What are people doing in our parks?

Understanding, comparing, and predicting the low-impact camping practices of Canadian Provincial Park over-night visitors

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Abstract

Canadian provincial parks attract millions of visitors every year; and while these visitors come to parks to enjoy their natural beauty, experience cultural and natural heritage, and participate in outdoor recreation they are also simultaneously having a negative impact on the park ecosystems. Damage is being done to soil, vegetation, animals, waterways, and more. There is not much of our Canadian park system that is not affected by human interactions. However, there are strategies in place to help mitigate these negative effects, and management approaches which help to educate park visitors on how to reduce their impact. Such strategies include visitor education programs like Leave No Trace [LNT]. LNT is a widely accepted educational program that seeks to reduce environmentally depreciative behaviours and promote responsible outdoor recreation through low-impact camping practices.

The purpose of this thesis was to investigate how LNT was understood and engaged by Canadian provincial parks users. The aim was to investigate which factors best predicted engagement in LNT as well investigate park users (front country vs. backcountry) engagement in LNT practices. In addition this thesis explored the LNT practices and environmental world views of park users in two geographically distinct provincial parks to determine if there was a difference between visitors to these different parks.

The two parks examined were Algonquin Provincial Park (APP) in Ontario and Peter Lougheed Provincial Park (PLPP) in Alberta. These parks are culturally comparable, have high visitation numbers, offer similar front country and back country camping opportunities, and provide a broad representation of visitors to provincial parks in Canada. Data was collected using a survey questionnaire administered on Android tablets and paper. Surveys were collected at trail

heads, campsites, permit offices, and visitor information centres. This resulted in 456 respondents, 229 visitors in Alberta and 227 in Ontario.

The first study examined the LNT knowledge and environmental world views of overnight park visitors and compared front country and back country users as well as APP and PLPP visitors. T-tests were employed to determine if there were statistical differences ($p<.05$) between the visitor groups with regard to self-reported LNT knowledge, actual LNT knowledge, and environmental world views. Results suggested statistical differences between front country and back country overnight visitors, as well as between Alberta and Ontario park visitors. It was back country overnight visitors who reported higher levels of LNT knowledge; however, it was those who camped in the front country who scored higher on actual measures of LNT awareness. Additionally, those who camped in the Alberta park reported higher levels of LNT knowledge and a more pro-environmental worldview but there was no statistical difference between the environmental world views of back country and front country overnight visitors.

The second study examined factors explaining park visitors' intention to engage in LNT practices while camping. Factors included: perceived behavioural control, subjective norms, attitudes, environmental values, environmental worldview, awareness of consequences, ascribed responsibility, personal norms, and knowledge of LNT. Guided by value beliefs norm theory and the theory of planned behavior, structural equation modeling was used to determine what the best predictors of LNT intentions were. Two separate models were tested (TPB and VBN) and both models were found to have good fit with the data and able to explain more than half of the variance in LNT intentions. Results further suggest that all factors with the exception of attitudes are significant predictors of LNT intentions.

Preface

This thesis is an original work by Clara-Jane Blye. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, Project Name "Do Canadian Park Users Leave No Trace? Examining Pro-Environmental Camping Practices in Canadian Provincial Parks," No. Pro00056613, 04/27/2014.

This thesis is formatted in two publishable papers, found as chapters two and three. The work of these two papers was led by Clara-Jane Blye as the lead author and I was responsible for all data collection. However, Dr. Elizabeth Halpenny, Dr. Howard Harshaw, and Dr. Farhad Moghimehfar were all contributors to the theories, data analysis, and conceptualization of ideas. Both papers will be submitted to peer reviewed journals. Financial support for this thesis was provided by The Social Science Research Council of Canada, The Queen Elizabeth II scholarship, and the Government of Alberta, Ministry of Environment and Parks.

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Chapter 1: Introduction and Overview

There is a presumption that those who experience and participate in outdoor recreation also share environmental ethics and understanding of the natural environment. However, not only is there ecological evidence to suggest otherwise but there is a lack of socio-cultural research to verify this claim. The goal of this research was to understand and compare the low-impact camping practices of overnight park visitors in two geographically distinct but culturally comparable Canadian provincial parks. Additionally, the use of prominent social-psychological theories, the Theory of Planned Behaviour [TPB] and the Values Beliefs Norms Theory [VBN] were employed to further understand pro-environmental behaviours of park visitors and to determine what best predicts intention to engage in low-impact camping practices.

Both Alberta and Ontario provincial park policies have a dual mandate of protecting provincially significant natural and cultural heritage resources while simultaneously providing sustainable recreation services to current and future generations of park users (Ontario Ministry of Natural Resources, 2011; Alberta Parks, 2009; Marion & Ried, 2007). Millions of people visit Canadian provincial parks annually. High visitation rates are linked to increased negative environmental impacts on these parks, including habitat loss and resource degradation (Hammitt, Cole, & Monz, 2015). Hiking and camping on designated trails and campsites allows already impacted surfaces to absorb visitor use. However, when visitors venture off designated trials, hike and camp in remote areas, or simply do not use recreational areas correctly, the effects can be devastating to the natural environment and ecosystem (Cole, 2004).

Park managers must use innovative and effective management strategies in order to mitigate the environmental impacts caused by outdoor recreation. Management strategies can include both direct and indirect methods (Hammitt et al., 2015). Of those methods, education is

viewed as a useful and efficient indirect management strategy. The goal of environmental education is to change visitor's behaviours to be more environmentally sustainable. Leave No Trace [LNT] is a widely accepted educational program that aims to reduce environmentally depreciative behaviours and promote responsible outdoor recreation through low-impact camping practices (Marion & Reid, 2001). While the principles delivered by LNT were initially developed for the back country, the concepts can and are being applied to front country camping areas (areas accessible by car). I chose to focus on LNT as a measure of pro-environmental behaviours as it has been widely used in Canadian parks and by partner organizations. In addition, one of the parks this research focused on has a formal partnership with LNT Canada and provides education and messaging throughout the park with the use of LNT logos, wording, images etc.

The two parks chosen, Algonquin Provincial Park in Ontario and Peter Lougheed Provincial Park in Alberta, are culturally comparable, offer similar back-country and front-country camping opportunities, and provide a broad representation of visitors to provincial parks in Canada. Algonquin Provincial Park offers more education programming related to LNT, thereby enabling rich opportunities to compare information campaign impacts.

Study Setting

The two parks chosen for this study (Algonquin Provincial Park and Peter Lougheed Provincial Park), offer rich and diverse mixes of recreational opportunities including camping, day use picnic areas, hiking, biking, snow shoeing, cross country skiing, canoeing, swimming, and wildlife viewing. Both parks report the highest visitation numbers of any park in their respective province, with Peter Lougheed hosting almost 250,000 day and overnight visitors annually and Algonquin hosting over 800,000 annually (Ontario Ministry of Natural Resources, 2010; Alberta Parks, 2005) and offer similar back country and front country opportunities. In addition, both parks are located close to large urban areas (Algonquin is less than 260 km from Toronto and Peter Lougheed is 130 km from Calgary) with high populations and are visited by many returning users.

As summer represents the busiest season for both parks, data collection was conducted from June 2015- September 2015. Only those visitors who were spending at least one night overnight in the respective park were asked to complete the questionnaire. Visitors were approached at trail heads, permit offices, visitor's centres, campsites, and canoe launches. The data was collected through the summer with an equal representation of week days, weekend days, and holidays in both parks. The researcher spent substantial time in the field while collecting data, this provided insight into locations of park visitors, allowed for observations, and resulted in many ad hoc discussions with park staff and visitors. Back country sites were also visited in both parks with access granted from canoeing and hiking to various locations.

In total 500 people were asked to participate in the study. However due to non-response of some mail back surveys, and incomplete data the final sample size resulted in 456 individuals. Of those 456 individuals 251 agreed to participate in a follow up survey intended to measure

actual LNT behaviours. Those 251 individuals were contacted via email and asked to participate in an online survey hosted by Survey Monkey, however, only 99 individuals completed the follow up survey.

Park Management

Algonquin Provincial Park (APP) and Peter Lougheed Provincial Park (PLPP) are both guided by Master Management Plans that document the parks mandates and strategies for educating park visitors about low-impact camping. These plans also help to enforceable rules and regulations that are in line with their minimum impact ideologies.

The APP management plan states that the park's mission is "To provide protection of natural and cultural features, continuing opportunities for a diversity of low-intensity recreational, wilderness, and natural environment experiences; and within this provision continue and enhance the park's contribution to the economic, social and cultural life of the region" (Ontario Ministry of Natural Resources, 1998, p. 6).With this mission in mind the park is classified as a Natural Environment Park and has been planned, zoned, and managed in accordance with the policies for this class of park (Ontario Ministry of Natural Resources, 2006). Those polices include providing outstanding recreational landscapes with representative natural features and historical resources to provide high-quality recreational and educational experiences (Ontario Ministry of Natural Resources, 2006).

The Ontario Ministry of Natural Resources has classified Algonquin as a Natural Environment Park in recognition of its outstanding recreational environment and abundance of natural and cultural resources. Algonquin's recreational opportunities are numerous, ranging from semi-wilderness experiences such as backpacking, snowshoeing, canoeing, and camping in the backcountry of the Park to picnicking swimming, hiking, cross-country skiing, and camping

in the more developed areas (Friends of Algonquin, 2016). The wildlife in Algonquin also makes it unique as the park is home to over 1000 vascular plant species, 100 species of birds, and more than 200 vertebrates (Ontario Ministry of Natural Resources, 1998). The management of APP is further guided by the following five objectives:

1. To protect provincially significant elements of the natural and cultural landscape of Algonquin Park;
2. To provide outdoor recreation opportunities ranging from high-intensity day use to low intensity wilderness experiences;
3. To provide opportunities for exploration and appreciation of the outdoor natural and cultural heritage of Algonquin Park;
4. To provide Ontario's residents and out-of-province visitors with opportunities to discover and experience the distinctive regions of Algonquin Park; and
5. To practise sustainable resource management in Algonquin Park for the long-term health of the Park's ecosystems and to provide recreational, cultural, and economic benefits.

While the overall management goal of the park is to provide high-quality recreational and educational experiences while simultaneously protecting natural and cultural features, the park also allows for resource extraction. Within the park there are seven distinct zones which are classified as: nature reserve, wilderness, natural environment, historical, development, access, and recreation/utilization. Figure 1 highlights the land totals within the park. It is important to note that zone seven (recreation and utilization) is unique to Algonquin and allows for forestry activities.

Zone Type	Area (ha.)	% of Park area
Nature Reserve	39,250	5.1
Wilderness	90,475	11.9
Natural Environment	13,765	1.8
Historical	1,680	0.2
Development	22,545	3.0
Access	735	0.1
Recreation/Utilization	594,860	77.9
Total	763,310	100.0

Figure 1
Land use zones within Algonquin park (Ontario Ministry of Natural Resources, 1998)

In comparison, the mission statement of Peter Lougheed Provincial Park is "to maintain ecological integrity and diversity and provide opportunities for outdoor recreation, heritage appreciation, tourism or any combination of those purposes, which are dependent on and compatible with the protection of the natural values found here" (Alberta Ministry of Environment and Sustainable Resource Development [AMESRD], Peter Lougheed and Spray Valley Provincial Parks Management Plan, pp 17, 2006). The objectives which guide the management of Peter Lougheed are similar to those of Algonquin:

1. Preservation: to preserve or enhance naturally occurring ecosystems including especially rare or uncommon species and to ensure that natural ecological processes are allowed to occur.
2. Outdoor Recreation: to provide opportunities for recreational uses such as camping, hiking, mountain biking, cross-country skiing, boating, and fishing.
3. Heritage Appreciation: to provide opportunities for visitors to experience, understand and appreciate the natural resources of the parks.

4. Heritage Tourism: to provide opportunities for visitors to experience and enjoy high quality natural, cultural and scenic resources through provision of appropriate sustainable tourism facilities and services.

Similarly Peter Lougheed's management plan describes five distinct zones within the park. The zones are classified as: preservation, wildland, integrated management, natural environment, and facilities. The areas zoned as integrated management represent places where Alberta Parks has partnered with industry for such things as hydroelectric dams, which is somewhat similar to Algonquin's' utilization zone (AMESRD, 2006)

Both plans offer similar generic visitor management approaches, as neither one is particularly detailed and tailored to the specific needs of the park. The plans do provide guidance for how to reduce conflict and minimize visitor impacts such as limit party size, limiting the length of stay, trail closures, permit enforcement, and segregating types of visitor (back country, equestrian, day use etc.) (Ontario Ministry of Natural Resources, 1998; AMESRD, 2006).

Algonquin's plan does suggest that providing information (such as park policies and rules) on signs, maps, and newsletters is the key means of delivering information and the plan further includes a recommendation for park staff to personally deliver education and information to park visitors. Peter Lougheed's plan does not offer any guidance for communicating information to park visitors, nor does it mention any subject matter for what visitors might need education on. However, the APP plan does offer some detail around what management should focus their educational efforts on. For example the plan states that visitors will be educated on areas of concern such as cutting live growth, littering, and the removal of natural objects (Ontario Ministry of Natural Resources, 1998). Neither plan addresses low-impact camping practices or strategies for educating visitors, even though both plans have a strong focus on ecological

integrity. Both parks do provide some visitor education and interpretive programs as well promote low-impact of LNT camping practices. Perhaps as these plans are somewhat outdated (Ontario Ministry of Natural Resources, 1998; AMESRD, 2006) low-impact camping was not as critical when they were drafted. While the recommendations are brief and vague, Algonquin appears to have included much more information and direction for managing recreational use than Peter Lougheed.

Leave No Trace

The concept of low-impact camping was first developed in response to a surge in outdoor recreation participation during the 1960's, 70's, and 80's in the United States. It was believed that park visitors did not have malicious intent behind their depreciative behaviours, but rather a lack of knowledge and awareness of the damages being caused to wilderness areas (Marion & Reid, 2001). Leave No Trace was a program that formed out of a multitude of earlier ideas developed by U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and the National Park Service (NPS) such as: Wilderness Manners, Wilderness Ethics, Minimum Impact Camping, and No-Trace Camping (Marion & Reid, 2001). It was not until 1991 that the formal program known today as Leave No Trace was created. At that time the US Forest Service developed a partnership with the National Outdoor Leadership School (NOLS) to create a formal low-impact camping skills program to address the deteriorating natural resources and ecosystems in US National Parks (Marion & Reid, 2001). The goal of the program is to avoid or minimize negative impacts to the natural environment and to help ensure that recreationists have a positive experience while in the outdoor (Marion & Reid, 2001; Leave No Trace Canada, 2009).

NOLS was instrumental in working with the USFS to ensure the program was evidence-based and had the support of the scientific and academic community (Marion & Reid, 2001).

From the initial success of the Leave No Trace education program also came the development of wildland ethics and the experiential training aspects of the LNT program. Currently Leave No Trace Centre for Outdoor Ethics [LNTCOE] offers training at many levels including a LNT trainer and master educator course (LNTCOE, 2012).

The current LNT program has the following mission and core values:

> LNTCOE is an educational, non-profit organization dedicated to the responsible enjoyment and active stewardship of the outdoors by all people, worldwide. The Center achieves its mission through research, education, and partnerships. Some of the more relevant Core Values for the program are that the Center:

- is committed to the enjoyment, health and protection of recreational resources on natural lands for all people;
- believes that education is the best means to protect natural lands from recreational impacts while helping maintain access for recreation and enjoyment;
- is founded on outdoor ethics whereby a sense of stewardship is gained through understanding and connecting with the natural world;
- believes that practicing the Leave No Trace principles is the most relevant and effective long-term solution to maintaining the beauty, health of, and access to natural lands;
- is science-based and builds ethical, pragmatic approaches to resource protection for varying types of outdoor recreation and enjoyment;
- strives to build key partnerships that support education programs, training and communities of volunteers, educators, land managers, organizations and corporations committed to teaching and instilling the values of Leave No Trace;

The original LNT program was designed for wilderness areas or for those who camped in the back country. However, in recent years the program has been expanded to included specific guidelines for the front country and urban day-use recreation settings (Marion, Lawhon, Vagias, & Newman, 2011). It is believed that LNT has expanded from an education program and rather into a wildland ethic that goes beyond the wilderness and transcends into "everyday" life (Hutson, 2012). LNT principles are used to shape individuals' philosophies about interacting with nature and develop pro-environmental behaviours. The current LNT principles are: plan ahead and prepare; travel and camp on durable surfaces; dispose of waste properly; minimize campfire impacts, leave what you find; be considerate of other visitors; and, respect wildlife (Leave No Trace Canada, 2009b). All education materials are managed by the Leave No Trace Centre for Outdoor Ethics and Leave No Trace Canada.

The success of LNT is due largely in part to the many parks and protected area partners the organization has established. The program is used all across the United States in federal, state, and municipal parks as well as taught in public and private schools (as well as colleges and universities). The same is true around the world and for Canada; however, we do not have as many formal relationships with LNT Canada as are currently in place in the USA. LNT messaging can be seen at trail heads, printed in maps, and is delivered by park staff throughout parks. In Canada the first formal relationship with a provincial park was in 2011 with Algonquin Provincial Park in Ontario, however, LNT has been spreading their message through schools and partner campaigns for many years.

There has been a substantial amount of research surrounding LNT and park visitors' understanding, awareness of and attitudes towards the principles. LNT is commonly used as a tool to assess pro-environmental behaviours (Jones & Bruyere, 2004; Lawhon et al., 2013; Poff

et al., 2013; Taff, Newman, Bright, & Vagias, 2011). While pro-environmental behaviours are much more far reaching than individuals' actions on trails and in recreational areas, LNT can provide insight into park and protected area visitors' environmental ethics (Poff et al., 2013). Environmental ethics are considered a philosophy that studies the moral relationship between human beings and the environment and its nonhuman living contents. The moral relationship between an individual and the natural environment can be guided by rules or codes of conduct such as LNT (Martin, Cashel, Wagstaff, & Breunig, 2006).

LNT was selected as a focus as it is a very well-known and highly used formal low-impact camping education program. The two studies that make up this thesis go beyond evaluating LNT programs and effectiveness. Instead they examine the level of awareness and engagement in LNT practices of Canadian provincial park users. Furthermore, with the use of theory in this research factors that are best able to predict park visitors' intentions to engage in LNT were identified. This knowledge and understanding of park visitors' LNT practices will help park manager's better design educational campaigns and targeted messaging, thereby enhancing their effectiveness in reducing negative visitor impact.

Objectives and Research Questions

The main purpose of this research was to understand and assess park visitors' awareness and practice of the seven Leave No Trace (LNT) principles as a measure of their engagement in pro-environmental behaviours. As park visitors vary in user type this research chose to compare the LNT knowledge, awareness and intentions of front country and back country visitors' as well as those in two geographically distinct Canadian provincial parks. Additionally, the research was interested in determining what factors best predict park visitors' intention to engage in LNT

practices while camping. Intentions were used as they are the most accurate predictor of behaviour (Ajzen, 1991, 2011) and measures of actual behaviour did not prove feasible do to insufficient sample size of respondents who reported their actual behaviours.

Study 1

Objective:

The purpose of this study was to understand the level of awareness and engagement in LNT practices of Canadian provincial parks users in two geographically distinct parks. The study compared those practices between front country and back country overnight visitors as well as between the two different parks located in Alberta and Ontario.

Research questions:

1) Are overnight park visitors aware of LNT?
2) What does LNT mean to overnight park visitors?
3) Do overnight park visitors have knowledge of LNT practices?
    a. How do front country and back country overnight park visitors differ in their self-reported knowledge of LNT?
    b. How do Algonquin Provincial Park and Peter Lougheed Provincial Park overnight visitors differ in their self-reported knowledge of LNT?
4) How do the ecological world views of overnight park visitors differ between front-county and back country campers?
5) How do the ecological world views of overnight park visitors differ between those who camp in Peter Lougheed Provincial Park and Algonquin Provincial Park?

Study 2

Objective:

This study was focused on determining what factors influence people's intentions to practice LNT with valid and reliable measurement scales utilizing the theory of planned behaviour and the value belief norm theory. In addition, LNT knowledge was as also investigated to determine if it was a significant predictor of LNT intentions. The study also compared the two theories to determine if one could better predict LNT intentions.

Research questions:

1) To what degree do values, beliefs, norms, attitudes, perceived behavioural control, pro-environmental knowledge, and camping experience affect park visitors' engagement in LNT practices?
2) Does one model (TPB vs VBN) better predict intention to engage in LNT practices than the other?
3) Is LNT knowledge a significant predictor in park visitors' intent to engage in LNT practices?

References

Alberta Parks. (2009). *Plan for parks.* Retrieved from http://www.albertaparks.ca/albertaparksca/about-us/plan-for-parks.aspx

Alberta Ministry of Environment and Sustainable Resource Development (2006). *Peter Lougheed and Spray Valley Provincial Parks management plan.* Retrieved from http://www.albertaparks.ca/peter-lougheed/park-research-management.aspx

Alberta Parks. (2014). *Our visitors.* Retrieved from http://www.albertaparks.ca/albertaparksca/about-us/our-visitors.aspx.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.

Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology, 52*, 27–58.

Cole, D. N. (2004). Environmental impacts of outdoor recreation in wildlands. *Society and resource management: A summary of knowledge*, 107-116.

Friends of Algonquin Park. (2016). *Friends of Algonquin Park*. Retrieved from http://www.algonquinpark.on.ca/foap/

Hammitt, W. E., Cole, D. N., & Monz, C. A. (2015). *Wildland recreation: ecology and management*: John Wiley & Sons.

Hutson, G. (2012). Does leave no trace make a difference beyond the scope of backcountry environmental practices. In Martin, B., & Wagstaff, M. (Eds). Controversial issues in adventure programming. Champaign, IL: Human Kinetics.

Jones, M. K., & Bruyere, B. (2004). *Frontcountry Leave No Trace Program Evaluation, City of Boulder Open Space and Mountain Parks.* Paper presented at the International Symposium on Society and Resource Management Keystone, Colorado.

Lawhon, B., Newman, P., Taff, D., Vaske, J., Vagias, W., Lawson, S., & Monz, C. (2013). Factors Influencing Behavioral Intentions for Leave No Trace Behavior in National Parks. *Journal of Interpretation Research, 18*(1), 23-38.

Leave No Trace Canada (2009a). *Leave No Trace Programs.* Retrieved from http://www.leavenotrace.ca/leave-no-trace.

Leave No Trace Canada (2009b). *Leave No Trace Principles.* Retrieved from http://www.leavenotrace.ca/principles.

Leave No Trace Centre for Outdoor Ethics (2012). *Leave No Trace For the Front Country.*Retrieved from: https://lnt.org/teach/outdoor-ethics-frontcountry

Marion, J. L., & Reid, S. E. (2001). The Development of the US Leave No Trace Program: An Historical Perspective.

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.

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

Martin, B., Cashel, C., Wagstaff, M., & Breunig, M. (2006). Outdoor ledership: Theory and practice. Champaign, Ill: Human Kinetics

Poff, R., Cleinmark, J., Stenger-Ramsey, T., Ramsing, R., & Gibson, F. (2013). Outdoor Ethics and Appalachian Trail Hikers: An Investigation of Leave No Trace Practices. *Kentucky Association of Health, Physical Education, Recreation and Dance*, 155.

Ontario Ministry of Natural Resources. (1998). Algonquin Provincial Park management plan. Retrieved from http://www.algonquinpark.on.ca/pdf/management_plan.pdf.

Ontario Ministry of Natural Resources. (2010). Ontario Provincial Parks Statistics 2010. Retrieved from http://www.ontarioparks.com/pdf/statistics/2010_park_statistics.pdf

Ontario Ministry of Natural Resources. (2011). State of Ontario's Protected Areas Report. Retrieved from http://www.mnr.gov.on.ca/en/Business/SORR/Publication/STDPROD_085570.html

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

Chapter 2: Do Canadians' Leave No Trace? A study examining the pro-environmental behaviours of front country and back country overnight visitors to Canadian provincial parks.

Abstract

Currently, visitation to provincial parks in both Ontario and Alberta is over 8 million visitors annually. In order to mitigate environmental impacts caused by outdoor recreation, park managers must employ multiple strategies, including both direct (e.g., rules and regulations) and indirect methods (e.g., education and interpretation programs). Leave No Trace (LNT) is a widely accepted educational program that aims to reduce environmentally depreciative behaviours and promote responsible outdoor recreation through low-impact camping practices. The purpose of this study was to understand the level of awareness and engagement in LNT practices as a measure of pro-environmental behaviours of Canadian provincial parks users and to compare those practices of front country and back country overnight visitors. Park visitors' knowledge of LNT, intent to engage in LNT practices as well as overall environmental world views were measured to determine if there was a difference between those who camped in the back country and front country and within Alberta and Ontario. Results suggest there are in fact statistical differences between front country and back country over-night visitors as well as those who visited parks in Alberta and Ontario. While those who camped in the back country had higher self -reported levels of LNT knowledge, those who camp in the front country scored higher on actual measures of LNT awareness. Additionally, those who camped in Alberta reported higher levels of LNT knowledge and a more pro-environmental worldview but there was no statistical difference between the environmental world views of back country and front country overnight visitors.

Management implications

In Canada, park managers are tasked with providing outstanding recreation opportunities while simultaneously conserving the natural environment. Depreciative behaviours of overnight visitor can be mitigated with better knowledge of park visitors. By understanding differences in front country and back country users' knowledge, attitudes and intentions, park managers can develop more effective education programs designed to foster pro-environmental intentions. Furthermore, there has been controversy in recent years related to the appropriateness and effectiveness of Leave No Trace. This research provides park managers more insight into the outcomes of Leave No Trace branded communication.

Introduction

Inherent in the term outdoor recreation is the interaction between humans and the natural environment. However, this interaction creates inevitable impacts on the natural environment, such as soil compaction and habitat fragmentation (Hammitt et al., 2015). This study examines how overnight visitors to Canadian provincial parks can minimize their impact through low-impact camping practices as a measure of pro-environmental behaviours (PEB). Furthermore, this study compared both front country and back country users within two Canadian provinces, Alberta and Ontario.

Outdoor recreation pursuits can cause lasting and potentially irreversible impacts to the natural environment (Hammit, Cole, & Monz, 2015). Hiking and camping on designated trails and campsites allows already impacted surfaces to absorb visitor use. However, when visitors venture off designated trials, hike and camp in remote areas, or simply do not use recreation areas correctly, the effects can be devastating (Cole, 2004). The most common impact to soil and vegetation due to hiking and camping is trampling. Trampling can cause abrasion, compaction of

soil, bruising, crushing, and uprooting of plants, increase erosion, reduce reproduction of plants, change soil biota and structure and more (Cole, 2004). Park visitors create "new" unofficial campsites which further spreads impacts rather than concentrating use as recommended. The impacts can be seen in the form of litter, mutilated trees, and built structures. In addition, loss of vegetation due to activities such as hiking, horses' hooves, and motorized vehicles can cause further impacts such as erosion, alteration of habitats, disturbance of ecosystems, and ultimately if left unmanaged, the loss of species (Hammit, Cole, & Monz, 2015). It is therefore the goal of park and protected area managers to find a balance between acceptable levels of use, potential impact and recreational use.

Alberta and Ontario provincial park policies have dual mandates of protecting provincially significant natural and cultural heritage resources while simultaneously providing sustainable recreation opportunities to current and future generations of park users (Marion & Reid, 2007; Ontario Ministry of Natural Resources, 2011; Alberta Parks, 2009). In response to the negative impacts that humans have on the natural environment, research has been conducted to investigate how back country overnight visitors mitigate these negative impacts through low-impact camping practices (Vagias & Powell, 2010). However, little has been done that focuses on the millions of front country overnight visitors to Canadian parks.

Over 8.5 million people visit Alberta parks every year, of which 1.5 million stay overnight for a minimum of one night (Alberta Parks, 2014). Within Ontario, there are over 9.5 million park visitors, and almost 2 million of those visitors stay in the park overnight (Ontario Ministry of Natural Resources, 2010). With such high visitation numbers it is not surprising that provincial parks in Canada are experiencing resource degradation, habitat loss, and lasting environmental impacts (Ontario Ministry of Natural Resources, 2011; Pigram & Jenkins, 2006).

Pigram and Jenkins (2006) and Dearden, Rollins and Needham (2016) further suggest that high visitation numbers push parks beyond their ecological carrying capacities, resulting in potentially irreversible declines in ecological integrity. In order to mitigate environmental impacts caused by outdoor recreation, park managers must employ multiple strategies, including both direct (e.g., enforcement of rules and regulations) and indirect methods (e.g., education and interpretation programs) (Leung & Marion, 2000; Hammit & Cole, 1998; Plummer, 2009).

Education is viewed as an indirect management strategy for parks and protected areas mangers. The goal of environmental education is to change visitors' behaviours to be more environmentally sustainable. Leave No Trace (LNT) is a widely accepted educational program that aims to reduce environmentally depreciative behaviours and promote responsible outdoor recreation through low-impact camping practices (Marion & Reid, 2001). While the principles identified by LNT were initially developed for the back-county, the concepts can and are being applied to front-county camping areas (areas accessible by car) (Leave No Trace Centre for Outdoor Ethics, 2012). Currently LNT is being used in all 50 US states and more than 30 countries around the world, including Canada (Leave No Trace Centre for Outdoor Ethics, 2012b). During the year 2015, it is estimated that over 9.5 million people took part in hands on training, workshops, or events, and that over 10 million people were exposed to campaigns promoting proper waste disposal, along with many more initiatives reaching millions of other individuals (Leave No Trace Centre for Outdoor Ethics, 2012b). While the brand outreach has been dominated by the American association (Leave No Trace Centre for Outdoor Ethics) Leave No Trace Canada launched its first official outreach program in 2015; the traveling trainers program and has hosted over 30 events (Leave No Trace [LNT] Canada, 2009a).

Literature Review

Leave No Trace

LNT was developed in response to a sharp increase in recreational land use in The United States during the 1960 and 1970s (Marion & Reid, 2001). LNT first began as an educational program to support park and protected areas management and regulations strategies. The goal of the program is to avoid or minimize negative impacts to the natural environment and to help ensure that recreationists have a positive experience while in the outdoors (Marion & Reid, 2001; LNT Canada, 2009a). The seven principles are as follows: (1) Plan ahead and prepare; (2) travel and camp on durable surfaces; (3) dispose of waste properly; (4) minimize campfire impacts; (5) leave what you find; (6) be considerate of other visitors; and, (7) respect wildlife (LNT Canada, 2009b). According to Leave No Trace Centre for Outdoor Ethics (2009a) LNT principles are a tool for teaching people how to use and enjoy the natural environment in a responsible manner. Hutson (2012) suggests that LNT is further positioned to be tied to an individual's identity and way of being in nature. It is therefore considered more than a set of rules but a philosophy and wildland ethic which can transform people's broader environmental ethics and awareness (Hutson, 2012).

LNT principles have been used to frame assessments of people's engagement in pro-environmental camping practices and their behaviours in parks in general (Jones & Bruyere, 2004; Lawhon et al., 2013; Newman, Manning, Bacon, Graefe, & Kyle, 2002; Poff, Cleinmark, Stenger-Ramsey, Ramsing, & Gibson, 2013; D. Taff, Newman, Bright, & Vagias, 2011). While pro-environmental behaviours are much more far reaching than individuals' actions on trails and in recreational areas, LNT can provide insight into park and protected area visitors' environmental ethics (Poff et al., 2013). Environmental ethics are a philosophy that studies the moral relationship between human beings and the environment and its nonhuman living contents.

The moral relationship between an individual and the natural environment can be guided by rules or codes of conduct such as LNT (Martin, Cashel, Wagstaff, & Breunig, 2006).

The original seven principles of LNT were developed for back country wilderness travel and only recently have been adapted to also include front country day use recreation areas (Marion & Reid, 2007). The Leave No Trace Centre For Outdoor Ethics (2012) has taken various demographic, geographic and behavioral factors into consideration in the development of the front country day use education program. A critique of this approach lies in its lack of consultation with published research.

Overnight park visitor's knowledge, use and acceptance of Leave No Trace

Visited by many different user types the Appalachian Trail (AT) is a recreation setting in which LNT practices are strongly encouraged. However, as with front country and back country users, different types of users on the AT follow LNT in varying degrees. Studies investigating the LNT practices of hikers along the Appalachian Trail compared types of hikers and their knowledge of LNT as well as likelihood to practice LNT (Newman et al., 2002; Poff et al., 2013). These studies showed no statistical differences in respondents' outdoor ethics but did find that external factors such as age and weeks on the trail affected adherence to specific LNT principles. Those who were more experienced and had an extended duration on the trail (thru hikers or section hikers) utilized the LNT principle 'Plan ahead and prepare' more than other groups. Experience in hiking likely made adherents aware that planning is essential for a hiking trip. Furthermore, those who plan to be on the trail for longer durations (thru hikers and section hikers) also require more planning for the success of long trips, therefore offering some explanations for the differences in trail user groups.

Both Poff et al. (2013) and Newman et al. (2003) used mail back survey response methods as opposed to the having AT users complete the survey in person. According to Mannesto and Loomis (1991) in person surveys have a much higher response rate and a much lower item-non response. In addition, the in-person method may be better suited for recalling past behavior questions such as LNT. The in-person method therefore may be considered strength of this research. In addition the LNT survey instrument used in the Newman et al. (2003) only assessed true or false statements which might have lead respondents to answer in a more biased manner; however, this research followed Vagias et al.'s approach (2012) in the evaluation of appropriateness of each LNT action. Further, this approach attempted to answer Newman et al.'s call for future research in scale development and level of difficulty.

Lawhon et al. (2013) investigated the factors that influence LNT behaviours with a survey of park visitors at Rocky Mountain National Park. Results of Lawhon et al.'s (2013) study show that many park visitors were unfamiliar with, or did not understand, LNT practices as many respondents answered the survey questions in ways that were not aligned with LNT practices. Respondents reported knowledge of the seven LNT principles but when asked specific questions about how the appropriateness of specific actions was in line with LNT, responses differed. For example 55% of respondents felt it was very appropriate to leave behind food scraps as a food source for animals (Lawhon et al., 2013). In contrast 60% of respondents rated their knowledge of LNT as above average to expert. In Vagias and Powell's (2010) study of back country users they found that many back country overnight park visitors were aware of LNT, between 89% and 94% depending on the park, and over 90% in all parks stating following LNT was important. However not all respondents were in agreement with all LNT practices. In particular, in all parks surveyed, visitors rated the action of "burying used toilet paper" as

appropriate, which is in direct contradiction of LNT principles. Furthermore, the high variability between back country users on the practices of LNT suggests that perhaps there is room for improvement of educational method (Vagias & Powell, 2010). Lawhon et al. (2013) and Vagias and Powell's (2010) study results suggests that there is a disconnect between self-reported or perceived level of LNT knowledge and actual knowledge or behaviours. Calling for future research to confirm this and suggesting that additional research of front country context is exceptionally necessary. The present study sought to confirm previous research and expand on the lack of knowledge of front country specific contexts.

Comparing front country and back country users

Currently there is a dearth of research comparing front country and back country overnight park visitors. Much of the current research comparing back country and front country users is heavily focused on crowding and density issues rather than low-impact camping practices and pro-environmental behaviour comparisons of the two user groups. It is suggested that these two user groups are different (Taff, 2012; Basman et al., 1996). Basman et al. (1996) suggest that front country and back country user groups have different salient norms and therefore might interact with the natural environment in different ways. The main difference between the back country and the front country groups was found in the salient norm "should minimally impact the resource." The users in the back country setting found this to be significantly more important than those in the front country. However, it is important to note that Basman et al. (1996) suggest their study was exploratory in nature and not comprehensive of all back country and front country norms, calling for future research comparing back country and front country user groups.

LNT Education Effectiveness

The effectiveness of LNT education and information programs has been investigated numerous times and in various settings (Boon, Fluker, & Wilson, 2008; Cole, Hammond, & McCool, 1997; Daniels & Marion, 2005; Jones & Bruyere, 2004; Kidd et al., 2015; Marion & Reid, 2007). Jones and Bruyere (2004) conducted a pre-education campaign and post-education campaign study of front country recreationists in Boulder, CO to determine if knowledge of LNT and behaviours changed following LNT education. The pre-education campaign survey was administered at five multi-use trail heads and the follow-up survey was mailed to participants following a five month educational program of park signage, brochures, local public access videos, and newspaper articles. The study found only a 2% gain in overall LNT knowledge. Personal contact at trailheads was rated the most effective at communicating LNT practices promoting change by 61% of respondents. According to Cole, Hammond, and McCool (1997), 67% of North American parks and protected areas have low-impact camping messaging posted at trail heads. However, the literature suggests the majority of these signs are not as effective as they could be. Retention of information has been found to increase when personal communication is involved and when programme efforts target users' values and personal norms (Daniels & Marion, 2005; Vagias et al., 2014). According to Marion and Reid (2007) education and interpretation is strengthened with personal communication, which supports Jones and Bruyers's (2004) findings.

Furthermore Lawhon et al. (2013) found that delivering new information was not as effective as programs that focus on the effectiveness of LNT and benefits to parks. Daniels and Marion (2005) studied the efficacy of a two day LNT course for people that want to become LNT trainers, and found that active participation, longer duration of programs, and a combination of field work and in classroom time are the ideal combinations for effective LNT

education. In addition Daniels and Marion's (2005) study suggested that LNT messaging should target individuals' ethics. Simply providing information is no longer enough, LNT education must include the why behind the actions. In order to increase low-impact camping practices such as LNT, parks must ensure the ease of doing so. While the specifics of a LNT campaign were not investigated in this study, one of the parks investigated does engage in formal LNT education and information while the other park does not. By comparing the two parks it is the intention of this study to add to the literature regarding LNT education and its effectiveness.

Pro-Environmental Behaviours (PEB)

Burgess, Harrison and Filius (1998) define pro-environmental behaviours as those "behaviors that consciously seek to minimize the negative impact of one's actions on the natural and built world' (p. 140). They are actions that promote sustainable use of a natural resource such as using environmentally friendly transportation (Halpenny, 2010). PEB can also be thought of as goal driven behaviours, in which an individual acts in a pro-environmental manner intrinsic or enjoyable reasons, for gain purposes, or for normative reasons (i.e. they believe it is the right thing to do) (Steg, Bolderdijk, Keizer, & Perlaviciute, 2014). It is the conflicts between these goals that limit all individuals from always engaging in PEB. Oreg and Katz-Gerro (2006) suggest that the culture within which individuals behave constitutes a meaningful context for the creation of the attitudes and beliefs that will guide their behaviour and potentially influence their likelihood of engaging in PEB. Drawing on this point, this study identified two possible cultural contexts: front country and back country camping and investigated campers who use these settings to examine if the environmental context affects participants engagement in pro-environmental behaviours.

Socio-demographic variables related to PEB: income, age, education, gender

Many studies have investigated the effect of socio-demographics variables on individuals' likelihood to and actual engagement in PEB (Cooper, Larson, Dayer, Stedman, & Decker, 2015; Cordell, Green, & Betz, 2002; De Silva & Pownall, 2014; Kollmuss & Agyeman, 2002; Larson, Whiting, & Green, 2011; Meyer, 2015). Of these studies the findings suggest that age, income, level of education completed, and gender may be predictors of PEB. Level of education completed or length of education appears to have the largest impact on the creation of, and engagement in PEB. However, this is not always the case for environment specific knowledge rather applies to those who are highly educated in general. Meyer (2015) found that more highly educated individuals tend to engage in more environmentally friendly behaviours and that when as the level of education increases so does one's engagement is PEB. There is also evidence to suggest a relationship between level of education and awareness that environmental issues have a direct impact on individuals' lives, thus making them more likely to engage in PEB (Meyer, 2015).

Studies have found that when investigating the relationship of gender on PEB, women tend to be more pro-environmental or make decisions that are more biocentric. Takahashi and Selfa (2015) reported that women have both higher levels of PEB and more positive attitudes towards conservation. Similarly Larson et al.'s (2011) and Vaske et al. (2001) studies reported that females were more biocentric than men. However, other studies have found inconsistent results, suggesting that while gender may play a role, this still remains unclear (Larson et al., 2011).

De Silva and Pownall (2015) found that when comparing those who have completed a university degree to those who have not, the individuals with university degrees placed more value on engaging in PEB than the others. In addition, female college graduates ranked the

highest when measuring likelihood to reduce carbon emissions and social welfare (De Silva & Pownall, 2014). Vaske et al. (2001) found consistent results, indicating that females and those with a college education ranked the highest on a scale measuring biocentric world views.

Individual's income levels have had varying degrees of support in the effect on PEB. Cordell et al. (2002) found that those with incomes lower than $25,000 were much more likely to believe that humans will ensure the future of the earth, have the right to modify the environment, and be able to control nature. This group is also shared the opinion that the environmental crisis is exaggerated. Furthermore, Larson et al. (2011) found corroborating evidence that lower incomes were highly associated with anthropenctric and egotistic world views among visitors to three state parks near the area of Atlanta, Georgia.

The Study

The purpose of this study was to understand the level of engagement in pro-environmental behaviours of Canadian provincial parks users within two comparable but geographically different provincial parks (Algonquin Provincial Park in Ontario and Peter Lougheed Provincial Park in Alberta). Furthermore, this study compared front country and back country overnight visitors' knowledge of, intent to engage in, and awareness of Leave No Trace (LNT), as well as their environmental world views. LNT principles were used a measure of engagement in pro-environmental behaviours. Study questions included the following:

1) Are overnight park visitors aware of LNT?
2) What does LNT mean to overnight park visitors?
3) Do overnight park visitors have knowledge of LNT practices?

a. How do front country and back country overnight park visitors differ in their self-reported knowledge of LNT?
b. How do Algonquin Provincial Park and Peter Lougheed Provincial Park overnight visitors differ in their self-reported knowledge of LNT?

