2017

Behaviors, Knowledge, and Education of Leave No Trace Principles in the Red River Gorge Rock Climbing Community

Brian Gregory Clark
Eastern Kentucky University

BEHAVIORS, KNOWLEDGE, AND EDUCATION OF LEAVE NO TRACE PRINCIPLES IN THE RED RIVER GORGE ROCK CLIMBING COMMUNITY

By

Brian Gregory Clark

Dissertation Approved:

Co-Chair, Advisory Committee

Co-Chair Advisory Committee

Advisory Committee

Advisory Committee

Dean, Graduate School

STATEMENT OF PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirements for a Doctorate of Education degree at Eastern Kentucky University, I agree that the Library shall make it available to borrowers under rules of the Library. Brief quotations from this thesis are allowable without special permission, provided that accurate acknowledgment of the source is made.

Permission for extensive quotation from or reproduction of this thesis may be granted by my major professor, or in [his/her] absence, by the Head of Interlibrary Services when, in the opinion of either, the proposed use of the material is for scholarly purposes. Any copying or use of the material in this thesis for financial gain shall not be allowed without my written permission.

Signature Brian A Clark

Date 10/27/17

BEHAVIORS, KNOWLEDGE, AND EDUCATION OF LEAVE NO TRACE PRINCIPLES IN THE RED RIVER GORGE ROCK CLIMBING COMMUNITY

By

BRIAN GREGORY CLARK

Master of Science
Eastern Kentucky University
Richmond, Kentucky
2011

Bachelor of Science
Eastern Kentucky University
Richmond, Kentucky
2005

Submitted to the Faculty of the Graduate School of
Eastern Kentucky University
in partial fulfillment of the requirements
for the degree of
DOCTOR OF EDUCATION
2017

DEDICATION

This dissertation is dedicated to my grandparents on my father's side, Joe and Ruth Clark who were always there for both my athletic and academic endeavors. My grandfather knew early on that bribing me with money for good grades was a very good motivational tactic for his first grandson. I would also like to dedicate this to my aunt, Connie Summe who was one of my biggest cheerleaders, always encouraging me throughout my life. I always thought I could accomplish anything with my grandparents and aunt in my corner. I wish they were still with us to see this chapter in my life.

I would also like to dedicate this to my grandparents on my mother's side, John and Kay Cottrill who have always supported and encouraged me and continue to do so. I love you both very much.

ACKNOWLEDGMENTS

First and foremost, I want to thank my amazing wife Lauren and our two wonderful sons, Spencer and Chase. Without their love and support, I would not have the confidence and perseverance to get through this stage of life and be where I am today. I love you all so very much.

To my parents, Greg and Jeanne Clark, I would not be the man I am today without your love and support. Every step of my life you both have been nothing short of amazing and supportive parents. You both have set a great example of what it takes to truly give your best, commit to something, and finish strong. I would also like to thank my mother and father in-law, Jerry and Karen Sander, as they have been the best support crew one could ask for. I am truly blessed to have such incredible in-laws. I would also like to thank the many friends and family members that have supported me throughout my life and academic endeavors, especially my sister Kellie Clark Miller and brother Jeff Clark. Thanks for putting up with me for all these years.

I would like to thank Dr. James Maples for his unwavering guidance and support throughout this entire process. To say you have been there every step of the way would be an understatement. To Dr. Sherwood Thompson, your wealth of knowledge and leadership both in the classroom and beyond has made me feel like family in this program from day one. Dr. Ryan Sharp, has been with me through this entire process as well, and I owe you a great deal of gratitude for allowing me the privilege of having a dissertation topic that I am passionate about. Dr. Bill Phillips, your kindred spirit has always made me feel welcome and reassured me that I was in the right place. I would also like to thank Dr. Jon McChesney who was the first person to see the potential in me

as a doctoral candidate. I don't know if this would have even been a thought without your foresight and support dating all the way back to my undergraduate days here at Eastern.

Also, I would like to thank Zachary Lesch-Huie and the Access Fund as well as the Red River Climbers' Coalition for the tremendous support and grant that allowed for so much time in the field collecting data. I would also like to thank Tim Eling and the Daniel Boone National Forest, as well as Rick and Liz Weber and the Friends of Muir Valley for the opportunity to access the amazing rock climbing areas in the Red River Gorge.

Finally, I want to recognize and thank all of the many rock climbers who have put in countless time, money, and effort over the many years to make the Red River Gorge one of the most special rock climbing destinations and communities in the world. Your hard work and dedication does not go unnoticed.

ABSTRACT

Rock climbing is becoming a very popular and mainstream outdoor activity. With the growth in rock climbing comes an increase in the number of visitors this sport attracts. The increase in visitor usage undoubtedly leads to an impact on the natural environment surrounding these rock climbing areas. Rock climbers acknowledge the impacts that are being made and are taking initiative to lessen their impact while visiting rock climbing areas such as the Red River Gorge (RRG) in rural southeast Kentucky. We know that rock climbers make a substantial economic impact while visiting and this dissertation looks at the environmental knowledge and background on Leave No Trace practices and principles. This research investigates the knowledge and reported behavior of minimal impact practices of the rock climbing community in the RRG. Specifically looking at the more knowledge one has on minimizing their environmental impact, the greater chance their behaviors might be minimal and becoming environmental stewards of the land.

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

LIST OF FIGURES

FIGURE PAGE

CHAPTER I.

INTRODUCTION

"Leave No Trace is the most simple and honorable concept growing in the outdoor movement today." - *Royal Robbins, Climber & Outdoor Pioneer*

The ecological impacts of visitor use throughout our country's natural areas is of growing concern; as more visitors go to public lands, the impact will correspondingly increase (Park, Manning, Marion, Lawson, & Jacobi, 2008). Leave No Trace (henceforth LNT) principles are an essential component for land managers and agencies to ensure that these areas can stay open for visitors to pursue recreational pursuits such as rock climbing (Lawhon, Taff, Newman, Vagias, & Newton, 2017). These principles proactively attempt to shape outdoor recreation behaviors *before* they create impact (Taff, Vagias, & Lawhon, 2014). Impacts to our natural areas through recreational pursuits are often a gradual buildup causing identification of impacted areas to be more difficult (Bissix, Rive, & Kruisselbrink, 2009), but LNT may offer one way to reduce and minimize this impact before it happens (Taff, Vagias, & Lawhon, 2014).

The U.S. National Park Service (NPS) is mandated to balance resource protection and visitor enjoyment while simultaneously addressing challenges including, but not limited to, incompatible adjacent land use, invasive species, climate change, as well as improper human behavior. Sensitive environments found in many protected areas may be vulnerable to significant degradation from nominal recreation use. This in turn requires managing visitor behaviors and their impacts an essential part for land managers as cumulative impacts can be substantial (Vagias and Powell, 2010). Understanding human behavior is complicated, but combining research, the utilization of relevant theory, and

established wilderness ethics that date back to the 1960s, researchers can look at an issue and attempt to understand and optimistically call for a change in such behavior that is potentially detrimental to our natural areas (Vagias, Powell, Moore, & Wright, 2014).

LNT is the most pervasive minimum-impact visitor education program used in protected areas and is designed to protect our environment (Taff, Vagias, & Lawhon, 2014; Marion, & Reid, 2007). LNT is a set of environmental ethics through seven principles established to help individuals that use our natural areas to lessen their impact so that future generations can enjoy the beauty to the same capacity as those who came before them (Marion, & Reid, 2007; Manning, 2003). A large part of this effort is looking at the human dimensions of natural resource management (HDNRM), where this specific area of social science theory and methodology can help researchers and managers understand the many aspects of natural resource management and environmental problem solving (Fulton, Nelson, Anderson, & Lime, 2000; Bromley, Marion, & Hall, 2013). As there seems to be a limited amount of research related to climbing and LNT behaviors, and concurrently climbing presents a high potential for environmental degradation, this makes examining LNT among climbers in major climbing destinations of major importance.

The Red River Gorge (RRG) is highly regarded as a world-class destination for rock climbing and with that comes substantial impact (Ellington, 2010; Ellington, & Stephens, 2015; Ellington & Bowling, 2017). It presents an excellent place to examine LNT among climbers. The economic impact of rock climbing in the RRG has tremendous value to a variety of entities, organizations and communities of Appalachian region of Eastern Kentucky that shapes the Red River Gorge geological area (Maples, Sharp,

Clark, Gerlaugh, & Gillespie, 2017; Sims, Hodges, & Scruggs, 2004). Less clear is the environmental impact that rock climbers have in areas such as the RRG, which is somewhat limited in research and data that focuses on climbing in other, much smaller areas such as Tennessee's Obed Wild and Scenic River climbing area (Sims & Hodges, 2004).

Statement of the Problem

Aside from Sims & Hodges (2004) study of the Obed in Tennessee, there seems to be a limited amount of research on climbing and how it relates to LNT, specifically perceived behaviors. As climbing grows in popularity, this leaves a huge dearth of research on exactly what land managers can expect the effect will be. For example, how well does the knowledge of LNT principles lead to user behavior (or perceived behavior)? Secondly, do people apply LNT knowledge to their experiences in the outdoors? The need for research concerning rock climbing and the relationship with the areas that the climbing community recreates on becomes more important as the popularity of rock climbing increases (Schuster, Thompson, & Hammitt, 2001, p. 404). Although research and literature involving minimum impact education and techniques is readily available, little research has been done assessing the minimum impact knowledge of outdoor visitors in general (Newman, Manning, Bacon, Graefe, & Kyle, 2003, p. 34) but climbing stands out as a big area of concern. Only recently has there been an increase in research concerning environmental ethics and their impacts in outdoor recreation (Stuessy, Harding, & Anderson, 2009).

This also pairs with an effort to educate climbers about LNT principles. Efforts by the climbing community and specifically the Access Fund and Red River Gorge

Climbers' Coalition (RRGCC) are underway to inform climbers about LNT through a mix of kiosk information, informational sessions, public presentations, and signage. A climbing community consists of each and every climber within a specific climbing area (www.accessfund.org, 2016). Community self-enforcement is also part of this process. A climbing community can also consist of those who have climbed and have experience and knowledge about this particular activity and group of outdoor enthusiasts. In order for future generations to enjoy our natural resources, it is imperative that we pay close attention to the principles and the mission of LNT (Marion, Lawhon, Vagias, & Newman, 2011; Morley, Chase, Day, & Lawhon, 2008). The Access Fund goes hand in hand with LNT and is "the national advocacy organization that keeps U.S. climbing areas open and conserves the climbing environment (www.accessfund.org, 2016)." The necessity of community outreach in order to educate those who enjoy recreating in the outdoors is imperative because it is only through these organizations and concentrated efforts that the sport of rock climbing will be able to continue and thrive at a rate that is sustainable. Educating and promoting environmentally responsible climbing is a top priority for environmental organizations and should be a mindset for all rock climbers (D'Antonio, Monz, Newman, Lawson, & Taff, 2012). Despite investments in educating climbers about LNT, limited research has examined if it actually *works* specifically when looking at whether LNT knowledge changes reported user behavior.

Purpose and Significance of the Study

The purpose of this study is to examine climbers' knowledge of LNT principles and the application of these principles as reported behaviors while climbing. Given the lack of research on this topic and the importance of knowing if efforts to educate

climbers have any real effect creates a critical significant outcome for this study. The study is significant in that it will also create new knowledge of applying LNT educational efforts in outdoor recreation communities and provide a foundation for future research on LNT in general.

In this study, environmental impact of climbers in the RRG will be examined by measuring their knowledge of LNT principles and reported use of LNT principles while climbing in the RRG. A field survey was developed using questions from work by Vagias and associates (Vagias et al 2012) LNT Attitudinal Inventory Measure (AIM) to measure climbers' awareness and adherence to LNT principles across two scaled measures that could be used in OLS regression to offer a predictive image of what effect LNT education is having in the area. The data were collected from various land management agencies throughout the RRG, both public and private. The land management agencies included Federal land within the Daniel Boone National Forest (U.S. Forest Service), the Red River Gorge Climbers' Coalition (RRGCC), Graining Fork Nature Preserve (GFNP), and private land owners such as Muir Valley, and Torrent Falls.

Background

Rock climbing dates back to the 1800's, although it gained more popularity in the mid 1900's. By the late 1980's and 1990's rock climbing was well on its way to becoming a competitive sport with the introduction of indoor climbing gyms and competitions, and not just an outdoor recreation pursuit (Bright, 2014; www.mojagear.com). When looking at this fairly new group of climbers, an estimated 5 million climbers identify as gym climbers or boulderers (Schwartz, Taff, Pettebone, & Lawhon, 2016). However, rock climbing in the Red River Gorge (RRG), KY, dates back

to the 1950's with routes such as Caver's Route (Ellington, 2010; Ellington, & Stephens, 2015; Ellington & Bowling, 2017).

The popularity of rock climbing is increasing greatly across the United States (Bost, 2016; Tessler, & Clark, 2016; Sheel, 2004). Active rock climbers in the United States have increased by 30% between 1994 and 2009 to reach an estimated 10 million climbers (Holzschuh, 2016, p. 154). An increase of 50 – 86% is projected by the year 2060 (Cordell, 2012). Additionally, rock climbing is now officially included in the 2020 Olympics. As a growing sport, there needs to be an emphasis on education and promoting minimum environmental impact practices to help protect the environment (Park, Manning, Marion, Lawson, & Jacobi, 2008). It is also important to remember that an international rock climbing destination exists in the rural Appalachia areas of eastern Kentucky. However, this also puts the RRG at the important crux of considering the effects of increased climbing there, making this study valuable to the U.S. Forest Service, other various land managers, scientists, researchers and more.

The outdoor recreation activity of rock climbing has grown exponentially since gaining mainstream popularity in the 1990's (Roper, 2013; Holzschuh, 2016). It is safe to say that the established climbing routes in the RRG may have even tripled since the early 2000's (Ellington, 2010; Ellington, & Stephens, 2015; Ellington & Bowling, 2017). According to www.redriverclimbing.com (2017) rock climbing in the RRG consists of six different route types (or disciplines) which include Sport, Traditional (Trad), Mixed, Toprope, Bouldering, and Aid. Sport climbing is the primary style of climbing in the RRG since 1987, following the early development of sport climbing in the Western part of the country a few years before. The routes are rated using the Yosemite Decimal

System (YDS) and range in difficulty from 5.1 to 5.14d (Ellington, 2010; Ellington, & Stephens, 2015; Ellington & Bowling, 2017). According to Ellington and Bowling (2017), "route development has surged at a furious pace, bringing the count of published routes to well over 3,000" (p. 32). Furthermore, we know that thousands of rock climber's congregate in the eastern portion of the state of Kentucky for the single outdoor recreation activity of rock climbing (Bost, 2016; Eling 2016). Rock climbing in the RRG is concentrated throughout a section of eastern Kentucky which include Powell, Wolfe, Menifee, Lee, and Estill counties, meaning the potential for negative environmental impact could cover a wide area. Recent efforts by the Red River Gorge Climbers' Coalition (RRGCC) and Access Fund have attempted to increase education of LNT principles in the climbing areas through kiosks, informational sessions, signage, and community reinforcement. This provides an ideal location and time for this study to occur.

The economic impact of rock climbing in the RRG has tremendous value to a variety of entities, organizations and communities of the Appalachian region of Eastern Kentucky that shapes the Red River Gorge geological area (Maples, Sharp, Clark, Gerlaugh, and Gillespie, 2017; Sims, Hodges, & Scruggs, 2004). Less clear is the environmental impact that rock climbers have on the RRG, which is limited in research and data (Stuessy, Harding, & Anderson, 2009; Sims & Hodges, 2004). There is research showing the environmental impacts of rock climbing in different areas but minimal research showing the relationship with LNT and education on minimizing environmental impact practices. Both the economic and environmental impacts of these areas play a

huge role when one discusses the outdoor recreational pursuit of rock climbing in Eastern Kentucky (Sims, Hodges, & Scruggs, 2004).

