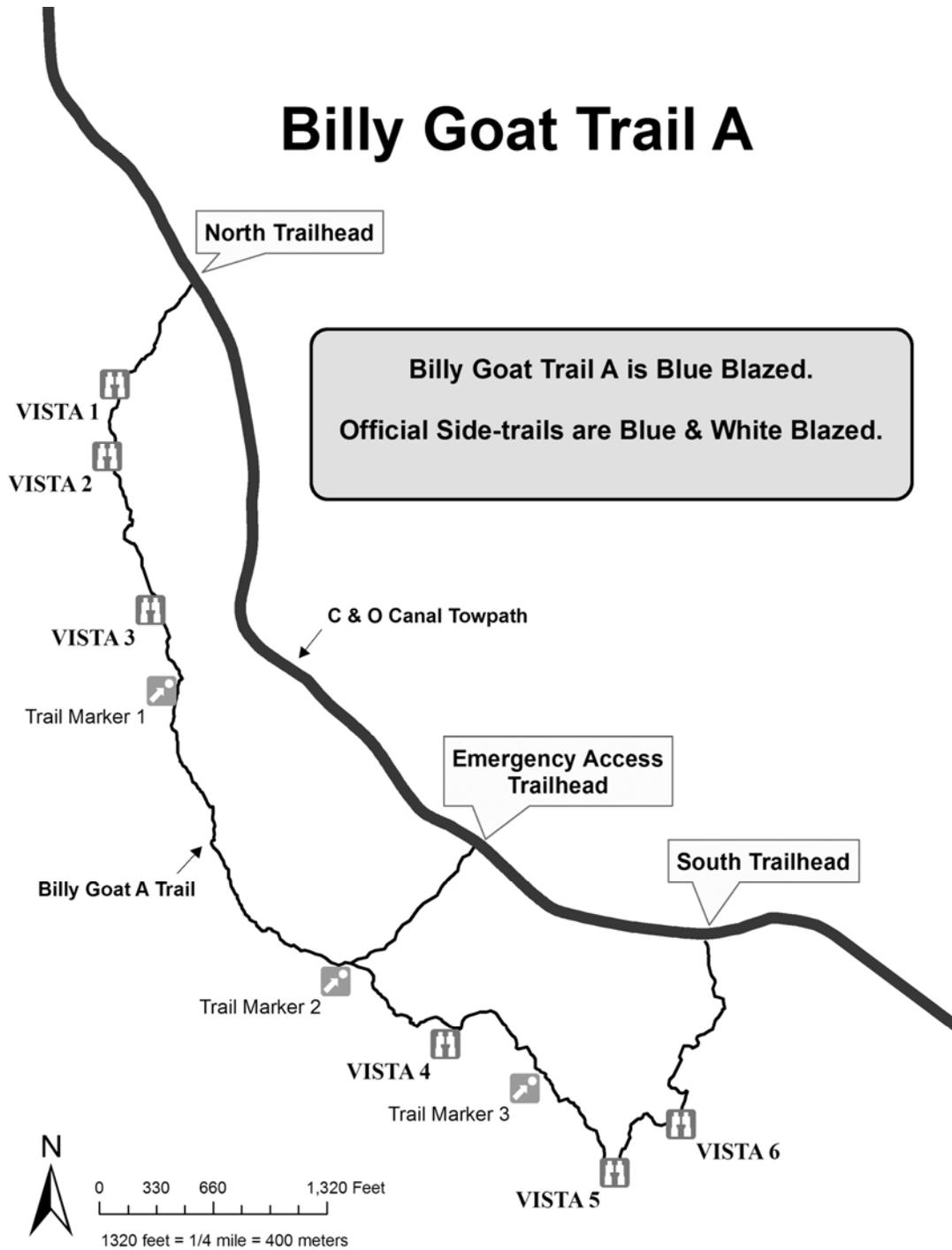
Completed Surveys:

- You will be provided with a folder of blank surveys, a folder for completed surveys, several clipboards, a box, and several pencils. Participants will place completed surveys into the box.
- When a participant completes a survey, make sure that all fields on the front are completed. Please leave the “Survey ID” field blank. This will be filled in by the research team for data entry.
- At the end of each survey period, please place all finished surveys in your “completed” folder. All supplies should be returned to the graduate student administrator at the end of each day.

NOTES:

APPENDIX 5: STUDY AREA MAP

Billy Goat Trail A



APPENDIX 6: TRAIL STEWARD SCRIPT

Instructions for Trail Stewards

This study treatment will position Trail Stewards about 50-100 yards in from each of the 3 Billy Goat Trail (BGT) trailheads to personally contact only the inbound hikers. We want the trail steward to hand a laminated double-sided sheet to inbound hikers and talk through what the two sides of the handout says (then retrieve the handout). One side has our message about not walking off-trail (w/rationale), the other side shows a map of the BGT showing the new vista spots. The interaction should take 1-2 minutes and be restricted to those topics. A recommended script is included below to help folks with the wording. Trail Stewards can bring a chair to sit in while waiting. They should be in "uniform" - a shirt and/or hat with the NPS VIP logos. They will not be available to respond to incidents – unless there are extra staff available to fill-in (i.e., our goal is to contact and give the personal message to 100% of BGT hikers).

Draft script for Trail Stewards:

Note that we are asking trail Stewards to disregard their prior training and messages for this work. We need you to be brief and to stick roughly to the script below for this treatment. Basically you are talking them through the text on the trailhead signs, which we will provide on a laminated copy you can hand to (and retrieve from) each group of visitors entering the BGT system.

- 1) Hi, my name is _____ and I'm a Trail Steward for the Billy Goat Trail. If you have just two minutes I'd like to describe some new hiking policies on the island here.
- 2) Great, let me **lend** you this laminated message and map so you can follow along. As you can see, the National Park Service and the Nature Conservancy land managers are asking visitors to stay on paint-blazed trails on the island to protect rare plants. Over 50 rare plants call this island their home. Visitors like yourselves have created several miles of unofficial tracks that can harm these species and managers are trying to close and restore these tracks.
- 3) You can assist them and protect the rare plants by not leaving the paint-blazed trails (point out a paint blaze). Everyone's cooperation is needed – even a few footsteps can prevent recovery.
- 4) If you'll flip that over you can see a site map showing the Billy Goat Trail (orient them to the map and which trailhead they are at). Please note that the Billy Goat Trail is blue blazed and all official side trails, including 6 short trails to six vista sites, are blue and white blazed.
- 5) That's all, thank you for your time and have a great hike.
- 6) If they ask you any questions tell them that you need to catch the next folks coming down the trail but may have some time to answer them. Keep your answers brief and on-topic to the extent possible. Extended discussions about trail length, difficulty, or trail management are not recommended. If they ask about the study you can say that the land managers are interested in their opinions about Billy Goat Trail management options so the university students are conducting a short survey. No decisions have been made concerning changes to management of the trail. If they have a dog with them you can politely remind them that dogs are not permitted on the Billy Goat Trail A but they are permitted on the BGT B and C trails just downriver and the other trails directly across the towpath (the Gold Mine Loop area trails). It would be best if you did not elaborate or become insistent on this topic or discuss other topics that are normally covered by the Trail Stewards (e.g., no swimming).

APPENDIX 7: STUDY PHOTOGRAPHS



Photo 1: Trailhead educational sign used in treatments 1-3 at all three entrances to the Billy Goat Trail



Photo 2: Fencing, “no hiking” sign, and restoration at the entrance to an informal trail