4) How do the ecological world views of overnight park visitors differ between front-county and back country campers?
5) How do the ecological world views of overnight park visitors differ between those who camp in Peter Lougheed Provincial Park and Algonquin Provincial Park?

Methods

Study Sites

The two parks examined were Algonquin Provincial Park in Ontario and Peter Lougheed Provincial Park in Alberta. These parks are culturally comparable, have high visitation numbers, offer similar back country and front country camping opportunities, and are characterized by a broad representation of visitors to provincial parks in Canada. Algonquin Provincial Park has an established formal relationship with Leave No Trace Canada and offers educational programming related to LNT, thereby enabling rich opportunities to compare impacts of information campaigns relating to LNT. On the other hand, Peter Lougheed Provincial Park does not employ formal Leave No Trace materials or content, instead its management in-house messaging to promote low-impact camping.

Algonquin Provincial Park

Algonquin Provincial Park is the oldest provincial park in Canada, founded in 1893 as Algonquin National Park, the name was changed to Algonquin Provincial Park in 1913 (Killian, 1993; OMNR, 1998). Algonquin is located in the province of Ontario, between Georgian Bay and the Ottawa River and encompasses 772,300 ha of provincially significant natural and cultural heritage (OMNR, 1998). This park was originally established to serve a variety of functions including: the maintenance of water supply, preservation of a primeval forest, protection of all flora and fauna, serve as an area for forestry research, and provide beneficial effects on climate (OMNR, 1998).

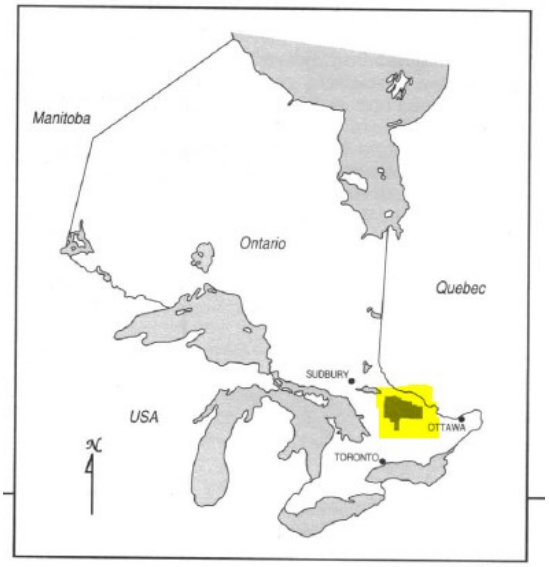

Figure 2
Map of Algonquin Provincial Park location within Ontario (OMNR,1998)

Due to the high level of biodiversity within the park, Algonquin is classified as a Natural Environment Park (OMNR, 1998) and incorporates "outstanding recreational landscapes with representative natural features and historical resources to provide high-quality recreational and educational experience" (OMNR, 1998 p. 13).The park boasts many recreational opportunities including backpacking, snow-shoeing, canoeing, camping, swimming, cross-country skiing, hiking, bird watching and more. In 2010 Algonquin hosted 830,899 visitors, of which 219, 991

were day use, close to 250,000 were back country users, and close to 400,000 overnight visitors made use of the parks 1330 front country or auto accessible campsites (OMNR, 2011). In addition to the front country campsites, Algonquin contains over 2000km of canoeing routes and back country hiking trails with over 1900 campsites (Friends of Algonquin Park, 2012).

In 2011 Algonquin Park became the first Canadian park to establish a formal relationship with Leave No Trace Canada (Algonquin Backcountry Recreationalist, 2011). The *Backcountry of Algonquin Park: Leave No Trace* principles were broadcasted in the *2011 Algonquin Park Information Guide,* and the September 2011 issue of *The Raven* newsletter (Friends of Algonquin Park, 2011). In addition LNT messaging is currently printed in the Park Tabloid (an annual visitor booklet), is posted on the park's website, and is found in both canoe route and back country hiking maps. The park also produced large placard board signs for all access point offices (see Appendix A). These LNT educational efforts will be compared to those of Peter Lougheed Provincial Park in Alberta, as well as the effects (if any) of all LNT promotion on park visitors.

Peter Lougheed Provincial Park

Peter Lougheed Provincial Park was established in 1977 in conjunction with the Kananaskis Country parks system, and covers 50,142 hectares of land (Alberta Ministry of Environment and Resource Development [AMERD], 2006). The park is located in the Alberta Bow River watershed, near the Great Divide in the Front Ranges of the Rocky Mountains.

Figure 3
Map of Peter Lougheed Provincial Park (AMERD, 2006)

Peter Lougheed Provincial Park (PLPP) includes both alpine and subalpine regions which are important habitat for ungulates and carnivores such as deer, elk, moose, bighorn sheep, mountain goats, grizzly bears, black bears, cougars and wolves (AMERD, 2006). This park encompasses the upper portions of the Kananaskis River drainage; a tributary of the Bow River. Along with important ecological features, Peter Lougheed Provincial Park also supports a wide variety of recreational opportunities including camping, hiking, boating, fishing, swimming, and cross country skiing.

Within Peter Lougheed Provincial Park, there are 546 regular front country or auto access camp sites, two group campsites, twenty day-use areas, and 83 back country campsites. A total

of 100,040 overnight visitors were reported in 2005 (Alberta Tourism Parks and Recreation, 2006); however, more detailed visitor statistics are not available at this time.

Comparing the two study sites

The following table highlights the major differences in LNT education and messaging within the two parks. As mentioned earlier Algonquin Park has a formal relationship with LNT Canada and therefore has the rights to use LNT logo and wording. Peter Lougheed Provincial Park uses Alberta Parks' in-house developed low-impact messaging.

Table 1
Comparing Leave No Trace education/messaging within APP and PLPP

Comparing Leave No Trace Education/Messaging within APP and PLPP	
Algonquin Provincial Park (APP)	**Peter Lougheed Provincial Park (PLPP)** **No use of LNT logo or messaging**
LNT messaging posted at trail heads, permit offices, visitor's centre and canoe route put-ins.	Low-impact camping and bear aware messaging posted at trail heads, visitors centres, campsites, and boat launches.
List of LNT principles and guidelines printed on all 2015 back country canoe route and hiking trail maps.	Low-impact camping and hiking information and park regulations printed on summer trails map online PDF.
LNT logo and information printed in 2015 information booklet.	Low-impact camping, bear aware messaging, and fire safety information is printed in the 2015 Kananaskis Country information (information is limited).

Methodology

A controlled comparison case study method was followed, as the goal was to compare the similarities and differences between the parks and user groups (Eggan, 1954; George & Bennett, 2005). According to Yin (2014) case studies are an effective method when research is exploratory, explanatory, and/or descriptive. Yin (2014) suggests that case study research is a preferred method when the researcher asks "why" questions, has little or no control over the situation, and is focused on a contemporary event rather than a historical one. The comparative approach to case study research requires the researcher to extensively describe each case and carefully compare the social phenomena within the distinct areas (Eggan, 1954; George & Bennett, 2005). George and Bennett (2005) suggest that it is essential to formulate a set of standardized general questions or a survey instrument to be used in each respective case; this was achieved in this study through the questionnaire. In addition, structure and focus are said to be easier to achieve in comparative case studies if a single investigator plans and conducts the study, as was done in this study by the first author (George & Bennett, 2005). Finally, as Nyaupane, Morais and Dowler (2006) suggest, a controlled comparison case study must consist of two phenomena, in this case user groups and parks, that share similarities, yet have distinct characteristics.

Survey design

A survey of overnight park visitors was conducted to examine the PEB differences between front country and back country users, as well as the differences between those camping in Algonquin Provincial Park and Peter Loughheed Provincial Park. There is no single tool or standard empirical method for assessment of PEB or LNT knowledge and practices. However, measuring pro-environmental behaviours has been accomplished through similar yet context specific scales (Halpenny, 2010; Larson et al., 2011; Okada, Okamura, & Zushi, 2013; Oreg &

Katz-Gerro, 2006; Stern, 2000; van Riper & Kyle, 2014). A similar range of techniques for investigating LNT knowledge and practices have been employed (Lawhon et al., 2013; Newman et al., 2002; Poff et al., 2013; Taff et al., 2011; Vagias & Powell, 2010; Vagias, Powell, Moore, & Wright, 2014). The survey instrument was developed from measures found in these previous studies.

A questionnaire was developed and administered to overnight park visitors in both front country and back country camping areas. Surveys were conducted between June 17th, 2015 to September 13th, 2015 and included both weekend days and weekdays as well as holidays and non-holiday days. Park visitors were intercepted at trail heads, campsites, permit offices, canoe put-ins, and visitor information centers. This temporally stratified convenience-based sampling approach resulted in a sample of n=459(230 visitors in Alberta and 229 in Ontario, of which 220 reported camping in the front country and 238 reported camping in the back-country). The self-administered questionnaires were completed on-site and returned to the lead author. Data was collected using both paper based questionnaires and Android Tablets, with an off line software tool, *Droid Surveys.* The questionnaires contained five distinct sections, general information about their current trip, LNT awareness and knowledge, ecological world views (Dunlap, Van Liere, Mertig, & Jones, 2000), factors relating to the creation and prediction of PEB, and general demographic information. The questionnaire design attempted to identify LNT actions for inclusion in the survey instrument that were applicable and appropriate for both front and country contexts and relevant for both Alberta and Ontario park settings. Assisting in this process was the lead author's LNT expertise. She held a LNT trainer certificate, providing even more in-depth understanding of the LNT principles and how they apply to all contexts.

LNT awareness and knowledge were assed using a self-reported level of knowledge scale ranging from 1 (no knowledge) to 7 (expert). Using a scale where 1 = inappropriate and 5 = appropriate respondents were then asked to rate the appropriateness of examples of LNT actions that either correctly corresponded with one of the seven LNT principles or was a direct contradiction. This scale was based on previous research that investigated knowledge, awareness, and attitudes of LNT principles (Lawhon et al., 2013; Mobley, Vagias, & DeWard, 2010; B. D. Taff, Newman, Vagias, & Lawhon, 2014; D. Taff et al., 2011; Vagias & Powell, 2010; Vagias et al., 2014). Ecological world views were measured using the New Ecological Paradigm (NEP) as described by Dunlap et al. (2000). NEP has been tested and used numerous times in similar studies (Dunlap et al., 2000) and has been proven to have both known group validity and predictive validity.

In addition to the LNT awareness scale, respondents were asked the open ended question "what does Leave No Trace mean to you" and results were coded and analysed for themes. This was done to add richness to the data and develop a deeper understanding of park visitors and their awareness and knowledge of LNT.

Analysis

Data was analyzed using Statistical Package for the Social Sciences (SPSS) Version 23. Data were first checked for errors and assessed for normality, outliers, and multicollinearity. As the primary focus of this study was to compare back country and front-country overnight park visitors, as well as the user groups within the two parks, independent sample t-tests were used. T-tests, conducted with SPSS 23.0 were run to determine if there were statistical differences between both user groups and parks with regard to self-reported LNT knowledge, actual LNT knowledge, and environmental world views. The p-value for statistical significance was set at

.05. In addition, to determine if demographic variables namely, gender, income, and education play a role in the relationship between parks and user groups on ecological world view and knowledge of LNT, ANCOVAs were conducted. Statistical power was determined by Cohen's d as a measure of effect size (Cohen, 1992).

Cronbach's alpha values were used as a measure of internal reliability of the LNT scale; values of .752 or above suggest adequate internal consistency (Nunnally, 1978). Principal components factor analysis was used to examine the factor structure of the LNT knowledge scale. Items that loaded 0.3 or above were retained (Pallant, 2005).

Data cleaning and scale assessment

Missing data was not a large concern within this data set, as the use of Android tablets ensured completion of all questions (setting in Droid software). In addition all responses with more than 5% missing from the main variables were deleted (Tabachnick & Fidell, 2012). However, the variable "age" was not recorded in the tablet surveys and as a result only 140 respondents' age was recorded. This error occurred as an oversight in survey design. The data was cleaned using Microsoft Excel and checked for errors (no data was found outside the possible values for any variable). Data was then assessed for normality and outliers. The distributions of both the LNT knowledge questions and the NEP scale failed the statistical tests for normality (i.e. non-significant results of the Kolmogorov-Smirnov text). However, Pallant (2013) suggests this is not uncommon for large sample sizes and therefore recommends investigating the construct being measured as well as the histograms. An evaluation of the histograms highlighted that most questions were either positively or negatively skewed. Which given the construct of LNT knowledge and ecological world view this is not surprising. Outliers

were found in a few specific measures however, again given the nature of the construct being measured this was not a concern.

The initial LNT knowledge scale was developed to represent a single factor measurement of overnight park visitors' LNT knowledge. A low, but adequate Cronbach's alpha score suggested modest internal consistency of the 21 item scale (i.e., α=.752). This encouraged the researchers to examine the scale's factor structure. Principal components factor analysis (exploratory and confirmatory) revealed the scale appeared to be measuring three rather than one LNT knowledge factors. However, the three factors did not represent LNT principles in a clear and categorically consistent manner. After an examination of the items that belonged to each factor, no clear conceptual labels for the factors could be identified. This lack of factor conceptual clarity, combined with a low observed Cronbach's alpha score for the overall LNT scale suggested the scale items would be better viewed as independent measures of LNT knowledge.

Results

Respondent characteristics

Overall, the participants were predominantly male (56%) under the age of 40 with some form of post-secondary education. Both in Alberta and Ontario males (53% and 59% respectively) outnumbered females (47% and 40.5% respectively) by a small degree. Male visitors (64.6%) outnumbered females (35.4%) in the back county; however, the reverse was true in the front country (46.8% and 52.7% respectively). Respondents had an average age of 36 years. Respondents tended to be highly educated, as over 70% having some form of post-secondary education. There were no significant differences between front country and back country users; however, respondents from Alberta more often reported having completed university bachelor degrees (38.7%) than those from Ontario (27.9%). Income levels reported for back country and front country users were similar and relatively high, which is consistent with park visitor statistics. In addition, those respondents from Alberta reported higher levels of income than those from Ontario, with 43.9% of Albertans earning $100,000 or more and only 30.8% on Ontarians reporting similar earning levels. The majority of visitors spent on average 2 nights in the parks (FC: 32.6%, and BC: 40.4%), camped with family and friends (89%) and had relatively small group sizes (< 5 per group 54.4%).

Table 2
Socio-demographic characteristics of overnight park visitors (percentages)

	All visitors	Back country visitors	Front country visitors	Alberta	Ontario
Gender %					
Male (percent)	56.0	64.6	46.8	53	59.0
Female (percent)	43.8	35.4	52.7	47	40.5
N	459	237	220	230	226
Age*					
Mean	35.53				
N	140				
Education %					
Elementary school	3.5	5.1	1.8	1.7	5.3
High school	24.1	22.5	25.9	21.3	27.0
College diploma	24.3	21.6	27.3	24.3	24.3
University bachelor degree	32.9	35.6	30.0	38.7	27.9
University graduate degree	15.1	15.1	15.0	14.8	15.5
N		237	220	230	226
Income %					
I prefer not to answer this question	19	20.9	17.3	20.4	17.6
Under $50,000	17.1	15.9	18.1	13.0	21.1
$50,000-$99,000	26.5	25.5	27.4	22.6	30.4
$100,000-$149,000	19.5	19.5	19.4	22.6	16.3
More than $150,000	17.9	18.2	17.7	21.3	14.5
N	459	220	237	230	227

*Tablet administered survey respondents age was not recorded.

LNT knowledge of back country and front country park visitors

Parks visitors were asked to rate their level of LNT knowledge from no knowledge to expert (Tables 3 and 4), following their self-reported knowledge visitors were asked to respond to a series of LNT specific actions and rate their appropriateness level. This measure of actual LNT knowledge is summarized in table 5. Results indicated a significant difference between front country and back country park visitors in terms of both self-reported knowledge of LNT (FC: *M*=3.86; BC: *M*=4.34, *p*=.001 d=.319) and actual LNT knowledge regarding specific LNT actions (see table 5). Twenty-three percent of the park visitors who camped in the back country reported having extensive or expert knowledge of LNT, while those who camped in the front country only reported 12%. It is important to note that while these findings are in line with previous research, suggesting back country users might have a higher level of self-reported knowledge, there is also a contradiction of this in the results of actual LNT knowledge. Front country users scored a higher level of actual knowledge when asked direct questions about LNT practices. The responses of front country and back country users to specific questions can be seen in table 5. Back country users only scored higher than front country users on two specific LNT questions, "use twigs and brush for small fires" (BC: M=3.58; FC: M=2.53, *p=.<.001, d=.782*) and "take breaks off the trail so that others may pass" (BC: M=4.14; FC: M= 3.87*, p=.009, d=.246).* These two LNT principles are more relevant toward backcountry users as using twigs and brush for fires is against park policies in the front country and many front country users may not know the correct trail etiquette as they might not travel on trails while camping in front country areas.

Table 3
Self-reported LNT knowledge of Algonquin Park and Peter Lougheed Park

	All visitors			***APP***			***PLPP***					
	N	*Mean (M)*	*Std Dev. (SD)*	*N*	*Mean (M)*	*Std Dev. (SD)*	*N*	*Mean (M)*	*Std Dev. (SD)*	*p-Value*	*t*	*Cohen's d*
LNT self-reported knowledge	*433*	4.02	1.52	218	3.67	1.57	215	4.38	1.37	<.001	-5.00	.481

Table 4
Self-reported LNT knowledge of back country and front country users

	All visitors			***Back country***			***Front country***					
	N	*Mean (M)*	*Std Dev. (SD)*	*N*	*Mean (M)*	*Std Dev. (SD)*	*N*	*Mean (M)*	*Std Dev. (SD)*	*p-Value*	*t*	*Cohen's d*
LNT self-reported knowledge	*433*	4.02	1.52	224	4.21	1.61	209	3.82	1.38	.008	-2.66	.260

Table 5
LNT actual knowledge by question

	All visitors			Back country visitors			Front country visitors			*p-Value*	*t*	*Cohen's d*
	N	*Mean (M)*	*Std Dev. (SD)*	*N*	*Mean (M)*	*Std Dev. (SD)*	*N*	*Mean (M)*	*Std Dev. (SD)*			
LNT principle 1: Plan ahead and prepare												
Plan meals to minimize fuel consumption	457	4.3	.855	238	4.25	.868	219	4.35	.840	-	-	
Read the park policies before arriving at the park	456	4.36	.803	238	4.34	.773	219	4.38	.773	-	-	
Develop travel plans to avoid poor campsite selection (e.g. Undesignated camp site)	455	4.42	.794	238	4.42	.785	217	4.41	.807	-	-	
LNT principle 2: Travel and camp on durable surfaces												
Travel on established trails	458	4.66	.642	238	4.61	.618	220	4.72	.664	-	-	
Placing a tent in an undisturbed spot, when camping in heavily used areas	**453**	**2.18**	**1.24**	**238**	**2.44**	**1.27**	**215**	**1.89**	**1.14**	**<.001**	**−4.849**	**.455**
Camp in groups of 10 or more people	449	2.74	1.15	237	2.81	1.11	212	2.67	1.18	-	-	
LNT principle 3: Dispose of waste properly												
Repack food to eliminate waste	458	4.59	.713	238	4.57	.694	220	4.61	.735	-	-	
Urinate on vegetation	**458**	**2.44**	**1.20**	**238**	**2.70**	**1.19**	**220**	**2.15**	**1.14**	**<.001**	**−4.943**	**.490**
Burying toilet paper If no facilities are available	451	3.27	1.38	236	3.26	1.30	215	3.28	1.46	-	-	
LNT principle 4: Leave what you find												
Keep a single small item like a rock or feather as a souvenir	455	2.66	1.21	238	2.82	1.20	217	2.48	1.21	-	-	
Alter a campsite so that it is more desirable	**452**	**2.22**	**1.14**	**237**	**2.36**	**1.10**	**215**	**2.06**	**1.18**	**.005**	**−2.816**	**.263**
Build a shelter or structure	**452**	**2.30**	**1.25**	**238**	**2.51**	**1.18**	**214**	**2.07**	**1.28**	**<.001**	**−3.795**	**.357**

LNT principle 5: Minimize campfire impacts												
Have a campfire where there is no existing fire pit	**456**	**1.72**	**.998**	**237**	**1.86**	**1.06**	**219**	**1.57**	**.888**	**.001**	**−3.228**	**.296**
Let fire wood burn completely prior to leaving the site	**457**	**4.18**	**1.22**	**238**	**4.04**	**1.28**	**219**	**4.33**	**1.15**	**.012**	**2.50**	**.238**
Use twigs and brush for small fires	**455**	**3.08**	**1.42**	**238**	**3.58**	**1.17**	**217**	**2.53**	**1.47**	**<.001**	**-8.377**	**.790**
LNT principle 6: Respect wildlife												
Feed wildlife	456	1.25	.662	237	1.27	.667	219	1.22	.656	-	-	
Hang food or store in proper container	456	4.70	.842	238	4.68	.827	218	4.72	.860	-	-	
Allow your dog off leash	**443**	**2.11**	**1.14**	**234**	**2.28**	**1.13**	**209**	**1.92**	**1.12**	**.001**	**−3.287**	**.319**
LNT principle 7: Be considerate of other visitors												
Taking breaks off the trail so that others may pass	**456**	**4.01**	**.842**	**238**	**4.14**	**.929**	**218**	**3.87**	**1.24**	**.009**	**-2.610**	**.246**
Leave all areas of the park in a better state	458	4.52	.766	238	4.54	.744	220	4.50	.791	-	-	
Keep noise levels to a minimum	**458**	**4.26**	**.911**	**238**	**4.17**	**.875**	**220**	**4.35**	**.942**	**.029**	**2.197**	**.197**

LNT knowledge of Algonquin Provincial Park and Peter Lougheed Provincial Parks visitors

When comparing overnight visitors to the two parks, a significant difference was found in self-reported knowledge of LNT (Table 4), in that those who camped in Peter Lougheed Provincial Park reported a higher level of self-reported LNT knowledge than those who camp in Algonquin Provincial Park (PLPP: M= 4.38; APP: M=3.67; p= < .000, d = .479). Moderator analysis using ANCOVAS was conducted to determine if socio-demographic variables could account for the difference between park visitor's self-reported level of LNT knowledge. Gender,

income, and level of education were controlled for. All demographic variables were non-significant covariates.