Research Questions and Hypotheses

The primary question this research aims to answer is whether or not increasing a climber's knowledge of LNT principles shapes their use of these behaviors while rock climbing. If this should prove true, then LNT education efforts in the RRG could be helping to make an impact. If not, LNT education efforts should be examined to understand where and when the process breaks down. However, a secondary question is what kind of controls could shape this relationship? Do factors like having more education impact LNT knowledge, or perhaps having more education simply changes behaviors? Likewise, do variables such as conservation membership or demographic measures like sex, age, and race influence reported LNT behaviors? These questions lead directly to five testable hypotheses for this study:

1. Does increasing a climbers' knowledge score on LNT principles increase their LNT behavior scores?

Ho: increasing the LNT knowledge score positively impacts the behavior score.
Ha: there is no relationship between knowledge and behaviors

2. Does being conservation-minded significantly shape this relationship?

Ho: Conservation organization membership positively changes the relationship between LNT knowledge and LNT behaviors.
Ha: Conservation membership has no effect on the relationship

3. Does education significantly shape this relationship?

Ho: Having more education positively shapes the relationship between LNT knowledge and LNT behaviors.

Ha: Education has no effect on the relationship

4. Does income significantly shape this relationship?

Ho: Having higher income positively impacts the relationship between LNT knowledge and LNT behaviors.

Ha: Income and LNT behaviors are not correlated.

5. Do common demographic measures significantly shape this relationship?

Ho: Demographics positively impacts the relationship between LNT knowledge and LNT behaviors.

Ha: Demographics have no effect on the relationship

This dissertation will address these hypotheses while exploring LNT principles among rock climbers. Using Vagias and associates (2012) LNT AIM measurement, two continuous variables were created that measure knowledge and behavior. Common demographic measures (such as income, race, education, and sex) were also used to create these variables. A survey to collect the data and study the population of climbers in Kentucky's Red River Gorge was created. OLS regression was used to test these hypotheses across multiple models to see what (if anything) shapes one's LNT-relevant behaviors while climbing. This study will make a number of contributions to the field of research on climbing and also teaching LNT to specific groups. Answering my research

questions also will lead to future research on the topic regardless of whether or not I prove my hypotheses. The endgame for this study will help develop more knowledge about LNT that could minimize environmental impact while climbing.

Definition of Terms

This section includes specific terminology used throughout the study.

Aid Climbing – A type of climbing that makes use of rope, fixed bolts, pitons or foot slings, rather than features on the rock itself, to ascend the face. Opposite of free climbing (https://www.rei.com/learn/expert-advice/rock-climbing-glossary.html).

Bouldering – Climbing close to the ground without the use of a rope. Typically used for practicing traverses, weight transfers, and foot and hand placements. Can be done on boulders or at the base of a rock face (https://www.rei.com/learn/expert-advice/rock-climbing-glossary.html).

Bureau of Land Management (BLM) – A division of the Department of the Interior that manages public lands and resources.

Cathole – A hole in the ground that is 6-8 inches deep and 4-6 inches wide that is dug with a garden trowel (or shovel) to aid in disposing of certain waste. This needs to be done 200 feet from and trail, campsite, or water source. After finished filling with waste (primarily human waste) disguise it with natural materials.

Conservation – The Protection of animals, plants, and natural resources; the careful use of natural resources (such as trees, oil, etc.) to prevent them from being lost or wasted; the things that are done to keep works of art or things of historical importance in good condition.

Graining Fork Nature Preserve (GFNP) – is an education, conservation, and recreation non-profit organization established to protect the natural, scenic and cultural resources of the area, and to encourage the public enjoyment of those resources (http://grainingfork.org/).

Leave No Trace (LNT) – The member-driven Leave No Trace Center for Outdoor Ethics (LNTCOE) teaches people of all ages how to enjoy the outdoors responsibly and is the most widely accepted outdoor ethics program used on public lands. Through relevant and targeted education, research and outreach, the LNTCOE ensures the long-term health of our natural world. In its simplest form, Leave No Trace is about making good decisions to protect the world around you - the world we all enjoy.

Mixed Climbing – A type of climbing that involves more than one type of climbing in regards to protection. This can be both fixed gear (bolts) and placed gear by the lead climber.

Miller Fork Recreational Preserve (MFRP) – is a 309-acre preserve located in Lee County, Kentucky, that the RRGCC closed on in May of 2013 with the help of the Access Fund's Land Conservation Campaign. The MFRP has been developed to include a wide variety of over 300 excellent climbing routes for climbers of all levels (http://www.redriverclimbing.com/millerfork/MFRPguidebooksales.htm).

Mound Fire – A backcountry technique used to minimize the impact of a campfire. Using a layer to separate the mineral soil that was collected, you build a dirt mound and make a lower section in the dirt to allow a small fire to burn inside the dirt mound. Once the fire is completely out you can disperse the mineral soil and ashes (Reid & Marion, 2005).

Muir Valley – The 360-acre Muir Valley Nature Preserve is a private preserve walled in by 7 miles of fine Corbin sandstone. Waterfalls and caves abound, as do arches and stone-bottomed creeks. Mountain Laurel, rhododendron, and many other plants grace the slopes and bottomlands. Muir is known for its large concentration of easy climbing – you'll find more 5.8s here than anywhere else in the gorge (Ellington & Bowling, 2017, p. 80).

National Park Service (NPS) – A division of the Department of the Interior, created in 1916 that administers national parks, monuments, historic sites, and recreational areas.

National Outdoor Leadership School (NOLS) – A nonprofit outdoor education school that seeks to help future outdoor leaders. The mission of NOLS is to be the leading source and teacher of wilderness skills and leadership that serve people and the environment (https://www.nols.edu/en/about/).

Pendergrass-Murray Recreational Preserve (PMRP) – A 750-acre region owned and maintained by the Red River Gorge Climbers' Coalition (RRGCC). The PMRP contains over 500 sport and traditional rock climbs from 5.6 to 5.14, with more climbs being developed each year. This was the largest direct land acquisition ever made by climbers and permanently secures access to a significant amount of the climbing in the Red (Ellington & Bowling, 2017, p. 154).

Poop Tube – A specially designed human waste storage container that is hauled with other equipment up a climb that is a longer duration such as a big-wall climb. In many big-wall climbing areas such as Zion and Yosemite National Park, it is mandatory to contain human waste by carrying a poop tube (https://www.mountainproject.com/v/poop-waste-disposal-strategies/108819255).

Red River Gorge (RRG) – A uniquely scenic area of the U.S. Forest Service located in the Daniel Boone National Forest. The area is known for its abundant natural stone arches, unusual rock formations, and spectacular sandstone cliffs. The Red River Gorge is designated as a national geological area by the U.S. Forest Service. The Red River Gorge has more than 100 natural arches and one of the finest collections of pinnacles and cliffs east of the Rocky Mountains (Ellington & Bowling, 2017, p. 26).

Red River Gorge Climbers' Coalition (RRGCC) – Is a nonprofit corporation started in 1996 by local climbers dedicated to securing and protecting open, public access to rock climbing in the Red River Gorge area of Kentucky, promoting conservation of the environment on the lands available to climb (Ellington & Bowling, 2017, p. 35).

Sport Climbing – Rock climbing using pre-placed protection and/or anchors such as bolts or a top rope. Frequently involves difficult, gymnastic moves. Opposite of traditional climbing (https://www.rei.com/learn/expert-advice/rock-climbing-glossary.html).

Toprope Climbing – A rope that is passed through a fixed anchor at the top of a climbing wall or cliff, with each end tied to the climber and the belayer at the bottom. A top rope (with a watchful belayer) ensures that the climber is always protected from falling very far, and is thus a good way to learn to climb. "Top-roping" is the term for this type of climbing (https://www.rei.com/learn/expert-advice/rock-climbing-glossary.html).

Traditional Climbing – Rock climbing using protection placed by the lead climber and removed by the second, as opposed to sport climbing, in which protection (bolts) is pre-placed (https://www.rei.com/learn/expert-advice/rock-climbing-glossary.html).

Unique Climbers – A climber that came and climbed at least one day out of the year.

United States Forest Service (USFS) – A division of the U.S. Department of Agriculture, created in 1905, that protects and develops the national forests and grasslands.

WAG Bag – Waste Alleviation and Gelling (WAG) bag is a human waste disposal system allowing you to pack out your human waste. It involves several bags that can seal and separate as well as chemicals that help breakdown solids and control odor (http://www.trailspace.com/articles/backcountry-waste-disposal.html).

Yosemite Decimal System (YDS) – A system to gauge how difficult a rock climb might be. This system is comprised of 5 classes, with the fifth class separated by a decimal point such as 5.1 - 5.15. Starting at 5.10 there is a separation of four letter grades that will follow the 5.10 rating (e.g. 5.10a - 5.10d) then it will go the next grade of 5.11a and so on (Sheel, 2004).

CHAPTER II.

LITERATURE REVIEW

Recreation has become one of the most dominant uses of public lands. Perhaps this is due to the numerous societal and individual benefits. Some of these benefits include but are not limited to: physical, emotional, and social. Our society benefits from enhanced commitment to environmental stewardship (Fresque & Plummer, 2009). It is imperative to protect our public lands and to limit visitor use impact (Lawhon, Taff, Newman, Vagias, & Newton, 2017). According to the authors of Training to Teach Leave No Trace: Efficacy of Master Educator Courses, negative ecological effects to ecosystems include soil erosion, tree damage, vegetation loss, and wildlife impacts (Marion, Leun, Eagleston, & Burroughs, 2016; (Marion, & Reid, 2007). Negative social effects include loss of solitude, crowding, and conflict (Schneider, 2000). The magnitude of such impacts varies with use-related attributes and environmental attributes (Bromley, Marion, & Hall, 2013, p. 63).

Leave No Trace (LNT) is a program designed to educate those who pursue outdoor recreation about minimum impact practices with the end goal of protecting our natural resources (Harmon 1997; Marion & Reid, 2001). Currently, the LNT message consists of seven principles. Each is designed to address a particular element of minimal environmental impact practices. The order in which the principles are presented is important as they tend to build off one another. The principles include: 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 (McGivney, 2003; Morley, Chase, Day, & Lawhon, 2008).

Plan ahead and prepare is the first principle and sets the tone for the remaining six principles (Lawhon, Taff, Newman, Vagias, & Newton, 2017). This principle consists of knowing the areas that you plan to visit and climb, including any regulations and special concerns as well as preparing for any foreseeable extreme weather, hazards, and emergencies (Turner, 2002). If possible, plan your visit to climb during times that will avoid high traffic or popular times such as the weekend or holidays. If in a group, make sure the group expresses all the intentions and expectations for the trip. Plan to have all the appropriate equipment for the intended areas and routes that you wish to climb. Be prepared and acquire all the technical skills such as climbing, belaying, route finding, anchor building, and wilderness medical training. Finally, understand the local areas climbing ethics on fixed gear and anchors. For example, fixed gear and anchors deal with natural and man-made protection (or anchors). Manmade anchors consist of drilling holes in the rock and either gluing in or hand cranking steel bolts into the rock. Hangers are then attached to the bolts to allow the climbers to clip carabiners to them and then a rope to protect from a fall. Natural anchors consist of using natural features found at the top of a climb such as rocks, trees, etc. to hook or attach ropes and/or webbing (one inch webbing) to allow a climber to connect their carabiners to along with a rope to create an anchor system.

Travel and camp on durable surfaces is the second principle (Lawhon, Taff, Newman, Vagias, & Newton, 2017). It involves the knowledge and use of durable surfaces for both travel and camping situations. A durable surface can include but is not limited to the following: established trails and campsites, rock, gravel, dry grasses, or snow (Cole & Monz, 2003; Potito & Beatty, 2005). Under this principle, climbers should

make sure to always use durable roads and trails to access climbing areas and routes so the impact on the natural environment is limited (Kuntz & Larson, 2006; Park, Manning, Marion, Lawson, & Jacobi, 2008). The level of environmental impact does not stay proportional to the amount of use (Adams & Zaniewski, 2012). In fact, it has been found that even relatively low levels of use can still impact these areas (Park, Manning, Marion, Lawson, & Jacobi, 2008).

Upon reaching a climbing route, climbers should plan to keep all of their equipment and gear in a central location and close proximity to their belay station area below the climb (Wimpey & Marion, 2010). Always attempt to use existing anchors when possible while climbing. When camping make sure to stay away from water sources with a distance of at least 200 feet. There is no need to alter natural areas, as good campsites and sleeping quarters are found, not made. Finally, it is always important to leave an area better than you found it (Hockett, Clark, Leung, & Park, 2010).

Dispose of waste properly is the third principle and is often referred to as pack it in, pack it out (Lawhon, Taff, Newman, Vagias, & Newton, 2017). However, it is much more than just packing out trash. One should inspect their climbing areas for food, trash, tape, chalk, and anything else that may have been there before your visit or could remain after your visit. It is important to carry out any forgotten gear or webbing that may have been used by another party. When using chalk, try to minimize the amount and be conscious of keeping your chalk bag closed and secure when not being used. For human waste, consider packing it out or using the approved method of burying it in a cathole. A cathole is a hole of 6 - 8 inches in depth and 4 - 6 inches wide at least 200 feet from any water, campsite, or trail (Ells & Monz, 2011). When finished with the cathole cover and

disguise to look natural or as if it were undisturbed by human traffic. Finally, it is preferred to pack out any toilet paper or hygiene products (Bridle & Kirkpatrick, 2005).

Leave what you find is the fourth principle and primarily deals with natural areas and preserving the historical and cultural artifacts and natural integrity of the areas (Lawhon, Taff, Newman, Vagias, & Newton, 2017). It is important not to develop new routes in or near archeological or historical sites, or sensitive wildlife habitat areas. This could be found on the cliff face or surrounding area on the ground where your gear and belayer (climbing partner who controls the rope while you climb) would stand. Climbers should preserve the past through observation but do not touch or alter these sensitive areas. You should always leave rocks, plants, and other natural objects as they were found. Make every effort to not introduce or transport any non-native species. Finally, do not alter the areas you use or visit during your climbing trip such as digging trenches, building structures, or furniture.

Minimize campfire impacts is the fifth principle and involves the lasting impacts of campfires in the natural and backcountry setting (Lawhon, Taff, Newman, Vagias, & Newton, 2017; Reid & Marion, 2005). When planning a visit, you should plan to bring a lightweight stove for cooking and headlamp for a light source rather than start a fire. The advancement in outdoor equipment and technology has allowed humans to not depend on fire as they once did for survival (Reid & Marion, 2005). When fires are permitted, only use established campfire rings, bring a fire pan, or build mound fires especially in the backcountry. It is important to only use small fires made from wood that is small enough to be broken by hand and already found on the ground. Do not bring firewood with you from another area as this can introduce tree killing insects or disease and can be

detrimental to the natural area (Marion, Leun, Eagleston, & Burroughs, 2016). Only buy wood near your destination that is from the local area or gather wood within your area that you are using. Finally, burn all wood, down to ash and make sure it is extinguished, then scatter the ashes (or pack it out) that are cool to the touch (Reid & Marion, 2005).

Respect wildlife is the sixth principle and requires you to know the local fauna of the destination or areas in which you are climbing (Lawhon, Taff, Newman, Vagias, & Newton, 2017). It is important to know the seasonal route closures for certain areas and be prepared to back off routes when unintentionally encountering wildlife. Always observe from a distance and do not approach wildlife (Marion, Leun, Eagleston, & Burroughs, 2016). Never feed wildlife as this disturbs their natural cycle and exposes them by altering their natural state (Marion, Dvorak, & Manning, 2008). This can leave wildlife vulnerable to predators and other dangers. Make sure you have an approved method of storing your food and trash so that the wildlife cannot access it. Additionally, if you are bringing your dog to the climbing area, make sure they are allowed and under control at all times or leave them at home. Finally, when climbing and recreating in the outdoors, make sure to avoid wildlife during sensitive times such as mating, nesting, raising young, or during the winter season.

