THESIS

INFLUENCING LEAVE NO TRACE BEHAVIORAL INTENTIONS IN FRONTCOUNTRY

VISITORS TO NATIONAL AND STATE PARKS

Submitted by

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ABSTRACT

INFLUENCING LEAVE NO TRACE BEHAVIORAL INTENTIONS IN FRONTCOUNTRY

VISITORS TO NATIONAL AND STATE PARKS

Resource degradation resulting from visitor behavior continues to be a significant

concern for land managers, and effective educational messages such as those promoted through

Leave No Trace, which target depreciative behaviors, are imperative. This thesis examined

psychological and knowledge variables that were hypothesized to influence Leave No Trace

behavioral intent of visitors to national and state parks. While knowledge, attitudes, beliefs and

behaviors of outdoor enthusiasts in the context of Leave No Trace have been studied in

backcountry visitors, research pertaining to frontcountry visitors is limited.

Chapter 1 examined specific factors that influence Leave No Trace behavioral intent in

visitors to Rocky Mountain National Park. Data were obtained from an on-site survey

administered to individuals ($N = 390$, response rate 74%) in the Bear Lake corridor of the park.

Results of a regression analysis revealed that *perceived effectiveness* of Leave No Trace practices

is a significant predictor of future behavioral intent ($\beta > .21$, $p < .001$, in all cases). Frontcountry

visitors like those at Bear Lake are more likely to practice Leave No Trace if they perceive the

practices to be effective at reducing impacts.

Chapter 2 examined variables that were hypothesized to influence Leave No Trace

behavioral intent in state park visitors. Data were obtained from an on-site survey administered

to individuals ($N = 346$, response rate 93%) in three Wyoming state parks and historic sites.

Results suggest that both *attitudes* and the *perceived effectiveness* of Leave No Trace practices

are meaningful predictors of behavioral intent in state park visitors, and that messaging targeting these variables can be effective at influencing behavioral intent.

Both chapters in this thesis provide specific managerial implications that could strengthen Leave No Trace educational efforts in frontcountry locations by targeting specific attitudes and perceptions about recommended Leave No Trace practices in order to influence behavioral intentions. Furthermore, the results indicate that visitors to national parks and state parks could generally benefit from a more uniform approach to Leave No Trace education, which is likely to enhance overall adoption of Leave No Trace by land managers across the agency spectrum.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Each year hundreds of millions of Americans participate in various kinds of recreational activities in the outdoors. According to Cordell, Betz and Green (2008), Americans' interest in outdoor recreation is on the rise despite media reports to the contrary. Recreational use of lands managed by the USDA Forest Service increased from 4.6 million annual visits in 1924 to a staggering 900 million in 1999. A similar increase in recreational visits to lands managed by the National Park Service (NPS) has occurred over the past several decades, increasing from an estimated 33 million visits in 1950 to approximately 287 million visits in 1999 (Marion & Reid, 2001). Increases in visitation to parks and protected areas can result in recreation-related resource damage, conflict and crowding (Manning, 1999). Leung and Marion (2000) posit that we should care about recreation impacts because, "they reflect success in meeting two primary legal mandates: resource protection and recreation provision" (p. 25).

Modern-day managers of lands used by the public for recreation face countless and complex management challenges. From external threats such as development to climate change to increasing recreational use, many land managers must strike a balance between resource protection and the provision of recreational opportunities. Though numerous parks and protected areas have a recreation mandate, resource degradation due to inappropriate visitor behavior continues to be a significant concern for managers (Leung & Marion, 2000; Taff, Newman, Bright, & Vagias, 2011; Vagias & Powell, 2010). In light of the fact that minimal recreational use can cause substantial impacts, especially since most impacts are cumulative over time, land managers must utilize an array of tactics to reduce these impacts (Hammitt & Cole, 1998; Leung & Marion, 2000).

Often, land managers deal with resource and social impacts through two primary strategies: indirect strategies such as education and/or direct strategies such as enforcement (Manning, 2003; Marion & Reid, 2007). Direct management approaches, including enforcement of regulations or site management, tend to be expensive and possibly limit visitors' sense of freedom (Marion & Reid, 2007). However, indirect management approaches such as visitor education have become a standard and effective method used to minimize high-impact behaviors of outdoor enthusiasts in parks and protected areas (Hammitt & Cole, 1998; Hendee & Dawson, 2002; Manning, 1999; 2003; Marion & Reid, 2001). This focus on education has led to the development of numerous initiatives aimed at minimizing recreation-related impacts (Marion & Reid, 2007). While there is variation between the different programs, the principal intent is to raise general awareness, decrease depreciative behaviors, increase knowledge, influence attitudes and to boost the overall experience of visitors (Vagias, 2009). In many protected areas, managers provide interpretive education concerning Leave No Trace practices to promote responsible visitor enjoyment of lands used for recreation. As such, Leave No Trace concepts have become one of the most commonly used approaches for educating visitors about minimizing impacts to the landscape (Harmon, 1997; Marion & Reid, 2001; Vagias & Powell, 2010).

Despite advances towards understanding attitudes and behaviors related to Leave No Trace in backcountry recreationists, there is limited information regarding the attitudes and perceptions frontcountry visitors have towards recommended Leave No Trace practices. Frontcountry, as defined by The Leave No Trace Center for Outdoor Ethics (the Center), includes areas such as state parks that are easily accessed by car and mostly visited by day users. These areas also include developed campsites (Leave No Trace Center for Outdoor Ethics, 2012a). Though park managers often direct most visitors to frontcountry locations (Kuentzel,

2

Laven, Manning, & Valliere, 2008), little is known about how managers can best promote Leave No Trace to visitors in these areas. According to the National Association of State Park Directors, the 6,600 state park units in the U.S. have an annual visitation of 725 million, a number that is projected to increase over time (National Association of State Park Directors, 2011). While the roots of the Leave No Trace program are in federally designated wilderness and backcountry areas, more recent educational efforts have been focused on frontcountry recreationists because this is where the majority of recreation occurs in the U.S. (Outdoor Industry Foundation, 2012). For example, though the NPS hosts nearly 300 million visitors per year, only 1.7 million visitors in 2010 camped overnight in the backcountry (NPS Statistics, 2010). Without an understanding of how to best message to outdoor enthusiasts in frontcountry settings, educational efforts may simply not be effective at influencing behavioral intentions for Leave No Trace behavior in this context.

Synopsis of the Theoretical Foundation

The Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) have often been applied to human dimensions of natural resource science (Fishbein & Manfredo, 1992; Manfredo, Teel, & Bright, 2004; Marion & Reid, 2007; Vagias & Powell, 2010). Both TRA and TPB are general theories of social psychology and seek to explain human behavior (Ajzen, 1991; Fishbein & Ajzen, 1975). The overarching assertion of both theories is that individuals make rational decisions and that the most accurate predictor of their behavior is the intention to engage in said behavior (Ajzen, 1991). Ajzen and Fishbein (1980) posited that intention (*how much effort an individual is willing to put towards performing a behavior*) is a function of attitude towards a behavior and subjective norms (*how others feel about the behavior*). Additionally, behavioral intentions are based on behavioral beliefs (*an attitude about*

3

the consequences of a particular behavior), normative beliefs (*social pressure to engage in a particular behavior*) and control beliefs (*the belief that one has the knowledge, skill, resources, etc. to engage in a particular behavior*) (Fishbein & Ajzen, 1975; Fishbein & Manfredo, 1992; Ham & Krumpe, 1996).

TPB posits that attitudes, subjective norms and perceived behavioral control can accurately predict the behavioral intentions of an individual and his or her eventual behavior (Ajzen, 1991). Furthermore, "a central factor in the theory of planned behavior is the individual's *intention* to perform a given behavior" (Ajzen, 1991, p. 181). Lastly, TPB has the specific function to, "predict and explain human behavior in specific context" (Ajzen, 1991, p. 181) This is perhaps the primary reason that TPB is so useful for orienting evaluations of the efficacy of visitor education programs such as Leave No Trace (Vagias, 2009). Figure 1 depicts the TPB (Ajzen, 1991).
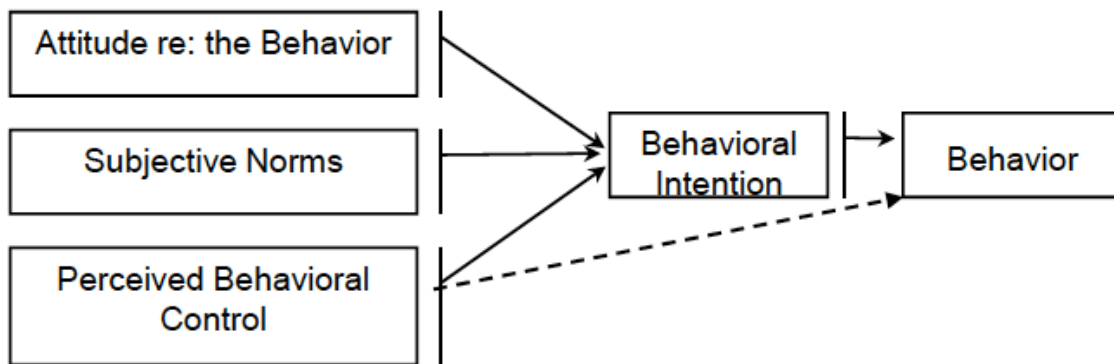
Figure 1. Theory of Planned Behavior (adapted from Ajzen, 1991).

Theory and previous research suggest that attitudes influence behavior, (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Manfredo, 1992; Ham & Krumpe, 1996) and one's attitude towards a specific behavior can govern his or her actions. As such, recreationist behavior in terms of Leave No Trace is theoretically determined in part by attitudes towards specific Leave No Trace recommendations. Therefore, understanding visitor attitudes related to Leave No Trace

is imperative for creating education and communication tactics that can influence visitor behavior to minimize overall recreational impact.

Behavior Change

In order to minimize recreation-related impacts, protected area managers often rely on educational strategies to both inform visitors and to attempt to change visitor behavior (Cialdini, 1996; Ham, 2007; Manning, 2003; Marion & Reid, 2007; Vagias, 2009). The sole purpose for some educational efforts is to change behavior (Heimlich & Ardoin, 2008). Yet, education efforts that focus solely on providing new knowledge to recreationists do not always result in changes in attitudes or behaviors (Petty, McMichael, & Brannon, 1992). Therefore, strategies other than simply imparting knowledge, such as persuasion, must be employed in order to achieve overarching educational objectives, and ultimately behavior change (Manning, 2003).

Visitor education efforts often draw on one of two pertinent models of persuasion: the central route to persuasion or the peripheral route to persuasion (Roggenbuck, 1992). The overall effectiveness of persuasion is largely dependent on the type of impact, the type of behavior and the motivations for the behavior in question (Roggenbuck, 1992). Park and protected area managers often rely on the central route to persuasion, which, "relies on visitor attention, consideration and internalization of the message" (Marion & Reid, 2007, p. 11). The central route to persuasion's effectiveness is due to the visitor processing the information by filtering it through prior knowledge and experience to evaluate the information (or arguments) presented in the message. Once a particular message is internalized by the visitor, and meshed with the visitor's belief structure, long-term behavioral change is possible (Marion & Reid, 2007). The peripheral route to persuasion generally relies on the source of the information rather than the quality or relevance of the information itself. As noted by Roggenbuck (1992), "the recipient

pays more attention to 'who said it' than to 'what was said'" (p. 195) in the context of the

peripheral route to persuasion. While this can be an effective strategy in the right context (e.g.

park ranger talk at a visitor center), this route to persuasion has limited effectiveness in creating

long term behavior change (Marion & Reid, 2007).

McGuire (1985) provides a model (Figure 2) for information processing that offers a

theoretical basis for programs designed to change behavior, which is particularly well suited for

parks and protected areas. As illustrated in the model, the process of persuasion begins when a

visitor is exposed to an educational message, which is followed by processing and

comprehension of the information. The next step, and perhaps the most critical in the process, is

the yielding step, which involves the visitor accepting the message and then altering their attitude

accordingly (Marion & Reid, 2007). The model further assumes that once a visitor has yielded to

the message and a change in attitude has occurred, that the changed attitude will be retained in

the visitor's memory thus guiding future behavior. Therefore, if the goal of a 'persuasion-based'

program is to create long-term behavioral change in park and protected area visitors, the central

route to persuasion is likely the most effective strategy (Petty et al., 1992).
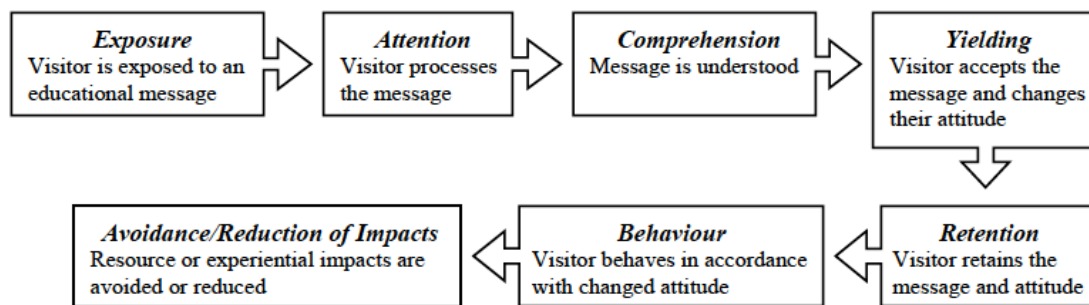
Figure 2. Information-processing model of persuasion and behavior change (adapted from
McGuire, 1985).

Despite the notion that behavior change in park and protected area visitors may not

directly result from attaining new knowledge, both Marion and Reid (2007) and Manning (2003)

have concluded that visitor education can be effective in changing the behavior of protected area visitors. Although education can be effective in changing behavior, the overall level of effectiveness varies by strategy (Vagias, 2009). One strategy that has merit is the use of multiple media to deliver educational messages rather than relying on any single medium (Manning, 2003). According to Ham (2007), making any meaningful difference in visitor behavior requires presenting strong, relevant themes that provoke a visitor to internalize the themes. This in turn impacts attitudes, which then can impact visitor behavior (Ajzen, 1991; Ham & Krumpe, 1996).

Efficacy of Visitor Education Programs

Research has shown that even nominal recreational use can cause considerable impacts, particularly since impacts are cumulative over time. Because of this inevitable impact, park and protected area managers must utilize a variety of strategies to minimize these impacts including visitor education (Hammitt & Cole, 1998; Hendee & Dawson, 2002; Leung & Marion, 2000; Manning, 2003; Vagias & Powell, 2010). Many land managers recognize that recreation-related resource impacts are not malicious by nature. Rather, they generally stem from a lack of knowledge of the consequences of such actions, and a lack of knowledge of appropriate minimum impact behaviors and techniques (Bradley, 1979; Marion & Reid, 2007). Education efforts that are designed to influence visitors to adopt minimum-impact practices are viewed by managers as a light-handed approach to managing resource impacts (Manning, 1999; Roggenbuck, 1992), and are generally preferred by park and protected area visitors rather than more direct management approaches (Hendee & Dawson, 2002; Park, Manning, Marion, Lawson, & Jacobi, 2008).