The items measuring actual LNT knowledge of park visitors was also compared and can be seen in table 6. Differences were observed for two of the LNT principles "*leave what you find"* and "*minimize campfire impacts"* as well as for a select few specific questions. The principle "*leave what you find"* was represented by three behaviour based questions "*keep a single item like a rock or feather as a souvenir"* (PLPP *M=2.36*; APP *M*=2.96; *p= <.001, d*=.509) *, "alter a campsite so that it is more desirable" (*PLPP *M=2.05*; APP *M*=2.39; *p= .002, d*=.299)*, and build a shelter or structure"* (PLPP *M=2.16*; APP *M*=2.45; *p= .012, d*=.233), Peter Lougheed visitors reported a higher level of understanding for all of the variables in principles #4 . Based on the level of appropriateness of "*placing a tent in an undisturbed spot, when camping in heavily used areas"* there was a statistical difference between Peter Lougheed and Algonquin park visitors (PLPP *M*= 1.95, APP *M* =2.42, *p* = <.001, *d* =.386). Park visitors also differed in their knowledge of LNT principle #6: *minimize campfire impacts* with regard to the behaviour *let fire wood burn completely prior to leaving the site (*PLPP *M*= 4.37; APP *M* =3.99; *p* = <.001, *d* =.314) and *use twigs and brush for small fires* (PLPP *M*= 2.74; APP *M* =3.42; *p* = <.001, *d* =.494). Lastly, the remaining LNT behaviour which the park visitors level of knowledge differed was in regards to LNT principle #6 *Respect Wildlife.* While both park visitors knew the behaviour of *feed wildlife* in appropriate, more visitors who camped in Peter Lougheed answered the question correctly (PLPP *M*= 1.13; APP *M* =1.37; *p* = <.001, *d* =.489). Overall Peter Lougheed Provincial Park visitors provided more accurate answers then those who visited Algonquin, suggesting that Peter Lougheed Provincial Park visitors have higher levels of LNT knowledge.

Table 6
LNT actual knowledge per question

	All visitors			Peter Lougheed PP			Algonquin PP					
	N	*Mean (M)*	*Std Dev. (SD)*	*N*	*Mean (M)*	*Std Dev. (SD)*	*N*	*Mean (M)*	*Std Dev. (SD)*	*t-value*	*Sig.*	*Cohen's d*
LNT principle 1: Plan ahead and prepare												
Plan meals to minimize fuel consumption	457	4.3	.855	230	4.31	.802	227	4.28	.907	-	-	-
Read the park policies before arriving at the park	456	4.36	.803	229	4.32	.806	227	4.40	.800	-	-	-
Develop travel plans to avoid poor campsite selection (e.g. Undesignated camp site)	455	4.42	.794	230	4.39	.811	225	4.44	.778	-	-	-
LNT principle 2: Travel and camp on durable surfaces												
Travel on established trails	458	4.66	.642	230	4.68	.619	228	4.64	.665	-	-	-
Placing a tent in an undisturbed spot, when camping in heavily used areas	**453**	**2.18**	**1.24**	**229**	**1.95**	**1.09**	**224**	**2.42**	**1.33**	**4.077**	**<.001**	**.386**
Camp in groups of 10 or more people	449	2.74	1.15	229	2.79	1.12	220	2.70	1.17	-	-	-
LNT principle 3: Dispose of waste properly												
Repack food to eliminate waste	458	4.59	.713	230	4.63	.716	228	4.55	.710	-	-	-
Urinate on vegetation	458	2.44	1.20	230	2.49	1.11	228	2.38	1.28	-	-	-
Burying toilet paper If no facilities are available	451	3.27	1.38	229	3.27	1.34	222	3.27	1.42	-	-	-
LNT principle 4: Leave what you find												
Keep a single small item like a rock or feather as a souvenir	**455**	**2.66**	**1.21**	**229**	**2.36**	**1.09**	**226**	**2.96**	**1.26**	**5.347**	**<.001**	**.509**
Alter a campsite so that it is more desirable	**452**	**2.22**	**1.14**	**227**	**2.05**	**1.08**	**225**	**2.39**	**1.19**	**3.118**	**.002**	**.299**
Build a shelter or structure	**452**	**2.30**	**1.25**	**229**	**2.16**	**1.14**	**223**	**2.45**	**1.34**	**2.517**	**.012**	**.233**

LNT principle 5: Minimize campfire impacts												
Have a campfire where there is no existing fire pit	456	1.72	.998	229	1.66	.958	227	1.78	1.00	-	-	-
Let fire wood burn completely prior to leaving the site	**457**	**4.18**	**1.22**	**230**	**4.37**	**1.05**	**227**	**3.99**	**1.35**	**-3.370**	**.001**	**.314**
Use twigs and brush for small fires	**455**	**3.08**	**1.42**	**229**	**2.74**	**1.43**	**226**	**3.42**	**1.32**	**5.305**	**<.001**	**.494**
LNT principle 6: Respect wildlife												
Feed wildlife	**456**	**1.25**	**.662**	**228**	**1.13**	**.514**	**228**	**1.37**	**.766**	**3.877**	**<.001**	**.489**
Hang food or store in proper container	456	4.70	.842	230	4.73	.851	226	4.66	.834	-	-	-
Allow your dog off leash	443	2.11	1.14	225	1.96	1.11	218	2.26	1.17	-	-	-
LNT principle 7: Be considerate of other visitors												
Taking breaks off the trail so that others may pass	456	4.01	.842	228	3.99	1.06	228	4.04	1.13	-	-	-
Leave all areas of the park in a better state	458	4.52	.766	230	4.51	.758	228	4.54	.776	-	-	-
Keep noise levels to a minimum	458	4.26	.911	230	4.21	.901	228	4.31	.921	-	-	-

Ecological world view

Following Dunlap et al.'s (2000) recommendation the NEP scale was treated as a single dimension (Table 6). Anti-ecological statements were reverse coded. The internal reliability of the scale was assessed, revealing a Cronbach's alpha score of .837. Results showed there was no statistical difference between back country and front country overnight visitors. However, there was a statistically significant difference between those who camped overnight in Alberta and Ontario in their ecological world view revealed, which can be seen in Table 7 (APP *M = 3.633;* PLPP *M= 3.749, p = .021, d=.209*). To determine if socio-economic demographics were a factor in these results education, income, and level of education were controlled for when conducting ANCOVS analyses. When education was controlled for, the relationship between the park the

visitor camped at and ecological world view was no longer statistically significant. Education was a statistically significant covariate when comparing differences between visitors to the two parks and ecological world view, F (1,450) = 5.47, p = .020, Eta_2 = .012. Gender and income were non-significant covariates when differences between visitors to the two parks and ecological world view were compared.

Table 7
New Ecological Paradigm

	All visitors			**Peter Lougheed**			**Algonquin**						
	N	*Mean (M)*	*Std. Dev*	*N*	*Mean (M)*	*Std. Dev*	*N*	*Mean (M)*	*Std. Dev*	*t-value*	*Sig.*	*Cohens d*	*Cronbach's alpha*
We are approaching the limit of the number of people the earth can support.	455	3.68	1.112	230	3.75	1.08	225	3.60	1.13	-	-		-
Humans have the right to modify the natural environment to suit their needs.	455	3.49	1.096	230	3.49	1.068	225	3.502	1.126	-	-		-
When humans interfere with nature it often produces disastrous consequences.	454	3.81	.984	230	3.80	1.007	224	3.83	.962	-	-		-
Human ingenuity will ensure that we do not make the earth unlivable.	453	3.05	1.126	228	3.01	1.130	225	3.10	1.123	-	-		-
Humans are severely abusing the environment.	454	4.04	.995	229	4.03	.995	225	4.06	.996	-	-		-
The earth has plenty of natural resources if we	**455**	**2.53**	**1.147**	**230**	**2.71**	**1.191**	**225**	**2.34**	**1.071**	**-3.447**	**.001**	**.326**	**-**

just learn how to develop them.													
Plants and animals have as much right as humans to exist.	454	4.35	.958	230	4.38	.949	224	4.33	.969	-	-		-
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	455	3.75	1.028	230	3.80	.971	225	3.70	1.083	-	-		-
Despite their special abilities humans are still subject to the laws of nature.	454	4.29	.784	229	4.32	.789	225	4.25	.779	-	-		-
The so-called "ecological crisis" facing humankind has been greatly exaggerated.	**452**	**3.61**	**1.136**	**228**	**3.72**	**1.092**	**224**	**3.50**	**1.171**	**-2.141**	**.033**	**.194**	**-**
The earth is like a closed system with very limited room and resources.	455	3.62	1.038	230	3.69	1.013	225	3.54	1.060	-	-		-
Humans are meant to rule over the rest of nature.	**454**	**3.87**	**1.120**	**230**	**4.06**	**.977**	**224**	**3.66**	**1.234**	**-3.874**	**<.001**	**.359**	**-**
The balance of nature is very delicate and easily upset.	**455**	**3.94**	**.897**	**230**	**3.97**	**.876**	**225**	**3.92**	**.920**	**-.590**	**-.05**	**.055**	**-**
Humans will eventually learn enough about how nature works to be able to control it.	455	3.47	1.092	230	3.63	1.068	225	3.31	1.094	-	-		-
If things continue on their present course we will soon experience a	455	3.85	1.036	230	3.84	1.046	225	3.85	1.028	-	-		-

major ecological catastrophe.												
Total	**3.69**	**.571**	**230**	**3.74**	**.558**	**225**	**3.63**	**.579**	**-2.17**	**.031**	**.188**	**.837**

Discussion

Overall, the results of this study offer some interesting and unique findings in relation to LNT knowledge and the difference and similarities between back country and front country campers. Additionally the findings suggest more research is needed to determine the success of LNT educational campaigns and branding in Canadian provincial parks.

Based on the findings of this study park visitors in Alberta have a higher knowledge of LNT practices than those who typically camp in Ontario. These results can potentially be explained by a multitude of factors such as demographics, previous and current low-impact camping education/campaigns, and geographically location. The study participants in Alberta had a higher percentage of bachelor level and post graduate level degrees, as well as on average a higher household income. Stern et al. (1999) suggested that those with higher income tend to have a more pro-environmental world view. This is similar to findings of Larson et al. (2010) in which higher levels of income were more highly associated with biocentric world views. Furthermore, like the results of this study, Meyer (2015) found that those with higher incomes and higher levels of income are more likely to engage in PEB such as low-impact camping. While neither education nor income were significant covariates in explaining the difference of LNT knowledge, there might still be a relationship between the socio-demographic variables and respondents' level of LNT knowledge, further research is required. It should also be noted that this research did not collect race/ethnicity data of the participants' and studies have shown that

race is highly correlated with income level and education completed and how these factors relate to PEB (Vagias et al., 2015; Meyer, 2015; Larson et al. 2010; Kollmuss & Agyeman, 2010).

The very nature of the low-impact camping messaging may have also influenced the level of LNT knowledge and understanding of respondents. While Alberta Parks does not use the trademarked branding of LNT and cannot use the exact language, the park does promote low-impacting camping, bear awareness, and fire safety (Alberta Parks, 2016). Alberta parks and protected areas are very active in their bear and fire safety messaging and communication to visitors (Alberta Parks, 2016). Within the parks there is signage, messaging, pamphlets etc. as well as regular communications from parks staff. In addition the threats of grizzly bears and fires are much more prevalent in Alberta parks and protected areas. Studies suggest that park visitors are more likely to follow low-impact camping or follow park rules when they are extrinsically motivated by consequences (such as a bear attack or threat of a forest fire) (Jones & Bruyere, 2004). Therefore the risks of not following certain LNT practices such as "proper food storage" can be combined with messaging in Alberta Parks and potentially have more of an impact. Furthermore, Lawhon et al. (2013) found that low-impact camping messaging is most effective when it relates to benefits on the park itself, i.e. minimizing campfire impacts will reduce the risk of forest fires and respecting wildlife includes being "bear aware". Much of this information also applies to LNT. These results may also suggest that perhaps LNT as a brand is not as important or useful as previously believed.

Algonquin Provincial Park has been implementing a LNT education campaign and using official logos and wording since 2011, whereas Peter Lougheed park uses generic low-impact camping information. However, King's (2015) study investigated the roles commercial tour operators in Algonquin park play as delivery agents for LNT knowledge and awareness and

reported that evidence of a LNT program within the park was sparse. In the years 2012, 2013, and 2014 information surrounding an LNT program was not included in park print media and park staff did not communicate to contract and licence holders (including professional tour operators) what their role in LNT communication was expected to be (if any) (King, 2015). The role of personal communication by park staff was found to be the most effective form of communication for low-impact camping messaging (Marion & Reid, 2007; Mason, 2007; Kidd et al., 2015). Therefore Algonquin is potentially missing essential opportunities to communicate LNT education to over-night park visitors.

In this study the researcher did not observe an active LNT education campaign within the Algonquin Park. While there are placard signs in permit offices and small signs placed at trail heads, many visitors did not report awareness of the parks LNT campaign (personal communication with park visitors, 2015). Algonquin's main focus of information appeared to be garbage removal or no littering. This is achieved by distributing large garbage bags to park visitors in all permit offices. While these bags do include low-impact camping messaging the main focus is on "pack it in pack it out" or no littering. Further research is needed to address the efficacy of Algonquin Parks LNT communication and education plan.

It is interesting to note that it was the front country users who had the highest scores on the LNT awareness scale. LNT has widely been used for educating back country users and has only recently been used in front country areas. However, Hutson (2012) suggests LNT has moved beyond a set of rules in which to apply when camping and traveling in the back country but rather form a holistic educational tool used to develop a deeper connection with the land and a wildland ethic. Hutson (2012) also suggests that this ethic can and is translated into both the front country campgrounds and past that into "everyday" life. Furthermore, LNT has developed a

specific set of practices designed for the front country and urban areas (Leave No Trace Centre for Outdoor Ethics, 2012). Studies focusing on the LNT awareness of day users and front country park visitors have also demonstrated a high level of knowledge and awareness of the principles (Jones & Bruyere, 2004) and Lawhon et al. (2013) results showed users were overall extremely likely to practice LNT in the future. While it remains unclear in this study as to the exact reason why front country users were more knowledgeable than back country users regarding LNT practices future studies should investigate these two user groups.

Limitations and future research direction

This study sought to fill the gap in literature regarding the comparison of front country and back country overnight park visitors however, in doing that there is an inherent limitation. Those visitors who camp in front country and in the back country on a given trip are not necessarily reflective of what type of camper that visitor is overall: there is a continuum of type of users, some might choose to camp in the front county when with friends or young children but might prefer the back country in other situations. This study compared the type of user the visitor was in regards to their current trip. In addition to this limitation, the dichotomy of front country and back country camping also added to the difficulty of accurately assessing LNT knowledge, as some actions are more applicable and acceptable in certain settings while others are not (i.e. using twigs and brush for small fires is the suggested LNT method but in the front country most parks prohibit this practice). Lastly, the author's felt that that some LNT actions did not apply correctly to each park. Those who camp in Alberta have different noise guidelines which are appropriate in "bear country" and as such may have contributed to a lack of comprehension validity.

Future research is still needed to address the gap in knowledge of front country over-night park visitors and their low-impact camping practices. In addition, this study suggests there is a distinct difference in the knowledge and awareness of LNT principles among user types and within these two geographic locations. Future studies may choose to investigate these differences further.

The LNT education strategies of Algonquin Provincial Park must also be investigated in more depth. This study did not evaluate or investigate the specifics of their education and interpretation programs but in order to effectively asses the effectiveness of the LNT brand partnerships further studies are needed. The creation of an accurate and valid scale measuring LNT awareness was not the intention of this study, however, while analysing the data it became apparent that the 21 item scale lacked congruency and internal measurement reliability. As such the authors feel that based on this study and others (Taff et al., 2014, Vagias et al., 2012) perhaps a single item measurement scale is not an effective way to measure LNT knowledge. A tool assessing actual practices through observation and survey data may be more effective.

References

Alberta Parks. (2009). *Plan for parks.* Retrieved from http://www.albertaparks.ca/albertaparksca/about-us/plan-for-parks.aspx

Alberta Ministry of Environment and Sustainable Resource Development (2006). *Peter Lougheed and Spray Valley Provincial Parks management plan.* Retrieved from http://www.albertaparks.ca/peter-lougheed/park-research-management.aspx

Alberta Parks. (2014). *Our visitors.* Retrieved from http://www.albertaparks.ca/albertaparksca/about-us/our-visitors.aspx.

Basman, C., Manfredo, M., Barro, S., Vaske, J., & Watson, A. (1996). Norm accessibility: an exploratory study of back-country and front-country recreational norms. *Leisure Sciences, 18,* 177-198.

British Columbia Ministry of the Environment. (2011). *Facts and figures.* Retrieved from http://www.env.gov.bc.ca/bcparks/aboutBCParks/fact_fig.html.

Boon, P. I., Fluker, M., & Wilson, N. (2008). A ten-year study of the effectiveness of an educative programme in ensuring the ecological sustainability of recreational activities in the Brisbane Ranges National Park, South-eastern Australia. *Journal of Sustainable Tourism, 16*(6), 681-697.

Burgess, J., Harrison, C. M., & Filius, P. (1998). Environmental communication and the cultural politics of environmental citizenship. *Environment and planning A, 30*(8), 1445-1460.

Cohen, J. (1992). A power primer. *Psychological bulletin, 112*(1), 155.

Cole, D. N. (2004). Environmental impacts of outdoor recreation in wildlands. *Society and resource management: A summary of knowledge*, 107-116.

Cole, D. N., Hammond, T. P., & McCool, S. F. (1997). Information quantity and communication effectiveness: Low-impact messages on wilderness trailside bulletin boards. *Leisure Sciences, 19*(1), 59-72.

Cooper, C., Larson, L., Dayer, A., Stedman, R., & Decker, D. (2015). Are wildlife recreationists conservationists? Linking hunting, birdwatching, and pro-environmental behavior. *The Journal of Wildlife Management, 79*(3), 446-457.

Cordell, H. K., Green, G. T., & Betz, C. J. (2002). Recreation and the environment as cultural dimensions in contemporary American society. *Leisure Sciences, 24*(1), 13-41.

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.

Dearden, Philip, Rick Rollins, and Mark Needham eds. Parks and protected areas in Canada: Planning and management. Toronto: Oxford University Press, 2014.

De Silva, D. G., & Pownall, R. A. (2014). Going green: does it depend on education, gender or income? *Applied Economics, 46*(5), 573-586.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of social issues, 56*(3), 425-442.

Eggan, F. (1954). Social Anthropology and the Method of Controlled Comparison*. *American Anthropologist, 56*(5), 743-763. doi:10.1525/aa.1954.56.5.02a00020

George, A. L., & Bennett, A. (2005). *Case studies and theory development in the social sciences*: Mit Press.

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

Hammitt, W. E., Cole, D. N., & Monz, C. A. (2015). *Wildland recreation: ecology and management*: John Wiley & Sons.

Hutson, G. (2012). Does leave no trace make a difference beyond the scope of backcountry environmental practices. In Martin, B., & Wagstaff, M. (Eds). Controversial issues in adventure programming. Champaign, IL: Human Kinetics.

J. Vaske, M. P. D., Daniel R. Williams, Sandra Jonker, Jerry. (2001). Demographic influences on environmental value orientations and normative beliefs about national forest management. *Society &Natural Resources, 14*(9), 761-776.

