

ABSTRACT

ADAMS, BRENDAN MICHAEL WADE. The Relative Importance of User Characteristics, Natural Resource-Oriented Experiential Education, and Concern for the Environment in Influencing Visitors' Responsible Environmental Behavior in Backcountry Areas. (Under the direction of Dr. Roger L. Moore).

The purpose of this study was to examine the effects of various factors that might influence individual responsible environmental behavior in backcountry areas. Individual responsible environmental behavior is important in terms of the preservation and sustainability of natural resources. Previous research has shown that particular user characteristics, exposure to natural resource-oriented outdoor experiential education, and individual's concern for the environment, each influence responsible environmental behavior. This study extends the existing literature by examining how these variables work together and by examining the relative importance of each on the likelihood an individual will behave in an environmentally responsible manner. The sample was comprised of individuals who completed hiking the entire Appalachian Trail (a 2,180 mile National Scenic Trail) from 2010 to August 2013. Data were collected using an online questionnaire administered through the Qualtrics survey platform that included questions about backcountry experience, sociodemographic variables, environmental concern, and adherence to responsible environmental behaviors. The target behaviors were based on the principles of Leave No Trace Center for Outdoor Ethics (LNT), a nonprofit organization seen as a leader in promoting responsible outdoor recreation behavior. The data were analyzed using logistical regression in the STATA statistical software. Seven-hundred and two completed surveys were collected representing a response rate of 57.2%. The average respondent was 32 years old, male, and had a 4-year college education. The average number of years of backcountry experience was 16. Seven percent

of respondents had an educational background in natural resources and only 10% of respondents had participated in natural resource-oriented experiential outdoor education programs such as Outward Bound or LNT training. Results showed that level of education, level of environmental concern, age, and participation in natural resource-oriented outdoor experiential education programs were significantly related individuals' responsible environmental behavior in some instances. The results of this study are intended to help guide natural resource management by aiding in the creation of more effective interventions to encourage better environment stewardship through more responsible environmental behavior.

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The Relative Importance of User Characteristics, Natural Resource-Oriented Experiential Education, and Concern for the Environment in Influencing Visitors' Responsible Environmental Behavior in Backcountry Areas

by
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DEDICATION

This thesis is dedicated to my parents. Without their support I would not be here today.

BIOGRAPHY

Brendan was raised in Blacksburg, Virginia and found his way to Raleigh, North Carolina in his mid-twenties. After growing tired of a career in the field of engineering and land design he decided it was time for a change. Upon completion of a B.S. in Parks, Recreation and Tourism Management at North Carolina State University he decided to further his studies in the field of natural resources management and policy.

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I would like to thank Roger Moore first and foremost. Without his guidance and support this thesis would not be possible. The other members of my committee, Aram Attarian and Yu-Fai Leung offered sound advice for getting this project off of the ground and completing my thesis, and their assistance is greatly appreciated as well. Dr. Jordan Smith was instrumental in helping me with my analyses and was always available to answer my questions even though he was never officially part of my committee. This study would not be possible without backing from the great people at the Appalachian Trail Conservancy. They were willing to provide the sample and hopefully the results of this study will help them in accomplishing their important mission.

Finally, I would like to thank the individuals in my personal life that supported me in more ways than even they know. Mike and Deidre, thanks for the couch after the late nights. Matt, thanks for the support and timely distractions. And to Katie, thanks for listening when nobody else would; even though we both know I was usually wrong. There is no way I could have made it through this process alone.

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CHAPTER 1

Introduction

For millennia humans have generally viewed societal and cultural development from an anthropocentric perspective. Environmental concerns and environmental impacts have often taken a backseat to desires for economic growth, comfort, technological innovation, and human progress. However, in the past century environmental protection and conservation have become more important considerations in the policy making process, particularly for natural resource managers. We have begun to realize that the world has finite natural resources and that a path of exploitation and over-consumption cannot continue indefinitely. Global climate change, population growth, urbanization, and deforestation are all issues that have brought environmental concern to the forefront in recent decades (Bamberg, 2003).

Over 60 years ago Aldo Leopold (1949) discussed the idea of a “land ethic” that could create a new way of viewing how people interact with their environments. He proposed that we should no longer strive to conquer the environment but should instead view all biological aspects as one community that must work together. Although the works of Leopold and other writers such as John Muir (1916) and Rachel Carson (1962) helped to spark the environmental movement of the 1960’s and 70’s, air and water pollution, species extinction, habitat destruction, and other natural resource related issues continue to create profound challenges.

Individual responsible environmental behavior is an essential part of achieving the preservation and sustainability of natural resources. These behaviors include actions such as recycling waste, choosing to use public transportation, reducing water and electricity use in the home, and following “Leave No Trace” outdoor recreation practices. Exhibiting responsible environmental behaviors is especially important in sensitive natural areas, many of which are located on public lands where agency policies are intended to guide human use and development. One way that public natural resources can be negatively impacted is through inappropriate outdoor recreation use. Activities such as camping, mountain biking, hiking, and rock climbing can all lead to negative impacts on the environment and on other users’ experiences. Soil erosion, trampled vegetation, wildlife harassment, and a host of other impacts can result from such activities (Marion & Leung, 2001). Practicing responsible individual environmental behaviors can help ensure that natural areas on public lands remain healthy and available for use by future generations.

Some previous research, as reviewed in the next section, has focused on what factors lead individuals to exhibit responsible environmental behaviors. Demographic variables such as age and gender, level and type of education obtained, and overall concern for the environment have all been shown to relate to responsible environmental behavior. However, past research has not addressed the relative importance of these various factors on individuals’ behaviors.

Understanding which of these specific factors have more importance in influencing responsible environmental behavior is critical for guiding environmental and natural resource

policy and management. Such an understanding would aid in creating more effective policies and interventions to encourage better stewardship of the environment to finite natural resources through more responsible environmental behavior. The question that guided this study was: What is the relative importance of user characteristics, natural resource-oriented outdoor experiential education, and concern for the environment in influencing visitors to behave in an environmentally responsible manner in backcountry areas?

CHAPTER 2

Literature Review

To guide this research, I examined the previous academic literature in several areas related to human behavior and the environment. This section will summarize the findings from these previous studies and discuss how they guide my current research. I will present literature related to the theory of planned behavior, responsible environmental behavior, the New Ecological Paradigm, Leave No Trace, and natural resource-oriented outdoor experiential education.

Theory of Planned Behavior

Although not tested directly in this present research, the theory of planned behavior provides a framework for understanding and predicting social behavior (Rivis & Sheeran, 2003; Ajzen, 1991). This theory is an extension of the earlier theory of reasoned action (Ajzen & Fishbein, 1980) and was developed in response to limitations in understanding behaviors over which individuals seem to have limited or no conscious control (Ajzen, 1991). To address this limitation, the theory of planned behavior includes the concept of perceived behavioral control. The level of opportunity and control available to an individual helps determine the likelihood of the behavior being exhibited. Thus, perceived behavioral control is considered to have an impact on the intentions and actions of an individual (Madden, Ellen & Ajzen, 1992).

The theory of planned behavior considers three independent determinants that affect intentions which, in turn, influence actual behavior. These three determinants are attitudes, subjective norms, and perceived behavioral control. The first two of these determinants were also part of the earlier theory of reasoned action (Ajzen & Fishbein, 1980). Attitude toward the behavior is a personal factor that refers to how the individual views the behavior in either a positive or negative manner. Subjective norms are social influences or pressures that refer to how individuals believe others will view them if they choose to perform the behavior in question (Madden et al., 1992). Perceived behavioral control can have both a direct and indirect influence on an individual's actions. For example, if two people have equally strong intentions to learn a new skill, the one with the higher level of perceived behavioral control is more likely to persevere (Ajzen, 1991).

Researchers have successfully applied the theory of planned behavior to a wide range of behaviors. Attitudes and subjective norms have been shown to explain 33 - 50% of the variance in intentions, while perceived behavioral control typically explains an additional 5 - 12% (Rivis & Sheeran, 2003). However, as individuals age, the relationships between subjective norms and intentions tend to be weaker than the relationships between attitude, perceived behavioral control, and intentions (Armitage & Conner, 2001). These findings suggest that personal factors are more influential than social influences in terms of actual intentions and actions.

The theory of planned behavior has been used as a basis for many studies in the field of parks and recreation management. To reduce the impacts of visitation on a high-use area

in Haleakala National Park, for example, researchers used the theory of planned behavior to better understand visitors' attitudes, intentions, and behaviors in order to develop successful interventions (Reigner & Lawson, 2009). They found that visitors generally had a desire to follow park regulations and that persuasive messages and signage about reducing resource impacts were more effective in influencing visitor attitudes than were messages emphasizing danger or risk of personal injury. Similarly, the same framework was used to influence visitor behavior in a national park in Tasmania (Brown, Ham, & Hughes, 2010). Researchers used the theory of planned behavior there to design persuasive messages targeting visitor attitudes and behavior regarding picking up litter.

Predicting participation in recreation activities has also been examined in the context of the theory of planned behavior. Hrubes, Ajzen, and Daigle (2010) found that an individual's frequency of hunting was more heavily influenced by their intentions than by their perceived behavioral control. In this case, perceived behavioral control had an indirect influence on the frequency of hunting. Participation in specific outdoor recreation activities by university students was found to be influenced by perceived behavioral control and attitudes towards the behavior (Kouthouris & Spontis, 2005). In that study, university students were surveyed about their intentions to participate in canoeing, orienteering, or archery programs offered by a campus club. Only 56% of those who indicated an intention to participate in the programs actually did so.

Responsible Environmental Behavior

One type of social behavior that has been studied within the framework of the theory of planned behavior is responsible environmental behavior (REB). Responsible environmental behavior refers to behavior that “consciously seeks to minimize the negative impact of one’s actions on the natural and built world” (Kollmuss & Agyeman, 2002, p. 240). These behaviors include actions such as recycling, commuting by bicycle, or advocating for the preservation of open space. In a larger context, however, indirect actions that affect national or international policy, world markets, or political outcomes can also be seen as behaviors that affect the environment (Stern, 2000). Basically, responsible environmental behavior can be viewed as a blend of self-interest, concern for others, or a broader altruistic ideology (Bamberg & Moser, 2007).

Early research in responsible environmental behavior hypothesized that an increase in knowledge would lead to more positive environmental attitudes, which in turn would lead to more responsible environmental behaviors. These linear models were deemed deficient as further research suggested that simply educating individuals about environmental issues would not necessarily result in increased responsible environmental behavior (Ramsey, Hungerford, & Tomera, 1981).

Hines, Hungerford, and Tomera (1987), therefore, expanded the somewhat simplistic model of responsible environmental behavior to more closely resemble the theory of planned behavior (Ajzen, 1985). Their research found that knowledge of an issue along with personal responsibility, locus of control, attitudes, and intentions were all factors that influenced an

individual to behave in an environmentally responsible manner. Hungerford and Volk (1990) continued to employ the theory of planned behavior in later research examining responsible environmental behavior. They found that general attitudes and knowledge, in-depth knowledge and beliefs, and locus of control and intentions were all important influences on responsible environmental behavior (Hungerford & Volk, 1990).