According to Manning (2003) problem behaviors of park and protected area visitors can be classified into five different types as shown in Figure 3. As illustrated in the figure, certain

types of problems are more apt to be effectively addressed by education than others. For two of the behaviors, illegal and unavoidable, Manning (2003) asserts that education will have little to no effect on curbing the undesirable actions. However, behaviors identified as careless, unskilled and uninformed have varying potential (from moderate to very high) of effectively being influenced by education efforts. The level of effectiveness of various communication efforts largely depends on the kind of impact, the specific depreciative behavior involved and the specific motivation for engaging in said behavior (Roggenbuck, 1992).

Application of Information/Education to Wilderness Management Problems (Manning, 2003)

Type of Problem	Example	Potential Effectiveness of Information/ Education
Illegal actions	Theft of Indian artifacts; use of wilderness by motorized off-road vehicles	Low
Careless actions	Littering; shouting	Moderate
Unskilled actions	Selecting improper campsites; building improper campfire	High
Uninformed actions	Using dead snags for firewood; camping in sight or sound of another group	Very high
Unavoidable actions	Disposing of human waste; trampling ground cover vegetation at campsites	Low

Figure 3. Typology of problem behaviors (adapted from Manning, 2003).

Other factors of efficacy include message rational, message delivery and source credibility (Marion & Reid, 2007). Christensen and Cole (2000) found that protected area visitors were more likely to be persuaded to change behavior by ecological rationales than by social rationales. In terms of message delivery, timing of messages is a critical factor for maximizing efficacy (Roggenbuck, 1992). This suggests that managers should strive to time the delivery of educational messages to reach recreationists early in the trip planning process for maximum effectiveness (Marion & Reid, 2007).

Educational efforts are an essential component of overall management efforts for ensuring protection of recreational resources. As noted by Marion and Reid (2007), there is

sufficient evidence that the majority of commonly used visitor education methods can affect visitor knowledge, attitudes and behavior. Similarly, Manning (2003) concluded that education can ultimately be effective in modifying park and protected area visitors' attitudes. Lastly, Marion and Reid (2007) state that, "It is clear that visitor education can be an effective management strategy for addressing visitor impacts to protected area resources" (p. 18).

Previous Research

While there are many studies that have examined the efficacy of visitor education programs, dating back to Fazio's (1979) study of camping practices in Rocky Mountain National Park, research into the efficacy of Leave No Trace efforts are much less common (Vagias, 2009). As a result, numerous researchers have recommended further examination of the program (Leung & Attarian, 2003; Marion & Reid, 2007; Newman, Manning, Bacon, Graefe, & Kyle, 2003; Vagias, 2009). Despite the lack of efficacy research pertaining to Leave No Trace, there are a few studies that are relevant to Leave No Trace efficacy, and program efficacy in frontcountry settings in particular (Daniels & Marion, 2005; Jones & Bruyere, 2004; Leung & Attarian, 2003; Mertz, 2002; Newman et al., 2003; Taff et al., 2011; Vagias & Powell, 2010). Some past Leave No Trace-focused studies have utilized increased knowledge as the primary measure of efficacy (Daniels & Marion, 2005). Though there are several issues with these types of knowledge evaluations, the principal concern is that an individual's behavior is principally determined more by attitudes than by knowledge (Ajzen, 1991). Kaiser, Wolfing and Fuhrer (1999) note that attitudes are considerably more important than knowledge in environmental context. This indicates a need to undertake Leave No Trace-oriented studies that address the attitudes pertaining to the behaviors in question rather than knowledge of specific Leave No

Trace practices (Vagias, 2009). Please note that the individual manuscripts in this thesis contain more robust reviews of this literature.

Purpose of Thesis

The research contained in this thesis intends to add to the growing body of literature regarding frontcountry visitors' attitudes and perceptions of recommended Leave No Trace practices in order to increase the efficacy of Leave No Trace educational efforts in frontcountry settings such as state parks. Determining specific factors that can influence behavioral intent in park and protected area visitors, particularly those visiting frontcountry locations, can lead to more effective Leave No Trace messaging, which may ultimately result in reduced recreation-related impacts. Additionally, since this research was specifically focused on frontcountry visitors in national and state parks, it intends to provide a baseline for greater understanding of this demographic in the context of Leave No Trace. By enhancing the collective understanding of how to effectively influence Leave No Trace behavioral intent of outdoor enthusiasts in frontcountry settings, land managers and the Center can advance and improve the overall Leave No Trace program in order to reach this large and growing segment of the recreating public.

Organization of Thesis

This thesis includes two studies and is presented as two chapters, one of which has been published (Chapter 1), and the other which is suitable for journal submission. Each chapter focuses on factors that were hypothesized to influence behavioral intentions for Leave No Trace behavior. Chapter 1 explored the influence of several variables on behavioral intentions in visitors to the Bear Lake area of Rocky Mountain National Park. Regression analysis revealed that *perceived effectiveness* of recommended Leave No Trace practices is a significant predictor of future behavioral intent in park visitors. Chapter 2 builds on the research from Chapter 1 by

exploring variables that were hypothesized to influence Leave No Trace behavioral intentions in visitors to state parks. Results from regression analysis indicate that both *perceived effectiveness* of and *attitudes* towards recommended Leave No Trace practices are significant predictors of future behavioral intent in state park visitors. Finally, the Conclusion ties the two chapters together, exploring broader implications, lessons learned across national and state parks, and next steps. Limitations of these studies as well as future research opportunities are also discussed in each chapter.

CHAPTER 1. FACTORS INFLUENCING BEHAVIROAL INTENTIONS FOR LEAVE NO

TRACE BEHAVIOR IN NATIONAL PARKS[1]

Introduction

Public land managers face a myriad of complex challenges. From invasive species to

inadequate funding and staffing to increasing recreational use, land managers must strike a

balance between resource protection and the provision of recreational opportunities in a manner

consistent with the law and agency policies. In many protected areas, including those with a

multiple use mandate, resource degradation due to inappropriate visitor behavior continues to be

a significant concern for managers (Leung & Marion, 2000; Taff, Newman, Bright, & Vagias,

2011; Vagias & Powell, 2010). Given the fact that even nominal recreational use can cause

considerable impacts, particularly since some impacts are cumulative over time, park and

protected area managers must utilize a variety of strategies to minimize these impacts (Hammitt

& Cole, 1998; Leung & Marion, 2000).

Land managers primarily address visitor use issues through one of two approaches:

indirectly through visitor education or directly through enforcement or sanctions (Manning,

2003; Marion & Reid, 2007). Direct management approaches including enforcement of

regulations and intensive site management such as fencing or hardening of recreation sites tend

to be costly and can limit visitors' sense of freedom (Marion & Reid, 2007). Indirect

management approaches such as visitor education have become a primary and effective method

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[1] Chapter 1 contains a manuscript that was published in the *Journal of Interpretation Research* in 2013, which has been included in this thesis under special permission from the journal's editor. The citation for the manuscript is as follows:

Lawhon, B., Newman, P., Taff, B. D., Vaske, J. J., et al. (2013). Factors Influencing Behavorial Intentions for Leave No Trace Behaviors in National Parks. *Journal of Interpretation Research*. *18*(1), 23-38.

used to minimize depreciative behaviors of protected area visitors (Hammitt & Cole, 1998; Hendee & Dawson, 2002; Manning, 1999; 2003; Marion & Reid, 2001). This has led to the development of several educational initiatives aimed at minimizing recreation-related impacts including Codes of Conduct, Leave No Trace, and Guidelines for Tourists (Marion & Reid, 2007). Although there is some variation between the programs, their overarching intent is to raise awareness, reduce depreciative behaviors, increase knowledge, influence attitudes, and enhance the visitor's experience (Vagias, 2009). In many parks and protected areas, managers provide minimum-impact visitor education in the form of the seven Leave No Trace principles for responsible use of lands. The Leave No Trace concepts and principles have become one of the most frequently used methods for encouraging responsible use of recreational resources (Harmon, 1997; Marion & Reid, 2001; Vagias & Powell, 2010).

In spite of recent advances towards understanding attitudes and behaviors related to Leave No Trace of backcountry recreationists, there is a dearth of information pertaining to the attitudes frontcountry visitors have towards Leave No Trace related behaviors and recommended practices (Taff, 2012). Frontcountry, as defined by The Leave No Trace Center for Outdoor Ethics (The Center), includes areas that are easily accessed by car and mostly visited by day users as well as developed campsites used for overnight car camping (Leave No Trace Center for Outdoor Ethics, 2012a). In many parks and protected areas, park managers direct most visitors to frontcountry locations (Kuentzel, Laven, Manning, & Valliere, 2008). This study investigated day-use visitor knowledge, behavioral intent, and beliefs concerning recommended Leave No Trace practices in the Bear Lake corridor of Rocky Mountain National Park. The study findings offer insight for improving educational messages targeting depreciative behaviors that could be

applied to the Bear Lake corridor and other similar frontcountry, day-use areas in other national parks.

Leave No Trace

Leave No Trace is the most prevalent minimum-impact visitor education program in use in parks and protected areas in the U.S. (Vagias & Powell, 2010). The intent of the Leave No Trace program is to educate recreationists about the nature of their recreational impacts with the goal of resource protection (Leave No Trace Center for Outdoor Ethics, 2013). Leave No Trace is particularly appealing to land managers because it offers a more light-handed approach to visitor management as opposed to more heavy-handed management strategies (Vagias, 2009). The Leave No Trace concept dates back to the 60's when the USDA Forest Service began promoting the notion of "pack it in, pack it out" to outdoor enthusiasts (Marion & Reid, 2001). The program was further developed through the 70's, and began to take shape as a minimum impact camping message. As recreation increased through the 80's, the effort gained additional attention as more focus was being placed on recreation impacts by the federal land management agencies. In the early 90's the USDA Forest Service forged a partnership with the National Outdoor Leadership School (NOLS), to begin jointly promoting a science-based approach to minimum impact recreation. This resulted in the development of numerous publications detailing minimum-impact recreational practices (Hampton & Cole, 2003; Marion & Reid, 2001; McGivney, 2003; Swain, 1996).

In 1993, three of the other primary federal land management agencies (Bureau of Land Management, National Park Service, and the U.S. Fish and Wildlife Service) adopted Leave No Trace as their chief minimum-impact educational program (Marion & Reid, 2001). Soon thereafter, an outdoor recreation summit in Washington D.C. led to the creation of a national

501(c)(3) non-profit Leave No Trace, Inc. Now known as the Leave No Trace Center for

Outdoor Ethics, the organization has continued to advance and grow the Leave No Trace

program, which has been adopted by most parks and protected areas in the U.S., as well as

numerous international land management agencies. The Center has the following mission, "To

teach people how to enjoy the outdoors responsibly" (Leave No Trace Center for Outdoor Ethics,

2012b). The seven Leave No Trace principles (Figure 4), which are the foundation of the

program, can be seen in many parks and protected areas. These principles are routinely used on

signage, in educational and promotional materials, and included in interpretive information and

programs.

Leave No Trace Principles:

1. Plan Ahead and Prepare
2. Travel and Camp on Durable Surfaces
3. Dispose of Waste Properly
4. Leave What You Find
5. Minimize Campfire Impacts
6. Respect Wildlife
7. Be Considerate of Other Visitors

Figure 4. Seven Principles of Leave No Trace (adapted from the Leave No Trace Center for
Outdoor Ethics, 2012c).

The Center has a variety of education, training, and outreach programs designed to

educate the recreating public about enjoying the outdoors responsibly. The Center and its

partners offer formal Leave No Trace courses ranging from a one-day course to a five-day,

intensive field-based course known as the Leave No Trace Master Educator Course (Leave No

Trace Center for Outdoor Ethics, 2012d). The organization has a current focus on three key

programmatic areas: youth, frontcountry, and local efforts (Leave No Trace Center for Outdoor Ethics, 2013).

Previous Research

Two primary scientific disciplines form the foundation of the Leave No Trace literature base: recreation ecology and human dimensions of natural resources. Recreation ecology research, "a field of study that examines, assesses and monitors visitor impacts, typically to protected natural areas, and their relationships to influential factors" (Leung & Marion, 2000, pg. 23), has provided the foundation for Leave No Trace messaging because of its focus on recreational impacts (Cole, 2004; Hammitt & Cole, 1998; Hampton & Cole, 2003; Leung & Marion, 2000). Recreation ecology has dominated most minimum-impact research, and reviews suggest that there have been over one thousand recreation ecology articles published within recent decades (Monz, Cole, Leung, & Marion, 2010). Yet, the behavior of recreationists is perhaps the largest determinant of impact, and human dimensions research, which focuses on the sociological, psychological, cultural, and economic aspects of recreationists (Ewert, 1996), is limited but growing with regard to Leave No Trace-related studies (Taff, 2012).

The majority of human dimensions research related to Leave No Trace has evaluated educational efficacy through various communication strategies in an effort to increase knowledge and influence behavioral change (Marion & Reid, 2007). For example, studies have evaluated communication strategies to mitigate human and wildlife conflict (Hockett & Hall, 2007; Lackey & Ham, 2003), reduce litter (Cialdini, 1996), minimize removal of natural objects (Widner & Roggenbuck, 2000; Widner & Roggenbuck, 2003), or deter off-trail hiking (Winter, 2006). Few studies have addressed Leave No Trace specifically, instead focusing on minimum-impact behaviors, and even fewer studies have evaluated the most common user-group,

frontcountry visitors (Taff, 2012). More recently, however, social scientists have explored

concepts such as knowledge, attitudes, beliefs, values, and behaviors of outdoor enthusiasts in

the context of Leave No Trace practices (Marion & Reid, 2007; Vagias, 2009, Vagias & Powell,

2010), and have begun examining the perceptions of frontcountry visitors (Jones, 1999; Jones &

Bruyere, 2004; Leung & Attarian, 2003; Mertz, 2002; Taff, 2012; Taff et al., 2011). This study

adds to this body of social science research by evaluating frontcountry visitor attitudes toward

Leave No Trace.

Theoretical Orientation

The Theory of Reasoned Action (TRA) and its successor the Theory of Planned Behavior

(TPB), which was used to orient this research, are general theories of social psychology that seek

to explain human behavior through an understanding of the determinants of said human behavior

(Ajzen, 1991; Fishbein & Ajzen, 1975). Both theories have been applied to investigations into

the human dimension of natural resource management science generally (Fishbein & Manfredo,

1992; Manfredo, Teel, & Bright, 2004; Marion & Reid, 2007; Vagias & Powell, 2010) and to

Leave No Trace investigations specifically (Taff, 2012; Vagias, 2009). The overarching assertion

of these theories is that individuals are rational creatures and that their behavior is largely

determined by their intention to engage in a particular behavior (Ajzen, 1991; Fishbein & Ajzen,

1975). Behavioral intentions are determined by attitudes, the influence of others (norms),

perceived behavioral control (Ajzen, 1991), and potentially other factors such as values and

emotions (Kollmuss & Agyeman, 2002).