Jones, M. K., & Bruyere, B. (2004). *Frontcountry Leave No Trace Program Evaluation, City of Boulder Open Space and Mountain Parks.* Paper presented at the International Symposium on Society and Resource Management Keystone, Colorado.

Kidd, A. M., Monz, C., D'Antonio, A., Manning, R. E., Reigner, N., Goonan, K. A., & Jacobi, C. (2015). The effect of minimum impact education on visitor spatial behavior in parks and protected areas: An experimental investigation using GPS-based tracking. *Journal of environmental management, 162*, 53-62.

King, L. J. (2015). The role of tour operators in delivering a Leave No Trace program: a case study of Algonquin Provincial Park. *Leisure/Loisir, 39*(1), 107-134.

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.

Larson, L. R., Whiting, J. W., & Green, G. T. (2011). Exploring the influence of outdoor recreation participation on pro-environmental behaviour in a demographically diverse population. *Local Environment, 16*(1), 67-86.

Lawhon, B., Newman, P., Taff, D., Vaske, J., Vagias, W., Lawson, S., & Monz, C. (2013). Factors Influencing Behavioral Intentions for Leave No Trace Behavior in National Parks. *Journal of Interpretation Research, 18*(1), 23-38.

Leave No Trace Canada (2009a). *Leave No Trace Programs.* Retrieved from http://www.leavenotrace.ca/leave-no-trace.

Leave No Trace Canada (2009b). *Leave No Trace Principles.* Retrieved from http://www.leavenotrace.ca/principles.

Leave No Trace Centre for Outdoor Ethics (2012). *Leave No Trace For the Front Country.*Retrieved from: https://lnt.org/teach/outdoor-ethics-frontcountry

Leung, Y.-F., & Marion, J. L. (2000). Recreation impacts and management in wilderness: A state-of-knowledge review. Cole, DN, McCool, SF, Borrie, WT, O'Loughlin, J.,(comps), Proceedings: Wilderness Science in a Time of Change, 5.

Marion, J. L., & Reid, S. E. (2001). The Development of the US Leave No Trace Program: An Historical Perspective.

Marion, J. L., & Reid, S. E. (2007). Minimising visitor impacts to protected areas: The efficacy of low impact education programmes. *Journal of Sustainable Tourism, 15*(1), 5-27.

Martin, B., Cashel, C., Wagstaff, M., & Breunig, M. (2006). Outdoor ledership: Theory and practice. Champaign, Ill: Human Kinetics

Meyer, A. (2015). Does education increase pro-environmental behavior? Evidence from Europe. *Ecological economics, 116*, 108-121.

Mobley, C., Vagias, W., & DeWard, S. (2010). Exploring additional determinants of environmental behavior: The role of environmental literature and environmental attitudes. *Environment and Behavior, 42*(4), 420-447.

Newman, P., Manning, R., Bacon, J., Graefe, A., & Kyle, G. (2002). An evaluation of Appalachian Trail hikers' knowledge of minimum impact skills and practices.

Okada, M., Okamura, T., & Zushi, K. (2013). The Effects of In-Depth Outdoor Experience on Attitudes toward Nature. *Journal of Outdoor Recreation, Education, and Leadership, 5*(3), 192-209.

Ontario Ministry of Natural Resources. (1998). Algonquin Provincial Park management plan. Retrieved from http://www.algonquinpark.on.ca/pdf/management_plan.pdf.

Ontario Ministry of Natural Resources. (2010). Ontario Provincial Parks Statistics 2010. Retrieved from http://www.ontarioparks.com/pdf/statistics/2010_park_statistics.pdf

Ontario Ministry of Natural Resources. (2011). State of Ontario's Protected Areas Report. Retrieved from http://www.mnr.gov.on.ca/en/Business/SORR/Publication/STDPROD_085570.html

Oreg, S., & Katz-Gerro, T. (2006). Predicting proenvironmental behavior cross-nationally values, the theory of planned behavior, and value-belief-norm theory. *Environment and Behavior, 38*(4), 462-483.

Pigram, J., & Jenkins, J. (2006). *Outdoor recreation management [electronic resource] / John J. Pigram and John M. Jenkins*: London ; New York : Routledge, 2006.

Plummer, R. (2009). *Outdoor recreation : an introduction.* New York :: Routledge.

Poff, R., Cleinmark, J., Stenger-Ramsey, T., Ramsing, R., & Gibson, F. (2013). Outdoor Ethics and Appalachian Trail Hikers: An Investigation of Leave No Trace Practices. *Kentucky Association of Health, Physical Education, Recreation and Dance*, 155.

Steg, L., Bolderdijk, J. W., Keizer, K., & Perlaviciute, G. (2014). An integrated framework for encouraging pro-environmental behaviour: The role of values, situational factors and goals. *Journal of Environmental Psychology, 38*, 104-115.

Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of social issues, 56*(3), 407-424.

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.

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

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

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.

van Riper, C., & Kyle, G. T. (2014). Understanding the internal processes of behavioral engagement in a national park: A latent variable path analysis of the value-belief-norm theory. *Journal of Environmental Psychology, 38*, 288-297. doi:10.1016/j.jenvp.2014.03.002

Takahashi, B., & Selfa, T. (2015). Predictors of Pro-Environmental Behavior in Rural American Communities. *Environment & Behavior*, *47*(8), 856-876. doi:10.1177/0013916514521208

Yin, R. K. (2014) *Case study research : design and methods.* 5 edition. Los Angeles, CA: Sage.

Chapter 3: Predicting Canadian park visitors' intentions to follow Leave No Trace practices; a comparison study of Value Belief Norm Theory and the Theory of Planned Behaviour

Abstract

The use of theory to predict pro-environmental behaviours has increased our understanding of factors contributing to behavioural intentions and subsequent actions. This study used the Theory of Planned Behaviour and the Value Belief Norm Theory to evaluate Canadian provincial park visitors' behavioural intentions to engage in Leave No Trace practices. As park managers learn more about the social psychological factors that influence park visitors' they can better tailor educational offerings to effect change. This study used structural equation modeling to compare the two theories and determine what factors predict intention to engage in LNT camping practices. The VBN Theory model explained 50% of total variance in LNT intentions and the TPB model was able to explain 55% of the LNT intention variance. Comparison of two models as well as recommendations to park agencies is provided.

Introduction and Study Background

The mission of many park managers in Canadian provincial parks is to successfully provide high quality recreation opportunities to park visitors while simultaneously protecting the natural environment (Dearden, Rollins & Needham, 2015). In order to best manage for sustainable outdoor recreation opportunities, such as camping, park managers must understand the behaviours of overnight park visitors and what shapes individuals' decisions to engage in pro-environmental behaviours. By understanding the factors that best predict a park visitor's intentions to engage in pro-environmental behaviours, such as low-impact camping, park managers can better tailor educational efforts to target specific behavioural factors. However, accurately predicting behaviours of park users has long been a challenge for both researchers and park managers (Lawhon et al., 2013; Taff et al., 2011; Vagias et al., 2014; Van Riper & Kyle, 2014). This research contributes to environmental psychology by comparing two major theoretical frameworks, Theory of Planned Behaviour and Values Beliefs Norms Theory to predict intention to engage in Leave No Trace camping practices (Ajzen, 1991; Stern, Dietz, Abel, Guagnano, & Kalof, 1999; Stern, 2000; Stern, Kalof, Dietz, & Guagnano, 1995). VBN proposes that individuals' actions are based on personal values (which are shaped by world views), the belief that things which are important to those values are under threat, and the notion that one's actions can help alleviate the threat posed (Stern et al., 1999; van Riper & Kyle, 2014). The notion of the natural environment being under threat in this study is presented as impacts due to outdoor recreation and overnight camping within Canadian Provincial Parks. Reducing visitor impacts by following low-impact camping practices such as LNT is one example of how to mitigate that threat. The TPB states that all behaviours are preceded by intentions, and that individuals' intentions are viewed as a function of three things: individuals' perceived control

over a situation, their attitude toward performing a particular act, and their subjective norms (Ajzen, 1991).

Guided by the two theoretical frameworks, this study measured a multitude of behavioural factors related to the popular low-impact camping educational program, Leave No Trace [LNT] as a means to assess over-night park visitors' engagement in PEB's. LNT was chosen as this minimum impact education programme is used extensively in Canada and is globally recognized (Leung & Marion, 2000; Marion & Reid, 2001). Furthermore, LNT practices were chosen as a representation of Pro-Environmental Behaviours (PEB) as they compare well with

Steg and Vlek's (2009) definition of PEB that is inclusive of a range of behaviors that benefit and or enhance the natural environment or seek to harm the environment as little as possible (Larson, Stedman, Cooper, & Decker, 2015). By using social-psychological constructs such as values, social norms, attitudes, and environmental world views, this study follows previous literature that has been successful in predicting pro-environmental behaviours and expands further by comparing two psychological theories to best achieve an understanding of an individual's intentions to engage in PEB (Guagnano, Stern, & Dietz, 1995; Oreg & Katz-Gerro, 2006).

Literature Review

Leave No Trace

LNT was first developed during the 1960's in the United States, as a response to a dramatic post war era rise in public participation in outdoor recreation. The program began as an education strategy for park and protected area managers who utilized messaging such as "pack it in pack it out". However, as time progressed so did visitor usage and it became clear that a more

detailed program was needed. During the 1990's the United States Forest Service commissioned the National Outdoor Leadership School (NOLS) to develop such a program and the LNT principles as we see them today were created. The seven principles can be seen in table 4 and are reflective of a guideline used to teach people how to use and enjoy the natural environment in a responsible manner (Leave No Trace Centre for Outdoor Ethics, 2009). Furthermore, Hutson (2012) suggests that LNT is also positioned to be tied to an individual's identity and way of being in nature. It is therefore considered more than a set of rules but a philosophy which can transform people's broader environmental ethics and awareness (Hutson, 2012).

LNT principles have been used to frame assessments of people's engagement in pro-environmental camping practices and their behaviours in parks in general (Jones & Bruyere, 2004; Lawhon et al., 2013; Newman et al., 2002; Poff et al., 2013; Taff et al., 2011). While pro-environmental behaviours are thought to be broader than individuals' actions on trails and in recreation areas, the level of engagement in LNT camping can provide insight into park and protected area visitors' environmental ethics (Poff et al., 2013). Environmental ethics are philosophies that study the moral relationship between human beings and the environment and its nonhuman living contents. The moral relationship between an individual and the natural environment can be guided by rules or codes of conduct such as LNT (Martin, Cashel, Wagstaff, & Breunig, 2006). It is these ethics which can shape a person's behaviours. While previous literature has examined LNT practices of over-night park visitors there is lack of theoretical foundation in understanding what guides an individual's intention to engage in LNT. Vagias et al. (2014) examined the viability of the TPB for predicting overnight backcountry visitors' intentions to comply with recommended LNT practices and found that both subjective norms and perceived behavioural control/perceived difficulty can have a direct influence on individuals'

behavioral intentions to comply with recommended LNT practices. Therefore it is in the interest of park managers to target social expectations regarding the appropriateness of performing LNT behaviors and the ease of performing these techniques as mechanisms to increase the adoption of recommended LNT practices (Vagias et al., 2014). This research seeks to further expand the literature surrounding social psychological constructs such as those found in both the TPB and the VBN Theory.

Leave No Trace Principles	**Examples of a Leave No Trace behaviour**
Plan ahead and prepare	Know the rules and regulations of the area you plan to visit. Prepare for all weather and hazards.
Travel and camp on durable surfaces	Hike and camp on established trails and surfaces such as rocks, snow and ice. Do not alter a campsite to make it more desirable.
Dispose of waste properly	Pack it in, pack it out. Wash dishes at least 200 feet from water sources.
Minimize campfire impacts	Use a lightweight cooking stove for meals and enjoy candle light in the evenings.
Be considerate of other visitors	Step off the trail so that others may pass. Keep noise levels to a minimum.
Leave what you find	Do not build structures or dig trenches. Leave all rocks, branches, and feathers untouched.
Respect wildlife	Never feed wildlife. Keep pets on leash or leave them at home.

Figure 4
Leave No Trace principles (www.lnt.org).

Pro Environmental Behaviours

Pro-environmental behaviours can be defined as actions whereby the individual or group seeks to minimize their negative impact on the natural environment or built environment or potentially provides benefits to one or both (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009). PEB can be both socially motivated or a function of self-interest (Ajzen, 1980) within these measures PEB are thought to either benefit society as a whole, such as supporting political platforms for climate change polices, and for more private behaviours, for example by purchasing low-emission cars or using LED lightbulbs (Stern, 2000)

Kollmuss and Agyeman (2002) investigated motivations and constraints to individuals' pro-environmental behaviours and compared numerous popular theories (including early work shaping both TPB and VBN). Findings suggest that environmental behaviours are shaped by a multitude of factors including but not limited to: economics, social forces, culture, motivations, awareness, values, emotion, locus of control, responsibility, priorities, and morals. Kollmuss and Agyeman (2002) also suggested that there is not a direct relationship between education or knowledge and pro-environmental behaviours; rather the relationships between education, values, attitudes and emotions are what shapes our 'pro-environmental consciousness'. To clarify these relationships, this current study included a self-reported LNT knowledge variable within the wider models as one of many factors that shape individuals intention to engage in LNT camping practices.

Theoretical foundation

This study compares the Value Belief Norm Theory and the Theory of Planned Behaviour in terms of their abilities to predict overall intentions to practice Leave No Trace camping (Ajzen, 1991; P. Stern, Dietz, Abel, Guagnano, & Kalof, 1999). The strengths of both theories are explained and discussed in detail in the hopes that this study will enhance theoretical knowledge and expand the literature in environmental behavioural studies. Kaiser, Hubner and Bogner (2005) suggest that the use of both theories in environmental psychology is rarely done but possibly beneficial as it allows for the understanding of more factors including the measure of individual's worldview of the environment. Furthermore, VBN Theory is values-centered and concerned with how individuals' decisions are guided within societal norms, whereas TPB ignores these norms and is grounded primarily in self-interest and rational choice or cognitive

decision making (Kaiser et al., 2005; López-Mosquera & Sánchez, 2012). By comparing the two this study offers a more well-rounded understanding of factors that predict PEB.

Value Belief Norm Theory

The Value Belief Norm Theory was developed in the context of the rise of the environmentalism movement. Researchers like Stern et al., (1999) felt there was a need for a theory which explained public support and has empirical support. According to Stern, Dietz, and Black (1986) the success of the environmental movement was largely dependent on the widespread view that environmental problems are morally intolerable or morally wrong. This appeal to individuals' moral norms is influenced by multiple factors as outlined in the VBN Theory. The theory is therefore founded upon the idea that individuals' base support for a movement or behaviour on their values, beliefs, and personal norms (Stern et al., 1986; Stern et al., 1999, Shawrtz, 1994; Stern, Dietz, Kalof, & Guagnano, 1995). The decision to act is propelled by the feeling of personal obligation and personal expectations, when an individual is aware of negative consequences and feels responsible they feel a moral obligation to act (Stern et al., 1986). This theory proposes five factors that are predictive of PEB: personal values, ecological worldview, awareness of consequences (AC), ascription of responsibility (AR), beliefs regarding the biophysical environment, and personal norms (see Figure 5).

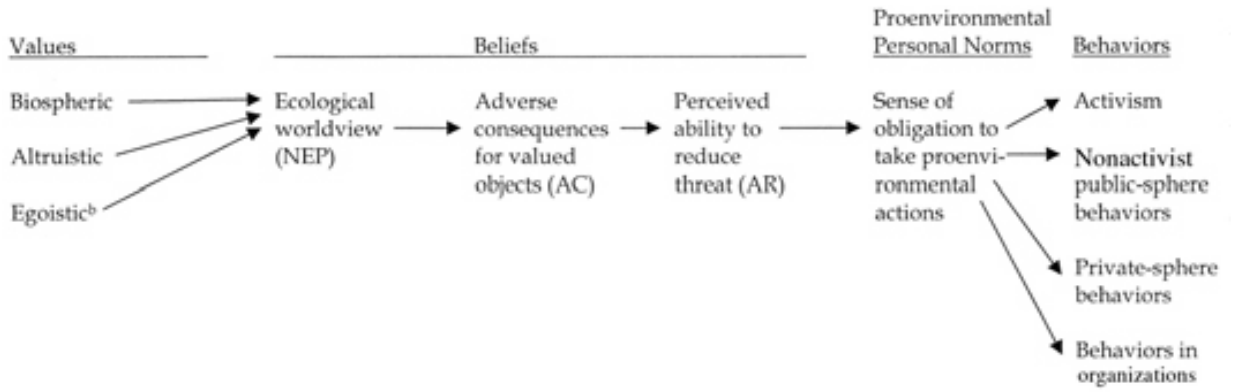

Figure 5
Value Beliefs Norm Theory (Stern, 2000)

Multiple theories and studies in the field of environmentalism were reviewed by Stern et al. (1999) to shape Value-Belief Norm Theory, and the inclusion of each component is supported by literature. In the VBN Theory the causal chain begins with personal values, this is due to the belief that values serve as guiding principles in life and help to define people's relationship with the environment (Stern et al., 1999). Altruism and self-interest have been identified by Stern et al. (1999) as the two values which most affect environmental behaviours. Schwartz (1992) defined a value as "a desirable transsituational goal varying in importance, which serves as a guiding principle in the life of a person" (p.21). Values have been measured as two or three tenants, biospheric, altruistic, and egoistic (Stern et al., 1999; Stern, Dietz, & Kalof, 1993). However, following Stern's (1994) suggestion, this study measured values as a two-dimensional variable, combining the biospheric and altruistic values as human and environmental welfare are one. Finally, an individual's beliefs are thought to be shaped by world views and general feelings towards the environment. The New Ecological Paradigm [NEP] scale (Dunlap et al., 2000) to measure peoples' beliefs about the environment is a widely accepted tool and it is suggested that higher scores on the NEP scale are directly related to the rise in biocentric environmental worldviews. Awareness of consequences, ascribed responsibly, and personal norms were

originally proposed by Schawrtz (1977) in the norm activation model as moral norms. This theory outlines that if individuals possess high biospheric/altruistic values and have ecologically positive worldviews when they are aware of the threats to the environment (AC) they will then feel a sense of responsibility to act in a way that might mitigate those threats (AR) thus activating their personal norms (Stern et al., 1999).

Stern (2000) proposes that each variable in the model seen in Figure 5 affects subsequent variables and may also have an effect on variables further down the chain both directly and indirectly. Based on previous studies no one single variable can account for activism or engaging in pro-environmental behaviours, the model works best when all variables are accounted for. Stern et al. (1999) did find evidence that personal norms are the strongest indicator for pro-environmental behaviours, when individuals were faced with a threat to the natural environment. Further, there is a relationship between personally held values and environmentalism, which is dictated by particular beliefs (Stern et al. 1993; Stern et al., 1995; Stern et al., 1999). This relationship is formed by observing how individuals are affected by environmental conditions (AC) and how their actions can possibly alleviate these threats to the environment (AR). Therefore suggesting that individuals' environmentalism is shaped by awareness of environmental issues, interpretation of how affected they are by this issue, and the individual's ability to reduce this threat.

This theory was chosen as a predictor for pro-environmental behaviour based on previous studies and similar research (Kaiser, Hübner, & Bogner, 2005; López-Mosquera & Sánchez, 2012; Oreg & Katz-Gerro, 2006; Stern et al., 1999; Stern, 2000; van Riper & Kyle, 2014) which have focused on pro-environmental behaviours such as conservation behaviour, willingness to pay, willingness to make sacrifices to benefit the natural environment, sustainable resource use,

anti-pollution and more. To date the VBN Theory has not been used to predict intentions to practice LNT and this study seeks to fill this gap.

Theory of Planned Behaviour

Predicting human behaviours is a complex and challenging task (Ajzen, 1991). There is no definite mix of factors that can constantly predict PEB. This study also utilized the Theory of Planned Behaviour to predict park visitors' engagement in LNT practices. TPB is based on Ajzen and Fishbein's (1980) theory of reasoned action. TPB however, expands this original theory to include behaviours in which individuals' have perceived volitional of control, meaning the individual can decide at will whether or not to perform an action. Many LNT behaviours are directly controlled by individuals such as disposing of waste properly or making the decision to not have a fire if no existing fire pit is provided. It is the level of control and perceived difficulty of this decision that the TPB attempts to measure.

TBP follows the proposition that behaviours (such as pro-environmental or LNT practices) are best predicted by intentions and that intentions are guided by three conceptually independent determinants of intention (attitude toward the behaviour, subjective norms, and perceived behavioural control) (Ajzen, 1991). TPB is represented in Figure 6.