Be considerate of other visitors is the seventh and final principle of LNT. Be respectful to other visitors and allow their experience to be pleasant and of high quality (Lawhon, Taff, Newman, Vagias, & Newton, 2017). Larger groups should try not to dominate climbing areas especially during high traffic times. Always be courteous to others while at the climbing areas and make sure that nature's natural sounds prevail and not your own (Schneider, 2000). Avoid loud noises unless it is necessary to

communicate with your climbing partner while climbing. Finally, consider wearing clothing that blends in with the surroundings and doesn't contrast to avoid being spotted from across the natural area (https://lnt.org/blog/leave-no-trace-rock-climbing).

The task of effectively educating the public regarding appropriate behaviors is complex with challenges such as the noncaptive nature of audiences, and limited contact time between park personnel and visitors (Lawhon, Taff, Newman, Vagias, & Newton, 2017). Some land managers can require visitors to abide by certain rules and require them to possess certain skills and equipment, but education is more common for encouraging visitors in minimizing their impacts (Cole, Petersen, & Lucas, 1987, p. 43). Education is typically preferred over enforcement because it provides managers an easier option for lessening visitor-induced impacts and is considered to be more in line with the spirit of the Wilderness Act (Hendee, and Dawson, 2002; Bissix, Rive, & Kruisselbrink, 2009). Education-based programs are preferred by both the land manager and visitors for protecting resources and reinforcing appropriate visitor behavior over enforcement (Lawhon, Taff, Newman, Vagias, & Newton, 2017; Siderelis & Attarian, 2004).

Leave No Trace (LNT) began in the 1960s when the origins of the LNT message can be traced back to initiatives undertaken by U.S. Forest Service (USFS). These early efforts included "pack it in, pack it out" messages at primary wilderness access points (Marion & Reid, 2001). These messages became precursors to what are now considered early minimum-impact messages (Daniels & Marion, 2005). In 1990, the USFS teamed with the National Outdoor Leadership School (NOLS) to consolidate the various minimum-impact messages that have developed over the years into one consistent message, provide structure to emerging best practices, and develop a complementary

training program (Marion & Reid, 2001). These advancements in LNT messaging were primarily based on science provided by the field of recreation ecology, "the field of study that examines, assesses and monitors visitor impacts, typically to protected natural areas, and their relationships to influential factors" (Leung & Marion, 2000, p.23). The term "impact" usually indicates a negative connotation in recreation ecology (Marion, Leun, Eagleston, & Burroughs, 2016). Impacts are categorized as being direct or indirect. Direct impacts are the immediate result(s) from outdoor recreation. Indirect impacts are negative changes that ultimately are the result of outdoor recreation (Bissix, Rive, & Kruisselbrink, 2009). Research in recreation ecology has emphasized the importance of knowing how one's outdoor recreation activity impacts the vegetation, wildlife, and water of the area they are recreating in (Fresque & Plummer, 2009; Marion, Leun, Eagleston, & Burroughs, 2016).

Throughout the 1990s and in partnership with NOLS, the LNT message continued to grow. In 1994, Leave No Trace, now called the Leave No Trace Center for Outdoor Ethics (LNTCOE), or just The Center was incorporated into a non-profit organization. The mission statement of the LNTCOE states that it is "dedicated to the responsible enjoyment and active stewardship of the outdoors by all people, worldwide" (www.lnt.org). In the same year, the USFS, Bureau of Land Management, U.S. Fish & Wildlife Service, and National Park Service (NPS) all formally adopted LNT as the "primary minimum-impact visitor education message promoted on federal lands." (Vagias & Powell, 2010).

It is imperative that an effective backcountry visitor management program have a strategic education strategy at its foundation (Vagias, Powell, Moore, and Wright, 2012).

Furthermore, said education strategy should consistently reach specific and predetermined outcomes such as reinforcing or influencing attitudes, knowledge, and behaviors of visitors in directions consistent with management objectives (Vagias, Powell, Moore, and Wright, 2012; Kulczycki, 2014). The LNT Principles were initially developed to curb impacts of backcountry-overnight visitors (Taff, Newman, Vagias, and Lawhon, 2014). "When using education to protect resources, protected area managers usually desire to influence or reinforce visitors' knowledge, attitudes, and/or behaviors (KAB). Knowledge refers to information we possess, or "what we know." Attitudes are defined as the "psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 1993, p. 1). Behavior, which is a broad umbrella term, refers to any number of actions a person may undertake" (Vagias and Powell, 2010).

Some psychological and social psychological theories propose that human behavior is determined by attitudes and underlying belief structures, particularly in environmental settings (Lawhon, Taff, Newman, Vagias, & Newton, 2017). The Theory of Planned Behavior (TPB) is widely used and applied when studying human behavior (Ajzen & Driver, 1992). Environmentally responsible behavior is any action taken to ensure that ecological relationships among living things do not deteriorate (Caltabiano & Caltabiano, 1995, p. 1080). A positive relationship between environmental attitudes and environmentally responsible behavior has been demonstrated empirically (Monz, 2009; Schwartz, Taff, Pettebone, & Lawhon, 2016; Manfredo, Yuan, & McGuire, 1992).

Land managers must address a wide variety of challenges including ensuring the long-term sustainability of resources while providing for visitor enjoyment, competing

recreational demands, changing visitation trends, limited budgets, and improper visitor behavior (Lawhon, Taff, Newman, Vagias, & Newton, 2017). There are two primary strategies for effective management of visitors, direct and indirect. Direct strategies "include enforcement, sanctions, and the use of barriers, boardwalks, and fencing" (Vagias et al., 2012). Indirect strategies, such as education, are preferred over direct strategies (Bissix, Rive, & Kruisselbrink, 2009).

In addition to these measures, social psychology has advanced understanding of human behavior and suggests attitudes influence and, in many instances, are the primary determinant of behavioral intentions and actions (Ajzen, 1992; Taff, Newman, Vagias, & Lawhon, 2014). To effectively change environmental behaviors, research indicates that education should target individuals' attitudes or the relevant belief structures that reinforce those attitudes (Ajzen, 1991; Pooley & O'Connor, 2000; Vagias & Powell, 2010).

Knowledge and awareness of minimum-impact skills are important components for mitigating environmentally depreciative behaviors. If visitors lack knowledge or awareness, they may unintentionally engage in unskilled or inappropriate behaviors. However, visitor knowledge and awareness of recommended behaviors alone does not necessarily mean that visitors will adopt or practice recommended behaviors (Lawhon, Newman, Taff, Vaske, Vagias, Bright, Lawson, & Monz, 2013; Vagias & Powell, 2010). As the authors of Mind the Gap pointedly state, to establish a new behavior, we must practice it (Kollmuss & Agyeman, 2002).

Brief History of LNT Development

The history of LNT dates back to the 1960s with the development of backcountry and federally-designated Wilderness areas through the passage of the Wilderness Act in 1964 (Turner, 2002). During the 1960s and 1970s, there was a substantial increase in outdoor recreation visitor usage. Land management agencies knew that if the growth over that ten-year period continued they would start noticing the effects of the natural resources and visitor usage in a negative way (Morley, Chase, Day, & Lawhon, 2008). During the 1960s land management agencies developed several slogans such as, "Wilderness Manners" and "Wilderness Ethics" (Daniels & Marion, 2005). Moving into the 1970s educational brochures were being developed to get this information out to the numerous user groups.

By the 1980s, the U.S. Forest Service (USFS) developed a more formal program called the "No Trace" program (Manning, 2003). This was viewed as a humanistic approach for wilderness ethics and low impact hiking and camping practices. The various land management agencies came up with programs such as "No-Trace Camping" and "Minimum Impact Camping." A "Leave No Trace Land Ethics" pamphlet was developed with the cooperation of the National Park Service (NPS) and the Bureau of Land Management (BLM).

During this time, public land management agencies such as the BLM, the USFS, and the NPS started several low impact hiking and camping programs such as "no-trace camping," to educate the visitors of these public lands. This grew from minimizing environmental impact regulations to educational programs to help supplement these regulations. The various land management agencies came up with programs such as *No-*

Trace Camping, *Wilderness Ethics*, *Wilderness Manners*, and *Minimum Impact Camping* (Turner, 2002). By the 1980s this movement had moved into a more formal program called the "No Trace" program.

There has been a substantial push in marketing the LNT message since its inception. Agencies have introduced social marketing and educational campaigns ranging from Woodsy the Owl, "Give a hoot and don't pollute," to Smoky the Bear "Only you can prevent Forest Fires," and even the Bigfoot Challenge slogan, "Leave No Trace, Bigfoot's been doing it for years." These low-impact educational programs were originally developed by the U.S. Forest Service and can even be seen in the RRG today at many local rock climbing trail heads (Vagias & Powell, 2010).

The early 1990s introduced Leave No Trace (LNT) as the name for an expanded national program (Turner, 2002). A formal agreement was established in 1991 by the USFS and NOLS the same year the first five-day master educator course was taught (Turner, 2002). With new data on visitor usage research and support on minimizing environmental impact, the USFS approached NOLS to assist in the development, training and education of low impact practices. The idea was to involve NOLS for their background and history of being a leader in educating the outdoor industry. This grew from minimizing environmental impact regulations to educational programs to help supplement these regulations (Turner, 2002; Manning, 2003).

The 1993 Outdoor Recreation Summit held in Washington D.C., including federal agencies, non-governmental organizations, and outdoor companies, recommended a new nonprofit to manage LNT nationally (Turner, 2002). As land managers saw the success of the partnership between the USFS and NOLS, the BLM formally joined the partnership

in 1993 followed by the NPS and the U.S. Fish and Wildlife Service (USFWS) in 1994 (Marion, Leun, Eagleston, & Burroughs, 2016). In 1994, LNT officially became an independent, national nonprofit organization based in Boulder, Colorado to lead development, education, research and expand public awareness (Manning, 2003). A new Memorandum of Understanding (MOU) was signed in 2000 to officially formalize the LNT partnership between the USFS, NOLS, BLM, NPS, and the USFWS. This effort also led to the development of what is now called Leave No Trace, the Center for Outdoor Ethics (LNTCOE). Figure 1 includes a short history of LNT.

Today, the Center partners with over 500 companies, land agencies, schools, universities, non-profits, outfitters and guides, and their constituents to promote the LNT message. The Center has a staff of more than 20, and a national board of directors to provide continued curriculum and leadership. There are over 30,000 trained volunteers across the country to provide local LNT programs (Marion & Reid, 2007). The LNTCOE is committed to delivering the most effective educational information and materials to the vast network of volunteers, supporters, and educators (www.lnt.org, 2017; Marion, & Reid, 2007).

Numerous countries around the world recognize the importance of protecting natural resources and environments. To that end, articles have been written analyzing Switzerland and studying Korea's environmental attitudes and practices. The hope is that education programs similar to Leave No Trace will help to protect each countries natural environments and teach citizens to act environmentally conscientious (Kaiser, Wölfing and Fuhrer, 1999; Hwang, Kim, & Jeng, 2000).

Brief Outline of LNT History

1960s - Wilderness Manners, Wilderness Ethics, Minimum Impact Camping and No Trace Camping originated in backcountry and federally-designated Wilderness areas.

1970s - Educational brochures were developed around this slogan-based program.

1980s - The USDA Forest Service formed a "No-Trace" program. In cooperation with the National Park Service and the Bureau of Land Management, developed a "Leave No Trace Land Ethics" pamphlet.

1991 - The National Outdoor Leadership School taught the first Master Educator Course in the Wind River Range and helped produce educational materials.

1993 - At an Outdoor Recreation Summit in D.C. the creation of a nonprofit called Leave No Trace, Inc. was recommended.

1994 - Leave No Trace, Inc., the nonprofit was created to guide development, establish partnerships, distribute educational materials and conduct fundraising.

1999 - Leave No Trace, Inc. partnered with Subaru to create the Traveling Trainer Program, which are teams of field educators who provide LNT outreach and education to diverse audiences across the country.

2000 - Leave No Trace, Inc. entered into the first of a series of Memorandums of Understandings with four primary federal land management agencies: Forest Service, Bureau of Land Management, Fish and Wildlife Service, and National Park Service.

2001 - Leave No Trace, Inc. partnered with REI to create the PEAK program, which educates youth ages 6-12 about LNT through hands-on activities.

2003 - Leave No Trace, Inc. became the Center for Outdoor Ethics.

2010 - The Bigfoot Challenge was established to encourage simple acts of environmental activism and teach LNT principles. The LNT Hot Spots program was also created to increase awareness about how to enjoy the outdoors responsibly by helping recreation places in need.

2011 - The Center for Outdoor Ethics has continued educational outreach with emphasis on youth, local, and front country efforts. By this time, programs in Canada, Ireland, and New Zealand had already joined the efforts.

Figure One: The History of LNT

What began as a backcountry wilderness education program has now expanded to the frontcountry - where people live and enjoy the outdoors in their home towns (Hendricks & Miranda, 2003; Vagias & Powell, 2010). According to the Outdoor Foundation – Outdoor Industry Association (OIA), the majority of recreationists are not there to stay overnight, and research suggests that day-use is increasing in protected areas (2012). In contrast, prior LNT research has primarily targeted backcountry-overnight visitors. A recent study was conducted to compare day-users' perceptions (perceived knowledge, awareness and support, and attitudes) of LNT with those of overnight users (Taff, Vagias, & Lawhon, 2014). Interestingly, studies have shown that day-users' and overnight users' perceptions of LNT are very similar, and suggest that similar informational approaches can be used for day-use and backcountry areas in the future (Marion, Lawhon, Vagias, & Newman, 2011). This sets the stage for examining how climbing, a specific group of outdoor enthusiasts, might utilize LNT to protect existing natural resources by minimizing their environmental impact for future generations.

Rock Climbing

Rock climbing has been around for quite some time, dating back to the late 1800's (Roper, 2013). Rock climbing, in the most modern sense of climbing a sheer rock face, came about from mountaineering and peak bagging (Abramson & Fletcher, 2007). This change of desire from summiting mountains to climbing rocks of various heights and features such as crags or boulders forever changed the sport. What once was seen as a form of training for the bigger goal of climbing mountains quickly became a sport and activity in its' own right.

The sport of rock climbing has seen an exponential increase in participation since the mid to late 1990's (Bost, 2016; Ellington, 2010; Sheel, 2004). The growing popularity of the sport over a relatively short period of time has made this a very important area of study. With the increase in visitor usage there will naturally be an increase in environmental impact (Fresque & Plummer, 2009; Camp & Knight, 1998). This research looks at the climbing population and examines to see what their environmental impact may be through reported behaviors (Holzman, 2013).

There has been a substantial increase in outdoor recreation over that past decade or so and with that comes a positive benefit such as the economic impact. Recent reports show that $3.8 million is spent annually by rock climbers in the RRG (Maples, Sharp, Clark, Gerlaugh, & Gillespie, 2017). Rock climbing in Nantahala and Pisgah National Forests see $13.9 million spent by rock climbers annually (Maples & Bradley, 2017). According to the Outdoor Industry Association, Kentucky's economy sees $12.8 billion in consumer spending, $3.6 billion in wages and salaries spread out over 120,000 direct jobs (www. outdoorindustry.org/state/kentucky, 2017). Outdoor recreation and specifically rock climbing is a huge economic driver to some very rural areas in Appalachia.