Both theory and previous research suggest that while numerous factors can influence

behavior, one's specific attitude towards a particular behavior is a determinant factor in

governing his or her actions (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Manfredo, 1992;

Ham & Krumpe, 1996). Eagly and Chaiken (1993) described an attitude as an individual's evaluation of a particular object. Once an evaluation has taken place, and a specific attitude has been formed, it is stored in memory and can be drawn on to guide behavior (Ajzen, 1991). Thus, behavior in terms of Leave No Trace is theoretically determined in part by attitudes (positive or negative) towards specific Leave No Trace recommendations and guidelines. Therefore, if attitudes can accurately predict behavioral intention, then to the extent attitudes can be modified, park and protected area managers can alter visitors' behaviors by changing the salient attitude or belief (Vagias, 2009). Thus, in order to create effective visitor education and communication tactics that can minimize overall recreational impact by influencing visitor behavioral intent, understanding visitor attitudes related to Leave No Trace is paramount.

Based on the TPB and previous research, we hypothesized that future Leave No Trace behavioral intent would be influenced by:

- ❖ Attitudes towards Leave No Trace

- ❖ The perceived effectiveness of Leave No Trace practices

- ❖ The perceived difficulty of practicing Leave No Trace

- ❖ Self-reported knowledge of Leave No Trace practices

The Theory of Planned Behavior was used to orient this research, but this study did not test the theory directly, nor did it measure either the perceived behavioral control or the influence of norms components of the TPB. It should be noted that some theorists conceptualize perceived behavioral control as multidimensional, consisting of two discrete dimensions: perceived control and perceived difficulty (Traifmow, Sheeran, Conner, & Finlay, 2002). Ajzen (2002) defined perceived behavioral control as "the perceived ease or difficulty of performing the behavior" (p. 665), which could be interpreted as two separate constructs. Despite the potential differentiation

of perceived behavioral control, the variable in this study that measured perceived difficulty of Leave No Trace practices was not operationalized to measure the construct in terms of the TPB. Therefore, based on previous investigations of Leave No Trace behavioral intentions (see Vagias & Powell, 2010), the primary component of the TBP under investigation in this research was attitude. According to Manfredo, Vaske and Decker (1995), "It is important to measure attitudes because they are believed to cause human behavior" (p. 19).

Methods

Data were collected between July 15 – August 15, 2009 in the Bear Lake corridor of Rocky Mountain National Park, a heavily visited and predominately day-use area of the park. Respondents were specifically targeted at the Glacier Gorge and Bear Lake trailheads, both of which offer numerous day-use recreational opportunities. These trailheads are two of the most heavily trafficked areas in the Bear Lake corridor due to the availability of parking for personal vehicles and the regular and convenient shuttle service to the area provided by the National Park Service (Park, Lawson, Kaliski, Newman, & Gibson, 2010; Taff, 2012).

The survey instrument explored social psychological and knowledge variables related to six of the seven Leave No Trace Principles. The survey did not address the fifth Leave No Trace Principle *Minimize Campfire Impacts* due to the park regulations that prohibit fire in the Bear Lake corridor. The researchers used a stratified random sampling procedure and asked visitors if they would be willing to participate in a "visitor opinion study." Data were collected at both trailheads with sampling designed to take place over a 16-day period, segmented equally between weekday and weekend, A.M. and P.M. sampling times. All surveys were completed by a single individual regardless of group size, and were completed on site. Sampling locations at both trailheads were near park interpretive signage that displayed the Leave No Trace principles.

For this reason, two methodological adjustments were made. First, the phrase "Leave No Trace" was not seen in the survey form until the last few questions. Second, researchers only approached those individuals or groups exiting trailheads to decrease the likelihood they recently viewed the signage.

A total of 390 completed surveys were collected providing a response rate of 74%. Because of the large sample size and high response rate, non-response bias was deemed to not be a concern. Based on sample size and visitation to these trailheads there is 95% confidence that these findings are accurate to +/- five percentage points (Vaske, 2008). There were no significant differences found between the Glacier Gorge and Bear Lake responses so results have been combined for analysis purposes.

Variable Measurement

The dependent variable was behavioral intent to perform recommended Leave No Trace practices in the future (Table 5), operationalized as how likely or unlikely visitors were to engage in Leave No Trace behavior in the future for each of the following categories: planning ahead, staying on designated trails, packing out all waste, leaving natural objects in place, not feeding, following or approaching wildlife, and taking breaks away from trails and other visitors. The independent variables consisted of the following: attitudes towards Leave No Trace practices (how appropriate or inappropriate practices are perceived; Table 1), perceived effectiveness of Leave No Trace practices (Table 2), perceived difficulty of Leave No Trace practices (Table 3) and self-described Leave No Trace knowledge (Table 4). All variables were measured on a 7-point scale.

Results

Descriptive Findings

      Attitudinal statements were used to analyze how park visitors felt about the appropriateness of specific Leave No Trace practices. The results (Table 1) indicate that many visitors are either unfamiliar with or simply misunderstand some Leave No Trace practices. In particular, the majority of respondents (55%) felt that it was *very appropriate* ($M = 4.64$) to leave food scraps behind as a food source for animals. Similarly, the majority of respondents (61%) felt that taking breaks along the edge of the trail was *very appropriate* ($M = 5.48$). These results indicate that visitor may not fully understand the Leave No Trace principles *Dispose of Waste Properly* and *Be Considerate of Other Visitors*, which recommend packing out all waste including food scraps and taking breaks away from trails on durable surfaces such as rock, bare ground, gravel, etc. when available to not impact the experience of others. Though limited in number, previous studies have found similar shortcomings in visitors understanding of these Leave No Trace concepts (see Taff et al., 2011; Vagias & Powell, 2010). For all other attitudes measured, mean scores were less than $M = 2.62$ indicating that respondents understood and had attitudes consistent with land manager recommendations towards these practices.

Table 1. Attitudes towards frontcountry Leave No Trace practices

How APPROPRIATE or INAPPROPRIATE do you think the following activities are for a visitor to do in Rocky Mtn. National Park…	N	Mean	S.D.	Percentage[a]						
				Very Inappropriate			Neutral			Very Appropriate
				1	2	3	4	5	6	7
Experience nature by not preparing for weather/hazards	388	2.51	1.9	46	19	11	7	6	4	8
Travel off trail to experience nature	388	2.62	1.9	43	18	9	11	8	5	6
Carry out all litter, leaving only food scraps	388	4.64	2.7	27	6	5	3	3	5	50
Keep a single item like a rock, plant, stick or feather as a souvenir	388	2.25	1.6	49	17	12	11	5	3	3
Drop food on the ground to provide wildlife a food source	388	1.43	1.2	82	10	2	2	1	1	3
Take a break along the edge of a trail	387	5.48	1.6	3	3	5	15	13	27	34

a. Percentages may not equal exactly 100% due to rounding.

Survey respondents were asked to rate whether certain Leave No Trace practices would reduce impact in the park. The concept of perceived effectiveness of Leave No Trace practices is important because it is possible that practices that are perceived as ineffective are likely to be practiced less than those with a higher perception of effectiveness. The majority of practices (Table 2) were perceived to reduce impact *every time* ($M \geq 6.02$), indicating that respondents felt impact would be reduced by following these practices. One practice, *taking breaks away from the trail and other visitors*, had a lower mean score ($M = 4.57$) indicating that respondents felt that this practice would only be effective at reducing impact *sometimes*.

Table 2. Perceived level of effectiveness of Leave No Trace practices

Participating in the following activities in Rocky Mtn. National Park would reduce impact…	N	Mean	S.D.	Percentage[a]						
				Never			Sometimes		Every time	
				1	2	3	4	5	6	7
Prepare for all types of weather, hazards and emergencies before getting on trail	387	6.02	1.16	1	0	1	13	14	23	48
Stay on designated or established trails	382	6.38	0.97	1	0	1	4	10	22	62
Carry out all littler, even crumbs, peels or cores	386	6.65	0.71	3	0	0	2	3	9	85
Never removing objects from the area, not even a small item like a rock, plant or stick	387	6.05	1.51	3	1	2	10	7	17	60
Never approach, feed or follow wildlife	388	6.19	1.54	5	2	1	6	5	16	66
Take breaks away from the trail and other visitors	387	4.57	1.88	10	8	9	21	15	20	18

a. Percentages may not equal exactly 100% due to rounding.

Respondents were asked to rate the level of difficulty in performing the same practices asked about previously. None of the practices received a mean score higher than $M = 2.65$ indicating that the practices were not viewed as being *extremely difficult* (Table 3). If specific practices are perceived as being too difficult, there is a greater likelihood that these recommended practices might not be followed.

Table 3. Perceived difficulty of practicing Leave No Trace

	N	Mean	S.D.	Percentage[a]						
Please indicate how DIFFICULT you think each of the following would be for a visitor to do in Rocky Mtn. National Park…				Not at all Difficult		Moderately Difficult			Extremely Difficult	
				1	2	3	4	5	6	7
Prepare for all types of weather, hazards and emergencies before getting on trail	387	2.65	1.56	33	21	13	22	7	3	2
Stay on designated or established trails	383	1.62	1.14	66	20	8	3	1	2	1
Carry out all littler, even crumbs, peels or cores	386	1.14	0.96	78	12	5	3	1	1	1
Never removing objects from the area, not even a small item like a rock, plant or stick	386	1.52	1.10	74	14	4	5	2	1	1
Never approach, feed or follow wildlife	387	1.61	1.22	71	14	7	4	1	2	1
Take breaks away from the trail and other visitors	386	2.12	1.39	49	19	12	14	4	1	1

a. Percentages may not equal exactly 100% due to rounding.

Survey respondents were asked to rate their knowledge of Leave No Trace on a 7-point scale (0 = no knowledge to 6 = expert). The mean score was 3.45, with nearly 60% reporting *above average* to *expert* in terms of their Leave No Trace knowledge (Table 4).

Table 4. Level of self-described Leave No Trace knowledge

N	Mean	S.D.	Percentage						
			No Knowledge	Very Limited	Limited	Average	Above Average	Extensive	Expert
			0	1	2	3	4	5	6
383	3.45	1.74	11	7	7	16	27	25	7

Respondents were asked how likely they were to engage in future Leave No Trace behaviors and practices (Table 5). On all survey items but one, the majority of respondents indicated that they were *extremely likely* to practice Leave No Trace in the future. The one exception was *taking breaks away from the trail and other visitors* ($M = 4.87$), indicating that visitors were only *moderately likely* to follow this recommendation. In all other categories, mean scores ($M = \geq 5.95$) indicated that respondents were *moderately* to *extremely likely* to practice Leave No Trace in the future.

Table 5.Behavioral intentions to practice Leave No Trace in the future

Please indicate how LIKLEY you are to do the following activity in the future…	N	Mean	S.D.	Percentage[a]						
				Not at all Likely			Moderately Likely		Extremely Likely	
				1	2	3	4	5	6	7
Prepare for all types of weather, hazards and emergencies before getting on trail	384	5.95	1.34	1	1	2	15	11	19	51
Stay on designated or established trails	382	6.22	1.18	1	1	1	10	8	21	59
Carry out all littler, even crumbs, peels or cores	378	6.70	0.89	1	0	2	3	2	8	85
Never removing objects from the area, not even a small item like a rock, plant or stick	379	6.09	1.60	4	3	2	10	5	11	66
Never approach, feed or follow wildlife	380	6.00	1.74	7	2	2	6	6	14	63
Take breaks away from the trail and other visitors	380	4.87	1.79	8	5	5	23	18	16	24

a. Percentages may not equal exactly 100% due to rounding.

Regression Analysis

Six separate linear regression models were run. For each of the models, one item from Table 5 served as the dependent variable. Consistent with the hypotheses, the analysis revealed that future Leave No Trace behavioral intent was influenced at varying levels by attitudes, perceived effectiveness, perceived difficulty, and self-reported Leave No Trace knowledge (Table 6). The analysis explained the most variance (R^2 = .34) in respondent's future likelihood of *staying on designated or established trails*. The next highest level of explained variance (R^2 = .29) was respondent's future likelihood of *preparing for all types of weather, hazards or emergencies*. The least amount of variance was explained (R^2 = .12) for the variable *taking breaks away from trails and other visitors*. Perceived effectiveness of Leave No Trace practices was the strongest predictor (β > .21, *p* < .001, in all cases) of future Leave No Trace behavioral intent. Despite the high level of self-reported knowledge of Leave No Trace, it was not shown to be a significant predictor (β < .17, *p* ≥ .05, in all cases) of future Leave No Trace behavioral intent. While attitudes towards Leave No Trace practices and perceived difficulty of Leave No Trace practices were statistically significant in some of the models (*p* < .05, in some cases), they were weaker predictors of future behavioral intent than perceived effectiveness. Taken together, these results indicate a need for park education and interpretation staff to focus messages on the effectiveness of recommended Leave No Trace practices in order to influence future behavioral intent in park visitors.

Table 6. Predicting future Leave No Trace behavioral intent[a]

Future Behavior	Appropriateness	Effectiveness	Difficulty	Knowledge	R^2
Preparing for all types of weather, hazards and emergencies	-.11*	.36**	.17	.17	.29
Staying on designated or established trails	-.25**	.40**	-.07	.06	.34
Carrying out all litter, including food scraps	-.07	.33**	-.19*	.01	.18
Not removing natural objects from the area	-.19**	.21**	-.14*	.12*	.17
Not feeding, following or approaching wildlife	-.08	.26**	-.12*	.14*	.15
Taking breaks away from trails and other visitors	-.03	.25**	-.16**	.13*	.12

a. Cell entries are standardized regression coefficients — * $p<.05$, ** $p< .001$

Discussion

This study examined the influence of attitudes, perceived effectiveness, perceptions related to the difficulty of following practices, and self-reported knowledge on future Leave No Trace behavioral intent in Rocky Mountain National Park. Of particular interest was determining which of these variables has the most influence on future visitor behavioral intent. Across all respondents, the majority indicated that they were *moderately* to *extremely likely* to practice Leave No Trace in the future. However, behavioral intent does not necessarily equate to actual behavior. Therefore, this study attempted to determine which variables most influence future Leave No Trace behavioral intent in national park visitors. If specific influences can be determined, park managers can effectively message to visitors in Rocky Mountain National Park, as well as in other park and protected areas, about how to minimize their recreation-related impacts. Data from this study indicate that perceived effectiveness of Leave No Trace practices is a significant predictor of future Leave No Trace behavioral intent.