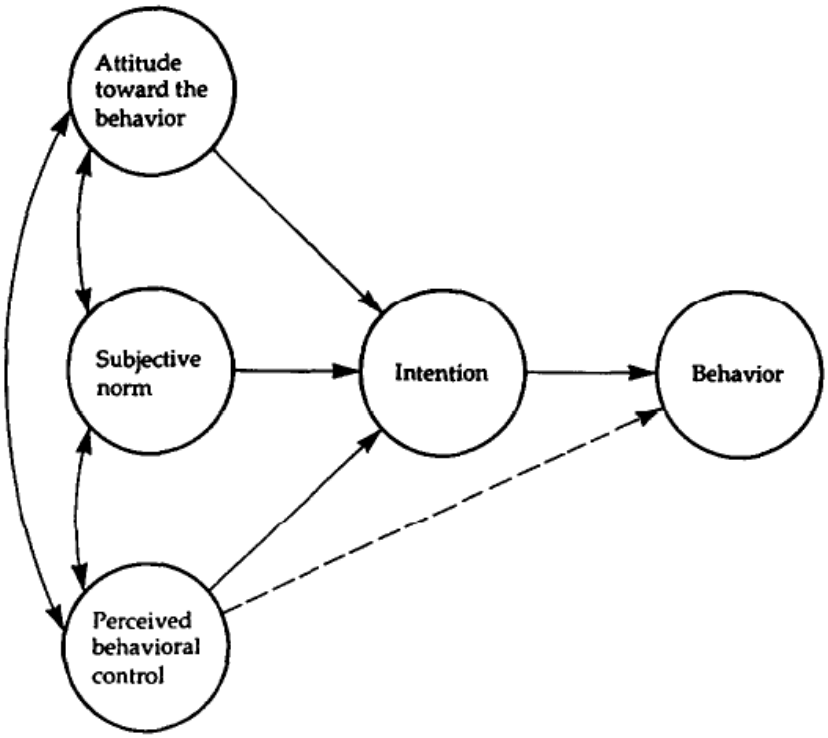

Figure 6
Theory of Planned Behaviour Model (Ajzen, 1991)

Ajzen (1991) further describes the determinants as follows:

> The first [predictor] is the attitude toward the behavior and refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question. The second predictor is a social factor termed subjective norm; it refers to the perceived social pressure to perform or not to perform the behavior. The third antecedent of intention is the degree of perceived behavioral control which… refers to the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles. As a general rule, the more favorable the attitude and subjective norm with respect to a behavior, and the greater the perceived behavioral control, the stronger should be an individual's intention to perform the behavior under consideration (pp.188).

TPB has been used in numerous studies seeking to understanding predictive factors in park visitors engagement in PEB and low-impact camping (Brown, Ham, & Hughes, 2010; Lawhon et al., 2013; Vagias et al., 2014). Vagias et al. (2014) investigated TPB's ability to predict LNT intentions and found the TPB model was able to explain 44.3% of the total variance in LNT intentions. This study also supports Bamberg and Möser (2007) findings in a meta-analysis of psycho-social determinants of PEB, suggesting that predictors of intention (attitude, subjective norms, and PBC) could capture 52% of the variance in intentions of PEB. In addition, Fielding, McDonald, and Louis (2008) studied environmental activism and found all TPB variables to be significant predictors of intention to engage in environmental activism.

A comparison of the performance of TPB vs. VBN Theory variables' ability to predict engagement in LNT practices will assist park managers in identifying what factors have the greatest impact on visitor PEB. This will therefore enable park agencies to be more effective in their intervention strategies. Additionally, the comparison of the two theories will add to the environmental behaviour scholars' theoretical dialogue regarding the importance of specific factors and their relationships to explain PEB.

Model Hypotheses

Following previous TPB models, we predict that those individuals who have positive attitudes towards the environment, who perceive support from their peers, and those who generally believe they are in control of their low-impact camping practices and PEB should have a higher likelihood to intend to engage in LNT camping practices. Similarly, in the VBN Theory model we predict that if individuals' values are in line with their overall environmental world view and they are aware of the consequences of their actions while camping, feel a sense of moral obligation or responsibility to engage in LNT camping, as well as have personal norms

that are in line with these beliefs they will have a higher likelihood to intend to engage in LNT camping practices. In addition, we predict that level of self-reported LNT knowledge will also influence individual's likelihood to intend to engage in LNT camping practices in both models.

Methods

Study Sites

The study sites selected were Peter Lougheed Provincial Park in Alberta and Algonquin Provincial Park in Ontario. These parks were selected as both offer similar front country and back country overnight camping experiences, provide access to hiking, swimming, canoeing, fishing and other popular outdoor recreation pursuits. Both parks are extremely popular sites within their respective provinces and are conveniently located to large urban metropolises, with Calgary only 130km from Peter Lougheed and Toronto only 250km from Algonquin. Peter Lougheed hosted over 100,000 over-night visitors in 2005 and Algonquin reported just over 600,000 over-night visitors in 2010 (OMNR, 2011; Alberta Tourism Parks and Recreation, 2006).

Both parks provide visitors with education and information surrounding low-impact camping practices and have rules and regulations in order to help park managers to enforce these practices. However, a formal LNT education campaign is only offered in Algonquin Provincial Park, where they have the legal rights to use official logos, wording, and messaging. Peter Lougheed uses low-impact camping messaging and wording similar to that of LNT, which encourages the practice of most if not all of the seven LNT principles.

Data collection/ sampling strategy

Data was collected using on-site-self-administered surveys during the summer of 2015 (June-September) as this reflects the highest visitor use time period for both parks. Within the data collection time period survey responses were collected during weekdays, weekend days and holidays. Park visitors were approached at random at various locations throughout the parks, including trail heads, permit offices, visitor information centres, boat launch areas, and campsites. This temporally stratified convenience-based sample strategy resulted in 456 completed surveys. Researchers used Android tablets, with an off line software tool-Droid Surveys and paper based surveys to collect all data on-site. The questionnaire included five separate sections including general information regarding their trip, self-reported LNT knowledge and awareness of principles, ecological world views, camping behaviours and attitudes, and park visitor demographic information.

Survey Design and Construct Measurement

The questionnaire was based on previous LNT and PEB literature focusing on either TPB, VBN Theory, or both (Bamberg & Möser, 2007; Kaiser, Hübner, & Bogner, 2005; Lawhon et al., 2013; López-Mosquera & Sánchez, 2012; Mobley et al., 2010; Oreg & Katz-Gerro, 2006; Vagias et al., 2014; van Riper & Kyle, 2014). Study constructs were operationalized following guidelines of the VBN Theory (Stern et al., 1999; Stern, 2000) and TPB (Ajzen, 1991, 2011), along with the LNT principles as guidelines for all variables (Marion & Reid, 2001) and can be seen in Table 8. All items were measured on a 5 point Likert scale. The dependent variable, intention to engage in LNT practices, was measured by eight items anchored by *strongly disagree* to *strongly agree.* Attitudes towards LNT practices were measured following Ajzen's (1980 and 1991) guidelines and Francis et al. (2004), suggesting that attitudes be measured with

both cognitive and affective forms and that they be anchored by bipolar adjectives such as *good* and *bad/easy* and *hard.* The original attitude scale was made up of five items with four anchors (*easy-hard, useful-useless, fulfilling-unfulfilling, and pleasant-unpleasant)* generating a total of 20 items. However, due to survey administration error with the digital data and collection instrument, which resulted in a high level of missing responses one anchor was removed (*easy-hard).* Subjective norms were measured with five constructs anchored by *strongly agree* to *strongly disagree* as was the final TPB variable, perceived behaviour control. The variables found in the VBN Theory were measured similarly. However, values were treated as a two dimensional scale including both egotistic and bioshperic-altruistic values as recommend by Stern and Dietz (1994) and van Riper and Kyle (2014). We drew the environmental value survey items from Schwartz's(1994) Value Inventory Scale to represent two dimensions that were conceptually and empirically supported in past research. Value items were anchored by *not important* to *very important* and there were 4 items for each value type, with a total of eight items in the scale. Environmental world view was measured by the New Ecological Paradigm scale (Dunlap, 2008; Dunlap et al., 2000) as in previous studies (López-Mosquera & Sánchez, 2012; van Riper & Kyle, 2014) and as suggested by Stern (1999). Awareness of consequences, ascribed responsibility, and personal norms were all measured by five item scales anchored with *strongly agree* to *strongly disagree.* Self-reported knowledge of LNT was measured with a single item on a seven point scale ranging from *no knowledge* to *expert* (Vagias et al., 2014).

Analysis

Data was analyzed using Statistical Package for the Social Sciences (SPSS) Version 23.0 and AMOS 24.0. Data were first checked for errors and assessed for normality, outliers, and multicollinearity. The distributions of all main variables failed the statistical tests for normality

(i.e. non-significant results of the Kolmogorov-Smirnov text). However, Pallant (2013) suggests this is not uncommon for large sample sizes and was therefore not unexpected. Responses were positively or negatively skewed in patterns that were anticipated by the researchers (eg. high levels of LNT were expected) and therefore deemed un-concerning. Multicollinearity was also assessed and correlations between the main variables in both model were within a preferred range (i.e., above .3 and below .7) (Pallant, 2005; Tabachnick & Fidell, 2007).

Preparing the data for structural equation modeling of park visitors' intention to engage in Leave No Trace camping practices, involved using SPSS 23.0 for identifying for random missing data and engaging in missing value estimation. In order to ensure all missing data was randomly missing Little's (2008) Missing Completely at Random (MCAR) test was conducted. The results highlighted all missing data were absent completely at random except for one variable, attitudes. The attitudes construct failed the MCAR tests and required further investigation. It was determined by the researchers that in fact there was an error in the survey design, the display of the attitude questions on the tablet version of the survey did not display the final scale of each attitude question (easy-hard, 1-5) and furthermore only had the first question in a list of 5 mandatory. This resulted in nine cases being removed and all easy-hard responses being deleted from the scale (as this measurement had more than 5% missing). All other variables however, did pass the MCAR test and therefore it was reasonable to engage in missing value estimation.

The Maximum Likelihood method was performed to replace missing values in the data set. This is done by using the Expectation Maximization Algorithm in SPSS 23.0, which creates multiple entries for each possible value and calculates the probability of observing that value to provide

the most accurate response. This method is considered one of the strongest approaches for dealing with missing values (Horton & Klienman, 2007).

Following the data preparation, exploratory factor analyses (EFA) and confirmatory factor analyses (CFA) were conducted with all latent variables. First, the 15 item scale measuring attitudes originally designed to measure two distinct attitudinal sub dimensions, affective and cognitive were subjected to an EFA and CFA, which confirmed two dimensions. However, the EFA identified a low factor loading for one item " When camping, keeping noise levels to a minimum is…" and as such this item was dropped, leaving a total of eight items measuring affective attitudes and four items measuring cognitive, for a total of 12 items. The CFA following the removal of items then revealed two factors, affective and cognitive attitudes with 64% of attitude variance explained. The EFA of the 5 item scale measuring subjective norms [SN] variable revealed one factor with 50% of the variance explained. Perceived behaviour control [PBC] was also measured by a 5 item scale however the EFA revealed 2 factors and recommended the removal of one item, "It is difficult to pack out litter and waste" due to low correlations with other PBC items. With this item removed the CFA revealed one factor with 51% of the PBC variance explained.

The factors related to the VBN Theory were also examined. As stated earlier the variable measuring values was represented by two dimensions, egotistic and biospheric-altruistic values. The EFA and CFA revealed two distinct factors and explained 60% of the variance in values. Personal norms [PN] were measured by a five item scale and the EFA and CFA revealed 1 factor, which explained 73% of the variance in PN. The variable, ascribed responsibility [AR] was also measured by a five item scale and the EFA revealed two factors and recommended the removal of one item, "I feel bothered by the amount of negative impact I have on the park" due

to low correlations with other AR items. Finally, the EFA for the five item scale measuring park visitors' awareness of consequences [AC] revealed two factors and due to low correlations it was recommended the one item be dropped, "I have a negative impact on the natural environment while camping in this park". After the removal of this item the CFA revealed one factor, which explained 52% of the variance related to AC.

To confirm internal consistency of all scales, Cronbach's alpha coefficients were generated. It is suggested that good scale reliability achieve a Cronbach's alpha coefficient of .7 or above (Nunnally, 1978) and all but three items achieved this, which can be seen in Table 9. The low Cronbach's alpha coefficients of Perceived behavioural control, Awareness of consequences, and egotistic values are however, acceptable based on previous literature (López-Mosquera & Sánchez, 2012; Vagias et al., 2014; van Riper & Kyle, 2014) and recommendations made by of Cortina (1983).

Table 8
Study Constructs

Constructs included in the structural models	Scale Items	Mean (N=456)	SD
Intentions	**α = .770**		
	I intend to stay on designated and established trails.	**4.38**	**.792**
	I intend to keep my fire as small as possible	**3.67**	**1.037**
	I intend to enjoy wildlife at a safe distance	**4.52**	**.692**
	I intend to keep noise levels at a minimum	**4.18**	**.919**
	I am willing to pack out litter and waste.	**4.53**	**.750**
Subjective Norms	**α = .745**		
	It is expected of me that I follow low-impact camping practices.	**4.44**	**.762**
	I feel social pressure to act responsibly towards the natural environment.	**3.75**	**1.095**
	The people whose opinions I value would approve of my efforts to practice low impact camping.	**4.26**	**.819**
	Most people who are important to me think I should protect the natural environment.	**4.20**	**.825**
	Other members of my group feel it is important to pack out all litter and waste.	**4.31**	**.897**
Perceived Behavioural Control	**α = .616**		
	I believe I have complete control over protecting the natural environment.	**3.31**	**1.108**
	For me it is easy to follow low-impact camping practices.	**4.09**	**.824**
	It is mostly up to me to protect the natural environment when camping.	**4.01**	**.983**
	It is easy to minimize my impact on wildlife.	**4.04**	**.901**
Attitudes*	**α = .919**		
Engaging in low-impact camping practices is…	Useful – Useless	**4.49**	**.826**
	Fulfilling - Unfulfilling	**4.54**	**8.23**
	Pleasant – Unpleasant	**4.45**	**.880**
When camping, protecting the natural environment is…	Useful – Useless	**4.70**	**.654**
	Fulfilling - Unfulfilling	**4.70**	**.657**
	Pleasant – Unpleasant	**4.64**	**.724**
Having Parks for future generations to enjoy is…	Useful – Useless	**4.86**	**.485**
	Fulfilling - Unfulfilling	**4.85**	**.538**
	Pleasant – Unpleasant	**4.82**	**.558**
When camping, minimizing my impact on wildlife is…	Useful – Useless	**4.71**	**.679**
	Fulfilling - Unfulfilling	**4.73**	**.680**
	Pleasant – Unpleasant	**4.68**	**.689**
Biospheric/Altruistic Values	**α = .826**		

	Having parks for future generations to use and enjoy.	**4.67**	**.612**
	Protecting park wildlife.	**4.68**	**.619**
	Minimizing my impact on the natural environment while camping.	**4.57**	**.678**
Egotistic Values	**α = .551**		
	Having a campfire even if there is no existing fire ring	**3.76**	**.913**
	Having command over nature	**3.62**	**1.357**
Awareness of Consequences	**α = .685**		
	The creation of unofficial trails by park users is a problem.	**3.61**	**1.007**
	Insecure food storage can harm wildlife.	**4.38**	**.773**
	A small campfire is better for the natural environment if I had small fires.	**3.98**	**.931**
Ascribed Responsibility	**α = .727**		
	I feel a shared responsibility for negative environmental impacts due to camping.	**3.98**	**.923**
	I feel a shared responsibility for protecting the wildlife in this park.	**4.39**	**.686**
	I feel a personal responsibility to act in an environmental friendly manner while camping.	**4.46**	**.681**
Personal Norms	**α = .907**		
	I feel morally obligated to minimise human impact on the natural environment while camping.	**4.35**	**.806**
	I would feel guilty if I were responsible for negative environmental impacts while camping.	**4.42**	**.783**
	I feel a sense of personal obligation to not litter while camping.	**4.60**	**.645**
	I would feel guilty if I did not follow low-impact camping practices.	**4.32**	**.815**
	Regardless of what others think I feel obligated to act responsibly while camping.	**4.53**	**.685**

Results

Respondent characteristics

Respondent's characteristics are shown in Table 9. The over-night park visitors were predominantly male (56%), with an average income of over $100,000 and highly educated, with more than 70% having completed some form of post-secondary education (college, bachelor degree, or graduate degree). High levels of income and well educated park visitors are consistent with park visitor statistics found in both Ontario and Alberta. In addition, respondents were primarily under the age of 40 with a mean age of 35. Ninety percent of participants were camping with family and friends in somewhat small groups of 5 individuals or less (68.8%). The majority were also returning visitors of the respective parks, with only 28% of park visitors camping for the first time in that particular park. In regards to LNT knowledge, 85.3% of all over-night park visitors had heard of the concepts LNT camping before. Of those who knew about LNT 33.6% reported having average knowledge, 16.4% said they had above average knowledge, and 17% suggested they had extensive or expert knowledge of LNT practices. With such high levels of awareness and self-reported knowledge of LNT in over-night park visitors it is essential to understand what other factors are contributing to the intention to engage in LNT practices as pro-environmental behaviours.

Table 9
Socio-demographic characteristics of overnight park visitors (percentages)

	All visitors
Gender %	
Male (percent)	56.0
Female (percent)	43.8
N	456
Age*	
Mean	35.53
N	140
Education %	
Elementary school	3.5
High school	24.1
College diploma	24.3
University bachelor degree	32.9
University graduate degree	15.1
N	
Income %	
I prefer not to answer this question	19
Under $50,000	17.1
$50,000-$99,000	26.5
$100,000-$149,000	19.5
More than $150,000	17.9
N	456

Structural Equation Models

Structural equation modeling (SEM) was used to test hypothesized relationships among variables and their ability to predict behaviour intentions of LNT practices. This was done using AMOS 24.0. Desirable statistical power was calculated based on Cohen's (1988; 1992) and Westland (2010) guidelines using Soper's (2016) A-priori sample size calculator for SEM. The final TBP model of the study included 16 observed and four latent variables. In contrast the VBN Theory model had 21 observed variables and eight latent variables. The sample of this study (n = 456) provided a desirable statistical power of above .90 at 5% probability level.

The TPB items subjective norms and perceived behavioural control were entered into the SEM analysis with their observed reflections; however, the attitude variable was entered using two parcels of which were aggregate means for the cognitive and affective attitude scales. The VBN Theory items were also entered into their respective model, however as per Dunlap (2008) the NEP scale was treated as one measure of environmental worldview and as such was entered using an aggregate mean. Both the TPB and VBN models achieved good fit and Table 10 highlights the fit indices for both (TPB = χ 290 ; *df* 97 ; RMSEA .06 ; CFI .912; IFI .913; VBN = χ 696.22 ; *df* 214 ; RMSEA .07 ; CFI .906; IFI .906). Model fit was assessed using a chi-square value, which in this case was relatively high though given this statistic's sensitivity to sample sizes larger than 200 (Kline, 2011, Barrett, 2007) other fit statistics were also referenced, including the root mean square error (RMSEA) which should be lower than 0.07 (Steiger, 2007), comparative fit index (CFI) and incremental fit index (IFI) > 0.90 (Bentler, 1990), and standardized root mean square residual (SRMR) < .05 (Hu & Bentler, 1999. Modification indices were also consulted to achieve good fit for each model; however, adjustments were only carried out when they were assessed to be theoretically sound (Kline, 2011).

Table 10
Model Fit Results

Model	□□	df	IFI	CFI	RMSEA
TPB	290	97	.913	.912	.06
VBN	696.22	214	.906	.906	.07

Notes. Model fit indices criteria: **IFI & CFI > .90; ***RMR < .05; ****RMSEA close to .05 * P < .001

All of the VBN Theory (Figure 7) variables were found to be significant predictors ($p < .001$). Biospheric/altruistic values ($\beta = .31$, $p < .001$) and egoistic values ($\beta = -.44$, $p < .001$) both influenced overall environmental worldview, however, egoistic values had a negative effect. Overall environmental world view as measured by the NEP scale had a positive and direct effect on awareness of consequences ($\beta = .60$, $p < .001$), awareness of consequences had a direct and positive effect on ascribed responsibly ($\beta = .84$, $p < .001$), ascribed responsibility had a positive and direct effect on personal norms ($\beta = .92$, $p < .001$), and finally personal norms had a direct and positive effect on behavioural intentions ($\beta = .69$, $p < .001$). In addition to the traditional VBN variables self-reported LNT knowledge was also significant and had a positive direct effect on behavioural intentions ($\beta = .15$, $p < .001$). The model was also able to explain a considerable amount of variance in hierarchal predictors of behavioural intentions (29% in environmental worldview, 36% of awareness of consequences, 70% of ascribed responsibility, and 85% of personal norms). Overall this model was able to predict 50% of the variation in the dependent variable, LNT behavioural intentions ($R^2 = .50$).