Rock climbers have seen over the past several decades, many area closures to rock climbing or have seen a severe limit to those who can access these areas to climb (Kuntz & Larson, 2006). With education and specifically, the knowledge of the seven LNT principles, rock climbers can strive to minimize their environmental impact. This will lead to less access issues and closures and will allow future generations to enjoy these incredible rock climbing areas such as Kentucky's RRG. The relationship between

LNT and rock climbers is a unique one. The climbing community has recognized that there is a problem and they will go to great efforts to protect these areas. The climbing community is a very close group of individuals and this could be why we see the positive correlation between the importance of LNT education and protecting our natural environment.

LNT currently uses a three-tiered training structure when looking at LNT and education. This includes a master educator course, a trainer course, and awareness workshops. An LNT master educator course consists of five-day comprehensive training in LNT skills and ethics. This is the most advanced level of training and is designed for people who are active educators and teachers focusing on backcountry skills and providing recreation information to the public. The LNT trainer course consists of a two-day introductory course that is designed for guides, educators, and other outdoor recreation employees (Daniels & Marion, 2005). Finally, the awareness workshop is typically a day or less and is strictly informative and provided to anyone who is interested (lnt.org, nd).

CHAPTER III.

METHODOLOGY

Study Design and Research Questions

To this point, there is insufficient research on climbing and the effectiveness of LNT principles. LNT provides an important perspective on addressing recreational user impact on managed spaces such as national parks (Vagias, Powell, Moore, & Wright, 2014). As climbing increases in popularity, the need for finding effective ways to limit climber impact on the environment is paramount (Farris, 1995; Sheel, 2004). Climber organizations such as the Access Fund are heavily involved in sharing LNT principle training and education among climbers hoping that this will help the issue, but no research has examined if this truly helps. Thus, this study provides an important contribution to the field by answering this last issue, as well as exploring other variables that may shape the relationship (Wood, 2016; Grijalva, Berrens, Bohara, Jakus, & Shaw, 2002).

For this study, an in-person survey was utilized to collect data to examine my research questions. This study attempted to answer five overlapping questions: is there a relationship between knowledge of LNT principles and behavior while climbing, does supporting conservation groups change this relationship, does education change this relationship, does income change this relationship, and do common demographic variables change this relationship? In the following sections, I outline how I created all my variables and provide their sources, discuss population and sampling, detail my data collection procedure, explain data entry and cleaning, and how I created my scales for LNT knowledge and behaviors. In subsequent chapters, I examine my analysis using

OLS regression across four models, explain what the results mean for climbing and LNT education, and discuss several new directions for this research.

Population and Sampling

My population for this study is rock climbers who climb in the RRG. Previous research documents the population size of rock climbers in the RRG is approximately 7,500 unique climbers per year (Bost, 2016; Maples et al., 2017), which is up from 5,000 unique climbers in 2002 (Hobbs, 2002). Using this value, I estimate (with a 95% confidence level and +-5% confidence interval) an amount of 365 completed surveys for a meaningful statistical sample. I used Creative Research Systems free online calculator located at http://www.surveysystem.com/sscalc.htm to create this estimate. Knowing that there is no exact way to measure the annual population of rock climbers visiting the RRG, I played it cautious and called the estimated 7,500 unique climbers a convenience sample.

Conceptualization and operationalization of variables

Leave No Trace behavior, the dependent variable, is measured on the survey using items from Vagias and associates' (2012) LNT Attitudinal Inventory and Measurement (LNT AIM) as my source of LNT behavioral intention questions (see Appendix A for full survey). The survey included four items most relevant to rock climbing in the RRG and asked respondents to react to these statements on a five level Likert item scale. This Likert scale consists of strongly agree, agree, neutral, disagree, and strongly disagree. This matrix is based on their most recent visit to the RRG, duplicating methodology from Sharp and associates (under review) which abbreviated Vagias and associates' (2012) measure for rock climbing purposes. Items included

discarding biodegradable waste in the back country, cutting corners on switchbacks, keeping something found in the backcountry, and walking off trail to avoid muddy spots. Responses to these questions were scaled using Cronbach Alpha to examine their inter-item reliability to create a continuous scale for regression analysis.

The first independent variable in this study, LNT knowledge, is conceptualized as knowledge and application of LNT on-trail principles. LNT knowledge was measured using items from Vagias and associates (2012). Seven items most relevant to rock climbing in the RRG (see Sharp et al., under review) were included and respondents were asked to react to these statements on a five level Likert item scale. This Likert scale consists of very appropriate, appropriate, neutral, inappropriate, and very inappropriate. This matrix is based on their opinion regarding backcountry practices. A scenario was provided stating the respondent was on a backcountry hike and will be camping for the night where there currently are no designated camping sites. Items included camping along the edge of a stream, moving rocks away from the tent site, keeping a single item (such as a rock or feather) as a souvenir, cooking over a fire in the backcountry, placing the tent in an undisturbed spot in a heavily used location, using soap in a stream, and building a fire ring if one is not present. Like the LNT behavior scale, this, too was made into a continuous scale for analysis using Cronbach Alpha to test for inter-item reliability.

The survey included several demographic variables. These include sex, race, ethnicity, educational attainment, income, and participation in conservation organizations. Sex categories included male, female, other sex, and do not record. Race was operationalized using three common Census categories (Asian, Black/African American, and White) as well as some other race, and do not record. Respondents could

check all that applied to them. Educational attainment used seven categories (less than high school or GED, completed high school or GED but no college, some college but no degree, two-year Associate or tech degree, Bachelor's degree, Master's degree, and Doctorate or terminal degree) and duplicates the same categories used in Maples and associates (2017). A write-in educational category was also included. Finally, annual individual income was included across seven categories, also from Maples and associates (2017): $0-19,999, $20-$29,999, $30-$39,999, $40-$49,999, $50-$74,999, $75,000-$99,999, and greater than $99,999. A 'do not record' option for income was also included. For statistical analysis, each of these were recoded into dichotomous dummy categories where one equals the presence of the trait and zero equals the absence of the trait. Finally, I included a category for participating in conservation groups, a proxy measure for being supportive of conservation in outdoor recreation. For each of the categorical variables, I can suitably include each of these variables into a regression analysis and treat them as continuous variables. Following demographic analysis, I would need to select a reference category for comparison and will discuss this further in my analysis section.

Survey implementation

The data for this study came from an in-person field survey I collected in the RRG. Once the variables were set on the survey, focus groups were developed to test the survey, examine any revisions to help make questions clearer, and so forth. Two test groups with rock climbers were conducted to ensure the survey worked well in person. The survey was further tested in a university course to determine question clarity, and gather comments on design, and visual components. Finally, an online test of the survey

was conducted with a larger audience of climbers. Aside from revising typos and reorganizing questions, there were no revisions. This is largely due to the use of pre-existing variable measures from existing studies.

With the survey finalized, IRB approval secured, and land owner permissions approved, data were collected over the span of sixteen visits to the RRG in the spring and fall climbing seasons in 2015. Surveys were administered and filled out by individuals that self-identified as rock climbers at parking areas and trails frequently used by climbers and at climbing crags where allowed by the landowner or land manager in advance of the researcher's arrival. The survey was offered to everyone that was in the area of research and was not a random sample. Each area had certain limitations to follow such as only going to parking lots or staying at the entrance and exit points of the trail heads.

Collection sites include Miller Fork Recreational Preserve (MFRP), Pendergrass-Murray Recreational Preserve (PMRP), Muir Valley, Torrent Falls, Graining Fork Nature Preserve (GFNP), and parking areas near Forest Service crags (particularly the Martin's Fork parking lot in the Gray's Branch Region for Military Wall and Left Flank, as well as parking pull-offs near Phantasia and Fortress Wall).

These areas covered an estimated 95% of known climbing areas in the RRG. Areas excluded include remote backcountry sites receiving few annual visits and any small, privately-owned locations that receive few annual visits. In all, 727 respondents consented to fill out the survey. Only 13 declined to take the survey. This is quite notable and ostensibly indicates that climbers (or perhaps outdoor recreationists in general) are self-invested in supporting research on their respective fields.

Using Vagias and associaties LNT AIM scale provided some basic backcountry scenarios and outdoor recreation questions. The scale was being duplicated to see what the rock climber's knowledge and reported behavior might be while out rock climbing. Focusing on the behavioral component of rock climbers was difficult to do as the scale was really fit to be a general outdoor recreation scale. This scale provided some issues at times that didn't pertain to rock climbers or a specific rock climbing area. However, this was the best scale out there for this research at the time.

Data cleaning

Post-data collection, all surveys were entered into Excel and then SPSS to prepare for cleaning. While cleaning the data, a limited number of respondents were omitted for specific reasons. As the LNT questions involve the main variables of interest (both dependent and independent), 30 cases were excluded which did not provide answers to every LNT question. Missing one or more questions would impact their scale scores, which occurred in 21 of the 30 cases. Nine of the 30 cases provided no LNT question answers. Next, respondent cases were dropped who did not self-identify as a rock climber (question one of the survey). This removed 55 cases from the study. Finally, in conducting Gauss-Markov assumptions for the regression analysis, I discovered three cases that reported undue influence on the regression equation. This also created issues with homoscedasticity. Dropping the three cases removed this issue. In efforts to better understand this occurrence, all three respondents gave odd and conflicting answers on their LNT scales, such as strong agreement with one LNT principle and strong disagreement with another. Although this is speculation, this likely explained the issue at hand.

Scale building

For this study, two standardized scales (mean of 1, standard deviation of zero) were constructed: LNT Behaviors and LNT Knowledge. For each scale, the Cronbach's Alpha was utilized to test inter-item reliability and checked to see if dropping items would increase the Alpha score. Preferably, the Alpha score should be .7 or higher, but Alpha scores of .5 or higher are adequate in my discipline (Vaske, 2008). For LNT Behaviors, the scale scored .651. LNT Knowledge scored .737. In each case, dropping items did not improve the Alpha.

CHAPTER IV.

ANALYSIS

This study examines LNT principles in the climbing community located in Kentucky's RRG. It pursues five overlapping research questions through OLS regression: 1. Does increasing a climbers' knowledge score on LNT principles increase their LNT behavior scores? 2. Does being conservation-minded significantly shape this relationship? 3. Does education significantly shape this relationship? 4. Does income significantly shape this relationship? 5. Do common demographic measures significantly shape this relationship? As described in the methodology, I use established and standardized scales for LNT knowledge and behavior measures and dichotomous dummy categories for all other variables except age, which is a continuous numeric measure. I analyzed the results across four models in OLS regression.[1]

Descriptive Statistics

Table 1 includes descriptive statistics for this study. Both LNT scales were standardized. The scale now has a mean of zero and a standard deviation of approximately one. This makes the scales able to provide more reliable results in the regression analysis. Approximately 62% of the respondents were male, and approximately 90% of the respondents were white. Less than one percent identified as being black/African American, but a notable seven percent identified as being Asian. Although the variable wasn't included in the study, 97% were non-Latino. In this

[1] Working with Dr. Maples, I experimented with using five models rather than four. The third model includes both education and income here as there were no significant results from treating education separately from income. Likewise, education was not significant and income had one category significant regardless of education being involved in the model. It also did not change the R^2 treating education separately from income. As such, we made the approach of simply doing four models for simplicity and clarity.

sample, approximately 33% were members of a conservation group or organization. The average respondent was about 28 years old. The age ranges were between 18 and 68. For income, each category was coded in dichotomous dummy format. This indicates that the means can be interpreted as a percentage of cases in that category by moving the decimal over two spaces. About 32% of the respondents made $0-$19,999 in personal annual income. About 24% of the respondents made $20K-$39,999 in personal annual income. About 24% of the respondents made $40K-$74,999 in personal annual income. Finally, about 17% of the respondents made $75K or greater in personal annual income. For education, each category was coded in dichotomous dummy format. This indicates that the means can be interpreted as a percentage of cases in the category by moving the decimal over two spaces. About 32% had less than a BA/BS degree. About 45% had a BA/BS degree. Finally, about 21% had greater than a BA/BS degree. There were international respondents from a variety of countries such as China, Japan, Canada, Germany, France, Great Britain, Spain, Italy, and India. Most respondents were not from Kentucky as there was a high number of respondents from all over the country.

Table 2 includes the regression results for the analysis. Model one examines the relationship between the two LNT scales. For each unit the LNT knowledge scale increases, the LNT behavior scale increases by .6. The R^2 is .285. Model two adds conservation membership to the analysis. In Model two only the LNT knowledge scale was significant with the coefficient of .584. The R^2 increased to .288. Model three adds income and educational attainment to the analysis. In Model three only LNT knowledge scale was significant. The R^2 increased to .294. Model four adds age, race, and sex to the analysis. In Model four both the LNT knowledge scale and being in the higher income

category was significant. First, for every unit the LNT knowledge scale increases the LNT behavior scale increased to .599. Second, being in the high-income category correlates with scoring .190 higher on the LNT behavior scale. The R^2 increased to .302. The high-income category suddenly becoming significant in Model four, hints that an interaction is present. My dissertation chair ran additional analyses checking for interaction but none were found. It is conjecture but the interaction may be that white males (which make up the bulk of the sample) earn higher incomes on average and this created an interaction of some kind.

This analysis provides answers to my five research questions and the hypotheses constructed around these questions. First, there is a clear correlation between the measures of LNT knowledge and reported behaviors. Changing knowledge should change self-reported behaviors. Second, conservation membership has no clear role in this relationship between knowledge and behavior. Third, education (whether run as its own model or together with income, see footnote at start of chapter) has no clear effect in the relationship between LNT knowledge and behavior. Fourth, income does matter, particularly being in the high-income category. Here, income has an unexpected and important positive effect on LNT self-reported behaviors. Fifth and finally, demographic additions were not significant in predicting the relationship between LNT knowledge and behavior, although income remained significant. This analysis provides unique and exciting insight into existing research on LNT principles, environmental impact, and also teaching best practices. (See Table One and Table Two)

Table One: Descriptive Statistics

Variable Name	Mean	Standard Deviation	Min	Max	Obs
LNT Behavior Scale	.000	.698	-1.893	1.108	639
LNT Knowledge Scale	.000	.623	-2.084	1.652	639
Sex (dichotomous, 1=male)	.621	.485	0	1	636
Race (dichotomous, 1=white)	.899	.300	0	1	609
Conservation Membership (dichotomous, 1=yes)	.334	.472	0	1	639
Age (in years)	28.776	8.603	18	68	635
Annual income (in $)	-	-	-	-	-
$0-$19,999	.324	.468	0	1	607
$20K-$39,999	.245	.430	0	1	607
$40K-$74,999	.250	.433	0	1	607
$75K or greater	.179	.384	0	1	607
Educational Attainment	-	-	-	-	-
Less than BA/BS	.328	.470	0	1	633
BA/BS	.459	.498	0	1	633
Greater than BA/BS	.211	.408	0	1	633

Table Two: OLS Regression of LNT Knowledge and other Variables on LNT Behavior Scale (Standard Error in Parenthesis)

Independent Variables	Model One	Model Two	Model Three	Model Four
LNT Knowledge Scale	.597*** (.036)	.584*** (.037)	.587*** (.039)	.599*** (.039)
Conservation Membership	-	.066 (.050)	.053 (.052)	.031 (.054)
Low Income	-	-	ref	ref
Middle Income	-	-	-.005 (.055)	.024 (.060)
High Income	-	-	.140 (.076)	.190* (.090)
Less than Bachelors	-	-	ref	ref
Bachelors	-	-	.007 (.056)	-.003 (.057)
More than Bachelors	-	-	.010 (.072)	.009 (.074)
Age	-	-	-	-.003 (.003)
Race	-	-	-	.130 (.079)
Sex	-	-	-	.016 (.050)
Constant	.001	-.022	-.038	-.081
R^2	.285	.288	.294	.302
N	700	700	658	630
F	279.821***	140.965***	45.130***	29.799***

***p=.001 **p=.01 *p=.05

CHAPTER V.