Of particular interest is the level of self-reported Leave No Trace knowledge. Nearly 60% of respondents rated their knowledge as *above average* to *expert* (Table 4), indicating that park visitors feel they have extensive experience with Leave No Trace skills and ethics. This is consistent with results from previous Leave No Trace-related investigations but in the absence of actually testing knowledge, the accuracy of self-reported knowledge is inconclusive (see Taff et al., 2011; Vagias & Powell, 2010). However, the results of the attitudinal measures (Table 1) suggest that some park visitors are either unfamiliar with or do not clearly understand recommended Leave No Trace practices. It is also plausible that visitors do not agree with certain Leave No Trace practices and therefore have a negative evaluation (attitude) of those practices. Furthermore, visitors may perceive some level of inconsistency among the Leave No Trace practices. This may be particularly likely with respect to recommendations to refrain from traveling off-trail yet at the same time recommending that visitors do travel off-trail to take breaks away from other visitors to minimize social impacts. These seemingly conflicting messages likely warrant further investigation in future studies, and suggest that the Center consider providing additional detail concerning the purpose of these recommendations.

In order to minimize depreciative behavior, protected area managers often rely on educational strategies both to inform visitors and attempt to change visitor behavior (Cialdini, 1996; Ham, 2007; Manning, 2003; Marion & Reid, 2007; Vagias, 2009). Heimlich and Ardoin (2008) noted that for some environmental education efforts, "the ultimate purpose…is to affect individuals' behaviors" (p. 215). However, education efforts that focus solely on providing new knowledge do not always result in attitude or behavior change (Hwang, Kim & Jeng, 2000; Kollmuss & Agyeman, 2002; Petty, McMichael, & Brannon, 1992). Data from this research supports the assertion that knowledge does not necessarily equate to behavioral intent, and

suggests that focusing on the effectiveness of Leave No Trace practices at reducing impacts to the landscape may lead to increased Leave No Trace behavior in the future.

Despite robust educational efforts by Rocky Mountain National Park, recreation-related impact continues to be a concern for park managers (National Park Service, 2012). Many park visitors may be unaware of both the nature of their impacts and Leave No Trace practices to reduce those impacts or they simply disagree with the recommended practices. As shown by this study, perceived effectiveness of Leave No Trace practices is a meaningful predictor of future Leave No Trace behavioral intent. Therefore, park managers and the Leave No Trace Center for Outdoor Ethics should consider focusing educational efforts on how effectively Leave No Trace practices minimize impacts to the landscape. While this study found that that knowledge is not a significant predictor of future behavioral intent, park visitors do need to be made aware of the recommended Leave No Trace practices for Rocky Mountain National Park and other similar protected areas. However, and perhaps more importantly, park visitors need to better understand why certain Leave No Trace practices are recommended, and why those practices are effective at reducing impacts.

For the past decade, the Leave No Trace Center for Outdoor Ethics has encouraged its educators to emphasize the effectiveness of recommended Leave No Trace practices in order to bolster understanding and compliance. This recommendation has largely been based on anecdotal evidence and feedback from course and workshop participants (Dana Watts, personal communication, August 10, 2012). However, this research suggest that education efforts specifically focused on the perceived effectiveness of Leave No Trace practices may prove more effective at modifying visitor behavior in order to minimize recreation-related impact in parks.

Study Limitations and Future Research

This study has several limitations that warrant further investigation in future studies. First, this study only examined one component of the TPB — attitudes. It is clear that other factors influence behavioral intent such as norms and perceived behavioral control (Vagias, 2009), neither of which were under investigation in this research. Second, reported behavioral intent was used as a proxy for actual behavioral intent, which has limitations in terms of making valid predictions about future behavioral intent. In the absence of testing of actual behavior through behavioral observation or other methods, it remains unclear in this context how well reported behavioral intent determines actual behavior. Third, anticipating and avoiding biasing effects from particular wording of survey questions is often challenging (Babbie, 2008; Vaske, 2008). Due to the structure of the Leave No Trace principles and how survey questions were crafted to address those principles, there is the possibility of inadvertent research-induced bias. Future studies of this kind should strive to minimize this potential bias to the extent possible. Lastly, this study did not examine other possible mediating variables of behavioral intent such as weather conditions. Despite the limitations of this study, the results confirmed the importance of visitor perceptions of the effectiveness of recommended practices in terms of behavioral intent to practice Leave No Trace in national parks.

Some past Leave No Trace-focused studies have utilized increased knowledge as a measure of efficacy (Daniels & Marion, 2005; Vagias, 2009). While there are issues with these kinds of knowledge evaluations, the primary concern is that an individual's behavior is largely determined more by factors such as attitudes, norms, perceived behavioral control, and perhaps other factors, than by knowledge (Ajzen, 1991). According to Kaiser, Wolfing and Fuhrer (1999), attitudes are far more important than knowledge in environmental contexts. This study

30

and previous research (Vagias, 2009) indicate a need to undertake studies that address attitudes, norms, perceived behavioral control, values, beliefs, and perceptions about the effectiveness of Leave No Trace behaviors in question rather than knowledge of specific Leave No Trace practices. Studies that focus specifically on Leave No Trace in frontcountry contexts may be most beneficial to both the Leave No Trace Center for Outdoor Ethics and land managers as trend data indicate that a continued increase in frontcountry recreation is likely to occur in the future (Cordell, 2012; Outdoor Industry Foundation, 2012).

Conclusion

Resource impact due to uninformed visitor behavior continues to be a chief concern for land managers, and effective educational messages such as those promoted through Leave No Trace, which target these behaviors, are essential. This study examined how psychological and knowledge variables influence future Leave No Trace behavioral intent of visitors in Rocky Mountain National Park. The results suggest that perceived effectiveness of Leave No Trace practices is a meaningful predictor of future behavioral intent. Education efforts are likely to be successful at influencing future behavioral intent if they focus on why certain Leave No Trace practices are recommended and why those practices are effective at reducing impacts.

CHAPTER 2. INFLUENCING STATE PARK VISITORS' LEAVE NO TRACE

BEHAVIORAL INTENT[2]

Introduction

A particularly complicated challenge for park and protected area managers is influencing visitor behavior in order to minimize environmental impact caused by recreation. Many land managers attempt to strike a balance between protection of resources and the provision of diverse recreational opportunities, yet resource degradation due to inappropriate visitor behavior continues to be a significant issue (Bullock & Lawson, 2007; D'Antonio, Monz, Newman, Lawson, & Taff, 2012; Halpenny, 2010; Vagias & Powell, 2010; Widner-Ward & Roggenbuck, 2003). Park and protected area visitor behaviors can impact wildlife, vegetation, water quality and other visitors. Many of these impacts are cumulative over time, and have been shown to occur at relatively low levels of use (Hammitt & Cole, 1998; Leung & Marion, 2000).

Land managers often use one of two primary approaches for dealing with visitor impacts: indirect management actions such as education and interpretation or direct management actions such as rules, regulations or restrictions on use or access (Hendee & Dawson, 2002; Manning, 2003; Marion & Reid, 2007; Martin, Marsolais, & Rolloff, 2009). Indirect management approaches such as visitor education, information dissemination and interpretative services are viewed as "light-handed" and are often favored by both the public and land managers (Bullock & Lawson, 2007; Manning, 1999; 2003; Marion & Reid, 2001; Martin et al., 2009). As a result, indirect strategies have increasingly become a primary tool and effective method used to minimize recreation-related impacts (Marion & Reid, 2007). Despite this preference for an educational approach, the job of effectively educating the recreating public about appropriate

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[2] Chapter 2 contains a journal manuscript that was in development at time of defense. The manuscript will be completed and submitted to a peer-reviewed journal for publication in 2014.

outdoor behavior is challenging. When attempting to educate visitors, managers must contend with limited timeframes, non-captive audiences and frequent distractions (Orams, 1997). In an effort to cope with these challenges, protected area managers have developed a wide variety of educational campaigns, and of these educational approaches, Leave No Trace is the most frequently used to inform visitors about minimizing recreation-related impacts (Harmon, 1997; Taff, 2012; Vagias, 2009).

Although there have been several recent advances in understanding knowledge, attitudes and behaviors related to Leave No Trace in visitors to backcountry and wilderness areas (Taff, 2012; Taff, Newman, Bright, & Vagias, 2011; Vagias & Powell, 2010), information about visitors to frontcountry areas in the context of Leave No Trace is limited. This study explores state park visitor attitudes, beliefs, behavior and knowledge concerning Leave No Trace practices in three select Wyoming state parks, and seeks to determine factors that influence Leave No Trace behavioral intent. The study findings offer guidance for developing effective educational messages targeting depreciative visitor behaviors that could be applied in Wyoming state parks and other similar frontcountry areas.

Study Context

Frontcountry includes areas that are easy to access by vehicle and predominately visited by day users (Leave No Trace Center for Outdoor Ethics, 2012a). These areas include designated sites used for overnight camping, which often have picnic tables, fire rings and toilet facilities. Visitation to frontcountry areas is increasing, and is often where managers direct the majority of visitors (Kuentzel, Laven, Manning, & Valliere, 2008). The vast network of over 6,600 state parks the U.S. provides extensive recreational opportunities in such settings. According to the National Association of State Park Directors (NASPD), annual visitation to state parks is 725

million, a number that is projected to significantly increase over time (National Association of State Park Directors, 2011). While Leave No Trace is widely used in federally managed parks and protected areas, it has been seldom utilized by state parks (Dana Watts, personal communication, August 29, 2013). Though there have been recent advances, to date there have been no studies specifically focused on state park visitors' attitudes and perceptions related to Leave No Trace. This research intends to help fill this void by evaluating Leave No Trace in the state park context. Findings from this study may encourage greater adoption of Leave No Trace by state parks in the U.S.

Leave No Trace

Leave No Trace is the predominant minimum-impact visitor education program in use in parks and protected areas in the U.S. (Marion & Reid, 2007; Vagias & Powell, 2010). The overarching intent of the program is to educate outdoor enthusiasts about the nature of their recreation-related impact as well as teach them techniques for minimizing the impact (Harmon, 1997; Leave No Trace Center for Outdoor Ethics, 2012b; Marion & Reid, 2007). The foundation of the Leave No Trace program is the seven principles (Figure 5), which are used on protected area signage, maps and websites as well as included in interpretive information.

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Seven Principles of Leave No Trace

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

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Figure 5. The Leave No Trace Principles (Leave No Trace Center for Outdoor Ethics, 2012c).

Leave No Trace concepts date back to the 1960s when the USDA Forest Service began promoting the idea of "pack it in, pack it out" to outdoor enthusiasts. As recreation continued to increase, the USDA Forest Service forged a partnership with the National Outdoor Leadership School (NOLS) in 1991 to jointly promote a science-based approach to minimum impact recreation. This effort resulted in the development of several publications focused on responsible outdoor recreation practices, and ultimately led to the creation of the 501(c)(3) Leave No Trace Center for Outdoor Ethics (Hampton & Cole, 2003; Marion & Reid, 2001; McGivney, 2003; Swain, 1996).

For nearly two decades the Center has been under a Memorandum of Understanding (MOU) with the five largest federal land management agencies in order to promote Leave No Trace on federal lands. In 2007 the Center entered into an MOU with the NASPD to create a stronger linkage between state parks and national Leave No Trace efforts. Currently, the Center has three primary focus areas: youth, frontcountry and local efforts (Leave No Trace Center for Outdoor Ethics, 2013).

Previous Research

The foundation of the Leave No Trace literature base stems from two primary scientific disciplines: recreation ecology and human dimensions of natural resources. Recreation ecology is a field of study that examines visitor impact to protected areas, and has largely provided the underpinning for Leave No Trace messaging because of its focus on recreation-related impacts (Cole, 2004; Hammitt & Cole, 1998; Hampton & Cole, 2003; Leung & Marion, 2000)). Most minimum impact research has been rooted in recreation ecology studies, and reviews indicate that there have been over one thousand recreation ecology articles published in recent decades (Monz et al., 2010). However, one of the most important aspects of environmental impact is

likely visitor behavior, and human dimensions research that focuses on psychological and cultural aspects of outdoor enthusiasts (Ewert, 1996) is limited but increasing with regard to Leave No Trace (Taff, 2012).

The preponderance of human dimensions research related to Leave No Trace has evaluated educational efficacy through various communication strategies in an effort to increase knowledge and influence the behavior of recreationists (Marion & Reid, 2007). For example, studies have evaluated strategies to diminish litter (Cialdini, 1996), minimize human and wildlife conflict (Hockett & Hall, 2007), curtail removal of natural objects (Widner-Ward & Roggenbuck, 2003), and discourage off-trail hiking (Winter, 2006). However, few studies have specifically addressed Leave No Trace and have instead focused on generic minimum impact behaviors. Even fewer of these studies have focused on visitors to frontcountry areas (Jones & Bruyere, 2004; Jones & Lowry, 2004; Leung & Attarian, 2003; Mertz, 2002; Taff, 2012). It should be noted that a significant percentage of these investigations have been atheoretical, and have largely utilized increased knowledge as the outcome variable. A primary shortcoming of using knowledge as the outcome variable is that the assumption of a linear relationship between environmental knowledge and behavior is largely false (Hungerford & Volk, 1990; Hwang, 2000; Manning, 2003; Petty, McMichael, & Brannon, 1992). In other words, personal awareness about environmental impact does not necessarily equate to a change in an individual's behavior.

Yet more recently, social scientists have explored the influence and effects of values, beliefs, attitudes and other factors of outdoor enthusiasts in the context of Leave No Trace (Vagias, 2009). Additionally, there has been an enhanced focus on examining the perceptions of frontcountry visitors with respect to Leave No Trace (Taff, 2012; Taff et al., 2011). This is an

important consideration in Leave No Trace-related research since attitudes influence behavior (Ajzen, 1991).

Theoretical Foundation

The Theory of Reasoned Action (TRA) and its successor the Theory of Planned Behavior (TPB), which was used to guide this research, have both been applied to human dimensions of natural resources science generally (Fishbein & Manfredo, 1992; Manfredo, Teel, & Bright, 2004; Vagias & Powell, 2010), and been used to inform Leave No Trace investigations specifically (Taff, 2012; Vagias, 2009). Both are general theories of social psychology that endeavor to explain human behavior. The predominant theme of these theories is that humans are reasonable creatures whose behaviors are chiefly determined by their intention to engage in said behavior (Ajzen, 1991; Fishbein & Ajzen, 1975). The behavioral intentions of people are determined by several factors including attitudes, the normative influence of others and perceived behavioral control (Ajzen, 1991), as well as other possible factors such as values and emotions (Kollmuss & Agyeman, 2002).

Previous research has established that attitudes influence behavior, and one's attitude towards a specific behavior can govern his or her actions (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Manfredo, 1992; Ham & Krumpe, 1996). In the context of human dimensions, attitudes are generally described as an individual's evaluation of a particular object (Eagly & Chaiken, 1993). Once an evaluation of an object has occurred, and a specific attitude about that object has emerged, it can be retained in an individual's memory and then can be drawn on to influence future behavior (Ajzen, 1991). Leave No Trace behavior is therefore theoretically influenced in part by attitudes towards specific Leave No Trace guidelines and recommended practices. Thus, if attitudes can influence behavioral intention, and to the degree attitudes can be

changed, then park managers can potentially alter visitor behavior by targeting and changing the salient attitude or belief (Vagias, 2009). Understanding visitor attitudes related to Leave No Trace is critical in order to craft effective educational messages that have the potential to reduce depreciative behavior in park and protected areas.