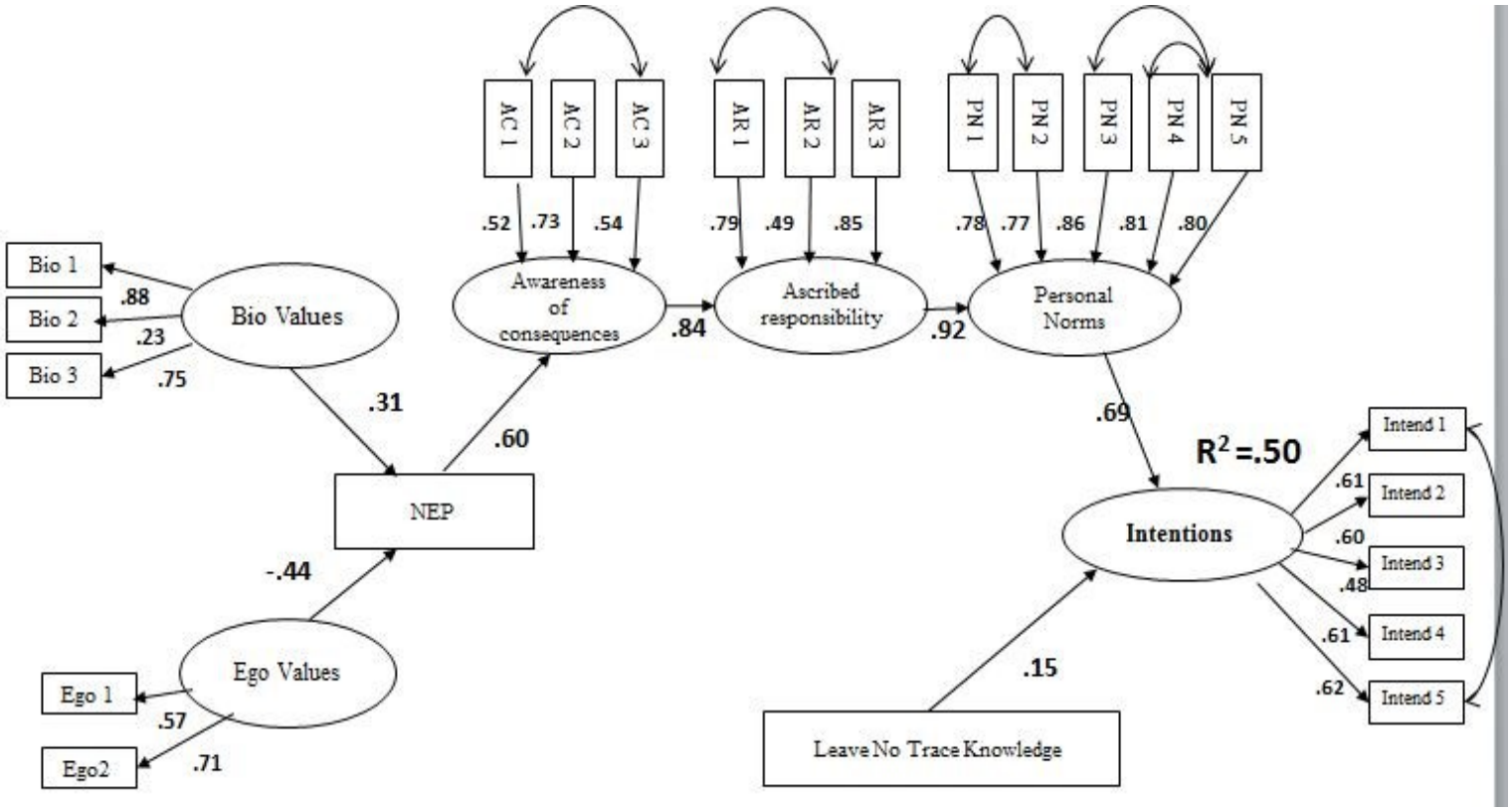

Figure 7
Structural equation model of intention to engage in LNT based on the VBN Theory

The TPB model (Figure 8) suggests that most of the variables are significant with the exception of attitudes towards LNT practices. Subjective norms (β = .23, p = .008), PBC (β =.51, p < .001), and self-reported knowledge of LNT practices (β = .11, p = .008) all positively and directly influenced behavioural intentions to engage in LNT practices. The overall model was able to predict 55% of the variation in the dependent variable behavioural intentions (R^2 = .55).

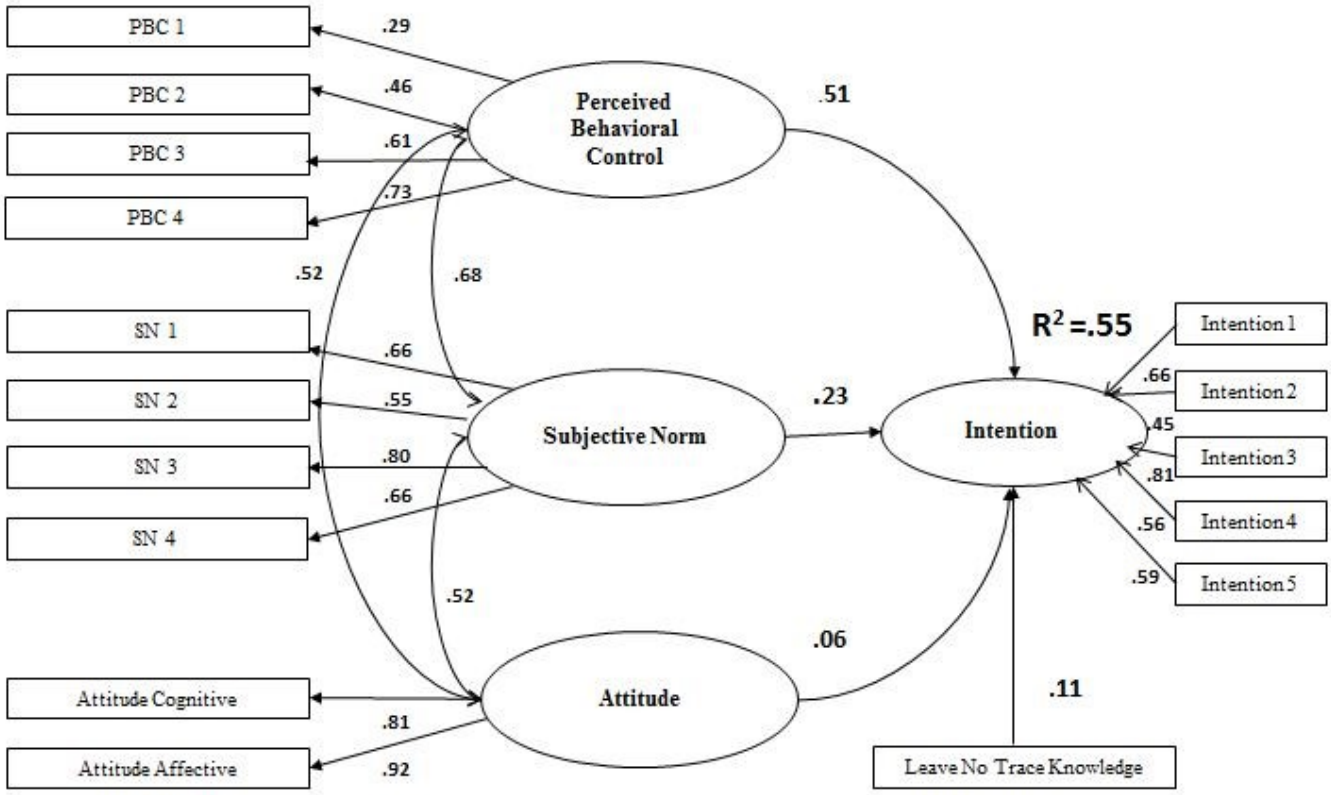

Figure 8
Structural equation model of intention to engage in LNT based on the TPB

Table 11
Regression Associations

Predictor	Dependent variable	β	SE	P value
a. The TPB model				
Attitudes	**Intentions**	.06	.064	NS
PBC	**Intentions**	.51	.208	< .001
SN	**Intentions**	.23	.084	.008
LNT Knowledge	**Intentions**	.11	.015	.008
b. The VBN model				
Biospheric/Altruistic values	**NEP**	.31	.047	< .001
Egoistic values	**NEP**	-.44	.044	< .001
NEP	**AWC**	.60	.064	< .001
AWC	**AR**	.84	.094	< .001
AR	**PN**	.92	.067	< .001
PN	**Intentions**	.69	.052	< .001
LNT Knowledge	**Intentions**	.15	.014	< .001

Comparison of the models

As previously stated both models achieved adequate fit to the data however the TPB model demonstrated slightly better fit (TPB = χ 290 ; df 97 ; RMSEA .06 ; CFI .912; IFI .913; VBN = χ 696.22 ; df 214 ; RMSEA .07 ; CFI .906; IFI .906). These findings suggest that both models could be used to predict over-night park visitors' intention to engage in LNT camping practices. In addition to achieving satisfactory goodness of fit we compared the two models' explanatory power. The results highlight that the proposed TPB model demonstrated better explanatory power (R^2 = .55) than the VBN Theory model (R^2 = .50) which is in line with other similar comparative studies (Kaiser et al., 2005; López-Mosquera & Sánchez, 2012). However, the VBN model was able to explain a high amount of variance within variables and provided a robust understanding of the factors.

Discussion

Understanding, encouraging, and facilitating LNT practices of over-night park visitors is a challenging and complex process for park managers and researchers alike. This study followed Ajzen's (1991) TBP and Stern et al.'s (1999) VBN Theory to create structural equation models aimed at understanding the predictors of behavioural intentions. The findings of this study suggest that both the TPB and VBN models offer a useful explanation of how social-psychological constructs such as values, subjective norms, perceived behavioural control, personal norms, attitudes, and environmental worldviews predict over-night park visitors' intentions to engage in LNT camping practices. Both models had good fit to the data and explained more than half of the variance in behavioural intentions and therefore the models allowed for detailed comparison and evaluation of the variables. We agree with Steg and Vlek (2009) and Wynveen, Wynveen, and Sutton (2015) in that park managers and park agencies can use the findings of this study to target engagement strategies. Such strategies are more effective when the factors that cause desired behaviors are carefully identified, understood, and used to design interventions aimed at those behavioral antecedents.

The TPB model suggests that individuals' attitudes towards LNT practices are non-significant in shaping individuals' intentions to engage in LNT. This finding is in line with previous studies focusing on LNT and other measures of PEB (López-Mosquera & Sánchez, 2012; Vagias et al., 2014) and other studies in which the association between attitudes and behavioural intentions was weaker in comparison to those of PN and PBC (Moghimehfar, 2016; Klöckner, 2013; Yoon et al., 2013). However, much of the literature surrounding PEB and TPB (Brown et al., 2010; Han, 2015; Kaiser et al., 2005; Oreg & Katz-Gerro, 2006) suggests a strong association between attitudes and intentions. One possible explanation for the non-significant result in this study is measurement error. The survey item measuring attitudes was designed

using a semantic differential scale and was formatted differently from all other questions. In addition, there was a design error on the tablet versions of the survey in which one of the cognitive measures of attitudes were missed by respondents.

Based on the strong predictive abilities of SN and PBC it is recommended that park managers focus their education efforts on those variables. Ajzen (1991) describes PBC as the ease or difficulty of performing a behaviour, this is also assumed to be a reflection of past experiences, therefore if park managers are able to make visitors understand the ease in which LNT can be practiced not only will they shape current behaviours but future ones as well. The findings also suggest that appealing to subjective norms of park visitors or the social norms of the wider society will also positively affect the likelihood of intention to engage in LNT practices. This finding is in line with Brown et al. (2010) who suggested that appealing to individual's subjective norms will likely have a positive effect on park manager's ability to persuade visitors to engage in LNT. Furthermore Vagias et al. (2014) suggests that future intervention and education efforts focus not only on knowledge and awareness of LNT but also the social expectations regarding the appropriateness of following LNT practices and the ease of performing these techniques as mechanisms to increase the adoption of recommended LNT practices. This finding is important because past research has largely looked at environmental knowledge and many LNT educational efforts focus solely on increasing recreationist's knowledge of LNT techniques (Hammitt et al., 2015).

It should not be overlooked however, that LNT knowledge was also a significant, albeit modest predictor ($\beta = .11$, $p = .008$) in determining park visitors' intention to practice LNT. Previous literature suggests that the addition of knowledge increases the explanatory power of TPB models and therefore should not be ignored (Moghimehfar, 2016; Vagias et al. 2014).

While the traditional forms of education delivery may be improved by focusing on social-psychological factors the fact remains that basic knowledge of LNT is also necessary.

The VBN model does not display as high explanatory power as the TPB model, nonetheless as a fully significant VBN path model it provides an insightful look into the factors affecting park visitors' behavioural intentions. As Stern (1999, 2000) suggests, the VBN is hierarchal and each construct may be directly related to any subsequent constructs in the model (Steg, Dreijerink, & Abrahamse, 2005). Thus, the values were modeled hierarchally and collectively predicated 50% of LNT practice intentions.

The VBN Theory is anchored in the belief that values are fundamental in shaping individuals' beliefs and actions or behaviours (De Groot & Steg, 2008) specifically when referring to PEB. Previous studies suggest that those who have more pro-social values or collective good values such as those measured on the biospheric and altruistic scale are more likely to engage in PEB (De Groot & Steg, 2008; Cameron, Brown, & Chapman, 1998, van Riper & Kyle, 2014). Similarly egoistic values are thought to have a negative affect on environmental worldviews and the liklehood to enage in PEB. These findings are in line with the current study, biospheric and altruistic values had a high positive association with environmental worldviews while egoistic values demonstrated a negative effect. As values are created at an early age and are influenced by social surroundings and cultures (Rokeach, 1973) it would be wise for park managers to continue targeting youth, as well as family and social connections.. In addition, park agencies may want to form formal relationships with schools as values can be formed and shaped during the children and youth spend in school.

Having demonstrated that values are a significant influencer of environmental worldview the tested model then suggested the influence of environmental world view on awareness of consequences, ascribed responsibility, and personal norms, and ultimately on behavioral intentions. Environmental worldviews, measured using the 15 item New Ecological Paradigm scale (Dunlap, 2008; Dunlap et al., 2000), accounted for 29% of the variance in environmental worldviews as a direct effect of values. Similarly, Van Riper and Kyle (2014),Wynveen, Kyle, and Sutton (2013) and Wynveen et al. (2015) also found that an individual's environmental world views does preceded all other variables in the VBN model.

As suggested by Stern et al. (1999) personal norms are activated when an individual is aware of an environmental threat and feel they can have influence to effect change. This study highlighted the accuracy of this theory, with 36% of the variance in awareness of consequences, 70% of variance explained in ascribed responsibility, and 85% of the variance in personal norms. Furthermore, AC and AR had the strongest associations within the model, suggesting that activating an individual's AC and AR would thereby directly influence their personal norms, resulting in engagement in LNT practices. These findings are directly in line with Wynveen et al., 2015, van Riper & Kyle, 2014 and Han, 2014 who also found strong correlations among these three variables and high proportions of explained variance. Kaiser et al. (2005) further suggest that this observation is essential to the VBN Theory.

In light of the findings of this study and validation of previous research, park managers may want to consider messaging and education content that targets an individual's level of awareness in terms of specific environmental issues or threats within a given park. In addition, park agencies should also point out strategies to mitigate these threats which targets not only the AR but also looks to the TPB variable PBC which was earlier pointed out to be highly predictive

of behavioural intentions. Wynveen et al. (2015, 2012) suggest utilizing both formal and informal education strategies which also include interactions between park staff and visitors that focus on current issues, causes, solutions, and how park visitors can effect change. These types of strategies might include workshops, presentations, and informal talks. However, the overarching goal is to activate park visitors personal norms through targeting their awareness of threats and sense of obligation to act.

Finally, as done in the TPB model we included a measure of self-reported knowledge to the VBN Theory model to test whether level of education surrounding LNT had any predictive power in park visitors' intentions to engage in LNT practices. Results suggest that knowledge of LNT is a significant, albeit modest, predictor of behavioural intentions. As stated earlier education and management interventions surrounding LNT or low-impact camping practices should still focus on knowledge translation and ensuring that park visitors are aware of LNT practices. However, this education will be strengthened with the inclusion of targeting park visitors' values, person norms, awareness of consequences, ascribed responsibility.

Limitations and Future Research

While there has been considerable research guided by theories such as TPB and VBN there is still much to learn in regards to the application of these theories in understanding park visitors' engagement in LNT practices. Park agencies stand to gain a significant improvement in their programs, educational efforts, communication techniques, and messaging when including social-physiological factors such as personal norms, perceived behavioural control and social norms.

The results of this study however, are not without limitations. We feel that there are several areas that could be improved upon in future research. More attention needs to be given to scale development and ensuring all measures are congruent with each other. The scale measuring attitudes may have been confusing for some participants, and as it was not similar in design to other factors which may have resulted in inaccurate completions. In addition, there was a problem with one of the cognitive attitude measurements being skipped by participants as the question did not appear on the screen (participants needed to scroll down the tablet to view and answer the question), this resulted in the measurement needing to be dropped due to a high percentage of missing values. As the use of tablets increases as a method of survey collection it is essential to fully test the software and design of all survey measures prior to administering surveys.

The models tested offered adequate fit to the data and accounted for more than half the variance in behavioural intentions. However, perhaps more refinement in indictor variables and the addition of other predictor variables might enhance the power of the models. This was successfully achieved by Moghimehfar (2016) by including constraints and motivations to the TPB as well as when Oreg and Katz (2005) added Inglehart's post materialist and Schwartz's harmony value dimensions as contextual antecedents in their model. These variables along with others might help to predict over-night park visitors' intention to engage in LNT practices. In addition, validating self-reported measures of LNT knowledge with actual on-the-ground measures would significantly strengthen this research.

Finally, this research focused on behavioural intentions of over-night park visitors rather than actual behaviour. This was not the desired outcome for the model, as a follow up survey intended to measure actual behaviours was sent to all participants who indicated their willingness to

complete such a survey. However, due to a low response rate of 39.5% combined with the large number of observed variables in the proposed models a much larger sample size was required. While intention is thought to be the most accurate predictor of actual behaviour, future research should seek to measure actual behaviour if possible.

The findings of this study offer valuable insight into the LNT intentions of Canadian provincial park visitors as well as shed light on their level of LNT knowledge and overall environmental world views. Future research efforts should look to evaluate intervention programs that focus on social-physiological factors to determine their success and possible improvements to current park offerings. In addition, research should expand into other Canadian provinces if possible to better understand the vast complexities of the Canadian population.

References

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

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211. doi:http://dx.doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2011). The theory of planned behaviour: reactions and reflections. *Psychology & health, 26*(9), 1113-1127.

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology, 27*(1), 14-25.

Boon, P. I., Fluker, M., & Wilson, N. (2008). A ten-year study of the effectiveness of an educative programme in ensuring the ecological sustainability of recreational activities in the Brisbane Ranges National Park, South-eastern Australia. *Journal of Sustainable Tourism, 16*(6), 681-697.

Brown, T. J., Ham, S. H., & Hughes, M. (2010). Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism, 18*(7), 879-900.

Cohen, J. (1992). A power primer. *Psychological bulletin, 112*(1), 155.

Cole, D. N. (2004). Environmental impacts of outdoor recreation in wildlands. *Society and resource management: A summary of knowledge*, 107-116.

Cole, D. N., Hammond, T. P., & McCool, S. F. (1997). Information quantity and communication effectiveness: Low-impact messages on wilderness trailside bulletin boards. *Leisure Sciences, 19*(1), 59-72.

Cooper, C., Larson, L., Dayer, A., Stedman, R., & Decker, D. (2015). Are wildlife recreationists conservationists? Linking hunting, birdwatching, and pro-environmental behavior. *The Journal of Wildlife Management, 79*(3), 446-457.

Cordell, H. K., Green, G. T., & Betz, C. J. (2002). Recreation and the environment as cultural dimensions in contemporary American society. *Leisure Sciences, 24*(1), 13-41.

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.

De Groot, J. I., & Steg, L. (2008). Value orientations to explain beliefs related to environmental significant behavior how to measure egoistic, altruistic, and biospheric value orientations. *Environment and Behavior, 40*(3), 330-354.

De Silva, D. G., & Pownall, R. A. (2014). Going green: does it depend on education, gender or income? *Applied Economics, 46*(5), 573-586.

Dunlap, R. E. (2008). The new environmental paradigm scale: From marginality to worldwide use. *The journal of environmental education, 40*(1), 3-18.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of social issues, 56*(3), 425-442.

Eggan, F. (1954). Social Anthropology and the Method of Controlled Comparison*. *American Anthropologist, 56*(5), 743-763. doi:10.1525/aa.1954.56.5.02a00020

Fielding, K. S., McDonald, R., & Louis, W. R. (2008). Theory of planned behaviour, identity and intentions to engage in environmental activism. *Journal of Environmental Psychology, 28*(4), 318-326.

George, A. L., & Bennett, A. (2005). *Case studies and theory development in the social sciences*: Mit Press.