Other researchers have focused on individual beliefs as important influences on environmental concern and behavior. For example, Stern, Dietz, Kalof and Guagnano (1995) suggested that four main factors, or *value clusters*, exist which influence the formation of individual environmental attitudes, which may influence actual behavior. These factors were biospheric-altruistic values, egoistic values, openness to change, and conservative or traditional values. Altruistic values include aspects such as unity with nature, social justice, and respect for the earth. Egoistic values include sense of self, wealth, and social power. Openness to change refers to an individual's willingness to accept new or different situations, and traditional values include family security, loyalty, and social order. These four value clusters have been utilized in many studies examining how an individual's belief system shapes concern for the environment. Schultz (2001) used a similar approach when studying a large sample of undergraduate university psychology students. In this study he used three attitudinal factors: egoistic, altruistic, and biospheric. Egoistic related to self, altruistic related to others and the community, and biospheric related to ecological and environmental aspects. Stern (2000) used these same three factors to describe the value determinants of environmentalism and used his results to develop a conceptual framework for studying

environmentally significant behavior. This was defined as any behavior that is undertaken with the intent to change the environment or any behavior that directly or indirectly impacted the environment, be it beneficial or negative. Vaske and Donnelly (1999) combined the four value clusters into two factors to examine attitudes towards wildland perseveration: anthropocentric and biocentric beliefs.

New Ecological Paradigm

Past research suggests that an individual's tendency to exhibit responsible environmental behavior is closely tied to that individual's level of environmental concern. To measure environmental concern and worldview, Dunlap and Leire (1978) developed the New Ecological Paradigm (NEP). The original instrument attempted to assess the changing relationship between humans and the environment and included twelve items that were measured on a five-point Likert scale from strongly agree to strongly disagree. The original scale had twelve items which related to three separate domains associated with environmental concern: balance of nature, anti-anthropocentrism, and limits to growth. The NEP scale was designed to measure the general environmental attitudes of an individual (Albrecht, Builtina, Hoiberg, & Nowak, 1982).

The NEP scale has become the mostly widely used scale to measure environmental attitudes. Since its inception it has been used in dozens of studies worldwide (Dunlap, 2008). However, the NEP scale is not without its detractors. The NEP scale has been criticized as being too simplistic and being a poor predictor of actual environmental behavior (Dunlap,

2008). Some researchers have argued that the NEP scale is incomplete and should be used in combination with other approaches to measuring environmental concern. For example, Stern, Dietz, and Guagnano (1995) along with Wiidegren (1998) used the NEP scale along with a measure of awareness of consequences. Both studies showed that these two measures may share similarities but the differences are great enough that they should be used in combination to gain a better understanding of environmental norms, attitudes, and behaviors.

In an effort to address such concerns, a revised NEP scale was developed in 2000 by Dunlap, Liere, Mertig, and Jones. The new scale, sometimes referred to as the revised NEP, has been expanded to include 15 items. These new items were included to increase validity, dimensionality, and to update the language used in the original scale. The new instrument also includes two new domains regarding environmental concern. Along with the original three subscales mentioned above, the new scale includes items designed to assess the possibility of an eco-crisis and the rejection of human exemptionalism (the idea that humans are not immune to the forces of nature). A higher score on the revised NEP scale has been shown to indicate a higher level of individual responsible environmental concern (Bamberg, 2003, Fransson & Garling, 1999). The revised NEP scale appears to be effective in tracking trends in changes in environmental concern in a world of ever changing environmental conditions (Dunlap, 2008).

Leave No Trace

In addition to the attitudes measured by the NEP, the principles of Leave No Trace (LNT) provide a means to assess actual responsible environmental behavior in the outdoors. Although many groups promote responsible environmental behavior (REB), the twenty-year-old nonprofit organization Leave No Trace Center for Outdoor Ethics, is recognized throughout the United States and internationally as a leader in promoting responsible outdoor recreation behavior (Daniels & Marion, 2005). The mission of the Leave No Trace Center for Outdoor Ethics is to “teach people how to enjoy the outdoors responsibly” (Leave No Trace, 2012). The Leave No Trace program is built around seven general principles intended to guide responsible visitor behavior in outdoor settings.

These seven principles of Leave No Trace are:

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

The Leave No Trace Center for Outdoor Ethics distributes information regarding the above seven principles through a booklet series, pamphlets, signage, videos, and training courses (Marion & Reid, 2007). Training courses are available in three formats; “Awareness

Workshops”, 2-day “Trainer Courses” and 5-day “Master Courses”. These seven principles have also been adapted for several specific outdoor recreation activities and settings including hunting, geocaching, winter use, and cultural heritage sites (Leave No Trace, 2012). Regardless of the setting, responsible environmental behaviors are now broadly articulated through the principles provided and promoted by Leave No Trace.

Several researchers have studied the efficacy of LNT training programs and their influence on actual responsible environmental behaviors. For example, Dowell and McCool (1985) evaluated the effectiveness of the predecessor to the Leave No Trace program in a wilderness setting. They found that through a variety of presentation formats Boy Scouts’ scores for knowledge, attitudes, and behaviors increased after they were presented with LNT information. Another study evaluated the effectiveness of a 2-day LNT trainer course (Daniels & Marion, 2005). They used a pre-test and post-test survey along with a four-month follow-up survey. The pre-test and post-test surveys evaluated knowledge of LNT principles, personal outdoor ethics, and self-reported responsible environmental behaviors. The follow-up survey also included questions about the extent to which participants had shared the LNT principles with others. Results of this study suggested that participation in the course improved participants’ knowledge and behavior in both the short-term (pre-test to post-test) and the long-term (post-test to follow-up). LNT principles are often presented and reinforced through participation in natural resource-oriented outdoor experiential education programs.

Natural Resource-Oriented Outdoor Experiential Education

Outdoor experiential education programs are designed to teach participants about the relationship between people and nature through various forms of field experiences. Such programs are typically intended to develop self-reliance, initiative, resourcefulness, and environmental awareness through individuals working together in group settings in the outdoors (Hattie, March, Neill, & Richards, 1997). These programs often involve physically challenging activities such as backpacking, rock climbing, rafting, or various combinations of them. Through first-hand experience in natural settings, such programs often attempt to instill an environmental ethic in their participants (Hammitt, 1995). Due to the intensity of these programs and the range of desired outcomes, outdoor experiential education courses typically have well defined curricula (Hattie et al., 1997). Numerous organizations now exist that provide such programs in backcountry settings.

The National Outdoor Leadership School (NOLS) is an example of an organization that provides outdoor experiential education opportunities. NOLS has six main learning objectives for their students: communication skills, leadership skills, small-group behavior, judgment in the outdoors, outdoor skills, and environmental awareness and concern (Gookin, 2006). Researchers studying a group of NOLS participants found that of the six objectives, 24% of the sample felt that they learned the most about environmental ethics. This can be tied to the objective of environmental awareness and concern. These students stated that they learned these ethics by practicing Leave No Trace principles throughout the course (Paisley, Furman, Sibthorp & Gookin, 2008). An earlier study of NOLS participants evaluated the

influence of the course on responsible environmental behavior (Hammit, 1995). Students in this study were given a pre-test, post-test, and a four-month follow-up survey upon completion of their program. The participants exhibited statistically significant ($p = .001$) increases in responsible environmental behavior compared to before the NOLS.

Outward Bound is another popular outdoor experiential education organization, with over 40,000 students having participated worldwide in 1994 (Hattie et al., 1997). Outward Bound develops programs that teach through experience, challenge, and adventure in a supportive environment while developing character, leadership, and commitment to service in its students (Outward Bound, 2013). Although environmental knowledge is not a primary focus of Outward Bound programs, courses do promote positive environmental ethics (Walter, 2009). Overall, participation in outdoor experiential education programs has been shown to increase interest in outdoor recreation, positive environmental attitudes, and commitment to conservation (D'Amato & Kransy, 2011). This was determined through a qualitative study with 23 participants of outdoor adventure education programs such as NOLS or Outward Bound. Some participants were interviewed directly before and after their course, some were interviewed only directly after course participation and others were interviewed one to five years after participation. This last group showed that the environmental concern and responsible environmental behavior learned through these courses is often long lasting.

Environmental Attitudes and Concern

Some sociodemographic variables, specifically gender, age, and education level have been shown to be related to environmental concern and behavior. Stern et al., (1993) found that gender played a role in levels of environmental concern. Women were found to have a higher level of concern regarding consequences of human interactions on the environment than were men. In a study about attitudes toward national forest management, researchers found that higher income was associated with stronger anthropocentric attitudes towards the environment. This same study found that being female and having a higher education level were both associated with more positive environmental behaviors (Arcury, 1990; Cottrell, 2003; Vaske, Donnelly, Williams, & Jonker, 2001a). Age has also been shown to influence environmental concern and behavior. As a group, older individuals tend to place human needs over those of the environment and exhibit less environmentally responsible behaviors (Cordell, Green, & Betz, 2010; Scott & Willits, 1994).

Participation in educational programs has also been shown to influence environmental concern and behavior (Vaske, Donnelly, Williams, & Jonker, 2001b). Elementary school aged children who participated in a classroom program designed to promote pro-environmental behavior and concern developed more positive levels of environmental concern compared to a control group (Leeming, Porter, Dwyer, Cobern, & Oliver, 1997). The same study also found that the parents of program participants also began to exhibit stronger pro-environmental behaviors at home. High school students who participated in an environmental science module that included lecture time and hands-on activities showed

more positive environmental attitudes upon completion of the course than did students who did not participate in the module (Bradley, Waliczek & Zajicek, 1999).

Participation in outdoor recreation activities and past recreation experiences have also been shown to relate to environmental concern and behavior. Individuals' outdoor recreation pursuits can expose them directly to the negative effects that human actions can have on the environment. People who participated in outdoor recreation activities showed higher levels of environmental concern and exhibited more responsible environmental behaviors than individuals that did not participate in outdoor recreation activities (Berns & Simpson, 2009). People who had a higher level of expertise in a specific outdoor recreation activity exhibited stronger pro-environmental attitudes and behaviors than the less experienced in the same user group (Dyck, Schneider, Thompson, & Virden, 2003).

In a study of forest recreationists, environmental concern differed significantly between appreciative recreationists (e.g., hikers, photographers, paddlers.) and motorized recreationists (e.g., OHV users, motorboaters, snowmobilers). Participants who engaged in appreciative activities showed stronger ecocentric environmental concern and were more likely to engage in responsible environmental behavior than those engaged in motorized forms of recreation (Thapa & Graefe, 2003). Similar studies examining the environmental concern and behavior of outdoor recreationists across several activities have been completed in other parts of the United States (Teisl & O'Brien, 2003) and in Norway (Bjerke, Thrane & Kleiven, 2006). These studies included participants engaging in activities ranging from hunting, wildlife watching, and camping, to cross country skiing. Results of these studies

showed that outdoor recreation participants generally had strong pro-environmental concern and behavior and that appreciative user groups had higher levels of environmental concern than did consumptive user groups.

After reviewing the related literature I developed the conceptual framework presented in Figure 1 below. As illustrated in Figure 1, the independent variables – concern for the environment, user characteristics, and participation in natural resource-oriented outdoor experiential education programs – are hypothesized to directly influence the dependent variable – responsible environmental behavior.

Based on the related literature, this study operationalized concern for the environment using the NEP factor score. User characteristics included the user's age and gender, past visitation to backcountry areas, level of education, and educational course of study. Natural resource-oriented outdoor experiential education was operationalized based upon whether or not an individual had participated in a natural resource-oriented outdoor experiential education program. Previous research has shown that each of these variables independently contributes to individual responsible environmental behavior. This study examined how these variables might work together to influence individual responsible environmental behavior. Specifically, I looked at the relative importance of user characteristics, natural resource-oriented outdoor experiential education, and concern for the environment in influencing visitors to behave in an environmentally responsible manner in backcountry areas.