Therefore, based on TPB and previous research, we hypothesized that Leave No Trace behavioral intent in state park visitors would be influenced by attitudes towards Leave No Trace; the perceived effectiveness of practicing Leave No Trace; the perceived difficulty of practicing Leave No Trace; and self-reported knowledge of Leave No Trace practices.

Methods

The Wyoming State Parks, Historic Sites and Trails agency manages 30 state parks and historic sites. Annual visitation to these areas is nearly 3 million, which represents a 66% increase over the past 20 years (Wyoming State Parks, 2009). In order to provide a representative sample of parks and historic sites, three units were selected for inclusion in this research: Glendo State Park (Glendo), Glendo, WY; Curt Gowdy State Park (Gowdy), Laramie, WY; Wyoming Territorial Prison Historic Site (Prison), Laramie, WY. The three study locations were selected because: 1) all receive significant annual visitation based on their size, location and amenities, 2) all locations receive both resident and non-resident visitors and 3) all three locations have existing visitor education programs. Glendo State Park primarily offers boating, camping and angling. Curt Gowdy State Park primarily offers boating, angling, camping, hiking and mountain biking. Wyoming Territorial Prison primarily offers historic sites and displays, interpretive programs, living history exhibits and limited hiking and cycling opportunities (camping is not allowed at the Prison).

Data were collected via an on-site researcher-administered survey over a 5-week period during June – July 2012. A stratified random sampling procedure was used to ensure representativeness (Vaske, 2008). Sampling was segmented equally between weekday, weekend and A.M. and P.M. sampling times. Respondents were targeted at a variety of locations (campground, boat ramp, visitor center, trailhead, etc.) within each unit based on consultation with each unit manager. The majority of respondents (54%) were surveyed in campgrounds, while 30% of respondents were surveyed at a visitor center. The remaining respondents were surveyed at trailheads (9%), boat ramps (5%), and along a greenway trail (1%). Trained surveyors asked visitors if they would be willing to participate in a "visitor opinion study." If a potential respondent declined, researchers recorded the time at which they encountered the individual and asked a single non-response question, "What is the primary purpose of your visit today?" All surveys were completed by a single individual regardless of group size, and were completed on site. In order to reduce survey instrument-induced bias, the phrase "Leave No Trace" was not seen until the third page of the survey. The survey did not address the fifth principle of Leave No Trace, "Minimize Campfire Impacts," because fires are not allowed at all Wyoming state parks and historic sites.

There were a total of 346 completed surveys with an overall response rate of 93%. The individual unit response rates were: 92% for Glendo ($N = 114$), 95% for Gowdy ($N = 125$) and 93% for the Prison ($N = 107$). Based on sample size and visitation to the three units, there is 95% confidence that these findings are accurate to +/– five percentage points (Vaske, 2008). One-way analysis of variance for all variables revealed no substantive differences between responses from the three units, thus results have been combined for analysis purposes.

Variable Measurement

All variables were measured on a 7-point Likert-type scale. The independent variables

included: attitudes towards recommended Leave No Trace practices (how appropriate or

inappropriate practices are perceived; Table 7), perceived effectiveness of recommended Leave

No Trace practices (Table 8), perceived difficulty of recommended Leave No Trace practices

(Table 9), and self-described knowledge of Leave No Trace (Table 10). The dependent variable

was respondents' behavioral intent to perform recommended Leave No Trace practices in the

future. This variable was operationalized as how likely or unlikely visitors were to engage in

Leave No Trace behavior in the future for each of the following: planning ahead, staying on

designated trails, packing out all waste, leaving natural objects in place, not feeding wildlife, and

taking breaks away from trails and other visitors (Table 11).

Results

Demographics

The mean age of survey respondents was 47 years. Over half of the respondents (58%)

were male. A majority of individuals sampled (46%) were from Wyoming with the remaining

54% coming from over a dozen different states including Colorado, Nebraska and Idaho among

others. The highest percentage of visitors indicated that the primary purpose of their visit was for

camping (29%). Just over 21% of respondents indicated that fishing was the primary purpose of

their visit. Another large portion of the sample (16%) indicated that visiting historical exhibits

was the primary reason for their visit. Other reasons indicated included sightseeing (11%),

mountain biking (10%), boating (4.5%), hiking (4%) and picnicking (2%). Nearly 29% of

respondents indicated this was their first visit to the park or historic site in the past twelve

months, while 35% indicated they had visited this park or site between one and two times in the

same timeframe. Another large percentage of visitors (23%) reported having visited the park or historic site between three and ten times in the past twelve months.

Attitudes Towards Leave No Trace Practices

Attitudinal statements were used to analyze how park visitors viewed the appropriateness of specific recommended Leave No Trace practices. The results (Table 7) suggest that some visitors either misunderstand or are unfamiliar with some Leave No Trace practices. Specifically, 50% of respondents felt that it was *very appropriate* ($M = 4.35$) to leave food scraps behind rather than pack them out with their other trash. Likewise, the majority of respondents (56%) indicated that taking breaks along the edge of the trail was *very appropriate* ($M = 5.34$). Mean scores for all other attitudinal measures were less than $M = 3.21$, indicating that respondents had a better understanding of these principles, and had an attitudinal orientation more in line with land manager recommendations regarding these practices.

Table 7. Attitudes towards frontcountry Leave No Trace practices

How APPROPRIATE or INAPPROPRIATE do you think the following activities are for a visitor to do in Wyoming State Parks and Historic Sites?	N	Mean	S.D.	Percentage[a]						
				Very Inappropriate			Neutral			Very Appropriate
				1	2	3	4	5	6	7
Experiencing parks by not preparing for weather/hazards	342	2.2	1.84	59	14	7	7	5	3	6
Traveling off trail to experience the natural environment	345	3.21	2.09	34	13	9	16	9	10	9
Carrying out all litter, leaving only food scraps	344	4.35	2.67	30	9	4	5	3	8	42
Keeping a single item like a rock, plant, stick or feather as a souvenir	345	2.94	1.84	35	15	8	24	8	6	5
Dropping food on the ground to provide wildlife a food source	345	1.68	1.32	68	17	5	6	.6	1	2
Taking a break along the edge of a trail	345	5.34	1.63	4	4	4	19	13	25	31

a. Percentages may not equal exactly 100% due to rounding.

Perceived Effectiveness of Leave No Trace Practices

Survey respondents were asked to indicate whether or not recommended Leave No Trace practices were effective at reducing impact in parks and historic sites. A majority of practices (Table 8) were perceived to be effective at reducing impact *every time* ($M \geq 5.26$). However, one recommended practice, *Taking breaks away from the trail and other visitors*, had a lower mean score ($M = 4.25$), suggesting that respondents felt this practice would only reduce impact *sometimes*.

Table 8. Perceived level of effectiveness of Leave No Trace practices

	N	Mean	S.D.	Percentage[a]						
Participating in the following activities in Wyoming State Parks and Historic Sites would reduce impact…				Never			Sometimes		Every time	
				1	2	3	4	5	6	7
Preparing for all types of weather, hazards and emergencies before getting on trail	346	6.17	1.14	.3	.3	1	11	11	21	56
Staying on designated or established trails	329	6.26	1.04	0	0	2	8	9	24	57
Carrying out all littler, even crumbs, peels or cores	340	6.53	1.00	0	1	2	4	5	12	76
Never removing objects from the area, not even a small item like a rock, plant or stick	344	5.26	1.79	6	3	6	21	11	16	37
Never approaching, feeding or following wildlife	343	5.60	2.02	9	3	4	9	4	14	55
Taking breaks away from the trail and other visitors	342	4.25	1.90	15	6	6	29	16	12	16

a. Percentages may not equal exactly 100% due to rounding.

Perceived Difficulty of Leave No Trace Practices

Subsequently respondents were asked to indicate the level of difficulty of performing the same recommended practices. None of the items received a mean score higher than $M = 2.23$, suggesting that respondents did not view the recommended practices as being *extremely difficult* (Table 9). It is possible that if specific practices are viewed as too difficult to perform, park visitors may not follow them.

43

Table 9. Perceived difficulty of practicing Leave No Trace

	N	Mean	S.D.	Percentage[a]						
Please indicate how DIFFICULT you think each of the following would be for a visitor to do in Wyoming State Parks and Historic Sites…				Not at all Difficult		Moderately Difficult			Extremely Difficult	
				1	2	3	4	5	6	7
Preparing for all types of weather, hazards and emergencies before getting on trail	341	2.23	1.40	40	21	11	17	4	2	.3
Staying on designated or established trails	314	1.72	1.22	62	22	5	7	2	1	1
Carrying out all littler, even crumbs, peels or cores	340	1.65	1.33	71	15	5	5	1	1	3
Never removing objects from the area, not even a small item like a rock, plant or stick	340	1.92	1.44	60	17	8	11	2	2	2
Never approaching, feeding or following wildlife	337	1.64	1.22	68	17	5	6	1	1	1
Taking breaks away from the trail and other visitors	339	2.15	1.42	45	24	11	13	3	1	2

a. Percentages may not equal exactly 100% due to rounding.

Self-reported Leave No Trace Knowledge

Respondents were asked to describe their current knowledge of Leave No Trace practices. This variable was measured on a 7-point scale ranging from (0) *no knowledge* to (6) *expert*. The majority of respondents (55%) rated their knowledge as *above average*, *extensive*, or *expert* (Table 10). Nearly one quarter of respondents (23%) rated their knowledge as *average*, with the remaining 22% of respondents rating their knowledge from *limited* to *no knowledge*.

Table 10. Level of Self-described Leave No Trace Knowledge

N	Mean	S.D.	Percentage[a]						
			No Knowledge	Very Limited	Limited	Average	Above Average	Extensive	Expert
			0	1	2	3	4	5	6
339	3.40	1.77	14%	4%	4%	23%	28%	18%	9%

a. Percentages may not equal exactly 100% due to rounding.

Likelihood of Practicing Leave No Trace in the Future

Survey respondents were asked how likely they were to perform recommended Leave No Trace practices in the future (Table 11). The majority of respondents indicated they were *extremely likely* to perform all recommended Leave No Trace practices with the exception of *Taking breaks away from the trail and other visitors* ($M = 3.94$). This finding suggests that respondents are only *moderately likely* to follow this Leave No Trace recommendation in the future.

Table 11. Behavioral intentions to practice Leave No Trace in the future

Please indicate how LIKLEY you are to do the following activity in the future…	N	Mean	S.D.	Percentage[a]						
				Not at all Likely			Moderately Likely		Extremely Likely	
				1	2	3	4	5	6	7
Prepare for all types of weather, hazards and emergencies before getting on trail	336	6.10	1.30	1	1	1	15	10	12	60
Stay on designated or established trails	329	6.09	1.30	1	.3	1	13	11	16	57
Carry out all littler, even crumbs, peels or cores	335	6.51	1.12	1	1	1	5	4	11	77
Remove objects from the area, not even a small item like a rock, plant or stick	336	2.95	2.12	44	10	6	18	6	7	10
Approach, feed or follow wildlife	334	2.59	2.23	56	11	5	8	2	4	14
Take breaks away from the trail and other visitors	335	3.94	1.98	18	8	10	30	8	9	16

a. Percentages may not equal exactly 100% due to rounding.

Regression Analysis

Data analysis included running six separate linear regression models. For each model, one item from Table 11 functioned as the dependent variable. The independent variables included: attitudes towards recommended Leave No Trace practices (Table 7), perceived effectiveness of recommended Leave No Trace practices (Table 8), perceived difficulty of recommended Leave No Trace practices (Table 9) and self-described knowledge of Leave No Trace (Table 10). The analysis revealed that Leave No Trace behavioral intent was influenced to varying degrees by attitudes, perceived effectiveness, perceived difficulty, and self-reported Leave No Trace knowledge (Table 12). These findings were consistent with the hypotheses. The

most variance ($R^2 = .31$) was explained in respondents' future likelihood of *Carrying out all litter, including food scraps*. The analysis explained the next highest level of variance ($R^2 = .24$) for respondents' likelihood of *Staying on designated or established trails*. The least amount of explained variance ($R^2 = .10$ in both cases) was for both *Not removing natural objects from the area* and *Not feeding, following or approaching wildlife*.

Table 12. Predicting Leave No Trace behavioral intent[a]

Behavioral Intent	Appropriateness	Effectiveness	Difficulty	Knowledge	R^2
Preparing for all types of weather, hazards and emergencies	.02	.24**	-.19**	.14*	.15
Staying on designated or established trails	-.21**	.31**	-.13*	.05	.24
Carrying out all litter, including food scraps	-.004	.44**	-.22**	.08	.31
Not removing natural objects from the area	.25**	.10	.18*	-.10	.10
Not feeding, following or approaching wildlife	.12	.10	.17*	.02	.10
Taking breaks away from trails and other visitors	.11	.34**	.004	-.003	.13

a. Cell entries are standardized regression coefficients — * $p < .05$, ** $p < .001$

Perceived effectiveness of Leave No Trace practices was the strongest predictor ($\beta \geq .24$, $p < .001$) in four cases: *Preparing for all types of weather, hazards and emergencies, Staying on designated or established trails, Carrying out all litter including food scraps,* and *Taking breaks away from trails and other visitors*. However, in the case of *Not removing natural objects from the area* ($\beta = .25$, $p < .001$), attitude (i.e., appropriateness or inappropriateness of a given practice) was the strongest predictor of behavioral intent to follow this Leave No Trace recommendation. Furthermore, in the case of *Not feeding, following or approaching wildlife*, perceived difficulty ($\beta = .17$, $p < .05$) was shown to be the most significant predictor of

behavioral intent to follow this practice. Despite the high level of self-reported Leave No Trace knowledge, it was not shown to be a significant predictor of behavioral intent ($\beta < .14$, $p \geq .05$, in all cases). Overall, these results indicate the need to focus visitor education efforts the effectiveness of recommended Leave No Trace practices and the appropriateness of the practices, as well as provide information for visitors regarding the perceived difficulty of practicing Leave No Trace.

Discussion

The purpose of this study was to examine how Wyoming state park visitors' behavioral intent may be influenced by attitudes, perceived effectiveness, perceived difficulty and knowledge about Leave No Trace principles. Though the majority of respondents indicated that they were *moderately* to *extremely* likely to practice Leave No Trace in the future, behavioral intent does not translate to actual behavior. However, by understanding the most significant influences on behavioral intent, state park managers may be able to more effectively message to park visitors about minimizing their recreational impact in the parks.