DISCUSSION

This study provides an exciting contribution to LNT related research while also creating a solid foundation for future research. In this analysis, OLS regression techniques demonstrate that a relationship does exist between LNT knowledge and self-reported behaviors: that increasing knowledge of LNT principles correlates with a beneficial increase in self-reported LNT behaviors. Income (and only a single category within income) shapes this relationship, and does so in a positive fashion, while other variables (such as conservation membership) do not. Several important points of discussion directly result from the analysis related to LNT and impacts how we teach and share LNT principles based on efficacy.

LNT Education

The findings support that LNT education should be a useful way to change (reported) behaviors in a positive way towards helping to minimize the environmental impact of rock climbing (Marion, & Reid, 2007). According to the LNTCOE, their goal is to educate and have participants accept environmentally conscious outdoor recreation and integrate into the LNT spectrum. For example, one can be on the extreme side or on the minimal side of one's personal land ethic beliefs and that is perfectly acceptable. Through education and LNT minded pedagogy the desire is to ensure education on the subject. As a result, one should make a conscious effort to think about how their impact affects the natural environment and others who will visit those areas. Our land ethic will change as we are educated and have more experiences to draw from, so therefore where we fall on the LNT spectrum will fluctuate over time as well.

It is important to know how to pass this knowledge on and have the educational training and tools necessary to be able to address and handle issues or concerns one may encounter as you participate in outdoor recreation activities. The essence of LNT trainings is the ability to not only know the seven principles, but also how to educate others through a variety of techniques. All trainings require (or strongly encourage) at least one overnight camping experience for the trainer courses and four (4) days in the field for the master educator training (Bromley, Marion, & Hall, 2013). All of these educational opportunities offer a hands-on opportunity to learn minimal impact skills and techniques. Also, focusing on how to present this information and, more importantly, how best to communicate this to others you encounter that may not have this knowledge (Marion, & Reid, 2007).

A great educational tool is introduced as the Authority of the Resource (AR) technique. This technique gives you an opportunity to explain the principles in such a way that the natural area is the authority and therefore you are not seen as the authority figure (Marion & Reid, 2007). This technique requires a certain skillset and knowledge of not only the seven principles, but the area in which you are visiting. This allows the person potentially doing something detrimental to the environment the opportunity to know "how" and "why" their actions may impact the area. Standing shoulder to shoulder and communicating in such a way as to offer a suggestion of an alternative method and to use the natural area as to why it is important to do so. This will lead to a better outcome with the individual you are speaking to and should make them less likely to be defensive to your suggestions.

Impacts of LNT Education

In the case of climbers in at least one location, the RRG, we see that LNT education is making a change in LNT reported behaviors. The RRG area has had a variety of LNT trainings and offerings. The RRG has been nominated as an LNT Hot Spot at least twice and, in 2010, was the first Hot Spot designated by LNT (lnt.org, nd). The RRG was part of an intense land management process called the Limits of Acceptable Change (LAC) and this helped spark the inception of the LNT Hot Spot program. This program is an outreach event bringing special attention, and various trainings to areas that desperately need to recover from the impact of visitor usage.

The process includes an LNT traveling trainer team to offer trail cleanups, trainer courses, and other educational opportunities for that community. The Red River Gorge Climbers' Coalition (RRGCC) has taken the next step and provides trainings and educational information at various kiosks at certain trailheads throughout popular climbing areas in the RRG. You can find other efforts by the RRGCC and the U.S. Forest Service (USFS) such as listing what LNT is and how to properly follow the seven principles through publishing such information on RRG trail topographic maps and rock climbing guidebooks. The Access Fund has played a key role in this as well by providing the resources and funding to allow these efforts to occur. The LNTCOE designed hang tags with LNT educational information on a small plastic reference card that lists the seven LNT principles and how said principles relate to various outdoor pursuits and activities. The cards are easily accessible and provide a quick reference by having it available at all times hanging from your backpack.

The RRGCC and Friends of Muir Valley (FOMV) have adopted this concept as well and have designed and produced hang tags specific to rock climbing at the RRG. These hang tags have specific emergency information and resources on one side and climbing ethics in the RRG on the other. With help and sponsorship from Kentucky's very own Ale-8-One and the RRG Fixed Gear Initiative (FGI) they state the following 5 components under RRG Climbing Ethics:

1) Pack out or bury human waste

2) Minimize impact

3) Bolt etiquette

4) Be pet conscious

5) Be a steward of the Red

All the aforementioned groups and organizations have come together in unison to agree that LNT is essential from a sustainability standpoint for the RRG to continue to be a popular climbing destination. This is evident by the strong show of support for all the LNTCOE does for the local climbing community and beyond. The platform for these organizations have encouraged professional climbers to spread awareness of minimum impact practices and offer their influence on the climbing community. Professional climbers are involved in various festivals and events offered annually in the local climbing areas of the RRG.

Influences of Income

Income may play a factor in the relationship between LNT knowledge and behaviors. This relationship may exist for a variety of reasons. There is certainly a correlation between people who have achieved a higher degree of formal education and

the ability to make more income. Additionally, further education can support the mindset of being more cognizant to protect our natural environment or at least the thought of knowing these natural areas are important and need to be protected.

Furthermore, income can undoubtedly influence the type of equipment one may buy or have access to which can lessen their impacts. The ability to have ultralight gear and equipment allows one to play harder, longer, and potentially leave less of an impact. For example, specific gear while traditional (trad) climbing will allow you to not have to rely on permanent bolts in the rock for fall protection and anchor placement at the end of a climb. Additionally, one may have a Waste Alleviation and Gelling (WAG) bag, or poop tube that would allow them to pack out their human waste. As we know, the two recommended ways to dispose of human waste properly is to bury it in a cathole or pack it out (Ells & Monz, 2011). WAG bags and poop tubes come with a price not everyone can afford, not to mention all the other incredible ultralight gear that is currently on the market.

Moreover, the higher income you have attained the easier it would be to travel which can lead to more experiences to reference and pull from. Ultimately, the more experiences you have in these areas increases your natural place attachment and thus a higher desire to make efforts to protect it (Fresque & Plummer, 2009; Tarrant & Green, 1999). Sense of place and place attachment can develop from which an individual may derive meaning and/or self-efficacy, which can be positively impacted in both the short and long term (Fresque & Plummer, 2009). With income one might be more likely to be a member of a conservation group or member of LNT. The opportunity to join these

environmentally friendly groups might be directly related to being able to afford the membership fees and one's ability to give both time and money.

Income can relate to higher education levels and can lead to more exposures and experiences such as climbing walls, outdoor clubs, and even groups through university campus life. With these experiences and exposures one might even have the opportunity to take classes, trainings, or workshops on tips and techniques related to LNT and what it is and why it's important. More research is needed to see just how much income may link with environmentally conscious outdoor recreation participants.

Self-Policing

As the number and diversity of visitors to parks and outdoor recreation areas has grown, so has concern regarding the potential effects of such growth on the quality of outdoor recreation experiences (Manning & Valliere, 2001; Schneider, 2000). Consequently, there has been an increase in self-policing throughout the rock climbing community. This could be related to climbing area closures resulting from the attitude of individuals that feel the rules don't apply to them.

The ultimate goal of dispensing information and education is to maintain visitor freedom while balancing ecological and social impacts of outdoor recreation (Newman, Manning, Bacon, Graefe, & Kyle, 2003). I have seen a greater number of knowledgeable climbers willing to educate other climbers potentially causing harm, or some sort of environmental impact while climbing outside compared to my first years of climbing back in the late 1990's. A knowledge gap between visitors and their perceptions of LNT is created due to the vast majority of outdoor recreationists frequently visiting non-wildness destinations (Lawhon, Taff, Newman, Vagias, & Newton, 2017). According to

the research, climbers are educated people and care about the environment. If improper techniques or etiquette are observed, more often than not, someone will intervene and ideally take care of the situation before it becomes an issue. This shows not only education and awareness, but also the mutual enforcement of the rock climbing community on one another.

This is even more evident with the recent development of the ROCK Project. The Access Fund has partnered with the outdoor company Black Diamond to launch the Climber's Pact that is devoted to the promoting responsible outdoor climbing knowledge. This is an excellent example of climbers being proactive and shows they have the ability to see a problem and address it within their own community. Commit to the Pact. The Climber's Pact includes the following important facets to climb by:

-Respect other users.

-Dispose of human waste properly.

-Park and camp in designated areas.

-Stay on established trails.

-Place gear and pads on durable surfaces.

-Clean up chalk and tick marks.

-Keep a low profile, minimizing group size and noise.

-Pack out all trash, crash pads, and gear.

-Respect closures.

-Be an upstander, not a bystander.

(http://blackdiamondequipment.com/en_US/access-fund-rock-project.html, 2017).

Demographics

The data support existing research on LNT showing things like race and sex as being irrelevant to learning about principles and becoming responsible stewards of our natural areas. We do need to express the importance of education being readily available to all of the rock climbing community. As noted earlier, it might only be accessible to those who have more available resources through formal or traditional educational attainment or possibly the amount of income one makes. This should not be the case as the LNT message needs to be spread to all who may choose to participate in outdoor recreational pursuits. Signage alone will not be enough as educational opportunities should be the preferred method.

Interpreting LNT Education

If the LNT knowledge and behaviors relationship continues to exists, we can use this to help increase the climbing population without sacrificing protection of the natural environment. We know there are projections of a drastic increase in rock climbing participation in the near future (Tessler, & Clark, 2016; Sheel, 2004). We also know the current rate and projected increase in participation would not be sustainable (Holzschuh, 2016). Therefore, this correlation between the relationship of LNT knowledge and behaviors having a positive effect on managing rock climbing in the future would help increase the opportunities for more rock climbing while concurrently being responsible stewards of the land.

CHAPTER VI.

CONCLUSION

In the end, climbers are the ones making some sort of impact to these specific climbing areas in some capacity due to the sheer numbers of rock climbers visiting the RRG. We continue to ask are we loving our wilderness and park areas to death (Marion, Leun, Eagleston, & Burroughs, 2016). It is undeniable the sport of rock climbing is growing, and with greater numbers of climbers there will be a greater impact to climbing areas. As previous research shows, with an increase in visitor use in any given area, there will be some sort of environmental impact increase. This is especially true if the carrying capacity of a specific area is being exceeded. More research is needed in many areas to tease out exactly how much impact climbers are making. Not only how much impact, but also the severity of the impacts being made. Are they minimal impacts that will recover in a short amount of time? Or are the impacts substantial enough that it might be a difficult recovery process for the areas affected? The strongest and most effective position being taken is the initiative and recent development of The Climber's Pact. This is taking the entire climbing community, professional climbers, climbing companies and organizations and allowing a strong voice to all climbers that we acknowledge a problem and the necessity to make a change.

Research Limitations

The research in this dissertation has several limitations that are worth noting and looking at. Is the RRG unique and will this research apply the same elsewhere? The RRG is somewhat unique with the fact that it has such great support from local organizations such as the RRGCC and FOMV. The RRG also has the support of the Access Fund. Not

to say there isn't great local climbing organizational support at climbing destinations all over the country, because there certainly is. When looking at number of visitors in this rural section of a state like Kentucky and the amount of visitor use and support from local and national organizations the RRG looks somewhat unique. This research may look different when looking at other places such as Joshua Tree National Park, Smith Rock State Park, Rifle Mountain Park, or even Yosemite National Park.

The exact population is technically unknown and therefore was treated as a convenience sample. It is worth noting that many believe the estimated 7,500 unique climbers to visit the RRG annually was a low estimate. Playing it cautious with a convenience sample and knowing that the unique climbers might be greater than 7,500 is something to remember and revisit later.

The LNT AIM scale from Vagias and associates (2012) that was duplicated and used for this study really focuses on hiking and camping. This is an area where LNT and climbing might have been hard to really focus on. Therefore, another scale more specific to LNT and climbing would be more appropriate. This could lead to even greater accuracy in data collection.

There were limitations with sampling and data collecting from a researcher's standpoint. Different stipulations from each land manager had to be followed such as staying to parking lots, trailheads, and certain shelters. This often made it more inconvenient for the climbers as they were being intercepted before they got to their climbing area for that day or after they were done climbing and ready to return home. Weather limitations and often being confined to parking lots limited the ability to get more surveys as well. The US Forest service and Daniel Boone National Forest use data

collection techniques in a very different way. They use what is called the National Visitor Use Monitoring Program (NVUM). This is a way that everyone is approached and asked multiple questions using a variety of forms and counting techniques. This is used to estimate the amount of recreation use and account for more information about the visitors who use these areas. This would be very difficult to do with climbers as these areas are often remote and researchers might need to limit what they can carry comfortably to access these areas. Using minimal data collection techniques also goes with the LNT philosophy.

Research was focused solely to the RRG and there was a definite connection between increasing climbers LNT knowledge and positively effecting LNT reported behaviors. Will this outcome hold true for other areas? This will be a great baseline to use when conducting research in other areas.

Lastly, the RRG is relatively close the three Universities in Kentucky. The question of are you a student was not on the survey, and should be put on future surveys. In addition, the question of how knowledgeable are you in regards to LNT would be nice to know as well.

Additions to the Current LNT Scale

Research has indicated certain tendencies using the LNT AIM scale. There may be additional measures to be considered in further research. Further research should ask the question of whether the respondent is familiar with the term Leave No Trace. If they have had any training or educational opportunities involving LNT. If so, what kind of training or educational opportunities did they have? Future researchers may consider

asking when they first heard about LNT. Additionally, I think asking participants the preferred method of educational information delivery may prove interesting.

Each principle can potentially have a more direct relationship to rock climbing. *Plan ahead and prepare* can look at stressing the importance of knowing the areas in which you are climbing in order to make an effort not to disturb the local cliff flora and fauna (Holzman, 2013). Avoiding sensitive times of the year for certain ecosystems such as nesting and mating times. Also, knowing what current rules and regulations for the areas you are traveling to and how best to manage your trip as a responsible steward is a critical step of the first LNT principle.

Travel and camp on durable surfaces can look at the specific belay and staging areas for a rock climb. This is where climbers spend most of their time, see the most impact, and are the most noticeable to anyone hiking to a climbing area. This staging area is usually under the climbing route or in very close proximity. Choose a durable surface that is more resilient to the impacts. This staging area is most likely where the climbers will be resting, eating, and hydrating in between climbs.

As mentioned earlier, the use of WAG bags and poop tubes can be required in certain types of climbing areas and situations as a way to *dispose of human waste properly*. Also, leaving any gear such as a fixed piece of protection (i.e. a Spring-Loaded Camming Device SLCD) or a tied piece of webbing to bail or lower from a climb using the rock or trees, etc. can be a common practice in climbing. Removing some of the previously left gear is good climbing etiquette as is brushing off holds after using chalk to dry your hands or the use of tick marks to indicate the best holds on a route.

Turning to the principle of *leave what you find*, be aware and try not to disturb the vegetation as you climb and develop routes. When developing a route, sometimes just the climbing traffic will clean up the route enough for others to climb and enjoy. This naturally removes dirt and smaller rocks as one climbs. It may also include brushing off the rock to remove lichen and other particles that are inhibiting a climber to feel the clean rock for optimal grip.

Minimize campfire impacts is usually not as big of an issue while climbing, but more when camping, and encourages the use of stoves and not campfires (Reid & Marion, 2005). Most climbers know that campfires are prohibited under rock shelters, but yet you still see this. Not knowing who exactly created the fire ring one might assume it came from rock climbers who visit the area. Campfires can leave lasting impacts under shelters or in the backcountry so it is imperative to know the fire rules, regulations and etiquette.