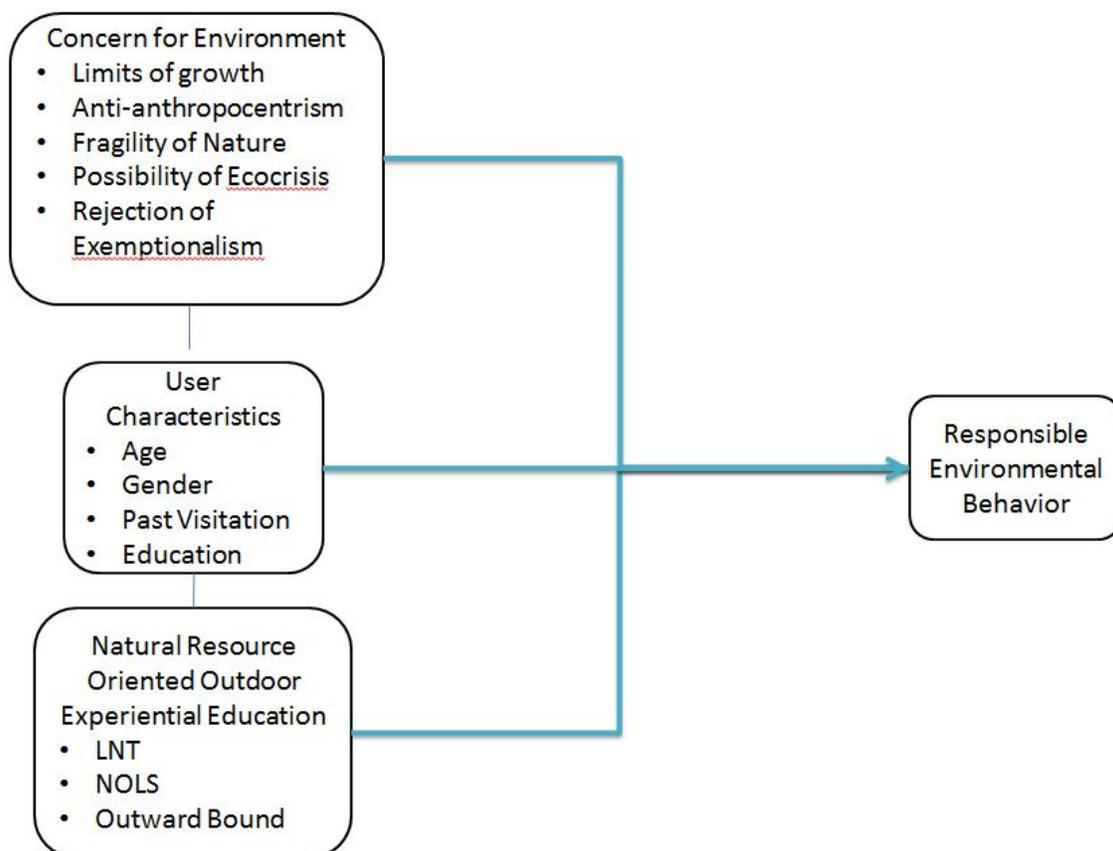


Figure 1. Conceptual Framework

CHAPTER 3

Methodology

This chapter presents the research methods used to address the study research question. I will discuss the sample used for the study, the survey instrument employed, and how study analyses were carried out to help answer the research question.

Sample

The study sample was comprised of people who had recently completed hiking the entire Appalachian Trail. The Appalachian Trail (A.T.) is a National Scenic Trail that traverses 2,180 miles of the Appalachian Mountains from Springer Mountain in Georgia to Mount Katahdin in Maine. The A.T. is popular among long distance hikers and nearly 2,000 individuals attempt to “Thru-Hike” the entire A.T. each year. These hikers are hoping to finish hiking the entire length of the A.T. in one extended trip over the course of a single annual hiking “season”. However, only about one in four of those who start actually complete their A.T. “thru-hike” trek (Appalachian Trail Conservancy, 2013). Many hikers also “section hike” the Appalachian Trail, meaning they complete the entire length of the trail during multiple trips over the course of years or even decades. Once a hiker completes the full length of the A.T. they are considered a “2,000 miler” and can register their accomplishment with the Appalachian Trail Conservancy (ATC). However, not every hiker registers their hike. The ATC is a nonprofit organization dedicated to preserving and managing the Appalachian Trail in partnership with the National Park Service, USDA Forest Service, and many other groups (Appalachian Trail Conservancy, 2013). The sample I used

for my study was comprised of the hikers who completed the entire Appalachian Trail in 2010, 2011, 2012 and 2013 and registered their hikes with the ATC by September 25, 2013. This sample included both thru-hikers and section hikers.

The Appalachian Trail corridor crosses through many different management jurisdictions including those of the National Park Service, USDA Forest Service, 14 states, many municipalities of varying sizes, and other agencies. The majority of the A.T. is located in backcountry areas. Such areas typically have no modern developed facilities, amenities, and have relatively few other people. Appalachian Trail 2,000-milers must spend a considerable amount of time living in the backcountry in order to complete the entire trail. This extensive backcountry use was the primary reason A.T. 2,000-milers were chosen as the sample for this study. Long distance A.T. hikers also represent a diverse group of backcountry users in terms of their characteristics and attitudes toward their hikes (Kyle et al., 2003; Kyle et al., 2004; MacLennan & Moore, 2004). The A.T. receives a large surge in use each spring as potential 2,000-milers embark on the typical northbound trip from Springer Mountain in Georgia and it is particularly important that these individuals behave in an environmentally responsible manner to lessen their potentially large impact on the trail and its surrounding natural resources.

Approximately 500 hikers report completing the entire A.T. each year (Appalachian Trail Conservancy, 2013). My sample frame included 1,228 “2,000 milers” from 2010, 2011, 2012 and 2013 who eventually registered their hikes with the ATC. The survey instrument was distributed on October 3, 2013 so not all of those registered after the 2013

hiking season were included. Only those individuals over the age of 18 who had given permission to the ATC to be contacted for research purposes were invited to participate in the study. See Table 1 below for details on the number of hikers included in the study by year. Please note that numbers from 2012 had not been reported by the ATC at the time of this publication.

The Appalachian Trail Conservancy provided the hiker email addresses used to reach the study sample. Many of the questions included in the study instrument were designed for future use by the ATC. The complete questionnaire can be found in Appendix A.

Table 1. Sample by Year

	2013	2012	2011	2010
Attempted Thru - Hike	3,133	-	1,738	1,716
Completed Thru-Hike	680	-	585	484
Completed Section Hike	132	-	130	40
Total	812	0	715	524
Included in Study	88	525	405	210
Percentage per year included	10.84%	N/A	56.64%	40.08%

Instrument

I used an online questionnaire to collect the data for this study. An online questionnaire was the only feasible method to reach the sample I targeted. Due to the length of the trail and the various behaviors of different hikers, traditional trail intercept surveys were not feasible. With an online survey I was able to reach four years of hikers who could then be located anywhere in the world. Another traditional method of survey research, mail surveys, was not economically viable for this study. The instrument was created using the Qualtrics online survey platform. A pilot test of twenty colleagues at North Carolina State University showed that the questionnaire took an average ten minutes to complete and that the questions were understandable.

The online questionnaire was used to collect participant information for all the dependent and independent variables as shown in the conceptual framework in Figure 1. I collected demographic information and user characteristics that included: age, gender, education level and course of study, income range, primary residence zip code, and past backcountry experience. Past backcountry experience was measured in terms of how many years the participant had been visiting backcountry areas. For the purposes of this study, I provided participants with the following definitions at the beginning of the questionnaire:

Backcountry areas – undeveloped recreation areas without modern developed facilities, amenities, or paved trails and where there are relatively few other people.

Frontcountry areas – more developed recreation areas where modern facilities, amenities, and paved trails are prevalent and many people are often present, such as paved "greenway trails".

Operationalizing the above terms was intended to help participants better understand the context for the questions being asked. The definitions of these important terms were derived using a variety of previous definitions found in literature.

Along with questions about previous backcountry experience, the survey instrument included questions about participation in natural resource-oriented outdoor experiential education programs. These questions were measured using a dichotomous yes or no format. I focused on three main types of programs to assess participation in natural resource-oriented outdoor experiential education. The questionnaire asked individuals to indicate whether they had ever participated in National Outdoor Leadership School programs, Outward Bound programs, or Leave No Trace training courses. There was also an "other" program option where survey participants could write in other natural resource-oriented outdoor experiential education programs in which they might have participated.

Concern for the environment was measured using the revised New Ecological Paradigm (NEP) scale (Dunlap et al., 2000). This well established scale includes 15 items that were rated using five point Likert scale items in this study. As presented in the literature review section of this thesis, the NEP scale includes questions designed to tap into five domains and which are used to produce an overall factor score to indicate an individual's general concern for the environment.

The particular behaviors I examined to assess responsible environmental behavior were based on the principles of Leave No Trace (LNT). The responses to these behavior questions were used as the dependent variables for my study. Specifically, I asked about behaviors related to three of the seven LNT principles: dispose of waste properly, leave what you find, and minimize campfire impacts (Leave No Trace, 2012). Behaviors related to these three principles, in particular, were chosen because the other four principles tend to be more subjective and therefore likely to have been more difficult to measure validly and reliably. Respondents self-reported their LNT-related behavior in terms of the following question context, “On your most recent overnight backcountry hiking trip did you...” followed by a description of each behavior. Asking about the most recent trip gave the participant a specific event on which to focus rather than asking them to try to make broad generalizations based on potentially many past experiences. This was intended to help improve the validity and reliability of the resulting data. I asked participants to self-report whether or not they performed twelve specific behaviors (four for each of the three LNT principles being examined) during their most recent overnight backcountry hiking trip.

I also asked participants to describe the area where their most recent overnight backcountry hiking trip took place. Participants chose between: “Primitive - greater than three miles from all roads or motorized trails, very little contact with visitors outside my group”, “Semi-Primitive - greater than one half mile from all roads or motorized trails, little contact with visitors outside my group”, and “Natural - easily accessible by roads, moderate contact with visitors outside my group”, to describe the area. These definitions were

modified from those used in the USDA Forest Service Recreation Opportunity Spectrum (USDA, 2001).

The questions related to disposing of waste included one for each of four behaviors, two of these behaviors related to litter and two related to human waste. The questionnaire included four behaviors related to leaving what you find and illegal harvesting. The two behaviors related to illegal harvesting concerned natural resources and cultural artifacts. Leaving what you find included a behavior focused on damaging live trees and a graffiti-related behavior. There were also four behaviors related to minimizing campfire impacts: campfire use, construction of fire rings, limbing trees for firewood, and scattering ashes and unused wood. A copy of the study questionnaire is included as Appendix A.

To distribute my questionnaire I followed a modified version of the Dillman Tailored Design Method (Dillman, 2000). I first coordinated with the ATC to acquire the emails needed for distribution of my questionnaire. On October 3, 2013, I used the Qualtrics online survey platform to send an email to each member of the sample explaining the purpose and importance of my study. This email included how and why the participant had been chosen, the topic that I was investigating, the importance of each individual's participation in the study, and an individual link to the questionnaire. This individual link allowed each participant to only submit one questionnaire.