Respondents indicated a high level of Leave No Trace knowledge, with nearly 55% reporting *above average* to *expert* Leave No Trace knowledge. Despite similar findings in previous Leave No Trace research using the same wording (Taff et al., 2011; Vagias & Powell, 2010), this variable was not found to be a strong predictor of behavioral intent. Though respondents indicated a high level of self-reported knowledge, the results of the attitudinal measures (Table 7) suggest that some park visitors either do not fully understand or are simply unfamiliar with certain Leave No Trace recommended practices. Specifically, visitors may not entirely understand the Leave No Trace principles *Dispose of Waste Properly* and *Be Considerate of Other Visitors*. Respectively, these principles recommend packing out all waste

including food scraps, and taking breaks away from trails on durable surfaces such as rock, sand, gravel or snow when available so as not to unnecessarily impact the experience of other visitors. Previous investigations of Leave No Trace found similar deficiencies in visitors' understanding of these Leave No Trace principles (Taff et al., 2011; Vagias & Powell, 2010). Additionally, the recommendation to *stay on designated trails to minimize erosion* may be perceived as inconsistent with the recommendation to move off trail to take breaks to minimize potential social impact with other trail users. Recommendations such as these may appear to park visitors to be in conflict and should be targeted in future studies. Furthermore, these results suggest that the Center should consider adding additional detail in the existing Leave No Trace literature in order to fully explain the rational underpinning these recommendations. Finally, since an attitude is an evaluation of a particular object or recommendation, it is possible that visitors may be fully aware of Leave No Trace practices but may simply hold negative view of certain recommended practices.

Respondents' perceptions of the perceived difficulty of carrying out recommended practices may have some influence on their behavioral intent as shown in the regression results in Table 12. It is plausible that if recommended Leave No Trace practices are perceived as being too difficult, there is a greater likelihood that park visitors will not follow those practices. However, the low mean scores for perceived difficulty of the Leave No Trace practices (Table 9) addressed in this study indicate that visitors feel that these practices are generally easy to adhere to when recreating in the parks. Many state parks offer amenities such as toilets, picnic tables, trashcans and fire rings, and it is likely that visitors find it easier to minimize their overall impact due to these amenities. Conversely, in backcountry situations where such amenities are generally not available, practicing Leave No Trace often requires more skills and effort.

Education has long been a principle tool for attempting to enlighten visitors and influence visitor behavior in parks and protected areas in order to minimize recreation related impacts (Cialdini, 1996; Ham, 2007; Manning, 2003). For some educational efforts, behavior change is the primary purpose (Heimlich & Ardoin, 2008). Yet, educational efforts that focus solely on knowledge gain as a metric of success do not always produce attitudinal shifts or changes in behavior (Kollmuss & Agyeman, 2002; Leung & Attarian, 2003; Petty et al., 1992). Results from this study support the notion that knowledge gain does not directly translate to a change in behavioral intent. However, state park visitors do need to be made aware of how impacts occur, how those impacts can be minimized and how recommended Leave No Trace practices are effective at minimizing those impacts. Furthermore, these results suggest that focusing on the effectiveness of recommended Leave No Trace practices, as well as the appropriateness of those practices, may significantly influence behavioral intent in state park visitors to practice Leave No Trace. Perceived effectiveness of recommended Leave No Trace practices is important because it is possible that those practices that are deemed as ineffective are less likely to be performed by park visitors than those with a heightened perception of effectiveness. Data from this study and previous Leave No Trace investigations (see Lawhon et al., 2013) suggest that perceived effectiveness, attitudes and perceived difficulty are meaningful predictors of Leave No Trace behavioral intent.

Overall, the results of this study highlight some important considerations for state park managers with regards to Leave No Trace educational efforts aimed at minimizing visitor impact. Despite the fact that three different types of parks were included in this study, the finding of no substantive differences among the parks through a one-day analysis of variance suggest that a single, consistent educational effort could be implemented by the Wyoming State Parks,

Historic Sites and Trails agency that would likely resonate with visitors regardless of which park they visit. While it is clear that educational efforts need to highlight both the kinds of behaviors that cause impact and the techniques needed to reduce those impacts, results also indicate that a park-by-park approach may not necessarily be needed. Although locally-tailoring Leave No Trace information is warranted in certain situations in order to make the information ecologically and environmentally relevant (Dana Watts, Executive Director, personal communication, November 11, 2012), these data suggest that park managers may be able to implement an effective "one size fits all" approach with some local adjustments as needed. This is important for modern-day land management agencies as education and interpretation resources are often limited. A more uniform approach to Leave No Trace education, thereby lessening the burden on the agency in terms of program development and implementation, could lead to greater adoption and use of Leave No Trace by state parks. This research suggests that Leave No Trace educational efforts in state parks that utilize this approach, regardless of park type, are likely to be effective at both educating visitors about Leave No Trace and minimizing recreation-related impacts through changing visitors' behavioral intent.

Study Limitations and Future Research

This study has some limitations that likely merit further investigation in future Leave No Trace-focused studies. While it is clear that many factors influence behavioral intent such as perceived behavioral control and social norms (Ajzen, 1991; Vagias, 2009), this study only examined one component of the TPB – attitudes. Second, it should be noted that behavioral intentions were studied in this research rather than actual behavior, which has limitations when making accurate predictions of actual future behavior. Of great interest to both the Leave No Trace Center and many land managers is changing future behavior of park and protected area

visitors, thus encouraging Leave No Trace behavioral intent is the overarching intended outcome. Studying behavior directly tends to be difficult and costly, and behavioral intentions have proven to be an effective proxy for future behavior (Fishbein & Ajzen, 1975). Third, an inherent challenge in creating surveys is predicting and preventing biasing effects from the wording of survey questions **(**Babbie, 1990; Vaske, 2008). Because of the maner in which the survey questions were created, and the specific wording of the Leave No Trace principles, it is possible that there was inadvertent researcher-induced bias in this study. To the degree possible, future Leave No Trace focused studies should attempt to reduce this conceivable bias. Lastly, there may be other mediating variables such as level of education, emotions, etc. that could potentially influence behavioral intent that this study did not examine. Despite these limitations, the results of this study verify the importance of factors such as perceived effectivness, attitudes and perceived difficulty of recommended Leave No Trace practices in terms of influencing behavioral intent in state park visitors.

Because the behavior of an individual is largely determined by factors such as attitudes, norms, perceived behavioral control and possibly other factors (Ajzen, 1991), studies that explore these variables are likely more beneficial in assessing and improving the efficacy of Leave No Trace educational efforts in frontcountry settings. While visitors need to be informed about Leave No Trace practices, it has been shown that attitudes are far more important in environmental contexts than knowledge (Kaiser, Wolfing, & Fuhrer, 1999). This study and previous research (Vagias, 2009) signify the need to further investigate concepts such as attitudes, norms, perceptions, perceived behavioral control and beliefs about Leave No Trace rather than knowledge of specific Leave No Trace practices. Recent trend data indicate that a continued increase in recreational use in frontcountry areas, such as those found in many state

parks, is likley to occur over the coming years (Cordell, 2012; Outdoor Industry Foundation, 2012). Therefore, Leave No Trace studies in the frontcountry context may be the most useful for both the Leave No Trace Center for Outdoor Ethics and land managers across the country.

Conclusion

Resource impact due to depreciative visitor behavior continues to be a principal concern for park and protected area managers. Educational messages such as those promoted through Leave No Trace, which focus on uninformed visitors, are essential for future protection of recreational resources from visitor-created impacts. This research examined the potnetial influence that various psychological and knowledge variables have on Leave No Trace behavioral intent in visitors to Wyoming State Parks and Historic Sites. Study results indicate that both perceived effectiveness of and attitudes towards Leave No Trace practices are important predictors of behavioral intent in state park visitors. Education efforts have an increased likelihood of meaningfully influencing behavioral intent if they focus on why Leave No Trace practices are appropriate in state parks and how those practices are effective at minimizing impacts.

CONCLUSION

Despite the fact that countless parks and protected areas have a recreation mandate, resource degradation due to inappropriate visitor behavior continues to be a significant concern for managers (Leung & Marion, 2000; Taff et al., 2011). For many protected area managers, education is an essential component of overall management efforts for ensuring protection of recreational resources. Leave No Trace is the most prevalent minimum-impact visitor education program in use in parks and protected areas in the U.S., due primarily to its light-handed approach to visitor management (Taff, 2012; Vagias & Powell, 2010). As noted by Marion and Reid (2007), there is sufficient evidence that visitor education can affect visitor knowledge, attitudes and behavior. However, until this thesis, research involving the investigation of knowledge, attitudes and behaviors of outdoor enthusiasts in the context of Leave No Trace, specifically in frontcountry settings such as state parks, had been nonexistent. The results of the studies contained in this thesis offer both the Center and land managers specific strategies for increasing the efficacy of Leave No Trace messages. By altering current Leave No Trace messages to more effectively target salient attitudes and perceptions, there is greater likelihood of influencing Leave No Trace behavioral intent in park and protected area visitors in frontcountry settings.

Though the original intent of Leave No Trace was to educate visitors in wilderness areas, it is clear that the program must continue to focus on visitors in frontcountry settings. According to the Center, nearly 90% of all outdoor recreation in the U.S. takes place in frontcountry (Leave No Trace Center for Outdoor Ethics, 2012a). Though there will likely always be a need to provide Leave No Trace information for wilderness and backcountry visitors, a continued and

strengthened focus on frontcountry visitors by the Center and its land management partners is warranted in order to educate the millions of individuals who recreate in frontcountry settings.

Another important finding in this thesis is that there are few differences in which factors influence Leave No Trace behavioral intent in visitors to national and state parks. Though state and national park visitors differ in some ways, particularly with respect to the types of amenities they seek, this research demonstrates that a similar approach to Leave No Trace education could be effective for both types of visitors in frontcontry settings. State parks tend to offer cabins, boat ramps, swimming pools, stable operations, golf courses and ski slopes (National Association of State Park Directors, 2013), while national parks tend to offer more rustic amenities such as campgrounds, hiking trails and picnic areas. Despite these differences in the types of amenities and recreational experiences visitors seek, the findings in this thesis indicate that both attitudes and perceptions of recommended Leave No Trace practices are significant predictors of future behavioral intent for both visitor types. This finding is particularly important for contemporary land management agencies that are often challenged by limited financial and staffing resources. Since behavioral intentions in visitors to different park types are influenced by similar variables, managers can utilize a more uniform approach to Leave No Trace education, thereby lessening the burden on state and federal agencies.

Because of current use and projected growth in frontcountry-focused outdoor recreation, including state park visitation, a more thorough understanding of frontcountry visitors' perceptions, beliefs and attitudes regarding Leave No Trace is paramount. Without this foundation, educational efforts in state parks and other frontcountry settings may be ineffective. Therefore, future research efforts should focus specifically on exploration of frontcountry visitors' perceptions, beliefs and attitudes about Leave No Trace to better inform management

decisions and guide educational efforts. Heightened understanding of predictors of behavioral intent will provide a platform from which effective Leave No Trace communication and education strategies can be developed. Once created, these strategies can be applied in state parks, national parks and beyond to help ensure effective protection of treasured recreational resources in the future.

Key Findings

- Leave No Trace behavioral intent in national park visitors in frontcountry settings is influenced by the perceived effectiveness of recommended Leave No Trace practices.

- Leave No Trace behavioral intent in state park visitors is influenced by both perceived effectiveness of and attitudes towards recommended Leave No Trace practices.

- For the past decade the Center has strongly encouraged its educators to stress the effectiveness of Leave No Trace practices at minimizing impact. To date this recommendation has largely been based on anecdotal evidence, yet the results of these studies validate this approach.

- Certain recommended Leave No Trace practices (e.g. *dispose of waste properly* and *take breaks away from the trail and other visitors)* are either poorly understood by visitors or visitors simply have a negative attitude towards those practices.

- The Center should adjust the language associated with these recommendations to better ensure adequate comprehension and adoption of these practices.

- Despite potential differences in national and state park visitors, a more uniform approach to Leave No Trace education is likely to be effective across the park and

protected area spectrum, thus potentially leading to greater adoption and use of Leave No Trace in state and federal protected areas.

- Increased knowledge does not necessarily equate to changes in behavior, which necessitates a more strategic approach to Leave No Trace messaging in order to target salient perceptions and attitudes about recommended practices.

- Leave No Trace messages should be modified to better convey why and how specific practices are effective at minimizing impacts.

- Examples of modified language:

    o *Disposing of human waste 200' from any water source keeps other visitors and animals from coming into contact with bacteria and viruses, which could make them sick. It is best to either bury human waste in a 6-8" deep cathole or consider packing it out.*

    o *Keeping your pet on leash protects both your pet and local wildlife. While your dog may be an obedience champion, many aren't. Keeping your dog on leash ensures that other visitors and native wildlife all can enjoy and thrive in the outdoors.*

    o *Stick to trails: Staying on trails protects wildlife and their homes. Shortcutting trails causes erosion and damages trailside plants. Please walk and ride on designated trails only.*

This thesis has demonstrated the benefit of targeting specific factors such as perceptions and attitudes towards Leave No Trace that have been found to influence behavioral intent in national and state park visitors in frontcountry settings. The studies included in this thesis add to a growing body of Leave No Trace literature, and lay the groundwork for future investigations of

57

Leave No Trace in the frontcountry context. Future research will hopefully build on the findings in this thesis to further enhance Leave No Trace educational efforts for the benefit of all lands used for recreation.

REFERENCES

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 32*(4), 665-683.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Englewood Cliffs, N.J.: Prentice-Hall.

Babbie, E. R. (2008). *The basics of social research*. Wadsworth Publishing Company.

Bullock, S. D., & Lawson, S. R. (2007). Managing the commons on Cadillac Mountain: A stated choice analysis of Acadia National Park visitors' preferences. *Leisure Sciences, 30*, 71-86.

Cialdini, R. B. (1996). Activating and aligning two kinds of norms in persuasive communications. *Journal of Interpretation Research, 1*(1), 3-10.

Cole, D. N. (2004). Environmental impacts of outdoor recreation in wildlands. In M. Manfredo, J. Vaske, B. Bruyere, D. Field & P. Brown (Eds.), *Society and Resource Management: A Summary of Knowledge* (pp. 107-116). Jefferson, MO: Modern Litho.

Cordell, H. K. (2012). *Outdoor recreation trends and futures: a technical document supporting the Forest Service 2010 RPA Assessment*: US Department of Agriculture, Forest Service, Southern Research Station.

D'Antonio, A., Monz, C., Newman, P., Lawson, S., et al. (2012). The Effects of Local Ecological Knowledge, Minimum-Impact Knowledge, and Prior Experience on Visitor Perceptions of the Ecological Impacts of Backcountry Recreation. *Environmental Management*, 1-13.

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.

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Ft. Worth, TX: Harcourt Brace Jovanovich College Publishers.

Ewert, A. W. (1996). Human dimensions research and natural resource management. In A.W. Ewert, D. J. Chavez, and A.W. Magill (Eds.), *Culture, conflict, and communication in the wildland-urban interface* (pp. 5-12). Boulder, CO: Westview Press.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behaviour: An introduction to theory and research*. Sidney, Australia: Addison-Wesley.

Fishbein, M., & Manfredo, M. J. (1992). A theory of behavior change. In M. J. Manfredo (Ed.), *Influencing human behavior theory and application in recreation, tourism, and natural resources management* (pp. 29-50). Champaign, IL: Sagamore Pub. Inc.

Halpenny, E. A. (2010). Pro-environmental behaviours and park visitors: The effect of place attachment. *Journal of Environmental Psychology, 30*(4), 409-421.