Respect wildlife has recently shown to be an area with substantial research on cliff wildlife and the impact climbers can have just by climbing (Holzman, 2013). This can certainly go back to route development and "cleaning a route." Also, this goes back to plan ahead and prepare and know the areas you are visiting to avoid sensitive times for wildlife and route closures related to this. Lastly, this principle reminds me how many climbers (myself included) like to bring their pets (most often dogs) with them to the crag. Maintaining control of your pet at all times, keeping them on a leash, cleaning up after them, etc. is very important to other visitors and the local habitat.

Being considerate of other visitors means respecting the experience of other visitors and being aware of what you and your group are doing to allow all to enjoy their

experience. Let nature sounds prevail by keeping your voices down. Always be aware of your gear and minimize the area you are occupying. These can all be duplicated from the LNT climbing specific hangtags and LNT skills and ethics rock climbing booklet.

Expanding LNT measures to other sports and other areas

While including a new measure of LNT principles that are applicable to specific sports, it is also important to expand the research of LNT principles to other sports. For example, this research establishes a precedent for climbers and LNT, but what about other outdoor pursuits? Do the findings in this study echo what might happen if we look at the impacts of paddling, mountain biking, or even OHV/ATV use? Likewise, it is important that this kind of research be conducted in multiple study areas. Presently, this study represents only LNT in the RRG, one of many climbing destinations. As further research is conducted, being able to make greater and greater generalizations over multiple areas would be a helpful analysis to contribute to our knowledge of LNT principles.

Additional Research Approaches

One recommendation for further research is to find another method to record LNT behaviors other than by self-reporting. Self-reporting has the potential for introducing error into the analysis. Field observations might be the best way to go about this since we can actually see what is happening at the climbing areas instead of what the climber reports as their behavior. Although we like to believe everyone, not all surveys are filled out as honestly as one would hope. Other field study techniques and methods should be considered and will benefit this study as it grows and will increase validity. It may prove interesting to compare the observations and field studies from an actual climber in the

field. I would think that if a researcher was quietly documenting observations while out climbing you might get your most truthful sample. You could compare the data collected from quiet observations versus declared or announced observations.

The recent development of the ROCK Project and The Climber's Pact, allows for greater educational efforts in the rock climbing community. This opens the opportunity to the self-policing mindset and taking matters into your own hands by declaring this knowledge to be passed on and spread throughout the climbing community. Much can be taken from this pact and adapted and measured to see how successful this will be in the near future.

Further research can be made involving income and the correlation between LNT educational opportunities and experiences and whether individuals with higher income have a greater likelihood of being exposed to minimal environmental impact practices. This could simply mean an individual has the resources and funds available to travel more, thus leading to more experiences. Furthermore, having greater funds and resources could lead to the ability to hire a rock climbing guide for training or to lead them on a guided trip. Higher income could also lead to being able to afford to sign up for educational trainings, certifications and so on.

There are other comparable organizations with a similar message such as Tread Lightly. Both seem to have the same message but vary on the recreational pursuits. More research can be done on how and what organizations like the RRGCC and FOMV do to promote LNT knowledge. These local RRG organizations can take the Climber's Pact and use that as their voice to all of the climbing community.

LNT Educational Approaches

More research is needed on the effectiveness of LNT. At this time, LNT is providing the necessary minimal environmental impact pedagogy to visitors. However, we are not sure what the most effective educational approach is and how best to disseminate such information. Furthermore, we are not sure what kind of LNT trainings or educational opportunities outdoor enthusiasts are getting, or if at all. It is possible that some are educating themselves or learning from their mentors or climbing partners just as a climber gains more technical skills and techniques. They may be gaining this in the field through experiences, observations, meeting other climbers and building rapport with them and so on. The community of rock climbers is very close-knit and this usually leads to word of mouth opportunities to educate fellow climbers.

Knowing there are many different approaches and types of educational trainings, how can we determine what might be working the best or potentially not at all? Indoor climbing gyms offering a gym to crag might be very beneficial if they incorporate this into their curriculum as many do already. Do these climbing gyms have employees with the training and education on teaching LNT or are they simply introducing this concept to their patrons? With so many climbing gyms producing new climbers going to the outdoors, hopefully they are knowledgeable when it comes to technical skills and how to climb safely. However, are they well-informed on the environmental impacts that they can and will cause when climbing outside, or is this just another example of a level of income and the ability to have a climbing membership shaping ones climbing aptitude?

Does the Source of Education Matter?

One valuable question raised late in my study post-data collection was, "does it matter where one gets their LNT knowledge?" Is getting it from the Internet the same as getting it from an LNT workshop? What about long-term commitments to environmental activism such as being part of organizations like the Boy Scouts and/or Girl Scouts? This is a study ripe for the picking among outdoor recreation users, as LNT principles are found in multiple sources.

LNT Community Accountability

The more involved the climber is within their local area and climbing organization, the more likely they are to have a better understanding of the impacts of climbers. This may take the form of helping with a trail clean up or trail build and allows firsthand knowledge of the environmental impacts when climbing, especially when large concentrations of climbers populate a certain area. It is imperative to encourage climbers and non-climbers to get involved in the educational opportunities that organizations like the RRGCC, Friends of Muir Valley (FOMV), and the Access Fund. For lack of a better term, there is inherently a quid pro quo in place between outdoor recreation enthusiasts and the beautiful environments they choose to visit and enjoy. The bottom line is, in order to keep our natural areas open and properly sustained, more people must donate time (by lending a hand with a trail day), money, and resources to help make sure these areas remain accessible for future generations to enjoy.

I feel as though different sports can reach a broader amount of people that are visiting and participating in outdoor recreation on our lands and relay the same concept through stewardship and environmentally minded education based communication. In a

related and perhaps comparable vein, the official Ironman triathlons have a philosophy to not only host a great event offering the opportunity to swim, bike, and run, but they also want to invest in the communities in which they offer these races. I have seen firsthand what a positive influence the Ironman race and organization can do for some of these communities. The Ironman proactively chooses to positively impact the environments of the communities hosting the event, such as building a beach area to allow swimming access, adding playgrounds and other activities for people to enjoy these areas.

The philosophy to not only take care of the areas that you are choosing to recreate on is important, but to leave these areas even better than you found them, is really the ultimate goal. This allows us to take giving back to these local areas one step further. This should start from within the climbing community proactively taking control of our own future and the continued future of rock climbing. Open and positive communication is the best way to educate rock climbers to be responsible stewards of our natural areas and to minimize your outdoor climbing impacts. I feel as though all the initiatives such as the ROCK Project and The Climber's Pact are heading in the right direction and we can only continue to build from this momentum to allow us to take control of the areas that we love and value for our future generations to enjoy as we have.

In closing, knowing that Vagias and associates LNT AIM (2012) scale tended to focus on hiking and camping, the researcher and his colleagues plan to focus on creating a LNT specific scale as the next step in furthering this research. Creating scales for other specific activities such as paddling, biking, and OHV usage using the existing information that LNT has focused on with their hangtags and booklets would be another step to further this research.

"We do not inherit the earth from our ancestors, we borrow it from our children."

- Native American Proverb

REFERENCES

Abramson, A., & Fletcher, R. (2007). Recreating the Vertical: Rock-Climbing as Epic and Deep Eco-Play. *Anthropology Today, 23*(6), 3-7. Retrieved from http://www.jstor.org/stable/4620395

Adams, M. D., & Zaniewski, K. (2012). Effects of recreational rock climbing and environmental variation on a sandstone cliff-face lichen community. *Botany, 90*(4), 253-259.Access Fund - Protect America's Climbing (2016). Retrieved from www.accessfund.org

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes, 50*(2), 179-211.

Ajzen, I., & Driver, B. L. (1992). Application of the theory of planned behavior. *Journal of Leisure Research, 24*(3), 207-224.

Bissix, G., Rive, K., & Kruisselbrink, D. (2009). Identifying key messages to encourage minimal impact on the cape split trail. *Leisure/Loisir, 33*(2), 615-636.

Bost, R. (2016) Rock Climbing, Waffles, and the Public Land." Presented to the Red River Gorge Climbers' Coalition Executive Committee on March 12, 2016: Slade, KY.

Bridle, K. L., & Kirkpatrick, J. B. (2005). An analysis of the breakdown of paper products (toilet paper, tissues and tampons) in natural environments, Tasmania, Australia. *Journal of environmental management, 74*(1), 21-30.

Bright, C. M. (2014). *A History of Rock Climbing Gear Technology and Standards* (Doctoral dissertation).

Bromley, M., Marion, J., & Hall, T. (2013). Training to teach leave no trace: Efficacy of master educator courses. *Journal of Park and Recreation Administration*, *31*(4).

Caltabiano, N. J., & Caltabiano, M. L. (1995). Assessing environmentally responsible behaviour. *Psychological reports*, *76*(3_suppl), 1080-1082.

Camp, R., & Knight, R. (1998). Effects of Rock Climbing on Cliff Plant Communities at Joshua Tree National Park, California. *Conservation Biology, 12*(6), 1302-1306. Retrieved from http://www.jstor.org/stable/2989849

Cole, D. N., & Monz, C. A. (2003). Impacts of camping on vegetation: response and recovery following acute and chronic disturbance. *Environmental Management*, *32*(6), 693-705.

Cole, D. N., Petersen, M., & Lucas, R. C. (1987). *Managing wilderness recreation use: common problems and potential solutions* (No. 230-232). US Dept. of Agriculture, Forest Service, Intermountain Research Station.

Cordell, H. K. (2012). Outdoor recreation trends and futures: a technical document supporting the Forest Service 2010 RPA Assessment. *General Technical Report-Southern Research Station, USDA Forest Service,* (SRS-150).

Creative Research Systems free online calculator (2017) retrieved from http://www.surveysystem.com/sscalc.htm

D'Antonio, A., Monz, C., Newman, P., Lawson, S., & Taff, D. (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, 50*(4), 542-554.

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.

Ellington, R. (2010). *The red river gorge*. New Castle, CO: Wolverine Publishing.

Ellington, R., & Stephens, D. (2015). Red river gorge north: A rockclimbing guidebook to Kentucky's red river gorge (Vol. 1). Northern regions. New Castle, CO: Wolverine Publishing.

Ellington, R., & Bowling, B. (2017). Red river gorge south: A rockclimbing guidebook to Kentucky's red river gorge (Vol. 2). Southern regions. (5th ed.) New Castle, CO: Wolverine Publishing.

Ells, M. D., & Monz, C. A. (2011). The consequences of backcountry surface disposal of human waste in an alpine, temperate forest and arid environment. *Journal of environmental management*, *92*(4), 1334-1337.

Farris, M. A. (1995). The Effects of Rock Climbing on the Cliff Flora of Three Minnesota State Parks. *Conservation Biology Research Grants Program, Division of Ecological Services, Final report to the Minnesota department of natural resources*.

Fresque, J., & Plummer, R. (2009). Accounting for consumption related to outdoor recreation: An application of ecological footprint analysis. *Leisure/Loisir*, *33*(2), 589-614.

Fulton, D. C., Nelson, K. C., Anderson, D. H., & Lime, D. W. (2000). *Human dimensions of natural resource management: emerging issues and practical applications*. University of Minnesota; US Geological Survey Biological Resources Division, Minnesota Cooperative Fish and Wildlife Research Unit and Cooperative Park Studies Program.

Grijalva, T., Berrens, R., Bohara, A., Jakus, P., & Shaw, W. (2002). Valuing the Loss of Rock Climbing Access in Wilderness Areas: A National-Level, Random-Utility Model. *Land Economics, 78*(1), 103-120. doi:10.2307/3146926

Harmon, W. (1997). *Leave no trace: minimum impact outdoor recreation*. Globe Pequot.

Hendricks, W. W., & Miranda, B. (2003). A service-learning approach to wilderness education. *Journal of Physical Education, Recreation & Dance, 74*(7), 21-24.

Hobbs, W. D. (2002). Economic impact of rock climbing on the communities surrounding the Red River Gorge, Kentucky. Master of Science thesis, Department of Kinesiology, Recreation, and Sport, Western Kentucky University.

Hockett, K. A., Clark, Y. F., Leung, J. L., & Park, L. (2010). *Deterring off-trail hiking in protected natural areas: Evaluating options with surveys and unobtrusive observation: Final report*. Virginia Tech College of Natural Resources, Forestry/Recreation Resources Management.

Holzman, R. (2013). Effects of Rock Climbers on Vegetative Cover, Richness and Frequency in the Boulder Front Range, Colorado.

Holzschuh, A. (2016). Does rock climbing threaten cliff biodiversity? - A critical review. *Biological Conservation*, *204*, 153-162.

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.

Kaiser, F. G., Wölfing, 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.

Kulczycki, C. (2014). Place meaning and rock climbing in outdoor settings. *Journal of Outdoor Recreation and Tourism, 7-8,* 8-15. Clark, P. & Hessl, A.E. (2015). The effects of rock climbing on cliff-face vegetation. *Applied Vegetation Science, 18*(4), 1-11.

Kuntz, K. L., & Larson, D. W. (2006). Influences of Microhabitat Constraints and Rock-Climbing Disturbance on Cliff- Face Vegetation Communities. *Conservation biology*, *20*(3), 821-832.

Lawhon, B., Newman, P., Taff, B. D., Vaske, J. J., Vagias, W. M., Bright, A. Lawson, S. R., & Monz, C. (2013). Factors influencing behavioral intentions for Leave No Trace behavior in national parks. *Journal of Interpretation Research, 18*(1), 23-38.

Lawhon, B., Taff, B. D., Newman, P., Vagias, W. M., & Newton, J.* (2017). Understanding and influencing State Park Visitors' Leave No Trace Behavioral Intent. *Journal of Interpretation Research*, *22*(1), 53-71.

Leave No Trace Center for Outdoor Ethics (2017). Retrieved from www.lnt.org

Leung, Y. F., & Marion, J. L. (2000, May). Recreation impacts and management in wilderness: A state-of-knowledge review. In *Wilderness science in a time of change conference* (Vol. 5, pp. 23-48).

Manfredo, M. J., Yuan, S. M., & McGuire, F. A. (1992). The influence of attitude accessibility on attitude-behavior relationships: Implications for recreation research. *Journal of Leisure Research*, *24*(2), 157.

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

Manning, R. E., & Valliere, W. A. (2001). Coping in outdoor recreation: Causes and consequences of crowding and conflict among community residents. *Journal of Leisure Research*, *33*(4), 410.

Maples, J.N., & Bradley, M.J. (2017). Economic impact of rock climbing in the Nantahala and Pisgah National Forests. Report submitted to Outdoor Alliance on August 5, 2017.

Maples, J. N., Sharp, R. L., Clark, B. G., Gerlaugh, K., & Gillespie, B. (2017). Climbing out of Poverty: The Economic Impact of Rock Climbing in and around Eastern Kentucky's Red River Gorge. *Journal of Appalachian Studies*, *23*(1), 53-71.

Marion, J. (2014). *Leave No Trace in the outdoors*. Stackpole Books.

Marion, J. L., Dvorak, R. G., & Manning, R. E. (2008). Wildlife feeding in parks: methods for monitoring the effectiveness of educational interventions and wildlife food attraction behaviors. *Human Dimensions of Wildlife*, *13*(6), 429-442.

Marion, J. L., Lawhon, B., Vagias, W. M., & Newman, P. (2011). Revisiting 'Beyond Leave No Trace'. *Ethics, Policy & Environment, 14*(2), 231-237.

Marion, J. L., Leung, Y. F., Eagleston, H., & Burroughs, K. (2016). A review and synthesis of recreation ecology research findings on visitor impacts to wilderness and protected natural areas. *Journal of Forestry*, *114*(3), 352-362.

Marion, J. L., & Reid, S. E. (2001). Development of the US Leave No Trace program: an historical perspective. *Boulder, Colorado.: Leave No Trace*.

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.

McGivney, A. (2003). *Leave no trace: A guide to the new wilderness ethic* (2nd ed.). Seattle, WA: Mountaineers Books.