Ten days after I sent out the initial email requesting participation in the study I sent a reminder email to those that had yet to complete the survey. This email again expressed the importance of each participant completing the survey and included another link to the

questionnaire. The Qualtrics online survey platform was used to distribute the questionnaires to participants through email and was also used to manage the responses. By using Qualtrics, I was able to send the questionnaire and all correspondence under the ATC name. This was done intentionally due to the participants' familiarity and relatively recent correspondence with that organization related to their completion of the A.T. This was intended to help increase the response rate from participants who might otherwise think the study emails were "spam".

Two weeks after distributing the reminder email I sent a final follow-up email to all non-respondents. This email served as a reminder of the study and the importance of each individual's participation. Dillman (2000) suggested contacting non-respondents in a different form (e.g., mail or phone), but due to funding limitations, following up via email was more feasible. Copies of the emails used are included as Appendix B. Qualtrics was able to keep track of each participant's response so those who had already completed the questionnaire did receive reminders. Qualtrics was also able to maintain participant anonymity by not allowing the administrator (myself) to link email addresses with participant responses.

Data Analyses

Descriptive statistics were used to summarize user characteristics. These characteristics included demographic variables, previous backcountry experience, type of

hiker (thru-hikers or section-hikers), experience in natural resource-oriented outdoor experiential education programs, as well as the results of the NEP scale responses.

Logistic regression (Institute for Digital Research and Education, 2013) was used to model the effects of the independent variables on the dependent variables. Since I used dichotomous yes/no responses for the three responsible environmental behaviors (twelve dependent variables) that were investigated, logistic regression was used to analyze the data to address my research question – the combined effects of all the independent variables on each of the twelve dependent variables. (Agresti & Finlay, 2007).

CHAPTER 4

Results

This chapter presents the results of the research. It begins by summarizing the characteristics of the 702 responses received from the trail users who participated in the study. This represents a response rate of 57.2%. The following section briefly describes the participants' trips along the Appalachian Trail. The next section presents the results regarding the New Ecological Paradigm followed by a section that includes the results of the dependent variables (i.e., compliance with the targeted Leave-No-Trace behaviors). The final section of this chapter reports the results of the logistic regression analyses designed to address the study research question as stated earlier.

User Characteristics

There was a wide range of ages among the participants of this study. The minimum age of survey participants was 19 while the maximum age was 84. The average age was 40.5 with a median of 32. The standard deviation was 16.73 (Table 2). Analysis of the data revealed that the majority of the respondents were male (77.33%) (Table 3). Respondents also had high educational levels with more than forty percent having received a Bachelor's degree, and another twenty-five percent having received a graduate degree (Table 4).

Table 2. Respondents' Age

Years	N	%
Under 20	8	1.1%
20-29	278	39.8%
30-39	137	19.8%
40-49	34	4.9%
50-59	91	13.0%
60-69	119	17.0%
Over 70	31	4.4%
Total	698	100%

Mean = 44, Median = 32, Standard Deviation = 16.73, Range 19-84

Table 3. Respondents' Gender

Gender	N	%
Male	539	77.33
Female	158	22.67
Total	697	100

Table 4. Respondents' Highest Level of Education

Level of Education	n	%
Some High School	1	0.14
High School / GED	41	5.87
Some College	95	13.59
2-Year College Degree	39	5.58
4-year College Degree	283	40.49
Some Graduate Education	62	8.87
Graduate Degree	178	25.46
Total	699	100

The college course of education completed by most of the respondents was not natural-resource focused. Only 7% of respondents reported that their academic studies were focused in this area (Table 5). Furthermore, only 10% of respondents answered that they had participated in natural resource-oriented experiential education courses such as NOLS, Outward Bound, or Leave No Trace training (Table 6). The average number of years of backcountry experience reported by respondents to this study was 16 with a minimum of zero and a maximum of 66 years (Table 7). This means that some respondents had no backcountry experience before hiking the entire A.T. during the past season.

Table 5. Natural Resource Curriculum Education

Natural Resource Curriculum Education	n	%
Yes	50	7.12
No	652	92.88
Total	702	100

Table 6. Natural Resource-Oriented Outdoor Experiential Education

Natural Resource-Oriented Outdoor Experiential Education Participation	N	%
Yes	72	10.26
No	630	89.7
Total	702	100
Courses participated in by those indicating "yes"*		
LNT	27	3.8
Project WILD	15	2.1
NOLS	27	3.8
Outward Bound	20	2.8
Other Programs	6	0.9

* Total does not add up to 72 or 10.26% due to some individuals participating in multiple courses

Table 7. Number of years of Backcountry Experience

Years	N	%
0	8	1.1%
1-9	278	39.8%
10-19	137	19.6%
20-29	34	4.9%
30-39	91	13.0%
40-49	119	17.0%
Over 50	31	4.4%
Total	698	100.0%

Mean = 16.35, Standard Deviation = 14.89, Range 0-66

Trip Characteristics

The majority of hikers who participated in this study had completed the entire Appalachian Trail in one season as a Thru-Hiker (79.34%) (Table 8). Of those Thru-Hikers, the majority (77.54%) traveled northbound from Georgia to Maine, 15% chose to travel southbound from Maine to Georgia, and 7% chose to flip-flop hike the trail. The term “flip-flop” refers to hikers who started at some midway point, such as in West Virginia, hiked to one end, returned to the midway point and continued in the other direction along the rest of the trail (Table 9). Section hikers complete the entirety of the A.T. by hiking shorter sections over many seasons. The more than twenty percent of respondents’ who reported being

section hikers, they took an average of 12 years to complete the entirety of the Appalachian Trail. One section hiker was able to complete the trail over two seasons while another took 57 years to hike the entire Appalachian Trail (Table 10).

Table 8. Type of Hiker

Type of hiker	N	%
Thru-Hiker	553	79.34
Section Hiker	144	20.66
Total	697	100

Table 9. Thru-Hiker Direction

Thru-Hiker Direction	N	%
Northbound	428	77.54
Southbound	85	15.4
Flip-Flop	39	7.07
Total	552	100

Table 10. Section Hike Duration

Section Hiker Years	
Min	2
Max	57
N	141

Mean = 12 years, Standard Deviation = 10.97

New Ecological Paradigm

The New Ecological Paradigm was used to determine the level of environmental concern of the respondents in this study. This well established scale uses 15 items representing 5 domains and was measured on a 5-point Likert scale ranging from 1 (Strongly Agree) to 5 (Strongly Disagree). The results of the NEP scale responses can be found below in Table 11.

Table 11. New Ecological Paradigm

Scale Item	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Mean	Std Dev	n
We are approaching the limit of the number of people the Earth can support.	169 (25%)	207 (30%)	163 (23%)	122 (17%)	36 (5%)	2.5	1.18	697
Humans have the right to modify the natural environment to suit their needs.	11 (1.5%)	170 (24%)	207 (30%)	233 (33.5%)	75 (11%)	3.27	0.99	696
When humans interfere with nature it often produces disastrous consequences.	163 (23%)	312 (45%)	135 (19%)	77 (11%)	11 (2%)	2.23	0.98	698
Human ingenuity will insure that we do not make the Earth unlivable.	30 (4%)	171 (24.5%)	206 (29.5%)	215 (31%)	75 (11%)	3.19	1.06	697
Humans are seriously abusing the environment.	294 (42%)	285 (41%)	65 (9%)	36 (5%)	17 (2%)	1.85	0.96	697
The Earth has plenty of natural resources if we just learn how to develop them.	75 (11%)	274 (39%)	147 (21%)	160 (23%)	40 (6%)	2.73	1.1	696
Plants and animals have as much right as humans to exist.	336 (48%)	231 (33%)	72 (10%)	44 (6%)	13 (2%)	1.8	0.99	696

Table 11. New Ecological Paradigm (continued)

The balance of nature is strong enough to cope with the impacts of modern industrial nations.	11 (2%)	61 (9%)	119 (17%)	341 (49%)	161 (23%)	3.84	0.93	693
Despite our special abilities, humans are still subject to the laws of nature.	339 (49%)	320 (46%)	30 (4.3%)	3 (0.4%)	2 (0.3%)	1.57	0.67	694
The so-called “ecological crisis” facing humankind has been greatly exaggerated.	17 (2%)	65 (9%)	142 (21%)	278 (40%)	190 (27%)	3.81	1.02	692
The Earth is like a spaceship with very limited room and resources.	117 (17%)	273 (39%)	169 (24%)	118 (17%)	16 (2%)	2.84	1.03	693
Humans were meant to rule over the rest of nature.	35 (5%)	77 (11%)	108 (16%)	219 (32%)	255 (37%)	3.84	1.18	694
The balance of nature is very delicate and easily upset.	121 (17%)	310 (45%)	147 (21%)	108 (16%)	7 (1%)	2.38	0.98	693
Humans will eventually learn enough about how nature works to be able to control it.	9 (1%)	63 (9%)	176 (25%)	297 (43%)	147 (21%)	3.74	0.94	692
If things continue on their present course, we will soon experience a major ecological catastrophe.	163 (24%)	299 (43%)	138 (20%)	77 (11%)	15 (2%)	2.25	1.01	692

Factor scores from the NEP items were used to create an overall measure of environmental concern for each respondent. The results of the principal-components factor analysis conducted are presented in Table 12. The overall mean for the NEP index was 3.69 with a standard deviation of .42. The range was 1 to 5.

Table 12. New Ecological Paradigm Factor Analysis

Scale Item	Mean	Factor 1	Factor 2	Factor 3
We are approaching the limit of the number of people the Earth can support. ¹	3.503	0.6693	-0.0292	-0.0491
Humans have the right to modify the natural environment to suit their needs. ²	3.274	0.4845	-0.0974	-0.2383
When humans interfere with nature it often produces disastrous consequences. ³	3.772	0.5783	-0.2441	0.0351
Human ingenuity will insure that we do not make the Earth unlivable. ⁴	3.192	0.4261	0.6007	0.1285
Humans are seriously abusing the environment. ⁵	4.152	0.6269	-0.1677	0.1242
The Earth has plenty of natural resources if we just learn how to develop them. ¹	2.736	0.3792	0.5642	-0.3092
Plants and animals have as much right as humans to exist. ²	4.197	0.5486	-0.3191	0.3567
The balance of nature is strong enough to cope with the impacts of modern industrial nations. ³	3.837	0.6042	0.1294	-0.2742
Despite our special abilities, humans are still subject to the laws of nature. ⁴	4.428	0.355	0.0026	0.5948
The so-called “ecological crisis” facing humankind has been greatly exaggerated. ⁵	3.808	0.7647	-0.0671	-0.0328
The Earth is like a spaceship with very limited room and resources. ¹	3.515	0.5873	-0.0381	-0.1815
Humans were meant to rule over the rest of nature. ²	3.839	0.6163	-0.0205	0.2527
The balance of nature is very delicate and easily upset. ³	3.62	0.4753	-0.2695	-0.4751
Humans will eventually learn enough about how nature works to be able to control it. ⁴	3.737	0.3861	0.5839	0.2009
If things continue on their present course, we will soon experience a major ecological catastrophe. ⁵	3.749	0.7697	-0.0934	-0.0056
Eigenvalue		4.804	1.324	1.108
Variance Explained		0.3203	0.0883	0.0739

Item Domains: 1 – Reality of limits to growth, 2 – Anti-anthropocentrism, 3 – Fragility of nature’s balance, 4 – Rejection of exemptionalism, 5 – Possibility of ecocrisis

Responsible Environmental Behaviors

Participants in this study were asked to self-report their adherence to 12 specific responsible environmental behaviors. These behaviors were based on three separate principles of Leave No Trace (LNT): dispose of waste properly, leave what you find, and minimize campfire impact. Adherence with each principle was assessed regarding four separate behaviors. Respondents were asked to reflect upon their most recent backcountry hiking experience anywhere and asked if they had followed these 12 behaviors. Although this question was not asked specifically regarding behaviors on the A.T., 44% of respondents indicated they were referring to their A.T. hike. Specifically, the following question was asked, “On your most recent overnight backcountry hiking trip did you...” followed by a description of each behavior. As reported in Table 13, a “positive behavior” indicates the individual followed responsible environmental behavior. Two of the behaviors required a “not applicable” option on the questionnaire and those selections were dropped prior to analyses. Seven of the 12 behavior items were reverse worded to avoid potential confusion from double negatives in the statement. For example, “did you collect any rocks, plants or other natural items to keep?” was used rather than “did you not collect any rocks, plants or other natural items to keep?” These items were reverse-coded prior to analyses and are reported after reverse coding in Table 13. As can be seen below, the majority of the respondents exhibited responsible environmental behavior for each separate behavior, however some negative (i.e., irresponsible) behaviors were reported.