Ham, S. H. (2007). *Can interpretation really make a difference? Answers to four questions from cognitive and behavioral psychology.* Paper presented at the Paper presented at the Interpreting World Heritage Conference, Vancouver, British Columbia Canada.

Ham, S. H., & Krumpe, E. E. (1996). Identifying audiences and messages for nonformal environmental education – A theoretical framework for interpreters. *Journal of Interpretation Research, 1*(1), 11-23.

Hammitt, W. E., & Cole, D. N. (1998). *Wildland recreation ecology and management*. New York: John Wiley & Sons.

Hampton, B., & Cole, D. (2003). *Soft Paths*. Mechanicsburg, PA: Stackpole Books.

Harmon, W. (1997). *Leave No Trace Minimum Impact Outdoor Recreation* Helena, MT: Falcon Publishing, Inc.

Heimlich, J. E., & Ardoin, N. M. (2008). Understanding behavior to understand behavior change: A literature review. *Environmental Education Research, 14*(3), 215-237.

Hendee, J. C., & Dawson, C. P. (2002). *Wilderness management stewardship and protection of resources and values*. Golden, CO: WILD Foundation and Fulcrum Pub.

Hockett, K. S., & Hall, T. E. (2007). The effect of moral and fear appeals on park visitors' beliefs about feeding wildlife. *Journal of Interpretation Research, 12*(1), 4-26.

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

Hwang, Y. H., Kim, S. I., & Jeng, J. M. (2000). Examining the causal relationships among selected antecedents of responsible environmental behavior. *The Journal of Environmental Education*, *31*(4), 19-25.

Jones, M. (1999). *Leave No Trace: Pilot project report*. Retrieved from http://www.bouldercolorado.gov/index.php?option=com_content&task=view&id =3054&Itemid=411

Jones, M., & Bruyere, B. (2004). *Frontcountry Leave No Trace program evaluation, city of Boulder Open Space and Mountain Parks*. Paper presented at the International Symposium on Society and Resource Management Keystone, Colorado, June 5, 2004.

Jones, M. K., & Lowry, R. (2004). *Effectiveness of Trailhead Education on Cleaning Up Dog Litter.* City of Boulder Open Space and Mountain Parks. Available at: http://www.bouldercolorado.gov/files/openspace/pdf_gis/IndependentResearchReports/Jones_Matt_Effectiveness_of_Trailhead_Education_on_Cleaning_Up_Dog_Litter_2004.pdf. Boulder, CO

Kaiser, F. G., Wolfing, S., & Fuhrer, U. (1999). Environmental attitude and ecological behaviour. *Journal of Environmental Psychology, 19*(1), 1-19.

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.

Kuentzel, W., Laven, D., Manning, R., & Valliere, W. (2008). When Do Normative Standards Matter Most? Understanding the Role of Norm Strength at Multiple National Park Settings. *Leisure Sciences, 30*(2), 127-142.

Lackey, B. K., & Ham, S. H. (2003). Assessment of communication focused on human-black bear conflict at Yosemite National Park. *Journal of Interpretation Research, 8*(1), 25-40.

Lawhon, B., Newman, P., Taff, B. D., Vaske, J. J., et al. (2013). Factors Influencing Behavorial Intentions for Leave No Trace Behaviors in National Parks. *Journal of Interpretation Research*. *18*(1), 23-38.

Leave No Trace Center for Outdoor Ethics. (2012a). Leave No Trace Frontcountry Program. Retrieved April 16, 2012, from http://lnt.org/programs/frontcountry.php

Leave No Trace Center for Outdoor Ethics. (2012b). Leave No Trace Mission. Retrieved April 16, 2012, from http://lnt.org/aboutUs/index.php

Leave No Trace Center for Outdoor Ethics. (2012c). Leave No Trace Principles. Retrieved April 16, 2012, from http://lnt.org/programs/principles.php

Leave No Trace Center for Outdoor Ethics. (2012d). Leave No Trace Training. Retrieved April 16, 2012, from http://lnt.org/training/index.php

Leave No Trace Center for Outdoor Ethics. (2013). Leave No Trace About Us. Retrieved April 19, 2013, from http://lnt.org/about

Leave No Trace Center for Outdoor Ethics. (2013). Strategic Objectives. Retrieved July 29, 2013, from http://lnt.org/about/what-we-are-working-now

Leung, Y. F., & Attarian, A. (2003). *Evaluating the effectiveness of the Leave No Trace program in the city of Durango, Colorado*. Final report submitted to the Leave No Trace, Inc.

Leung, Y. F., & Marion, J. L. (2000). Recreation impacts and management in wilderness: A state-of-knowledge review. In D. N. Cole, S. F. McCool, W. T. Boorie & J. O'Loughlin (Eds.), *Wilderness science in a time of change conference-Volume 5 Wilderness ecosystems, threats, and management: 1999 May 23-27; Missoula, MT. Proceedings RMSR-P-VOL-5* (pp. 23-48). Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Manfredo, M. J., Teel, T. L., & Bright, A. D. (2004). Application of the concepts of values and attitudes in human dimensions of natural resources research. In M. J. Manfredo, J. J. Vaske, B. L. Bruyere, D. R. Field & P. J. Brown (Eds.), *Society and natural resources: A summary of knowledge* (pp. 271-282). Jefferson, MO: Modern Litho.

Manfredo, M. J., Vaske, J. J., & Decker, D. J. (1995). Human dimensions of wildlife management: Basic concepts. In R. L. Knight & K. j. Gutzwiller (Eds.), *Wildlife and recreationists: coexistence through management and research.* Island Press, Washington, DC, USA (pp. 17-31).

Manning, R. E. (1999). *Studies in outdoor recreation search and research for satisfaction*. Corvallis, OR: Oregon State University Press.

Manning, R. E. (2003). Emerging principles for using information/education in wilderness management. *International Journal of Wilderness, 9*(1), 20-27.

Marion, J. L., & Reid, S. E. (2001). Development of the US Leave No Trace program: An Historical Perspective. In M. B. Usher (Ed.), *Enjoyment and Understanding of the National Heritage* (pp. 81-92). Edinburgh, Scotland: Scottish Natural Heritage & the Stationery Office.

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.

Martin, S. R., Marsolais, J., & Rolloff, D. (2009). Visitor perceptions of appropriate management actions across the recreation opportunity spectrum. *Journal of Park and Recreation Administration, 27*, 56-69.

McGivney, A. (2003). *Leave no trace: A guide to the new wilderness etiquette*. Seattle, WA: Mountaineers.

Mertz, S. (2002). *Compliance with Leave No Trace frontcountry principles: A preliminary examination of visitor behavior*. City of Boulder Open Space and Mountain Parks. Retrieved from http://joomla.ci.boulder.co.us/files/openspace/pdf_research/obsv-stdy-report.pdf

Monz, C.A., Cole, D.N., Leung, Y.F., & Marion, J.L. (2010). Sustaining visitor use in protected areas: Future opportunities in recreation ecology research based on the USA experience. *Environmental Management, 45*, 551-562.

National Association of State Park Directors. (2013). State Park Facts. Retrieved September 3, 2013, from http://www.naspd.org/

National Association of State Park Directors. (2011). Retrieved November 14, 2011, from http://www.naspd.org/

National Park Service, Rocky Mountain National Park, 2012 Compendium: 36 CFR 1.7(b). Retrieved from http://www.nps.gov/romo/parkmgmt/upload/compendium_2012.pdf

Orams, M. B. (1997). The effectiveness of environmental education: can we turn tourists into'Greenies'? *Progress in tourism and hospitality research, 3*, 295-306.

Outdoor Industry Foundation. (2012). *Outdoor Recreation Participation Report 2012.* Boulder, CO.

Park, L., Lawson, S., Kaliski, K., Newman, P., & Gibson, A. (2010). Modeling and mapping hikers' exposure to transportation noise in Rocky Mountain National Park. *Park Science 26*(3), 59 – 64.

Petty, R. E., McMichael, S., & Brannon, L. A. (1992). The elaboration likelihood model of persuasion: Applicaions in recreation and tourism. In M. J. Manfredo (Ed.), *Influencing human behavior theory and application in recreation, tourism, and natural resources management* (pp. 77-101). Champaign, IL: Sagamore Pub. Inc.

Swain, R. (1996). Leave No Trace – Outdoor skills and ethics program. *International Journal of Wilderness, 2*(3), 24-26.

Taff, B. D. (2012). *Messaging and national park visitor attitudes.* Doctoral Dissertation. Colorado State University, Fort Collins, CO.

Taff, D., Newman, P., Bright, A., & Vagias, W. (2011). Day-User Beliefs Regarding Leave No Trace in Rocky Mountain National Park. *Journal of Outdoor Recreation, Education, and Leadership, 3*(2), 112-115.

Traifmow, D., Sheeran, P., Conner, M., & Finlay, K. (2002). Evidence that perceived behavior control is a multidimensional construct: Perceived control and perceived difficulty. *British Journal of Social Psychology, 41*, 101-121.

Vagias, W. M. (2009). *An examination of the Leave No Trace visitor education program in two US National Park Service units.* Ph.D. Dissertation, Clemson University, Clemson, SC.

Vagias, W. M., & Powell, R. B. (2010). Backcountry Visitors Leave No Trace Attitudes. *International Journal of Wilderness, 16*(3), 21-27.

Vaske, J. J. (2008). *Survey research and analysis: Applications in parks, recreation and human dimensions*. State College, PA: Venture Publishing.

Widner-Ward, C., & Roggenbuck, J. (2003). Understanding Park Visitors' Response to Interventions to Reduce Petrified Wood Theft. *Journal of Interpretation Research, 8*, 67-82.

Winter, P. L. (2006). The impact of normative message types on off-trail hiking. *Journal of Interpretation Research, 11*(1), 35-52.

Wyoming State Parks, Historic Sites and Trails. (2009). *Visitor Survey.* Cheyenne, WY

APPENDIX A: ROCKY MOUNTAIN NATIONAL PARK SURVEY INSTRUMENT

Colorado State University

1. Please indicate your level of agreement with the following statements using the scale '1' NOT AT ALL UNDER MY CONTROL to '7' COMPLETELY UNDER MY CONTROL. *Circle the number of your response for each statement.*

		Not at all under my control			Neutral		Completely under my control	
a.	How I act while in Rocky Mountain National Park is...	1	2	3	4	5	6	7
b.	The way I act while on the trail in Rocky Mountain National Park is...	1	2	3	4	5	6	7
c.	My recreation practices in Rocky Mountain National Park are...	1	2	3	4	5	6	7
d.	The way the individuals in my group act while in Rocky Mountain National Park is...	1	2	3	4	5	6	7

2. Please indicate how INAPPROPRIATE or APPROPRIATE you think each of the following activities is for a visitor to do in Rocky Mountain National Park. *Circle the number of your response for each statement.*

Activities		Very Inappropriate			Neutral		Very Appropriate	
a.	Experience nature by not preparing for all types of weather or hazards before I get on a trail	1	2	3	4	5	6	7
b.	Schedule my trip during times of high use to reduce overall impact	1	2	3	4	5	6	7
c.	Travel off trail to experience the natural environment	1	2	3	4	5	6	7
d.	Walk around muddy spots on the trail	1	2	3	4	5	6	7
e.	Use the bathroom in a lake, river or stream if there are no public facilities	1	2	3	4	5	6	7
f.	Carry all litter back out, leaving only food scraps behind	1	2	3	4	5	6	7
g.	Keep a single item like a rock, plant, stick or feather as a souvenir	1	2	3	4	5	6	7
h.	Move rocks and/or logs to make a resting location more comfortable	1	2	3	4	5	6	7
i.	Drop food on the ground to provide wildlife a food source	1	2	3	4	5	6	7
j.	Approach wildlife to take a photo	1	2	3	4	5	6	7
k.	Hike side by side with members of my group on existing trails	1	2	3	4	5	6	7
l.	Take a break along the edge of the trail	1	2	3	4	5	6	7

Figure 6. Rocky Mountain National Park Survey Instrument

3. Please indicate the level at which you think each of the following activities would reduce negative impacts and improve visitor experiences in the Park. *Circle the number of your response for each statement*.

Participating in the following activities in Rocky Mountain National Park would reduce impact…	Never			Sometimes			Every time
a. Prepare for all types of weather, hazards, or emergencies before I get on a trail	1	2	3	4	5	6	7
b. Schedule trip to avoid times of high use	1	2	3	4	5	6	7
c. Stay on designated or established trails	1	2	3	4	5	6	7
d. Walk single file in the middle of the trail, even when wet or muddy	1	2	3	4	5	6	7
e. Carry out all litter, even crumbs, peels, or cores	1	2	3	4	5	6	7
f. Never remove objects from the area, not even a small item like a rock, plant, stick, or feather	1	2	3	4	5	6	7
g. Never approach, feed, or follow wildlife	1	2	3	4	5	6	7
h. Take breaks away from the trail and other visitors	1	2	3	4	5	6	7

4. The same activities are listed below. Regardless of how effective you think each of the following activities are, please indicate how DIFFICULT you think each of the following activities would be for a visitor to do in Rocky Mountain National Park. *Circle the number of your response for each statement*.

Activities	Not at all Difficult			Moderately Difficult			Extremely Difficult
a. Prepare for all types of weather, hazards, or emergencies before I get on a trail	1	2	3	4	5	6	7
b. Schedule trip to avoid times of high use	1	2	3	4	5	6	7
c. Stay on designated or established trails	1	2	3	4	5	6	7
d. Walk single file in the middle of the trail, even when wet or muddy	1	2	3	4	5	6	7
e. Carry out all litter, even crumbs, peels, or cores	1	2	3	4	5	6	7
f. Never remove objects from the area, not even a small item like a rock, plant, stick, or feather	1	2	3	4	5	6	7
g. Never approach, feed, or follow wildlife	1	2	3	4	5	6	7
h. Take breaks away from the trail and other visitors	1	2	3	4	5	6	7

5. The same activities are listed below. In COLUMN A tell us if you DO each activity by *circling* **NEVER, SOMETIMES or ALWAYS.**
In COLUMN B, please indicate how LIKELY are you to do the activity in the future by *circling the number of your response for each statement.*

Column A				Column B How Likely Are You To Do This In The Future?						
Activities	Do You Do This Now?			Not at all Likely			Moderately Likely			Extremely Likely
a. Prepare for all types of weather, hazards, or emergencies before I get on a trail	Never	Sometimes	Always	1	2	3	4	5	6	7
b. Schedule trip to avoid times of high use	Never	Sometimes	Always	1	2	3	4	5	6	7
c. Stay on designated or established trails	Never	Sometimes	Always	1	2	3	4	5	6	7

Figure 6 (continued). Rocky Mountain National Park Survey Instrument.