Merriam Webster - (2017). Retrieved from www.merriam-webster.com

Mojogear - A Brief History of Rock Climbing (2017). Retrieved from www.mojagear.com

Monz, C.A. (2009). Climbers' attitudes toward recreation resource impacts in the Adirondack Park's Giant Mountain Wilderness. *International Journal of Wilderness, 15*(1), 26-33.

Morley, L., Chase, M. R., Day, R. W., & Lawhon, B. (2008). Conviction of the heart: Implementing Leave-No-Trace principles in outdoor recreation. *Journal of Physical Education, Recreation & Dance, 79*(7), 29-34.

Mountain Project - Poop: Waste Dsiposal Strategies (2017). Retrieved from https://www.mountainproject.com/v/poop-waste-disposal-strategies/108819255

Newman, P., Manning, R., Bacon, J., Graefe, A., & Kyle, G. (2003). An evaluation of Appalachian Trail hikers' knowledge of minimum impact skills and practices. *International Journal of Wilderness*, *9*(2), 34-38.

Outdoor Industry Association (2017). Retrieved from https://outdoorindustry.org/wp-content/uploads/2017/05/2017-Outdoor-Recreation-Participation-Report_FINAL.pdf

Outdoor Industry Association (2012). Retrieved from https://outdoorindustry.org/pdf/2012-OIA-Annual-Report-med-res.pdf

Park, L. O., Manning, R. E., Marion, J. L., Lawson, S. R., & Jacobi, C. (2008). Managing Visitor Impacts in Parks: A Multi-Method Study of the Effectiveness of Alternative Management Practices. *Journal of Park & Recreation Administration*, *26*(1).

Potito, A. P., & Beatty, S. W. (2005). Impacts of recreation trails on exotic and ruderal species distribution in grassland areas along the Colorado Front Range. *Environmental Management*, *36*(2), 230-236.

Powell, R.B., Wright, B.A., & Vagias, W.M. (2008). Preliminary evaluation of recreational skills and ethics training programs occurring on public lands: The Leave No Trace visitor education program. Technical Report, Clemson, SC: Clemson University and U.S. National Park Service.

Red River Climbing (2017). Retrieved from http://www.redriverclimbing.com/RRCGuide/?type=advanced_search

Reid, S. E., & Marion, J. L. (2005). A comparison of campfire impacts and policies in seven protected areas. *Environmental Management*, *36*(1), 48-58.

Roper, S. (2013). *Camp 4: Recollections of a Yosemite rockclimber*. Seattle, WA: The Mountaineers Books.

Siderelis, C., & Attarian, A. (2004). Trip response modeling of rock climbers' reactions to proposed regulations. *Journal of Leisure Research*, 36(1), 73-88.

Sims, C., & Hodges, D. G. (2004). Use, Demographics, and Economic Impacts of Rock Climbing in the Obed Wild and Scenic River Area.

Sims, C. B., Hodges, D. G., & Scruggs, D. (2004). Linking outdoor recreation and economic development: a feasibility assessment of the Obed Wild and Scenic River, Tennessee.

Schneider, I. E. (2000). Revisiting and revising recreation conflict research. *Journal of Leisure Research, 32*(1), 129.

Schuster, R. M., Thompson, J. G., & Hammitt, W. E. (2001). Rock climbers' attitudes toward management of climbing and the use of bolts. *Environmental Management, 28*(3), 403-412.

Schwartz, F., Taff, B. D., Pettebone, D., & Lawhon, B. (2016). Boulderers' attitudes and perceptions of Leave No Trace in Rocky Mountain National Park. *International Journal of Wilderness, 22*(3), 25-32.

Sharp, R., Maples, J.N., & Gerlaugh, K. (Under Review). "Impacts of Leave No Trace perceptions on conservation behaviors of rock climbers."Submitted to *Journal of Outdoor Recreation and Tourism* on February 19, 2016.

Sheel, A. W. (2004). Physiology of sport rock climbing. *British journal of sports medicine, 38*(3), 355-359.

Stern, M. J., Powell, R. B., & Ardoin, N. M. (2008). What difference does it make? Assessing outcomes from participation in a residential environmental education program. *The Journal of Environmental Education*, *39*(4), 31-43.

Stuessy, T.L., Harding, J., & Anderson, J. (2009). Environmental ethics of rock climbers in the Adirondacks: A quantitative approach. *Journal of Outdoor Recreation, Education and Leadership, 1*(1).

Survey System - Creative Research Systems (2016). Retrieved from http://www.surveysystem.com/sscalc.htm

Taff, B. D., Newman, P., Vagias, W. M., & Lawhon, B. (2014). Comparing day-users' and overnight visitors' attitudes concerning leave no trace. *Journal of Outdoor Recreation, Education, and Leadership, 6*(2), 133-146.

Tarrant, M. A., & Green, G. T. (1999). Outdoor recreation and the predictive validity of environmental attitudes. *Leisure Sciences*, *21*(1), 17-30.

Tessler, M., & Clark, T. A. (2016). The impact of bouldering on rock-associated vegetation. *Biological Conservation*, *204*, 426-433.

Trail Space Outdoor Gear Reviews (2017). Retrieved from http://www.trailspace.com/articles/backcountry-waste-disposal.html

Turner, J. M. (2002). From Woodcraft to 'Leave No Trace': Wilderness, consumerism, and environmentalism in twentieth-century America. *Environmental History*, *7*(3), 462-484.

Vagias, W. M., Powell, R. B., Moore, D. D., & Wright, B. A. (2014). Predicting behavioral intentions to comply with recommended leave no trace practices. *Leisure Sciences*, *36*(5), 439-457.

Vagias, W.M., Powell, R.B., Moore, D.D., & Wright, B.A. (2012). Development, psychometric qualities, and cross-validation of the Leave No Trace attitudinal inventory and measure (LNT AIM). *Journal of Leisure Research, 44*(2), 234-256.

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.

Wimpey, J. F., & Marion, J. L. (2010). The influence of use, environmental and managerial factors on the width of recreational trails. *Journal of Environmental Management, 91*(10), 2028-2037.

Wood, M. (2016). On norms and their transgression in serious leisure: Two case studies from rock climbing. *Culture and Organization, 22*(3), 1-31.

APPENDIX A:

Survey Questions

First, we would like to know about you and your time spent in the Red River Gorge.

1. Do you self-identify as being a rock climber? OYes ONo

2. On your current visit, how many days will you spend in the Red River Gorge? _____ days this visit

3. In a typical year, how many days do you spend visiting the Red River Gorge? _____ days per year

4. What is your home zip code? (If you are not a US resident, please list your home country) _____

Next, we would like to know more about your expenditures while here in the Red River Gorge.

5. Please tell us how much you will spend on the following categories on this trip inside and outside the Red River Gorge. Please be as precise as possible, as this data will be helpful to RRGCC and Access Fund.

	Amount spent *inside* the RRG area	Amount spent *outside* RRG but in Kentucky
Lodging		
Food and drinks at restaurants		
Food and drinks purchased at gas stations		
Food and drinks purchased at grocery stores		
Vehicle costs (such as gasoline, oil, and parking)		
Rental car expenses		
Climbing gear purchases		
Retail purchases other than food and gear		
Entertainment		
Climbing guide services		
Personal services (such as showers and laundry)		

6. *Counting yourself*, how many persons will you be paying for on this trip? _____ persons, including myself

7. Please tell us on a scale of one to ten (one being little interest, ten being highly interested) your enthusiasm for the possibility of the following future developments in the Red River Gorge area.

	Little interest									Highly interested
Locally-owned restaurants	1	2	3	4	5	6	7	8	9	10
National chain restaurants	1	2	3	4	5	6	7	8	9	10
Live music	1	2	3	4	5	6	7	8	9	10
Outdoor festivals	1	2	3	4	5	6	7	8	9	10
Liquor stores	1	2	3	4	5	6	7	8	9	10
Liquor by the drink	1	2	3	4	5	6	7	8	9	10
Plays or dinner theaters	1	2	3	4	5	6	7	8	9	10
Retail shops	1	2	3	4	5	6	7	8	9	10
Natural foods grocer	1	2	3	4	5	6	7	8	9	10
National chain grocer	1	2	3	4	5	6	7	8	9	10
Other (write in below) _____	1	2	3	4	5	6	7	8	9	10

Please turn to the next page.

Next, we would like to know more about your environmental knowledge, feelings, and actions.

8. First, are you a member of any conservation organizations? OYes ONo O I'm not sure.

9. Please tell us if you strongly agree, agree, are neutral, disagree, or strongly disagree with the following statements based on your most recent visit to the Red River Gorge.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I discarded biodegradable waste (like apple cores) in the backcountry.					
I cut corners on trail switchbacks.					
I kept something I found in the backcountry, such as a feather or a rock.					
I walked off the trail to avoid wet or muddy spots.					

10. Let's pretend that you are on a backcountry hike. Please tell us if you find the behaviors below very appropriate, appropriate, neutral, inappropriate, or very inappropriate on this pretend backcountry hike.

	Very Appropriate	Appropriate	Neutral	Inappropriate	Very Inappropriate
Camping along the edge of a stream or lake					
Moving rocks from where I plan to place my tent					
Keeping a single small item like a rock or a feather as a souvenir					
Cooking over a fire in the backcountry					
When camping in heavily used areas, placing the tent in an undisturbed spot					
Using soap in streams as long as there are currents to help dilute the suds					
Building a fire ring if one is not present					

11. Now, please tell us if you strongly agree, agree, are neutral, disagree, or strongly disagree with the following statements. Please note that LNT stands for *Leave No Trace*.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
It is important to use minimum impact/LNT techniques when in the backcountry.					
If I learned my actions in the backcountry damaged the environment, I would change my behaviors.					
I get upset when I see others not following minimum impact/LNT practices in the backcountry.					
I insist that minimum impact/LNT practices are followed by all members of my group.					

Please turn to the next page.

Finally, we'd like to know more about you.

12. What is your sex? ○Female ○Male ○Other Sex ○Do Not Record

13. What is your age? _____

14. What is your race? ○Asian ○Black/African American ○White
○Some Other Race ○Do Not Record

15. Are you Hispanic or Latino? ○Hispanic or Latino ○Not Hispanic or Latino ○Do not record

16. Which category best describes your current highest educational level?
○Less than high school degree or GED equivalent ○Completed high school or GED, no college
○Completed some college, but no degree ○Completed two-year Associate/technical degree
○Completed Bachelor's degree ○Completed Master's degree
○Completed Doctorate or terminal degree ○Other (write in answer) _____

17. Which category best describes your current annual income before taxes?
○$0-$19,999 ○$20,000-$29,999 ○$30,000-$39,999 ○$40,000-$49,999
○$50,000-$74,999 ○$75,000-$99,999 ○ Greater than $99,999 ○ Do not record

18. In your own words, what is your job or profession? _____

19. Which of the following statements describe your relationship with the Red River Gorge Climbers' Coalition (RRGCC)? You may mark all that apply.

○I donate money to the RRGCC via recurring PayPal donation.
○I donate money to the RRGCC via Access Fund Joint Membership.
○I donate money to the RRGCC via a one-time donation (once or more in a year).
○I donate money to the RRGCC via other means.
○I do not donate money to the RRGCC.

20. Are you presently a member of the Access Fund? ○Yes ○No ○ I'm not sure

21. Is there anything else you would like to tell us about your experiences in the Red River Gorge? If so, please write them in the box below. We appreciate your thoughts.

If you would like to receive information on the final results of this study, please write your email address in the line to the right. If not, you may leave it blank. _____@_____._____

Thank you for participating in this survey. Please return your completed survey to the data collection agent and have a nice day visiting the Red River Gorge.

APPENDIX B:

IRB Approval

EASTERN KENTUCKY UNIVERSITY
Serving Kentuckians Since 1906

Graduate Education and Research
Division of Sponsored Programs
Institutional Review Board

Jones 414, Coates CPO 20
521 Lancaster Avenue
Richmond, Kentucky 40475-3102
(859) 622-3636; Fax (859) 622-6610
http://www.sponsoredprograms.eku.edu

NOTICE OF IRB EXEMPTION STATUS
REVISION to Protocol Number: 15-083
Institutional Review Board IRB00002836, DHHS FWA00003332

Principal Investigator:	**Dr. James Nathanial Maples**
Project Title:	**The Economic, Environmental, Tourism, and Demographic Impact of the Red River Gorge's Rock Climbing Community for Estill, Lee, and Powell Counties, Kentucky**
Revision Approval Date:	**4/26/15**
Approved by:	**Dr. Sarah Morris, IRB Member**

This document confirms that the Institutional Review Board (IRB) has granted exempt status for the above referenced research project as outlined in the application submitted for IRB review with an immediate effective date. Exempt status means that your research is exempt from further review for a period of three years from the original notification date if no changes are made to the original protocol. If you plan to continue the project beyond three years, you are required to reapply for exemption.

Principal Investigator Responsibilities: It is the responsibility of the principal investigator to ensure that all investigators and staff associated with this study meet the training requirements for conducting research involving human subjects and follow the approved protocol.

Adverse Events: Any adverse or unexpected events that occur in conjunction with this study must be reported to the IRB within ten calendar days of the occurrence.

Changes to Approved Research Protocol: If changes to the approved research protocol become necessary, a description of those changes must be submitted for IRB review and approval prior to implementation. If the changes result in a change in your project's exempt status, you will be required to submit an application for expedited or full IRB review. Changes include, but are not limited to, those involving study personnel, subjects, and procedures.

Other Provisions of Approval, if applicable: None

Please contact Sponsored Programs at 859-622-3636 or send email to tiffany.hamblin@eku.edu or lisa.royalty@eku.edu with questions.