Table 13. Responsible Environmental Behaviors

On that trip did you....	Positive Behavior	Negative Behavior	n
Dispose of waste properly			
...carry out all of your own litter?	684 (98.42%)	11 (1.58%)	695
...carry out all of the litter found even if it was left by others before you?	379 (55.01%)	310 (44.99%)	689
...did a "cathole" to dispose of your human waste when a privie/outhouse was unavailable? ¹	474 (84.19%)	89 (15.81%)	563
...wash yourself and dishes at least 200 feet away from all streams and other bodies of water?	534 (77.73%)	153 (22.27%)	687
Leave what you find			
...collect any rocks, plants or other natural items to keep? ²	646 (93.22%)	47 (6.78%)	693
...collect any cultural artifacts to keep? ²	691 (99.42%)	4 (0.58%)	695
...cut or remove any limbs from a live tree or shrub? ²	655 (94.79%)	36 (5.21%)	691
..."tag", deface, or add graffiti to any trees, shelters or other natural or man-made surfaces? ²	684 (98.70%)	9 (1.30%)	693
Minimize campfire impacts			
...build a campfire? ²	325 (46.97%)	367 (53.03%)	692
...construct a new fire ring? ²	642 (92.64%)	51 (7.36%)	693
...remove limbs from a live or dead tree to use as firewood? ²	548 (79.31%)	143 (20.69%)	691
...scatter your unused wood and ashes prior to leaving your campsites? ¹	143 (41.33%)	203 (58.67%)	346

¹ Item included a "not applicable" option which was remove before analyses and not included in this table.

² Item was reverse coded prior to analyses and prior to reporting in this table to reflect positive behavior related to the item in question.

Addressing the Study Research Question

This section presents the results of the statistical tests used to address the study research question which was: What is the relative importance of user characteristics, natural resource-oriented outdoor experiential education, and concern for the environment in influencing visitors to behave in an environmentally responsible manner in backcountry areas?

Logistic regression using STATA release 12 statistical software (Statacorp, 2011) was employed to examine the relationship between the independent variables and each of the dependent variables. Examination of the responses to the 12 Leave No Trace (LNT) behavior questions revealed that, for three of the 12, less than 5% of respondents reported engaging in the less environmentally responsible behavior. Consequently, the 12 particular behaviors were collapsed into those representing each of the three LNT principles. Hence, each of the resulting three collapsed dependent variables was comprised of four items with each representing one specific LNT principle, which was then used in the models examining responsible environmental behaviors. In order to collapse the 12 behaviors into the three final dependent variables, it was decided that if a respondent exhibited a negative behavior on any of the four behaviors representing the principle, then that person was considered to be noncompliant in terms of that entire principle. The three resulting dependent variables were, therefore, binary (i.e., LNT non-responsible versus LNT responsible, or no versus yes, respectively).

The first logistic regression model examined the dependent variable “dispose of waste properly”. The independent variables included in the model were age, gender, years of backcountry experience, level of education, participation in natural resource-oriented outdoor experiential education, natural resource education curriculum, and environmental concern (i.e., NEP score). This model showed that respondents’ level of education and environmental concern were both significant at the .01 level with level of education negatively and environmental concern positively related to performing responsible environmental behavior regarding disposing of waste (Table 14).

Table 14. Logistic Regression - Dispose of Waste Properly

Logistic regression			N=666			
Log likelihood = -443.05496			Pseudo R2	0.0243		
Dispose of Waste	Coeff	Std. Err.	z	P>z	[95% Conf. Interval]	
Age	-0.0095896	0.0059043	-1.62	0.104	-0.0211618	0.0019826
Gender	-0.0853851	0.1951506	-0.44	0.662	-0.4678733	0.2971031
Backcountry Experience	0.010559	0.0063339	1.67	0.095	-0.0018551	0.0229731
Level of Education	-0.1683427	0.0565466	-2.98	0.003	-0.2791721	-0.0575133
NR Exp Edu	0.2793586	0.2632737	1.06	0.289	-0.2366485	0.7953656
NR Curriculum Edu	-0.4276507	0.3197019	-1.34	0.181	-1.054255	0.1989534
Env Concern	0.1633812	0.0827734	1.97	0.048	0.0011484	0.325614
_cons	0.7813264	0.3116614	2.51	0.012	0.1704813	1.392172

The second logistic regression model examined the dependent variable of “leave what you find”. Again, the independent variables included in the model were age, gender, years of backcountry experience, level of education, participation in natural resource-oriented outdoor experiential education, natural resource education curriculum, and the NEP score representing level of environmental concern. The collapsed dependent variables were the four behaviors found in this category in Table 13 above. This model showed that respondents’ age was significant at the .01 level and positively related to performing responsible environmental behavior regarding leaving what you find (Table 15).

Table 15. Logistic Regression - Leave What You Find

Logistic regression			N = 666			
Log likelihood = -229.4868			Pseudo R2	0.0295		
Leave what you Find	Coeff	Std. Err.	z	P>z	[95% Conf. Interval]	
Age	0.0272019	0.0103476	2.63	0.009	0.0069209	0.0474829
Gender	-0.0533883	0.297927	-0.18	0.858	-0.6373145	0.5305378
Backcountry Experience	-0.0070088	0.0108287	-0.65	0.517	-0.0282327	0.0142151
Level of Education	-0.1083946	0.0924064	-1.17	0.241	-0.2895079	0.0727186
NR Exp Edu	-0.345671	0.3670422	-0.94	0.346	-1.065061	0.3737186
NR Curriculum Edu	-0.6049422	0.3930291	-1.54	0.124	-1.375265	0.1653807
Env Concern	0.1563867	0.128046	1.22	0.222	-0.0945788	0.4073523
_cons	1.791536	0.5008008	3.58	0	0.8099846	2.773088

The third logistic regression model examined the dependent variable of “minimize campfire impacts”. Again, the independent variables included in the model were age, gender, years of backcountry experience, level of education, participation in natural resource-oriented outdoor experiential education, natural resource education curriculum, and environmental concern (i.e., NEP score). The collapsed dependent variables are the four behaviors found in this category in Table 13 above. This model showed that respondents’ age and level of education were both significant at the .001 level and participation in natural resource-oriented outdoor experiential education was significant at the .01 (Table 16). All three of these independent variables were positively related to performing responsible environmental behavior regarding minimizing campfire impacts.

Table 16. Logistic Regression - Minimize Campfire Impacts

Logistic regression			N	666		
Log likelihood = -418.17083			Pseudo R2	0.0895		
Minimize Campfire	Coeff	Std. Err.	z	P>z	[95% Conf. Interval]	
Age	0.0328578	0.0060653	5.42	0.000	0.0209701	0.0447455
Gender	0.1219644	0.2014978	0.61	0.545	-0.2729641	0.5168929
Backcountry Experience	0.0016786	0.006482	0.26	0.796	-0.0110259	0.0143831
Level of Education	0.1910847	0.0587021	3.26	0.001	0.0760308	0.3061387
NR Exp Edu	0.7827293	0.2813241	2.78	0.005	0.2313442	1.334114
NR Curriculum Edu	-0.2957818	0.3247129	-0.91	0.362	-0.9322073	0.3406437
Env Concern	0.1231751	0.0858323	1.44	0.151	-0.0450531	0.2914032
_cons	-2.59282	0.3411206	-7.6	0	-3.261404	-1.924236

CHAPTER 5

Discussion and Implications

This chapter will present the discussion of the study results, management implications, and possible areas for further research. The purpose of this study was to explore the relative importance of several previously studied independent variables on the dependent variable of responsible environmental behavior. The first part of this chapter will be devoted to discussing the characteristics of the sample participants. The results directly related to the research question will then be discussed. This will be followed by a discussion of the strengths and limitations of this study. The chapter will conclude with implications for management and future research.

User Characteristics

Some respondent characteristics documented in this research were similar to those found in previous studies involving long-distance trail hikers. In a study including hikers from the Appalachian Trail and the Pacific Crest Trail, Anderson and others (2009) found 70% to be male and an overall mean age of 33. The mean age of participants in this study was 40.5 with a median age of 32. The majority of respondents in this current study were also male (77.33%). This is also similar to results found by Kyle and others (2003). That study found that 82% of thru-hikers along the Appalachian Trail were male as were 78% of section hikers.

The level of education reported by respondents in this study was also similar to that found in previous studies of long-distance A.T. hikers. For example, Kyle and others (2004) found that 46.4% of thru-hikers on the Appalachian Trail had completed a Bachelor's degree. In this current study, 40.5% reported having completed a Bachelor's degree. The previous study by Kyle and others (2004) also found that only 0.7% of thru-hikers along the A.T. had not completed high school. Results from this current study were similar, with only 0.14% of respondents having not completed high school. Some of the individuals that selected "some college" might have been too young to have completed a 2 or 4 year degree and could have been in the progress of completing a degree.

For the purposes of this study, respondents were given nine choices for their college/university course of study or formal curriculum. These choices were chosen to be consistent with majors typical of colleges and universities at tier 1 research institutes and were: agriculture, biological science, design, education, engineering, humanities, management, natural resources, and physical science. An "other" category was also included for those who felt their course of education did not fit into one of those categories. Only 7% of respondents noted that they received an education with a natural resources focused curriculum. This is actually higher than the national average. In the 2011-2012 academic year, 1.7% of all bachelor's degrees conferred were in the field of natural resources (National Center for Education Statistics, 2013). The higher percentage found for this study may be due to the fact that those with natural resource education backgrounds find activities such as overnight backcountry hiking more enjoyable than those in other education fields.

It was surprising that only 10% of respondents reported having participated in some form of natural resource-oriented outdoor experiential education. Participants were given the option of choosing NOLS, Outward Bound, and formal Leave No Trace trainings. The researcher would have expected higher participation in such programs especially in Leave No Trace, as that organization makes workshops readily available and often free. These workshops often take place in local parks and other areas that are easily accessible to the general public (Leave No Trace, 2012). And as stated in Chapter 2 above, Outward Bound had over 40,000 students in one year in the mid 1990's.