Activities	Do You Do This Now?			Not at all Likely			Moderately Likely			Extremely Likely
d. Walk single file in the middle of the trail, even when wet or muddy	Never	Sometimes	Always	1	2	3	4	5	6	7
e. Carry out all litter, even crumbs, peels, or cores	Never	Sometimes	Always	1	2	3	4	5	6	7
f. Never remove objects from the area, not even a small item like a rock, plant, stick, or feather	Never	Sometimes	Always	1	2	3	4	5	6	7
g. Never approach, feed, or follow wildlife	Never	Sometimes	Always	1	2	3	4	5	6	7
h. Take breaks away from the trail and other visitors	Never	Sometimes	Always	1	2	3	4	5	6	7

6. How FAMILIAR are you with the Leave No Trace Center for Outdoor Ethics? *Please circle only one number*.

Not at all Familiar	Slightly Familiar	Moderately Familiar	Quite Familiar		Extremely Familiar	
0	1	2	3	4	5	6

7. How would you describe your current knowledge of "Leave No Trace" practices? *Please circle only one number*.

No Knowledge	Very Limited	Limited	Average	Above Average	Extensive	Expert
0	1	2	3	4	5	6

8. Please indicate how strongly you AGREE or DISAGREE with the following statements. *Circle the number of your response for each statement*.

Activities	Strongly Disagree			Neutral			Strongly Agree
a. Sometimes it is too difficult to practice "Leave No Trace."	1	2	3	4	5	6	7
b. Practicing "Leave No Trace" takes too much time.	1	2	3	4	5	6	7
c. Practicing "Leave No Trace" violates the rights of an individual to do as they please in the outdoors.	1	2	3	4	5	6	7
d. Practicing "Leave No Trace" does not reduce the environmental harm caused by travel in the Park.	1	2	3	4	5	6	7
e. Practicing "Leave No Trace" effectively protects the environment so that future generations may enjoy it.	1	2	3	4	5	6	7
f. Practicing "Leave No Trace" enhances my outdoor experience.	1	2	3	4	5	6	7
g. It is important that all visitors practice "Leave No Trace."	1	2	3	4	5	6	7
h. It is important that Park regulations require all visitors to practice "Leave No Trace."	1	2	3	4	5	6	7
i. The people I recreate with believe it is important to practice "Leave No Trace."	1	2	3	4	5	6	7
j. In general, the opinions of others have little effect on my practicing "Leave No Trace."	1	2	3	4	5	6	7

Figure 6 (continued). Rocky Mountain National Park Survey Instrument.

Activities	Strongly Disagree			Neutral			Strongly Agree
k. I practice "Leave No Trace" because the people I recreate with believe it is important.	1	2	3	4	5	6	7
l. I practice "Leave No Trace" because the Park regulations state that I should do so.	1	2	3	4	5	6	7
m. It is important to practice "Leave No Trace" techniques when in the Park.	1	2	3	4	5	6	7
n. If I learned my actions in the Park damaged the environment, I would change my behavior.	1	2	3	4	5	6	7
o. I get upset when I see other individuals in the Park not following "Leave No Trace" practices.	1	2	3	4	5	6	7
p. I insist that "Leave No Trace" practices are followed by all members of my group.	1	2	3	4	5	6	7

9. How FREQUENTLY in the past 3 months, did you do any of the following activities related to "Leave No Trace?"
Circle the number of your response for each statement.

Activities	Not at All			Often			Very Frequently
a. Talk with others	1	2	3	4	5	6	7
b. Read articles and books	1	2	3	4	5	6	7
c. Take courses or attend meetings	1	2	3	4	5	6	7
d. Teach others	1	2	3	4	5	6	7
e. View websites ("Leave No Trace," Facebook, YouTube or Twitter)	1	2	3	4	5	6	7

Other (Please specify): _____

10. Where did you first learn about "Leave No Trace?" *Please check only one answer.*
☐ Leave No Trace website ☐ Information kiosk/ Park literature ☐ Popular media (magazines, books)
☐ Course or seminar ☐ Park personnel/Interpretive talk ☐ Other (Please specify):_____

11. What is your gender? ☐ Male ☐ Female

12. In what year were you born? _____

13. Do you live in the United States?
☐ Yes – What is your zip code? _____
☐ No – In what country do you live? _____

14. What is the highest level of education you have completed?
☐ Some high school ☐ High school graduate or GED ☐ Some college, business, or trade school

☐ College, business, or trade school graduate ☐ Some graduate school ☐ Master's, doctoral, or professional degree

15. What is your race? (Check one or more)
☐ American Indian or Alaskan Native ☐ Asian ☐ Black or African American
☐ Native Hawaiian or Pacific Islander ☐ White or Caucasian

Thank you for participating in this survey. Your input is very important to Colorado State University and Rocky Mountain National Park.

Figure 6 (continued). Rocky Mountain National Park Survey Instrument.

APPENDIX B: WYOMING STATE PARKS SURVEY INSTRUMENT

Wyoming State Parks and Historic Sites Visitor Survey

This study is part of a research effort by Wyoming State Parks, Historic Sites and Trails. We appreciate your willingness to participate in this study. Your participation is completely voluntary, and all the answers you give are confidential and anonymous. Filling out this questionnaire will take approximately 10 minutes. If you do not wish to continue, you can stop at any time. Thank you for your participation in this important research.

1. Please indicate how INAPPROPRIATE or APPROPRIATE you think each of the following activities is for a visitor to do in Wyoming State Parks and Historic Sites. *Circle the number of your response for each statement.*

Activities	Very Inappropriate			Neutral			Very Appropriate
a. Experiencing parks and historic sites by not preparing for all types of weather or hazards before I get on a trail	1	2	3	4	5	6	7
b. Scheduling my trip during times of high use to reduce overall impact	1	2	3	4	5	6	7
c. Traveling off the trail to experience the natural environment	1	2	3	4	5	6	7
d. Traveling around muddy spots on the trail	1	2	3	4	5	6	7
e. Disposing of human waste in a lake, river, or stream if there are no public facilities	1	2	3	4	5	6	7
f. Carrying all litter out, leaving only food scraps behind	1	2	3	4	5	6	7
g. Keeping a single item like a rock, plant, stick, or feather as a souvenir	1	2	3	4	5	6	7
h. Moving rocks and/or logs to make a campsite more comfortable	1	2	3	4	5	6	7
i. Dropping food on the ground to provide wildlife a food source	1	2	3	4	5	6	7
j. Approaching wildlife to take a photo	1	2	3	4	5	6	7
k. Traveling side by side with members of my group on existing trails	1	2	3	4	5	6	7
l. Taking a break along the edge of the trail	1	2	3	4	5	6	7

2. Please indicate the level at which you think each of the following activities would REDUCE NEGATIVE IMPACTS in Wyoming State Parks and Historic Sites. *Circle the number of your response for each statement.*

Participating in the following activities in Wyoming State Parks and Historic Sites would reduce impact…	Never			Sometimes			Every time
a. Preparing for all types of weather, hazards, or emergencies before I get on a trail	1	2	3	4	5	6	7
b. Scheduling trip to avoid times of high use	1	2	3	4	5	6	7
c. Staying on designated or established trails	1	2	3	4	5	6	7
d. Traveling single file in the middle of the trail, even when wet or muddy	1	2	3	4	5	6	7
e. Carrying out all litter, even crumbs, peels, or cores	1	2	3	4	5	6	7
f. Never removing objects from the area, even a small item like a rock, plant, stick, or feather	1	2	3	4	5	6	7
g. Never approaching, feeding, or following wildlife	1	2	3	4	5	6	7
h. Taking breaks away from the trail and other visitors	1	2	3	4	5	6	7

Figure 7. Wyoming State Parks Survey Instrument.

3. The same activities are listed below. Regardless of how effective you think each of the following activities are, please indicate how DIFFICULT you think each of the following activities would be for a visitor to do in Wyoming State Parks and Historic Sites. *Circle the number of your response for each statement.*

Activities	Not at all Difficult			Moderately Difficult			Extremely Difficult
a. Preparing for all types of weather, hazards, or emergencies before I get on a trail	1	2	3	4	5	6	7
b. Scheduling trip to avoid times of high use	1	2	3	4	5	6	7
c. Staying on designated or established trails	1	2	3	4	5	6	7
d. Traveling single file in the middle of the trail, even when wet or muddy	1	2	3	4	5	6	7
e. Carrying out all litter, even crumbs, peels, or cores	1	2	3	4	5	6	7
f. Never removing objects from the area, not even a small item like a rock, plant, stick, or feather	1	2	3	4	5	6	7
g. Never approaching, feeding, or following wildlife	1	2	3	4	5	6	7
h. Taking breaks away from the trail and other visitors	1	2	3	4	5	6	7

4. The same activities are listed below. In COLUMN A, tell us if you DO each activity by *circling* **NEVER, SOMETIMES or ALWAYS.**

In COLUMN B, please indicate how LIKELY are you to do the activity in the future by *circling the number of your response for each statement.*

Activities	Column A			Column B How Likely Are You To Do This In The Future?						
	Do You Do This?			Not at all Likely			Moderately Likely			Extremely Likely
a. Prepare for all types of weather, hazards, or emergencies before I get on a trail	Never	Sometimes	Always	1	2	3	4	5	6	7
b. Schedule trip to avoid times of high use	Never	Sometimes	Always	1	2	3	4	5	6	7
c. Stay on designated or established trails	Never	Sometimes	Always	1	2	3	4	5	6	7
d. Travel single file in the middle of the trail, even when wet or muddy	Never	Sometimes	Always	1	2	3	4	5	6	7
e. Carry out all litter, even crumbs, peels, or cores	Never	Sometimes	Always	1	2	3	4	5	6	7
f. Remove objects from the area, even a small item like a rock, plant, stick, or feather	Never	Sometimes	Always	1	2	3	4	5	6	7
g. Approach, feed, or follow wildlife	Never	Sometimes	Always	1	2	3	4	5	6	7
h. Take breaks away from the trail and other visitors	Never	Sometimes	Always	1	2	3	4	5	6	7

Figure 7 (continued). Wyoming State Parks Survey Instrument.

5. Please indicate your level of agreement with the following statements. *Circle the number of your response for each statement.*

	Not at all under my control			Neutral		Completely under my control	
a. How I act while in Wyoming State Parks and Historic Sites is…	1	2	3	4	5	6	7
b. The way I act while recreating in Wyoming State Parks and Historic Sites is…	1	2	3	4	5	6	7
c. My recreation practices in Wyoming State Parks and Historic Sites are…	1	2	3	4	5	6	7
d. The way the individuals in my group act while in Wyoming State Parks and Historic Sites is…	1	2	3	4	5	6	7

6. How FAMILIAR are you with the Leave No Trace Center for Outdoor Ethics? *Please circle only one number.*

Not at all Familiar	Slightly Familiar		Moderately Familiar	Quite Familiar		Extremely Familiar
0	1	2	3	4	5	6

7. How would you describe your current knowledge of "Leave No Trace" practices? *Please circle only one number.*

No Knowledge	Very Limited	Limited	Average	Above Average	Extensive	Expert
0	1	2	3	4	5	6

8. Please indicate how strongly you DISAGREE or AGREE with the following statements. *Circle the number of your response for each statement.*

Activities	Strongly Disagree			Neutral			Strongly Agree
a. Sometimes it is too difficult to practice "Leave No Trace"	1	2	3	4	5	6	7
b. Practicing "Leave No Trace" takes too much time	1	2	3	4	5	6	7
c. Practicing "Leave No Trace" violates the rights of individuals to do as they please in the outdoors	1	2	3	4	5	6	7
d. Practicing "Leave No Trace" does not reduce the environmental harm caused by recreation	1	2	3	4	5	6	7
e. Practicing "Leave No Trace" effectively protects the environment for future generations to enjoy	1	2	3	4	5	6	7
f. Practicing "Leave No Trace" enhances my outdoor experience	1	2	3	4	5	6	7
g. It is important that all visitors practice "Leave No Trace"	1	2	3	4	5	6	7
h. It is important that Park regulations require all visitors to practice "Leave No Trace"	1	2	3	4	5	6	7
i. The people I recreate with believe it is important to practice "Leave No Trace"	1	2	3	4	5	6	7
j. In general, the opinions of others have little effect on my practicing "Leave No Trace"	1	2	3	4	5	6	7
k. I practice "Leave No Trace" because the people I recreate with believe it is important	1	2	3	4	5	6	7
l. I practice "Leave No Trace" because the park regulations state that I should do so	1	2	3	4	5	6	7

Figure 7 (continued). Wyoming State Parks Survey Instrument.

Activities	Strongly Disagree			Neutral			Strongly Agree
m. It is important to practice "Leave No Trace" techniques when in the park	1	2	3	4	5	6	7
n. If I learned my actions in the park damaged the environment, I would change my behavior	1	2	3	4	5	6	7
o. I get upset when I see other individuals in the park not following "Leave No Trace" practices	1	2	3	4	5	6	7
p. I insist that "Leave No Trace" practices are followed by all members of my group	1	2	3	4	5	6	7

9. How FREQUENTLY in the past 3 months, did you do any of the following activities related to "Leave No Trace?" *Circle the number of your response for each statement.*

Activities	Never			Occasionally			Frequently
a. Talk with others about Leave No Trace	1	2	3	4	5	6	7
b. Read articles or books about Leave No Trace	1	2	3	4	5	6	7
c. Take Leave No Trace course or attend a workshop	1	2	3	4	5	6	7
d. Teach others about Leave No Trace	1	2	3	4	5	6	7
e. View websites or social media ("www.LNT.org," Facebook, YouTube or Twitter)	1	2	3	4	5	6	7
f. Other (please specify):							

10. Where did you first learn about "Leave No Trace?" *Please check only **one** answer.*

☐ Leave No Trace website   ☐ Information kiosk/park literature   ☐ Popular media (magazines, books)
☐ Course or workshop   ☐ Park personnel/ranger talk   ☐ Other (please specify):_____

11. What is the primary purpose of your visit? *Please select only **one** answer.*

☐ Hiking   ☐ Mountain biking   ☐ Fishing   ☐ Picnicking   ☐ Historical Exhibits
☐ Camping   ☐ Boating   ☐ Climbing   ☐ Sightseeing   ☐ Other (please specify):_____

12. How many times have you visited this park in the past 12 months? *Please check only **one** answer.*

☐ No visits   ☐ 1-2 visits   ☐ 3-5 visits   ☐ 6-10 visits   ☐ 11-20 visits
☐ 21-30 visits   ☐ 31-40 visits   ☐ 41-50 visits   ☐ More than 50   ☐ Other (please specify):_____

13. It bothers me when I see trash left behind by others in Wyoming State Parks and Historic Sites. *Circle the number of your response.*

Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree
1	2	3	4	5	6	7		

14. If I learned that taking all of my trash out of the park or historic site when I leave would help keep fees low, I would take all of my trash out of the park or historic site. *Circle the number of your response.*

Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree
1	2	3	4	5	6	7		

15. What is your sex?   ☐ Male   ☐ Female

16. In what year were you born? _____

17. What is your zip code/country code? _____

Thank you for participating in this research study. Your input is very important to Wyoming State Parks, Historic Sites and Trails.

Figure 7 (continued). Wyoming State Parks Survey Instrument.