VITA

Brian G. Clark

Candidate for the Degree of Doctor of Education

Dissertation: BEHAVIORS, KNOWLEDGE, AND EDUCATION OF LEAVE NO TRACE PRINCIPLES IN THE RED RIVER GORGE ROCK CLIMBING COMMUNITY

Education

Eastern Kentucky University (2017)
Doctor of Education (Ed.D.) Educational Leadership and Policy Studies

Eastern Kentucky University (2011)
Master of Science in Recreation and Park Administration

Eastern Kentucky University (2005)
Bachelor of Science in Outdoor Recreation and Natural Resources

Research Interests

Outdoor recreation behavior and management

Visitor-use management of parks and protected areas

Environmental impacts of outdoor recreation

Leave No Trace practices

Professional/Academic Experience

Eastern Kentucky University (2015 – present)

Assistant Professor – Department of Recreation and Park Administration

- REC 102 Introduction to Recreation leadership (2015 – present)
- REC 180 Outdoor Adventure Activities (2013 – 2015) *Designed this class
- REC 290 Adventure Programming (Spring 2014 – present)
- REC 350 Supervision of Recreation Personnel (2015 – present)
- REC 401 Management of Recreation Services (Spring Semesters)
- REC 406 Planning, Design, and Maintenance of Recreation Facilities (2015 – present)
- REC 409 Independent Study (Summer 2016 – Summer 2017)
- REC 530/730 Park Management (Summer 2015 – Present)

- REC 463 Senior Practicum (Spring 2017)
- REC 590/790 Special Topics: Teaching in the Outdoors (Summer 2017)

Eastern Kentucky University (2008 – 2015)

Adjunct/Part-Time Faculty – Recreation and Park Administration

- REC 180 Outdoor Adventure Activities (2013 – 2015) *Designed this class
- REC 190 Introduction to Challenge Course Management (2009 – 2011, Spring 2014)
- REC 590-790/EMS 864s Teaching in the Outdoors (2009, 2011, 2013)

Lecturer – Guest Lecturer/Speaker in Various Departments (2008 – present)

- REC 101 Leisure Services Careers
- PHE 415 Outdoor Education and Lifelong Motor Skills
- WLD 586/786 Wetland Wildlife Management

Eastern Kentucky University (2007 – 2015)

Assistant Director of Campus Recreation – Adventure Programs

- Supervised and managed the Fitness & Wellness Center climbing wall, challenge course and our satellite outdoor adventure center/equipment rental facility
- Directly Supervise student employees and one Professional staff employee
- Handled all outdoor equipment purchases, installation, and maintenance
- Manage annual budget and allocate funding for various programming and areas
- Develop all manuals pertaining to risk management, staff policies and procedures
- Conduct training of CSI Facility Management Operating system to student workers
- Responsible for the updating and maintenance of website and social media marketing
- Handled the outdoor adventure center/equipment rental facility renovation (Adventure Programs Base Camp)
- Developed the RECycle bike fleet program, which included the research and purchase of 47 bikes (31 commuter bikes and 16 mountain bikes) and supervision of all maintenance and upkeep
- Instrumental in acquisition of the EKU challenge course and creating the new coordinator position, including the bid proposal, selection of company and oversight of the renovation and rebuilding of the new course
- Collaborate with academic departments and other student development areas on campus to implement curriculum and opportunities for the students to gain skills in the following areas: environmental education, leadership, team building, natural resource and land management
- Assist in the planning and implementation of both university and departmental strategic plan
- Involvement in re-accreditation process of the Department of Recreation and Park Administration

- Participating in collaborative efforts with the offices of Student Life, First Year Programs, Housing, Exercise Science, Health Education, Biology Department and Disabilities office
- Certified over 30 students as Leave No Trace Trainers since completion of master educator course in 2013
- Created and implemented all motor vehicle training and risk management procedures for Campus Recreation vehicle fleet: one 12-passenger van, one truck with towing capabilities, and one canoe trailer
- Provided annual wilderness medical courses to university community, including Wilderness First Responder, Wilderness First Aid, and Wilderness First Responder Re-certification

Certifications

- **American Mountain Guide Association**
  - Certified Single Pitch Instructor (2008 - present)

- **Wilderness Medicine Institute - National Outdoor Leadership School**
  - Wilderness First Responder (2004 - present)

- **Leave No Trace Master Educator**
  - Ability to teach Leave No Trace Trainer courses and certify participants

- **Graduate of NOLS Pacific Northwest Outdoor Educator**
  - Mountaineering Course - backcountry backpacking, single-pitch & multi-pitch rock climbing, group dynamics, land navigation, backcountry travel and emergency management techniques

- **Adaptive and Therapeutic Technical Climbing/Ropes Systems Facilitator**
  - No Limits - Mark Wellman instructional clinic and adaptive climbing equipment technical systems

- **Recreational Tree Climbing Facilitator**
  - Tree Climbing USA - 3-day instructional class on climbing/arborist techniques and technical systems. Including single rope technique, double rope technique and emergency response

- **Challenge Course Facilitator Trainer**
  - Challenge Design Innovations, Phoenix Experiential Designs. Including high and low ropes facilitation. Specific areas: Aerial Teams Course, Tango Tower, Zip Line, and low ropes.

- **Project Water Education for Teachers (WET) Facilitator**
  - Certified to hold environmental education curriculum workshops

- **Project WILD Facilitator**
  - Wildlife-focused conservation education program for K-12 educators

- **Project Aquatic WILD Facilitator**
    - Project WILD format with an emphasis on aquatic wildlife and aquatic ecology

- **Project Learning Tree Facilitator**
    - Environmental education program designed for teachers and other educators

Professional Involvement

- National Outdoor Leadership School (NOLS) Alumni Representative (2004-present)
- Kentucky Mountain Bike Association (KYMBA) Madison County representative (2011)
- Assisted Kentucky Executive Director Office of Adventure Tourism in Marketing efforts and database collection (2011-2013)
- Association of Outdoor Recreation and Education Access and Permitting committee member (2011)

Professional Development

- Attended 2-day Metacognition workshop and presentation by Dr. Saundra McGuire hosted by EKU's Noel Studio for Academic Creativity (2015)
- Attended the Provost's Professional Development Speaker Series as part of scholarship week 2016. "Real-time Student Assessment" by Dr. Maki.
- Attended Emergencies 101 training with Gary Folckemer
- Attended Suicide Prevention Training
- Attended Crowd Management Training with Gary Folckemer

Professional Presentations and Publications

**Denotes Student*

Maples, James N., Brian G. Clark, Ryan Sharp, and Katherine Gerlaugh. 2016.

"Economic Impact of Rocktoberfest 2015". Submitted to Red River Gorge

Climbers' Coalition on June 1, 2016.

Maples, James N., Braylon Gillespie*, Katherine Gerlaugh, Brian Clark, and Ryan Sharp.

2016. "Climbing Out of Regional Poverty: The Economic Impact of Rock

Climbing in the Red River Gorge, KY." To be presented at the Southern

Sociological Society Annual Meeting, April 14, 2016: Atlanta, GA.

Maples, J. N., Sharp, R. L., Clark, B. G., Gerlaugh, K., & Gillespie, B. (2017). Climbing out of Poverty: The Economic Impact of Rock Climbing in and around Eastern Kentucky's Red River Gorge. *Journal of Appalachian Studies*, *23*(1), 53-71.

Staley, L.*, & Clark, B.G., (2017). Trail Building – It takes a collaborative effort. *Kentucky Recreation and Parks Society Quarterly*, Summer 2017.

Brandon, J.*, & Clark, B.G., (2017). Obstacle Course Racing – A call to the bluegrass state. *Kentucky Recreation and Parks Society Quarterly*, Summer 2017.

Invited Speaker:

Maples, James N., Brian G. Clark, Ryan L. Sharp, Braylon Gillespie*, and Katherine Gerlaugh. "Economic Impact of Rock Climbing in the Red River Gorge, KY." Invited presentation at Lee County Tourism Commission Annual Appreciation Dinner. Beattyville, KY: April 1, 2016.

Gillespie, Braylon*, Maples, James N., Brian G. Clark, Ryan L. Sharp, and Katherine Gerlaugh. "Economic Impact of Rock Climbing in the Red River Gorge, KY." Invited presentation at University of Kentucky Sociology Mock Presentations. Lexington, KY: April 1, 2016.

Maples, J.N., Gillespie, B., Gerlaugh*, K., Clark, B. & Sharp, R.L. (2016 - accepted). Climbing out of regional poverty: The economic impact of rock climbing in the Red River Gorge, KY. *Southern Sociological Society Annual Meeting.* Atlanta, GA. April 13-16.

Brian Clark (2015). Recreational tree climbing. *2015 Kentucky Recreational and Park Society Annual Conference.* Lexington, KY. November 18-20.

Michelle Gerken, Brian Clark (2015). PTSD, team building, and the importance of the outdoors. *2015 Kentucky Recreational and Park Society Annual Conference.* Lexington, KY. November 18-20.

Chris Cantrell*, Brian Clark & Ryan Sharp (2015). Understanding motivations for college student participation in campus based adventure programming. *2015 Southeastern Recreation Research Conference*. Asheville, North Carolina.

Mark Howard & Brian Clark (2014). Outdoor trip leader payment administration methods & myths. *2014 National Intramural-Recreational Sports Association Conference.* Nashville, Tennessee.

Brian Clark & Mark Howard (2012). Trip Leaders: Do you pay them?! *2012 Association of Outdoor Recreation and Education Conference.* Salt Lake City, Utah.

Brian Clark (2011). Adventure Programming: Re-visiting the importance of outdoor recreation through the eye of Eastern Kentucky University's Adventure Programs. *2011 Kentucky Association for Health, Physical Education, Recreation & Dance conference.* Lexington, Kentucky.

Brian Clark (2016). L'Escalade Fitness Climbing Gym in Lexington, KY Leave No Trace Awareness Workshop to rock climbing community.

Technical Reports
**Denotes Student*

Eggett, K., Maples, J.N., Bradley, M.J., Clark, B.G., & McSpirit, S. "Maywoods 5K Trail Run and Walk: Participant Summary." Submitted to Eastern Kentucky University's Division of Natural Areas on June 2, 2016.

Maples, J.N., Gerlaugh, K., Sharp, R.L., Clark, B., Wickline, T., Gillespie, B., Crump, M. & Krasnopolsky, L. (2015). Preliminary summary of selected data from the Red River Gorge Rock Climbing Economic Impact Study. Report submitted to the Red River Gorge Climbers' Coalition board of directors. Lexington, KY.

Poster Presentations
**Denotes Student*

Gammon, A.*, Clark, B.G. (2017) Getting Lost: Do Vacation Days Matter? *2017 3rd Annual College of Health Sciences Scholars Day.* Richmond, KY. April 18, 2017.

Jones, B.*, Clark, B.G. (2017) Obstacle Course Racing, Trend or Here to Stay? *2017 3rd Annual College of Health Sciences Scholars Day.* Richmond, KY. April 18, 2017.

Dees, E.*, Clark, B.G. (2017) Childhood Obesity - America's Silent Killer. *2017 3rd Annual College of Health Sciences Scholars Day.* Richmond, KY. April 18, 2017.

Smith, S.*, Clark, B.G. (2017) How Technology is Depriving Youth of The Outdoors. *2017 3rd Annual College of Health Sciences Scholars Day.* Richmond, KY. April 18, 2017.

White, E.*, Clark, B.G. (2017) Benefits of Yoga and Meditation Practice. *2017 3rd Annual College of Health Sciences Scholars Day.* Richmond, KY. April 18, 2017.

Preston, D.*, Clark, B.G. (2017) Benefits of Campus Recreation on College Students. *2017 3rd Annual College of Health Sciences Scholars Day.* Richmond, KY. April 18, 2017.

Hammel, J.*, Clark, B.G. (2017) The Importance of Leave No Trace Ethics in Public Lands. *2017 3rd Annual College of Health Sciences Scholars Day.* Richmond, KY. April 18, 2017.

Wells, N.*, Clark, B.G. (2016) Participation in After-School Programs. *2016 Kentucky Recreation and Park Society Conference.* Hopkinsville, KY. November 16, 2016.

Williams, K.*, Clark, B.G. (2016) Rock Climbing and the Environment: Are Leave No Trace Principles Practiced in the Climbing Community? *2016 Kentucky Recreation and Park Society Conference.* Hopkinsville, KY. November 16, 2016.

Harmon, A.*, Clark, B.G. (2016) The Positive Social Outcomes of Camps for Children who come from Abusive Homes. *2016 Kentucky Recreation and Park Society Conference.* Hopkinsville, KY. November 16, 2016.

Sims, S.*, & Clark, B.G. (2016). Does the Knowledge of Leave No Trace Impact Visitor Behaviors in the Parks? *2016 College of Health Sciences Scholars Day.* Richmond, KY. April 19, 2016.

Parr, L.*, & Clark, B.G. (2016). Economic Impacts of Rock Climbing on Areas Surrounding the Red River Gorge, KY. *2016 College of Health Sciences Scholars Day.* Richmond, KY. April 19, 2016.

Greer, A.R.*, & Clark, B.G. (2016). How can Kentucky Adventure Tourism be more involved in the Outdoor Industry Boom? *2016 College of Health Sciences Scholars Day.* Richmond, KY. April 19, 2016.

Buehler, A.*, Driver, H.*, & Clark, B. (2015). Getting students outside: The importance of getting students out of the classroom. *2015 Kentucky Recreational and Park Society Annual Conference.* Lexington, KY. November 18-20.

Zickel, M.* & Clark, B. (2015). Kentucky adventure tourism: What can we do to increase marketing efforts? *2015 Kentucky Recreational and Park Society Annual Conference.* Lexington, KY. November 18-20. (Awarded Runner-up for Best Poster)

Morrison, Z.* & Clark, B. (2015). Leave no trace: Does knowledge change behavior? *2015 Kentucky Recreational and Park Society Annual Conference.* Lexington, KY. November 18-20.

Morton, J.* & Clark B. (2015). Motivations and outcomes of people choosing to participate in adventure based outings. *2015 Kentucky Recreational and Park Society Annual Conference.* Lexington, KY. November 18-20.

Lynch, A.*, Hogan, K.*, & Clark, B. (2014). *Does adventure fit you?* 2014 National Collegiate Honors Council Conference. Denver, Colorado. November 5-9.

Funded Grants/Contracts

Primary Investigators:	Michael Bradley, William Bennett, & Brian Clark
Year(s):	2013
Amount:	$5,000.00
Funding Agency:	Bluegrass Greensource, Inc.
Project Title:	Connecting today's digital learners with nature
Status:	Complete

Primary Investigators:	Michael Bradley & Brian Clark
Year(s):	2016 - 2017
Amount:	$7,396.36
Funding Agency:	United States Forest Service
Project Title:	National Visitor Use Monitoring
Status:	Complete

Primary Investigators:	Michael Bradley & Brian Clark
Year(s):	2017 - 2018
Amount:	$27,819.19
Funding Agency:	United States Forest Service
Project Title:	National Visitor Use Monitoring
Status:	Complete

Primary Investigators:	Michael Bradley & Brian Clark
Year(s):	2017 - 2018
Amount:	$116,509.66
Funding Agency:	United States Forest Service
Project Title:	National Visitor Use Monitoring
Status:	Complete

Grant/Contracts in Review

Primary Investigators:	Brian Clark & Melissa Newman
Year(s):	2016 - 2017
Amount:	$2,580,969.00
Funding Agency:	Appalachian Regional Commission
Project Title:	Adventure Tourism & Recreation Education Center
Status:	Under Review

Primary Investigators:	James Maples, Brian Clark, & Neil Kasiak
Year(s):	2016 - 2017
Amount:	$4,454.38
Funding Agency:	Kentucky Oral History Commission
Project Title:	"Endless Red Sandstone, Sweet Pockets, and Gentle Overhangs: An Oral History of Kentucky's Vibrant Rock Climbing Community in the Red River Gorge."
Status:	Complete

Primary Investigators:	James Maples, Ryan Sharp, & Brian Clark
Year(s):	2014 - 2015
Amount:	$15,000
Funding Agency:	The Access Fund
Project Title:	Understanding the economic and environmental impact of rock climbers in the Red River Gorge area of the Daniel Boone National Forest
Status:	Complete

Conferences & Associations

- Kentucky Recreation and Parks Society (2004, 2015 - present)
- Association of Outdoor Recreation and Education (2007 - present)
- Kentucky Association for Health, Physical Education, Recreation & Dance (2011)
- National Intramural-Recreational Sports Association (2007- 2015)
- Red River Gorge Climbers Coalition (2000 - present)
- Kentucky Mountain Bike Association (2011 - 2014)
- American Mountain Guide Association (2007 - present)
- Leave No Trace (2007 - present)
- The Access Fund (2015 - present)

University/Community Committees

- EKU Faculty Senate (2017 - Present)
- EKU College of Health Sciences Recruitment Committee (2015 - Present)
- EKU Division of Natural Areas Advisory Board (2009 - Present)
- EKU Recreation and Park Administration Practitioner Advisory Board (2010-2015)
- EKU Division of Natural Areas Lilley Cornett Woods field station committee
- City of Richmond Pedestrian Master Plan Committee
- University Housing Living Learning Community Investor - Outdoor Pursuits (2007-present)
- Academic Engagement/Service Learning Task Force Committee Member

Related Experience

Phillip Galls Outdoor and Ski (June 2005-May 2007)

Camping and Climbing Buyer/Receiving Manager

Eastern Kentucky University (September 2004-May 2005)

Adventure Programs Intern

Activities / Volunteerism

- Athletic Scholarship Glenville State College Football (1996-1997)
- Completed Ironman Louisville (2010)
- University mentor for EKU Obstacle Course Racing team in Battlefrog College Championship airing on ESPN
- Upward Bound Basketball Coach (2013-2014)
- Richmond Little League Coach (2017)