Given that the median age of the respondents was 32 years it is not surprising that the average years of backcountry experience was 16.35. Most individuals develop a passion for recreation activities in their teens that then carry forward into adulthood (McLean & Hurd, 2012). However, it was surprising to find that some individuals had zero years of backcountry experience. This means that they undertook one of the most grueling adventures with little to no previous experience as to what to expect in backcountry travel and were still able to complete all 2,180 miles of the Appalachian Trail.

According to the Appalachian Trail Conservancy (2013), the typical A.T. 2000-miler is a thru-hiker heading northbound on the trail. The results of this study supported this generalization. Almost 80% of respondents were thru-hikers and 77% of them completed the hike in a northbound direction from Georgia to Maine. Only 15% of the respondents reported hiking southbound from Maine to Georgia. The other 7% of respondents were what is known as flip-flop hikers. The number of flip-flop hikers has increased in recent years as

the trail has become more popular (ATC, 2013). Flip-flop hikers are often seeking to avoid the large “bubble” of northbound hikers in the spring by starting in a different location. Of the 20% of respondents that were section hikers, it was most interesting to find that one of the respondents reported section hiking the entirety of the trail over a period of 57 years.

The Role of Environmental Concern

The results regarding overall environmental concern using the New Ecological Paradigm (NEP) scale were very consistent across domains and made logical sense for the most part. This shows that respondents put thought into their responses regarding environmental concern. As a reminder, the 15 NEP items are scored on a 5 point Likert scale 1 being strongly agree and 5 being strongly disagree. The scale item “humans are seriously abusing the environment” had a mean score of 1.85, “plants and animals have as much right as humans to exist” had a mean score of 1.8, and “despite our special abilities, humans are still subject to the laws of nature” had a mean score of 1.57. So not only do many respondents agree that we are abusing the planet, they believe mankind must be conscious of nature’s limits and that we are equals with other species. That complements the results on the scale item “the balance of nature is strong enough to cope with the impacts of modern industrial nations” with a mean score of 3.84 and the scale item “humans will eventually learn enough about how nature works to be able to control it” which had a mean score of 3.74. Respondents generally disagreed with both of those statements. They also believed that the current “eco-crisis” is real and tangible. The scale item “the so-called ‘ecological crisis’ facing humankind has been greatly exaggerated” had a mean score of 3.81 which

indicated that respondents generally disagreed with that statement. These results are not surprising as the individuals in this study have had extended experiences in backcountry areas and have seen firsthand the negative impacts that humans can have on the environment as a result of human interactions in natural places. Therefore they would logically have a higher level of environmental concern in general.

Addressing the Study Research Question

The study's research question asked: What is the relative importance of user characteristics, natural resource-oriented outdoor experiential education, and concern for the environment in influencing visitors to behave in an environmentally responsible manner in backcountry areas? Logistic regression was used to explore the potential relationship between seven independent variables and each of the three dependent variables representing the various categories of responsible environmental behavior. The dependent variables were based upon principles of Leave No Trace (LNT) intended to guide and promote responsible environmental behavior. Three models were developed in order to address the study research question.

The first model explored the relationship between the independent variables and the responsible environmental behavior of disposing of waste properly. The respondents' level of education was showed to be significant related to these behaviors. However, the coefficient was negative meaning that the higher the level of education of the respondent, the less likely they were to engage in disposing of waste properly. This is contradictory to the

previous studies as discussed in Chapter 2 that found that those with higher levels of education typically were more likely to have a higher level of concern and were more likely to engage in responsible environmental behavior. Again, due to the way the data behaviors were collapsed if you failed one behavior you failed all four. A higher level of education is often related to a higher level of income and these individuals may feel that it is not their job to clean up after themselves or others. Further studies need to explore this relationship and discover the true implications of level of education and level of income on responsible environmental behavior. This model also showed that level of environmental concern (i.e., NEP score) was significant at the 0.05 level. This relationship was positive meaning that higher levels of environmental concern were associated with engaging in more responsible environmental behaviors. These findings are similar to those in previous research as discussed in the literature review. This may be due to the fact that those with a higher level of environmental concern are more likely to strictly follow the principles of Leave No Trace and want to leave the areas where they recreate in a better condition than they were found. However, this model was not strong as the pseudo R^2 suggests that it only explains 2% of the variance.

The second model explored the relationship between the independent variables and the responsible environmental behavior of leaving what you find. The respondents' age showed to be significant for this behavior with a p-value of .009. This was a positive relationship meaning that as age increased, respondents were more likely to engage in this responsible behavior. Previous research has shown that older individuals are more likely to

engage in responsible environmental behavior and typically have a higher level of environmental concern. These findings are similar to those in previous research as discussed in the literature review section above. This may be due to the fact that older individuals often have more experience in backcountry settings and outdoor recreation in general. They might be willing to exhibit responsible environmental behaviors in these areas as they may be more attached to these places due to previous experiences. It may also be possible that older individuals have previously removed natural objects or artifacts in earlier years and no longer have the need or desire to engage in such activities. This model was also not very strong and only explained approximately 3% of the variance.

The third model explored the relationship between the independent variables and the responsible environmental behavior of minimizing campfire impacts. The respondents' level of education was found to be significant for this behavior with a p-value of .001. This was a positive relationship meaning higher levels of education were associated with stronger efforts to minimize campfire impacts. These results are similar to previous studies discussed in chapter 2 above that found that those with a higher level of education typically were more likely to have a higher level of concern and engage in responsible environmental behavior. This model also showed that a respondents' age was significant with a p-value of .000. This was a positive relationship suggesting that older hikers are more likely to engage in this responsible behavior. Previous research has shown that older individuals are more likely to engage in responsible environmental behavior and typically have a higher level of environmental concern. These findings are similar to those in previous research as discussed

in the literature review. This model also showed that participation in natural resource-oriented outdoor experiential education courses was positive and significant with a p-value of .005. As discussed previously, individuals that participate in these courses have been shown to have a higher level of environmental concern and tend to behave in an environmentally responsible manner. Furthermore, these courses often teach participants how to cook with a camp stove and how to stay warm with proper gear and equipment. Campfires are used in these programs as social gatherings and are not shown to be necessary for actual survival purposes (Hattie et al., 1997). This was the strongest of all of the three models and explained nine percent of the variance. The strength of all of these models will be discussed further in the limitations section below.

Strengths and Limitations

Using an email survey proved effective for the purposes of this study. A large number of participants were able to be reached who otherwise would have been difficult to contact or would not have had the opportunity to participate in this study. This also allowed the researcher to expand the sample to include users from multiple years. This method allowed the researcher to reach a large sample with relative ease.

Using the Qualtrics survey platform to manage all correspondence with the sample participants made it easy to send follow-up reminders. Qualtrics stored the individual emails of those who had not yet responded and follow-up emails could be targeted only to those

individuals. Only once did a participant email the researcher and ask to be removed from the mailing list.

The main limitation of this study was the uniqueness of the sample. Even though the questionnaire specified that the respondents describe their behavior regarding their most recent backcountry hiking trip, almost half (44%) of respondents were referring to their Appalachian Trail hike. More importantly, this sample represented a group of people who were heavy backcountry users and not typical hikers. Not all of the Appalachian Trail 2000-milers registered their hikes with the ATC and not all of those that did register wanted to be contacted for research purposes. Therefore, natural resource managers of long-distance trails should be cautious in generalizing the results of this study. These results do not represent all hikers of the A.T or all backcountry users.

That being said, this unique sample did include a broadly diverse group of individuals. This is a large sample that includes people from very different age groups, educational backgrounds, and outdoor experiences. This sample may not be representative of a typical group of backcountry users, but it is diverse across demographic and behavioral variables. The broad range of user characteristics and experiences can be seen as a strength of this sample.

Another limitation with this study was the use of self-reported behaviors. Although it was promising that some respondents were apparently truthful in reporting negative behavior such as defacing structures or keeping cultural artifacts, we have no way of knowing if all

participants were 100% truthful. The only way to get honest results on actual behaviors would be to observe the respondents in a backcountry setting.

None of the models used in this study are very strong, with each explaining less than 10 percent of the variance in the behavior of individuals. This indicates that other variables are affecting individual responsible environmental behavior and they were not included in this study. Future research should focus on discovering and testing for other variables that may play a role in positively affecting responsible environmental behavior. Such models may be made stronger by more explicitly including the constructs of the theory of planned behavior as indicated in the literature review.

Implications

Based on the results of this study, natural resource managers should continue to be concerned about the number of people not following Leave No Trace principles. Their concerns should be focused, not just in backcountry areas, but across all natural areas where recreation activities take place. This sample did exceptionally well at following the principle of “leaving what you find” compared to the other behaviors of “disposing of waste properly” and “minimizing campfire impacts”. All of these LNT principles need to be reinforced by management.

The LNT concept of “pack it in – pack it out” does not apply to only one’s own waste. The principles of leave no trace were designed to help recreationists leave a natural area better than they found it when they entered the area. This is especially true with the “dispose of waste properly” principle. Individuals should be concerned not just with their

own waste, but waste they may come across left by others and be willing to remove that from the area as well. While 98% of respondents to this study claimed they removed their own waste from backcountry areas, nearly 45% admitted to not removing waste left behind by others. Management of natural resource recreation areas need to emphasize this particular part of “pack it in – pack it out”. It was significant that older individuals were more likely to exhibit this responsible environmental behavior. Management should gear education campaigns towards a younger crowd and possibly hold LNT workshops specifically aimed at children.

Almost a quarter (22%) of respondents admitted to washing themselves or their dishes within 200 feet of a stream or body of water. A creek may seem like an easy place to wash yourself or dishes but this should not be done. Water quality can be degraded by the chemicals used in soaps and detergents. If multiple users in a concentrated area, such as near an established campsite, are utilizing the same area to wash, that area and downstream areas will suffer. Management needs to focus on this part of Leave No Trace particularly. Possibly, Leave No Trace or natural resource management agencies need to publish and better communicate educational materials that describe alternative ways to wash yourself or dishes while in the backcountry and other recreation areas. The easiest way, in a creek, is not the responsible option.

Managers of natural resource recreation areas also need to emphasize the negative impacts of campfires. Campfires destroy the life in the surrounding soil and can be a trigger for wildfires. The principles of Leave No Trace are designed to minimize these negative

impacts. The majority of respondents to this study (53%) admitted to building a campfire on their last overnight backcountry hiking trip. Furthermore, of those who did build campfires, some removed dead or live limbs from trees in the surrounding area to use as firewood. This behavior leads to empty and barren landscapes in heavily used camping areas. Also, 59% of respondents did not scatter their unused ashes or firewood prior to breaking camp. Some respondents also created new fire rings. A barren campsite with multiple fire rings does not lead to a very positive experience for recreationists. Managers may need to have established fire rings in designated campsites and strict rules about firewood collection. This may be difficult to enforce, but better educating recreation participants about the negative impacts of campfires is a good start.

For future research, this study could be replicated in terms of users of other similar long-distance trails such as the Pacific Crest Trail (PCT) which traverses 2,654 miles of the western coast of the United States or the Continental Divide Trail which traverses 3,100 miles along the Rocky Mountains in the United States. This study could also be replicated using samples of other, more typical, backcountry users. This could include visitors to state or national parks who use backcountry areas for shorter periods of time than the long-distance hikers included in this study.

As in previous studies, environmental concern, age, and participation in natural resource-oriented experiential education were all shown to be significantly related to individual responsible environmental behavior in some cases. Future researchers should also attempt to include the constructs of the Theory of Planned Behavior in their

questionnaire and analysis. Some of those constructs have been shown to influence responsible environmental behavior. They were not included in this study because the research was focused primarily on the characteristics and background of the users and not the attitudes or subjective norms and perceived behavioral control. Other variables that could be of interest include user preferences for frontcountry or backcountry settings, or how parents or other role models teach younger generations about responsible environmental behavior and how they do so. As discussed previously, including these constructs and variables may provide additional meaningful results and shed more light onto what leads an individual to behave in a responsibly environmental manner.

Conclusion

Overall this research has provided some insights into the variables associated with individual responsible environmental behavior. The variables studied in my research have been previously studied independently, but this research has suggested how these variables work together and which may be more important in gaining a better understanding of individual responsible environmental behavior. In today's world of global climate change, stressed natural resource reserves, and population explosion, traditional intervention methods may not be enough to curb the environmental impacts caused by human interactions with recreation areas. A better understanding of the variables associated with responsible environmental behavior and how to successfully promote such behavior is a good place to begin.

REFERENCES

- Agresti, A., & Finlay, B. (2009). *Statistical methods for the social sciences*. (4 ed.). Upper Saddle River, New Jersey: Prentice Hall.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. *Action control: From cognition to behavior*, 11-39.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behaviour.
- Albrecht, D., Bultena, G., Hoiberg, E., & Nowak, P. (1982). Measuring environmental concern: The new environmental paradigm scale. *The Journal of Environmental Education*, 13(3), 39-43.
- Anderson Jr, S., Rebholz, C. M., White, L. F., Mitchell, P., Curcio III, E. P., Feldman, J. A., & Kahn, J. H. (2009). The impact of footwear and packweight on injury and illness among long-distance hikers. *Wilderness & environmental medicine*, 20(3), 250-256.
- Appalachian Trail Conservancy. (2013). *Appalachian trail conservancy*. Retrieved from <http://appalachiantrail.org/>
- Arcury, T. A. (1990). Environmental attitude and environmental knowledge. *Human Organization*, 49(4), 300-304.
- Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*, 40(4), 471-499.

- Bamberg, S. (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. *Journal of Environmental Psychology, 23*(1), 21-32.
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of environmental psychology, 27*(1), 14-25.
- Berns, G. N., & Simpson, S. (2009). Outdoor recreation participation and environmental concern: A research summary. *Journal of Experiential Education, 32*(1), 79-91.
- Bjerke, T., Thrane, C., & Kleiven, J. (2006). Outdoor recreation interests and environmental attitudes in Norway. *Managing Leisure, 11*(2), 116-128.
- Bradley, J. C., Waliczek, T. M., & Zajicek, J. M. (1999). Relationship between environmental knowledge and environmental attitude of high school students. *The Journal of Environmental Education, 30*(3), 17-21.
- Brown, T. J., Ham, S. H., & Hughes, M. (2010). Picking up litter: an application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism, 18*(7), 879-900.
- Carson, R. (1962). *Silent spring*. Boston: Houghton Mifflin Company.
- Cordell, H.K., Green, G.T., & Betz, C.J. (2002). Recreation and the environment as cultural dimensions in contemporary American society. *Leisure Sciences: An Interdisciplinary Journal, 24*(1), 13-41

- Cottrell, S. P. (2003). Influence of sociodemographics and environmental attitudes on general responsible environmental behavior among recreational boaters. *Environment and Behavior*, 35(3), 347-375.
- D'Amato, L. G., & Krasny, M. E. (2011). Outdoor adventure education: Applying transformative learning theory to understanding instrumental learning and personal growth in environmental education. *The Journal of Environmental Education*, 42(4), 237-254.
- Daniels, M. L., & Marion, J. L. (2005). Communicating Leave No Trace ethics and practices: Efficacy of two-day trainer courses. *Journal of Park and Recreation Administration*, 23(4), 1-19.
- Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (Vol. 2). New York: Wiley.
- Dowell, D. L., & McCool, S. F. (1986). Evaluation of a wilderness information dissemination program. *GEN. TECH. REP., INTERMT. RES. STN.*, 494-500.
- Dunlap, R. E. (2008). The new environmental paradigm scale: From marginality to worldwide use. *The Journal of Environmental Education*, 40(1), 3-18.
- Dunlap, R. E., & Van Liere, K. D. (1978). The new ecological paradigm. *Journal of environmental education*, 9, 10-19.
- Dunlap, R. E., Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised nep scale. *Journal of Social Issues*, 56(3), 425-442.

- Dyck, C., Schneider, I., Thompson, M., & Virden, R. (2003). Specialization among mountaineers and its relationship to environmental attitudes. *Journal of Park and Recreation Administration*, 21(2), 44-62.
- Fransson, N., & Gärling, T. (1999). Environmental concern: Conceptual definitions, measurement methods, and research findings. *Journal of environmental psychology*, 19(4), 369-382.
- Gookin, J. (Ed.). (2006). *NOLS wilderness educator notebook*. National Outdoor Leadership School.
- Hammit, J. P. (1995). Responsible environmental behavior: Metaphoric transference of minimum-impact ideology (Doctoral dissertation, University of Montana).
- Hattie, J., Marsh, H. W., Neill, J. T., & Richards, G. E. (1997). Adventure education and Outward Bound: Out-of-class experiences that make a lasting difference. *Review of Educational Research*, 67(1), 43-87.
- Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of Environmental Education*, 18(2), 1-8.
- Hrubes, D., Ajzen, I., & Daigle, J. (2001). Predicting hunting intentions and behavior: An application of the theory of planned behavior. *Leisure Sciences*, 23(3), 165-178.
- Hughes, M., Ham, S. H., & Brown T. (2009). Influencing park visitor behavior: A belief-based approach. *Journal of park and recreation administration*, 27(4), 38-53.

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *Journal of environmental education, 21*(3), 8-22.

Institute for Digital Research and Education. (2013). *Resources to help you learn and use Stata*. Retrieved from <http://www.ats.ucla.edu/stat/stata/>

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?. *Environmental education research, 8*(3), 239-260.

Kouthouris, C., & Spontis, A. (2005). Outdoor recreation participation: an application of the Theory of Planned Behavior. *The sport journal, 8*(3).

Kyle, G., Graefe, A., Manning, R., & Bacon, J. (2003). An examination of the relationship between leisure activity involvement and place attachment among hikers along the Appalachian Trail. *Journal of leisure research, 35*(3), 249-273.

Kyle, G., Graefe, A., Manning, R., & Bacon, J. (2004). Predictors of behavioral loyalty among hikers along the Appalachian Trail. *Leisure Sciences, 26*(1), 99-118.

Leave No Trace. (2012). *Leave no trace: Center for outdoor ethics*. Retrieved from <http://lnt.org/>

Leeming, F. C., Porter, B. E., Dwyer, W.O., Cobern, M.K. & Oliver, D.P. (1997). Effects of participation in class activities on children's environmental attitudes and knowledge. *The Journal of Environmental Education, 28*(2), 33-42.

Leopold, A. (1949). *A Sand County Almanac*. New York: Oxford University Press.

- MacLennan, J., Moore, R.L. (2011). Conflicts between recreation subworlds: The case of Appalachian Trail long-distance hikers. *LARNet; The Cyber Journal of Applied Leisure and Recreation Research*, 13(1), 1-17.
- Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin*, 18(1), 3-9.
- Marion, J. L., & Leung, Y. F. (2001). Trail resource impacts and an examination of alternative assessment techniques. *Journal of Park & Recreation Administration*, 19(3).
- Marion, J. L., & Reid, S. E. (2007). Minimising visitor impacts to protected areas: The efficacy of low impact education programmes. *Journal of Sustainable Tourism*, 15(1), 5-27.
- McLean, D., & Hurd, A. (2012). Kraus' recreation and leisure in modern society. (9th ed.) Sudbury, MA: Jones & Bartlett Publishers.
- Muir, J. (1916). *A thousand mile walk to the gulf*. Boston: Houghton Mifflin Company.
- National Center for Education Statistics. U.S. Department of Education, Institute of Education Sciences. (2013). *Digest of education statistics*. Retrieved from website: https://nces.ed.gov/programs/digest/2013menu_tables.asp
- North Carolina Department of Environment and Natural Resources, (2012). *North Carolina state parks and recreation 2012 annual report*. Parks by Nature. Retrieved from: http://www.ncparks.gov/News/media_room/docs/2012_annual_rpt.pdf

Outward Bound. (2013). *Outward bound*. Retrieved from <http://www.outwardbound.org/>

Paisley, K., Furman, N., Sibthorp, J., & Gookin, J. (2008). Student learning in outdoor education: A case study from the National Outdoor Leadership School. *Journal of Experiential Education*, 30(3), 201-222.

Ramsey, J., Hungerford, H. R., & Tomera, A. N. (1981). The effects of environmental action and environmental case study instruction on the overt environmental behavior of eighth-grade students. *The Journal of Environmental Education*, 13(1), 24-29.

Reigner, N., & Lawson, S. R. (2009). Improving the efficacy of visitor education in Haleakalā National Park using the theory of planned behavior. *Editorial Assistant*, 21.

Rivis, A., & Sheeran, P. (2003). Descriptive norms as an additional predictor in the theory of planned behaviour: A meta-analysis. *Current Psychology*, 22(3), 218-233.

Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, 21(4), 327-339.

Scott, D., & Willits, F. K. (1994). Environmental attitudes and behavior a Pennsylvania survey. *Environment and behavior*, 26(2), 239-260.

Singer, E. (2002). The use of incentives to reduce nonresponse in household surveys. *Survey nonresponse*, 163-177.

StataCorp. 2011. Stata Statistical Software: Release 12. *Statistical Software*. College Station, TX: StataCorp LP.

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407-424.

- Stern, P. C., Dietz, T., & Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior*, 25(5), 322-348.
- Stern, P. C., Dietz, T., Kalof, L., & Guagnano, G. A. (1995). Values, beliefs, and proenvironmental action: Attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology*, 25(18), 1611-1636.
- Teisl, M., & O'Brien, K. (2003). Who cares and who acts? Outdoor recreationists exhibit different levels of environmental concern and behavior. *Environment and Behavior*, 35(4), 506-522.
- Thapa, B., & Graefe, A. R. (2003). Forest recreationists and environmentalism. *Journal of Park and Recreation Administration*, 21(1), 75-103.
- USDA. U.S. Department of Agriculture, Forest Service. (2001). *The built environment image guide for the national forests and grasslands* (FS-710). Retrieved from website: http://www.fs.fed.us/recreation/programs/beig/BEIG_readers_guide.htm
- Vaske, J. J., & Donnelly, M. P. (1999). A value-attitude-behavior model predicting wildland preservation voting intentions. *Society & Natural Resources*, 12(6), 523-537.
- Vaske, J. J., Donnelly, M. P., Williams, D. R., & Jonker, S. (2001a). Demographic influences on environmental value orientations and normative beliefs about national forest management. *Society & Natural Resources*, 14(9), 761-776.
- Vaske, J. J., Donnelly, M. P., Williams, D. R., & Jonker, S. (2001b). Relationship between environmental knowledge and environmental attitude of high school students. *Society & Natural Resources*, 14(9), 761-776.

Walker, G. J., & Chapman, R. (2003). Thinking like a park: the effects of sense of place, perspective-taking, and empathy on pro-environmental intentions. *Journal of Park and Recreation Administration*, 21(4), 71-86.

Walter, P. (2009). Philosophies of adult environmental education. *Adult Education Quarterly*, 60(1), 3-25.

Wiidegren, O. (1998). The new environmental paradigm and personal norms. *Environment and Behavior*, 30(1), 75-100.

APPENDICES

Appendix A

Questionnaire

NC STATE UNIVERSITY



2013 Backcountry Use and Attitudes Study

Thank you for agreeing to participate in this research study about backcountry use and attitudes. The purpose of this study is to gain a better understanding of the behavior of visitors to backcountry areas such as those found along much of the Appalachian Trail (A.T.). The results of this study will help resource managers from the Appalachian Trail Conservancy (ATC) and their partners develop strategies to effectively care for backcountry areas for visitors like you. At any given time, you may choose to withdraw from this study or not complete particular questions.

For the purposes of this study, "backcountry" is defined as undeveloped recreation areas without modern developed facilities, amenities, or paved trails and where there are relatively few other people, like the majority of the A.T. "Frontcountry" areas are more developed recreation areas where modern facilities, amenities, and paved trails are prevalent and many people are often present, such as paved "greenway trails".

All your responses are anonymous and confidential and results will only be reported as summaries. In fact, the Qualtrics software we are using makes it impossible for us to link your answers to you or your email address. Your email address will not be shared with anyone and it will be deleted upon completion of the survey. Participation in this study is voluntary.

If you have any questions or concerns about this study, please contact the lead researcher at North Carolina State University:

Brendan Adams
badams@ncsu.edu

Your Backcountry Experience:

In what year did you first have an overnight visit to a backcountry area?

In what year was your most recent completion of the entire 2,180 miles of the Appalachian Trail?

Did you complete the Appalachian Trail that time by:

- Thru-hiking
- Section Hiking (more than 12 months)

At the southern end of the trail, did you sign the register at Amicalola Falls State Park?

- Yes
- No

In which direction did you hike the Appalachian Trail?

- Northbound
- Southbound
- Flip-Flop

Which year did you first start section hiking the Appalachian Trail?

Which of the following did you use for guidance and/or navigation? (Select all that apply)

- A.T. Thru-Hikers' Companion, hard copy
- Digital Copy of A.T. Guide or Thru-Hikers' Companion
- Official A.T. Maps (Published by ATC)
- Official A.T. Guidebooks (Published by ATC)
- The A.T. Guide by David "Awol" Miller, hard copy
- The A.T. Guide: A Handbook for Hiking the Appalachian Trail, hard copy
- Pocket Map/Profiles
- Digital Maps/Apps

About how much did you spend for your hike (including gear purchased specifically for the trip, transportation, supplies, etc. and in towns along the way)?

About how many nights have you visited any backcountry area (Not necessarily on the A.T.) in the past 12 months?

Which type of setting do you generally prefer for your outdoor recreation pursuits?

- Backcountry
- Frontcountry

Which of the following environmental or experiential education programs have you participated in? (Select all that apply)

	Yes
Leave No Trace awareness workshop	<input type="checkbox"/> Yes
Leave No Trace trainer course	<input type="checkbox"/> Yes
Leave No Trace master educator course	<input type="checkbox"/> Yes
Project WILD program	<input type="checkbox"/> Yes
National Outdoor Leadership School (NOLS) course	<input type="checkbox"/> Yes
Outward Bound Course	<input type="checkbox"/> Yes
Other (Please List) <input type="text"/>	<input type="checkbox"/> Yes

Did your participation in any of the above program(s) take place after your most recent overnight backcountry hiking trip (Not necessarily on the A.T.)?

- Yes
- No
- Not Applicable

How familiar are you with the principles of Leave No Trace (LNT)?

- Extremely Familiar

Somewhat Familiar

Not Familiar At All

Have you seen any LNT material during your Appalachian Trail hikes (select all that apply)?

No

Yes, I saw trailhead signage

Yes, I saw signs/posters in shelters

Yes, in other locations (Please describe):

Which of the following outdoor recreation or environmental protection/conservation organizations are you a member of (select all that apply)?

Appalachian Trail Conservancy

American Hiking Society

National Parks Conservation Association

A.T. Maintaining Club (Please list)

Sierra Club

Wilderness Society

Other: (Please list)

Your Most Recent Overnight Backcountry Hiking Trip: Please answer the questions in this section based on the last overnight backcountry hiking trip you took anywhere, not necessarily on the A.T. Remember that your answers are anonymous and confidential.

On that trip how many nights did you spend in the backcountry?

On that trip what was the size of your group?

Which of the following best describes the area where your most recent overnight backcountry hiking trip took place:

Primitive - greater than three miles from all roads or motorized trails, very little contact with visitors outside my group

Semi-Primitive - greater than one half mile from all roads or motorized trails, little contact with visitors outside my group.

Natural - easily accessible by roads, moderate contact with visitors outside my group

On that trip did you carry out all of your own litter?

Yes

No

On that trip did you carry out all the litter you found even if it was left by others before you?

Yes

No

On that trip did you dig a "cathole" to dispose of your human waste when a privie/outhouse was unavailable?

Yes

No

Not Applicable

On that trip did you wash yourself and dishes at least 200 feet away from all streams and other bodies of water?

Yes

No

On that trip did you collect any rocks, plants or other natural items to keep?

Yes

No

On that trip did you collect any cultural artifacts to keep?

Yes

No

On that trip did you cut or remove any limbs from a live tree or shrub?

Yes

No

On that trip did you "tag", deface, or add graffiti to any trees, shelters or other natural or man-made surfaces?

Yes

No

On that trip did you build a campfire?

Yes

No

On that trip did you construct a new fire ring?

Yes

No

On that trip did you remove limbs from a live or dead tree to use as firewood?

Yes

No

On that trip did you scatter your unused wood and ashes prior to leaving your campsite?

Yes

No

Not Applicable

Was your most recent overnight backcountry hiking trip (the one you have been referring to above) on the Appalachian Trail?

Yes

No

Please indicate how strongly you agree or disagree with each of the following statements:

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
--	----------------	-------	----------------------------	----------	-------------------

We are approaching the limit of the number of people the Earth can support.

Humans have the right to modify the natural environment to suit their needs.

When humans interfere with nature it often produces disastrous consequences.

Human ingenuity will insure that we do not make the Earth unlivable.

Humans are seriously abusing the environment.

The Earth has plenty of natural resources if we just learn how to develop them.

Plants and animals have as much right as humans to exist.

The balance of nature is strong enough to cope with the impacts of modern industrial nations.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
--	----------------	-------	----------------------------	----------	-------------------

Despite our special abilities, humans are still subject to the laws of nature.

The so-called “ecological crisis” facing humankind has been greatly exaggerated.

The Earth is like a spaceship with very limited room and resources.

Humans were meant to rule over the rest of nature.

The balance of nature is very delicate and easily upset.

Humans will eventually learn enough about how nature works to be able to control it.

If things continue on their present course, we will soon experience a major ecological catastrophe.

The seven principles of Leave No Trace are:

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

Which of the following statements best describes your view of the Leave No Trace Principles (LNT)?

- I strictly follow the seven principles of Leave No Trace every time I am in the backcountry
- I follow most of the Leave No Trace Principles
- I follow none of the Leave No Trace principles, but I have developed my own set of principles that fit me better
- The Leave No Trace principles do not fit into my recreation lifestyle

Please indicate how strongly you agree or disagree with each of the following statements regarding the principles of Leave No Trace (LNT):

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
--	----------------	-------	----------------------------	----------	-------------------

The issues relating LNT to the environment are familiar to me.

Following the principles of LNT is beneficial to the environment.

My friends and colleagues would approve of me following the principles of LNT.

I alone can make a difference in the environment by following the principles of LNT.

I can follow the principles of LNT if I choose to do so.

I care what my friends and colleagues think of me following the principles of LNT.

It is my personal responsibility to follow the principles of LNT.

About You: (Questions in this section refer to your personal background. This information is important for the purposes of this study. Please remember, all responses are anonymous and results will only be reported as summaries.)

In what year were you born?

Which are you?

Male

Female

What is the highest level of education you have completed?

Some High School

High School / GED

Some College

2-year College Degree

4-year College Degree

Some Graduate Education

Graduate Degree

What is/was your primary course of study (select all that apply if you completed multiple degrees)?

Agriculture

Biological Science

Design

Education

Engineering

Humanities

Management

Natural Resources

Physical Science

Other (Please List)

In what zip code is your primary residence located?

Thank you for participating in this study. Please click the next button below to submit your answers.

Appendix B

Email Correspondence

Reply-To Email:badams@ncsu.edu

Subject:Question for 2,000-Milers

Message:

AT Hikers

Dear Recent 2,000-Miler,

First of all, congratulations again on completing the entire Appalachian Trail! Yours is a notable accomplishment and one worth celebrating. I am contacting you now because the Appalachian Trail Conservancy (ATC) has partnered with researchers from North Carolina State University to conduct a study designed to help us better understand hikers' use of backcountry areas like those found along most of the A.T. By participating in this study you will be helping us accomplish our mission of preserving and managing the A.T. now and for future generations.

When you registered your hike with ATC you indicated that you would be willing to be contacted by email for research efforts related to the A.T. Participation in this study is voluntary and your responses will remain completely anonymous and confidential. If you choose to participate we ask that you complete the online survey available at the link below. It will take less than 15 minutes of your time.

Follow this link to the Survey:

[\\${!://SurveyLink?d=Take the Survey}](#)

Or copy and paste the URL below into your internet browser:

[\\${!://SurveyURL}](#)

Thank you for your time and ongoing support of the Appalachian Trail!

Laurie Potteiger
Information Services Manager
Appalachian Trail Conservancy
799 Washington Street | P.O. Box 807
Harpers Ferry, WV 25425-0807
Phone: [304.535.2200](tel:304.535.2200) x128
lpotteiger@appalachiantrail.org
www.appalachiantrail.org



The Appalachian Trail Conservancy's mission is to preserve and manage the Appalachian Trail – ensuring that its vast natural beauty and priceless cultural heritage can be shared and enjoyed today, tomorrow, and for centuries to come. To become a member, volunteer, or learn more, visit www.appalachiantrail.org.

Dear Recent 2,000-Miler,

I recently emailed you with an invitation to participate in a study designed to help us better understand hikers' use of backcountry areas like those found along most of the A.T. By participating in this study you will be helping us accomplish our mission of preserving and managing the A.T. now and for future generations.

This study is being conducted by researchers at North Carolina State University through a partnership with the Appalachian Trail Conservancy. Your experiences and opinions are important to us! Please take the time to complete the survey linked below so that we may better serve you and other Appalachian Trail hikers. The survey will take less than 15 minutes of your time.

Follow this link to the Survey:

[\\${://SurveyLink?d=Take the Survey}](#)

Or copy and paste the URL below into your internet browser:

[\\${://SurveyURL}](#)

Thank you for your time and ongoing support of the Appalachian Trail!

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Dear Recent 2,000-Miler,

I recently emailed you an invitation to participate in an important study about hikers' use of backcountry areas like those found along most of the Appalachian Trail. So far we have not received your response. We will not trouble you again with this request, but we do hope you participate since the impact of the results depends on having a high response rate. By participating in this study you will be helping us accomplish our mission of preserving and managing the A.T. for hikers like you and for future generations.

This study is being conducted by researchers at North Carolina State University through a partnership with the Appalachian Trail Conservancy. Your experiences and opinions are important to us! Please take the time to complete the survey linked below so that we may better serve you and other Appalachian Trail hikers. The survey will take less than 15 minutes of your time.

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