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

Hammitt, W. E., Cole, D. N., & Monz, C. A. (2015). *Wildland recreation: ecology and management*: John Wiley & Sons.

Han, H. (2015). Travelers' pro-environmental behavior in a green lodging context: Converging value-belief-norm theory and the theory of planned behavior. *Tourism Management, 47*, 164-177.

Jones, M. K., & Bruyere, B. (2004). *Frontcountry Leave No Trace Program Evaluation, City of Boulder Open Space and Mountain Parks.* Paper presented at the International Symposium on Society and Resource Management Keystone, Colorado.

Kaiser, F. G., Hübner, G., & Bogner, F. X. (2005). Contrasting the Theory of Planned Behavior With the Value-Belief-Norm Model in Explaining Conservation Behavior1. *Journal of Applied Social Psychology, 35*(10), 2150-2170.

Kidd, A. M., Monz, C., D'Antonio, A., Manning, R. E., Reigner, N., Goonan, K. A., & Jacobi, C. (2015). The effect of minimum impact education on visitor spatial behavior in parks and protected areas: An experimental investigation using GPS-based tracking. *Journal of environmental management, 162*, 53-62.

King, L. J. (2015). The role of tour operators in delivering a Leave No Trace program: a case study of Algonquin Provincial Park. *Leisure/Loisir, 39*(1), 107-134.

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.

Larson, L. R., Stedman, R. C., Cooper, C. B., & Decker, D. J. (2015). Understanding the multi-dimensional structure of pro-environmental behavior. *Journal of Environmental Psychology, 43*, 112-124.

Larson, L. R., Whiting, J. W., & Green, G. T. (2011). Exploring the influence of outdoor recreation participation on pro-environmental behaviour in a demographically diverse population. *Local Environment, 16*(1), 67-86.

Lawhon, B., Newman, P., Taff, D., Vaske, J., Vagias, W., Lawson, S., & Monz, C. (2013). Factors Influencing Behavioral Intentions for Leave No Trace Behavior in National Parks. *Journal of Interpretation Research, 18*(1), 23-38.

Leung, Y.-F., & Marion, J. L. (2000). Recreation impacts and management in wilderness: A state-of-knowledge review. *Proceedings: Wilderness Science in a Time of Change, 5*.

López-Mosquera, N., & Sánchez, M. (2012). Theory of Planned Behavior and the Value-Belief-Norm Theory explaining willingness to pay for a suburban park. *Journal of environmental management, 113*, 251-262.

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., & Reid, S. E. (2001). The Development of the US Leave No Trace Program: An Historical Perspective.

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.

Meyer, A. (2015). Does education increase pro-environmental behavior? Evidence from Europe. *Ecological economics, 116*, 108-121.

Mobley, C., Vagias, W., & DeWard, S. (2010). Exploring additional determinants of environmental behavior: The role of environmental literature and environmental attitudes. *Environment and Behavior, 42*(4), 420-447.

Moghimehfar, F. (2016). *Predicting pro-environmental behavioural intentions of front-country campers* (Doctoral dissertation) . Retrieved from ProQuest Digital Dissertations.

Newman, P., Manning, R., Bacon, J., Graefe, A., & Kyle, G. (2002). An evaluation of Appalachian Trail hikers' knowledge of minimum impact skills and practices.

Okada, M., Okamura, T., & Zushi, K. (2013). The Effects of In-Depth Outdoor Experience on Attitudes toward Nature. *Journal of Outdoor Recreation, Education, and Leadership, 5*(3), 192-209.

Oreg, S., & Katz-Gerro, T. (2006). Predicting proenvironmental behavior cross-nationally values, the theory of planned behavior, and value-belief-norm theory. *Environment and Behavior, 38*(4), 462-483.

Poff, R., Cleinmark, J., Stenger-Ramsey, T., Ramsing, R., & Gibson, F. (2013). Outdoor Ethics and Appalachian Trail Hikers: An Investigation of Leave No Trace Practices. *Kentucky Association of Health, Physical Education, Recreation and Dance*, 155.

Rokeach, M. (1973). *The nature of human values* (Vol. 438): Free press New York.

Schwartz, S. H. (1977). Normative influences on altruism. *Advances in experimental social psychology*, *10*, 221-279.

Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology*, *25*, 1-65.

Steg, L., Bolderdijk, J. W., Keizer, K., & Perlaviciute, G. (2014). An integrated framework for encouraging pro-environmental behaviour: The role of values, situational factors and goals. *Journal of Environmental Psychology, 38*, 104-115.

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309-317.

Stern, P., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review, 6*(2), 81-97.

Stern, P., Kalof, L., Dietz, T., & Guagnano, G. A. (1995). Values, Beliefs, and Proenvironmental Action: Attitude Formation Toward Emergent Attitude Objects1. *Journal of Applied Social Psychology, 25*(18), 1611-1636. doi:10.1111/j.1559-1816.1995.tb02636.x

Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of social issues, 56*(3), 407-424.

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.

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

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

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.

van Riper, C., & Kyle, G. T. (2014). Understanding the internal processes of behavioral engagement in a national park: A latent variable path analysis of the value-belief-norm theory. *Journal of Environmental Psychology, 38*, 288-297. doi:10.1016/j.jenvp.2014.03.002

Vaske, J., Donnelly, M., Williams, D., & Jonker, S. (2001). Demographic influences on environmental value orientations and normative beliefs about national forest management. *Society &Natural Resources*,*14*(9), 761-776.

Wynveen, C. J., Kyle, G. T., & Sutton, S. G. (2013). Environmental worldview, place attachment, and awareness of environmental impacts in a marine environment. *Environment and Behavior*, 0013916513484325.

Wynveen, C. J., Wynveen, B. J., & Sutton, S. G. (2015). Applying the Value-Belief-Norm Theory to Marine Contexts: Implications for Encouraging Pro-Environmental Behavior. *Coastal Management, 43*(1), 84-103.

Chapter 4: Discussion and Conclusion

This study sought to understand and assess park visitors' knowledge of and intention to practice the seven Leave No Trace (LNT) principles as a measure of their engagement in pro-environmental behaviours. To best achieve this goal two studies were designed. The first study addressed a major gap in the literature, the understanding of front country park visitors. Much of the current research focuses on back country parks users and as such this research investigates and compares the LNT knowledge, awareness and intentions of front country and back country visitors. Park managers have different strategies for managing visitors and some park agencies choose to educate park visitors regarding low-impact practices using the principles set forth by the Leave No Trace Centre for Outdoor Ethics. It is this difference in management that this study investigated. Algonquin Provincial Park has a formal partnership with LNT Canada and therefore uses LNT logos, wording, messaging and design to educate park visitors while Peter Lougheed uses in house low-impact camping messaging. To understand the difference between LNT and non-LNT pro-environmental messaging, a comparison of LNT knowledge, awareness and intentions of park visitors who camped in an Alberta versus an Ontario park was conducted.

The results of Study 1 highlight the difference between the type of park visitor and the differences between the two parks (Algonquin and Peter Lougheed). Findings suggests that while back country users have a higher level of self-reported LNT knowledge ($M = 4.34$) than front country users ($M = 3.86$) the results are not as clear when comparing actual LNT knowledge. When asked about the appropriateness of specific actions back country users did not score as high (in terms of knowledge) as front country users on multiple LNT practices including placing a tent in an undisturbed spot when camping in heavily used areas, urinating on vegetation, having a campfire where there is no existing fire pit, letting fire wood burn completely prior to

leaving the site, allowing your dog off leash, keeping noise levels to a minimum, and more. Lawhon et al. (2013) found similar discrepancies between self-reported LNT knowledge and actual knowledge of LNT practices. Lawton et al.'s findings align with this current study, suggesting that users' perceptions of their LNT knowledge are clearly not consistent with their actual knowledge. This finding is not surprising, as visitors are still causing damage to the natural environment while camping and likely not following LNT principles they claim to understand. While front country users scored higher in terms of actual LNT knowledge there was no statistical difference in the two users' overall environmental worldview.

Back country users are typically highly educated in terms of LNT as Vagias and Powell (2010) found that more than 90% of back country visitors in Olympic National Park and Glacier National Park had knowledge of LNT and reported practicing LNT while on back country trips. In addition Jones and Bruyere, (2004), Lawhon et al. (2013), and Taff et al. (2014) all looked at front country and day users and found similar results: The majority of front country users were also keenly aware of LNT practices and these studies suggest they were extremely likely to practice LNT on future camping trips. The literature comparing front country and back country users LNT practices is very new and this study is more exploratory in nature rather than confirmatory. As such more research is needed to better understand the differences between front country and back country users.

When comparing park visitors to Algonquin Provincial Park in Ontario to those of Peter Lougheed Provincial Park it was hypothesized that those who camped in Ontario would achieve higher results in terms of actual LNT knowledge. However, the opposite was reported. It was those who camped in Alberta who scored higher in 35% of all LNT questions, while for the remaining 65% questions there was no difference. Essentially, those who camped in Ontario

knew the same if not less than those who camped in Alberta. As previously mentioned APP does have a formal partnership with LNT Canada and promotes the principles throughout the park on maps, trailhead signage, in permit offices, and through educational offerings. PLPP only uses in house developed low-impact camping messaging (although it is similar and covers the majority of LNT principles). More research is needed to explain this difference as this study did not focus on the LNT education campaign, rather was interested to see if any differences existed between the two.

In Study 2 the social psychological factors that influence PEB were investigated; this was done to help the researcher better understand park visitors and provide robust recommendations to park agencies. Following TPB and VBN Theory this research used structural equation models to measure what factors were able to best predict LNT intentions. The factors measured included: perceived behavioural control, subjective norms, attitudes, values, environmental world view, awareness of consequences, ascription of responsibility, and personal norms. In addition, this study added the measurement of self-reported LNT knowledge to extend both theories and evaluate if knowledge was a significant factor in predicting LNT intentions.

Both the TPB and VBN models achieved good fit with the data and were able to explain over 50% of the variance in LNT intentions. The study further expanded theoretical contributions, through the confirmation of predictive factors and the comparison of the two models. The TPB model was able to predict 55% of behavioural intention and achieved overall better fit indices; therefore in this case it proved to be the superior theory for predicting park visitors' intention to engage in LNT practices. In both models knowledge of LNT was also a significant factor in predicting LNT intentions. As knowledge is not typically included in either theory, this study has further expanded both theories, suggesting that in conjunction with

important social psychological factors, knowledge of LNT may influence individuals' likelihood to engage in LNT. Further research investigating the role of knowledge is suggested.

Together these two studies contribute to and enhance our understanding of provincial park overnight visitors. They attempt to explain the differences in back country and front country users, comparing users across two geographical locations, investigating the possible effects of LNT branding and partnerships, and by understanding what factors influence individuals' intentions to engage in LNT camping practices. The findings are further expanded to benefit park agencies in the next section by offering management implications.

Management Implications

Park agencies have much to gain from the two studies presented in this study. To begin with the results of the LNT knowledge scale demonstrate that perhaps there is a difference in the level of LNT knowledge between park visitors. If in fact front country visitors are more knowledgeable then we have two issues for park managers to address; how do we better educate the back country users? and why is knowledge not enough? How do we influence the behaviours of both front country and back country users?

Better education can be achieved for all park visitors; the key is to not only educate but to motivate. There are multiple avenues that parks managers can and should use to communicate LNT education. These include: trail head placards, radio advertisements, newspaper and other print media, social media (targeted campaigns), websites, maps, and of course staff presentations and personal communication with park visitors. Within these educational offers, it would be wise to remember some key points. To begin with the ideal number of messages that can be retained by viewers is two and the ideal viewing time for retention is over five seconds (Cole, Hammond, & McCool, 1997). Therefore park managers should aim to keep information brief but eye

catching, park visitors need to stop and pay attention to the information rather than pass it buy. Look for alternative designs and be strategic in placement. In terms of the content Lawhon et al. (2013) found that low-impact camping messaging is most effective when it relates to benefits on the park itself or explains what harm can be caused. Examples would include informing visitors that improper food storage can result in human bear interactions that prove fatal to the bear (park staff forced to remove the bear or kill due to increased visitor risk). Explaining the "why" behind an action is essential. Furthermore, Daniels and Marion (2005) investigated the efficacy of a two day LNT trainer course and found that knowledge was not directly correlated with behaviour. Rather they suggest that in order to influence behaviour an ethical appeal would prove more useful. Park agencies must go beyond displaying the "rules" and begin using more effective targeted messaging to educate park visitors.

In addition to the information provided by park agencies the method of delivery is a second opportunity for park managers to increase visitors' likelihood to engage in LNT camping practices. According to Marion and Reid (2007) and Mason (2007) education and interpretation is strengthened with personal communication and specifically with park staff in uniform. We as a society are conditioned to listen to and follow what those in a place of authority communicate. We also assume that those who work for the park are experts. While budgets might not allow for specific park staff to focus solely on LNT education the same results could be achieved with the use of volunteers and "friends" groups. Providing uniforms or park branded clothing may prove useful to park managers.

The third recommendation to park managers comes for the findings of Study 2. Results indicate that targeting individuals' perceived behavioural control and subjective norms will most likely have an effect on the LNT behaviours. Vagias et al. (2014) found similar results and

therefore it is suggested that LNT education focus on specific LNT skills and ease of action to decrease visitors' level of perceived difficulty. The goal is that park visitors understand that a particular skill such as proper food storage is in fact easy, and provide examples of what exactly that means (food lockers, place all items in car etc.). In addition, communication should target social expectations of park visitors' and their groups. This can be done by speaking to groups of campers together such as in permit offices or campsites, large presentations that address multiple park visitors at once, and promoting an environmentally friendly camping culture.

Research has also demonstrated that activating personal norms proves to be very effective in retention of information and likelihood to engage in pro-environmental behaviours such as LNT. Lawon et al. (2013),Vagias et al. (2014) and van Riper and Kyle (2014) suggests that park managers should attempt to spark feelings of moral obligation in those park visitors' who hold pro-environmental worldviews and associate with high levels of biospheric values. Both Algonquin and Peter Lougheed visitors were found to hold predominately pro-environmental worldviews with high altruistic and bioshperic values, therefore making these parks ideal sites for park managers to target personal norms. To do so Brown et al. (2010) suggest making park visitors aware of threats to the environment such as litter, and informing them that they have a responsibility to "do something about it." In their study Brown et al. (2010) used persuasive signage, in the face of litter on the ground in a wilderness park; visitors encountered a sign stating "*if not you than who?"* which resulted in a 37% increase in the proper disposal of waste. This example highlights an excellent strategy for activating personal norms that can easily be translated to other LNT principles.

Finally, this research has further confirmed the importance of values on the influence of LNT intentions. However, values are a challenging factor for park agencies to target. While

further research is still needed, the findings of this study suggest that park managers develop programs specifically for younger generations and promote family (parent or guardian and child) attendance at LNT education and information sessions. This would serve beneficial as values are influenced at a young age and by those closest to us/ those who have influence over values development.

Limitations and future research

The findings of this research offer new and detailed insight into Canadian provincial park visitors' LNT awareness and engagement, however, as with most research both studies have limitations. Two major limitations of this research were the self-reported LNT scales, including overall level of LNT knowledge and specific questions, as well as the lack of actual behaviour measures. While attempts were made to include a measure of actual behaviour with the addition of a follow up survey, the response rate was insufficient in providing an adequate sample size needed for statistical analysis.

Additionally, self-reported measures were used due to convenience, rather than measures of actual behaviours. This research did not have the time or the funding to develop a more in-depth tool or spend extended periods of time observing participants. However, that is a recommendation for future research.

Generalizability is a second limitation of this research. Attempts were made to include two geographically representative locations but the fact remains that one park in Ontario and one in Alberta cannot be seen as an accurate representation of all Canadian provincial park visitors and as such this research is not generalizable beyond these areas. A study investigating the LNT awareness and practices of provincially representative parks is therefore recommended.

The use of software and Android tablets is both a limitation and an enhancement to this research. The tablets themselves proved to be an effective method of data collection as they increased convenience for both the participants and the researcher. However, in this particular case more testing and practice with the use of *Droid* software and the tablets would have improved this research. Finally, a single scale measuring all seven LNT principles was attempted (based on previous studies) however, results indicated that this scale was not measuring one single factor (LNT) rather multiple factors that did not theoretically align with the seven LNT practices.

Reflection of research questions

Reflecting on the seven research questions this study sought to answer has provided some interesting results. I believe that overall Canadian provincial park visitors are aware of, and have knowledge of, Leave No Trace and the seven principles; however, the level of awareness certainly varies between user types and park. The brand "LNT" does seem to hold some relevance to park visitors but through this research process I have wondered how important or how current the Leave No Trace principles are to Canadian outdoor recreation participants. Low-impact camping and environmentally friendly camping practices seem to exists even without knowledge of LNT, and as highlighted the by the overnight visitors to Peter Lougheed the use of LNT branded messaging may not be a significant factor in educating park visitors on low-impact camping practices. Furthermore, the second research question addresses the meaning of LNT, and this study found an overwhelming amount of respondents felt that Leave No Trace meant not littering, packing out what they brought it, and cleaning up both their own garbage as well as other garbage they find. Anti-littering campaigns have been delivered across the country for many years and have not always been related to LNT messaging. It is unclear if respondents

derived their meaning from LNT education and specific knowledge or if the idea of pack it in pack it out has been developed over time and through social and cultural norms. Lastly, park visitors felt that to Leave No Trace meant leaving the park in a better state then how they found it. Ultimately, respondents expressed the desire for the natural areas of the park to be preserved and appear untouched or undisturbed by their use (as much as possible) so that the next visitor would be able to appreciate the campsite and surrounding areas.

The comparison of park visitors highlighted the differences between back country and front country overnight visitors as well as between those who camped in Algonquin and Peter Lougheed. This research provided evidence to suggest that front country overnight visitors are more aware of and have better knowledge of LNT practices, however, that is only reflective of the current trip being studied (meaning that participants could be both front county and back country users but for the purposes of this study were labelled based on their trip taking place at the time of participation). Therefore, the research question being asked regarding the difference between front country and back country users was answered but may not be reflective of who the participants are as overnight park visitors on an on-going bases. The comparison of park visitors between the two parks also resulted in a difference of LNT knowledge, suggesting that those visiting Peter Lougheed Provincial Park were more knowledgeable of LNT practices even without the use of the LNT brand (logos, messaging, wording etc.). As previously mentioned, perhaps the Leave No Trace messages and principles have transcended the brand itself and park visitors are developing low-impacting practices through experiences and less formal education.

The overall environmental world views of park visitors was measured using the NEP scale and findings propose that in fact there is no statistical difference in the environmental world views of back country and front country users. This is not surprising as there may be very little

distinction between the two users groups and quite possibly overlap based on previous and future overnight park visits. The difference in environmental world view between those who visited Algonquin versus those who camped overnight in Peter Lougheed suggested that the participants in Alberta were more bio-centric than those from Ontario. Based on certain demographic information this finding is not surprising however future studies comparing geographic locations should look to better understand more demographic information to draw a rich comparison of the two locations.

The use of theory allowed this research to better understand park visitors and what factors guide their intentions to engage in low-impact camping practices. All of the factors measured with the exception of attitudes, had a significant impact on park visitors' intentions. The factors perceived behavioural control and personal norms appeared to have the most influence on behaviour intentions. However, both models provided an in-depth understanding of park visitors and the psychological factors influencing behavioural intention to engage in LNT. The models also included a self–reported measure of LNT knowledge. This proved to be significant in predicting behavioral intentions, suggesting that knowledge and awareness of LNT is important and not something park managers can afford to stop delivering. However, this research has recommended ways in which the delivery of low-impact camping education can be improved upon and therefore become more successful and result in higher uptake of desired behaviours.

In conclusion this research was able to answer all seven research questions and provide deep insight into the LNT practices of provincial park overnight visitors. It has been both interesting and challenging disseminating the results of both studies and developing recommendations to park managers. Ultimately, the goal of this research was to better understand park visitors and

their intentions to engage in pro-environmental behaviours such as Leave No Trace camping and I feel that this was accomplished.

References

Alberta Parks. (2009). *Plan for parks.* Retrieved from http://www.albertaparks.ca/albertaparksca/about-us/plan-for-parks.aspx

Alberta Ministry of Environment and Sustainable Resource Development (2006). *Peter Lougheed and Spray Valley Provincial Parks management plan.* Retrieved from http://www.albertaparks.ca/peter-lougheed/park-research-management.aspx

Alberta Parks. (2014). *Our visitors.* Retrieved from http://www.albertaparks.ca/albertaparksca/about-us/our-visitors.aspx.

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

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.

Ajzen, I., Joyce, N., Sheikh, S., & Cote, N. G. (2011). Knowledge and the prediction of behavior: The role of information accuracy in the theory of planned behavior. Basic and Applied Social Psychology, 33, 101-117.

Ajzen, I. (2001). Nature and operation of attitudes. Annual Review of Psychology, 52, 27–58.

Ajzen, I. (2011a). Constructing a theory of planned behavior questionnaire. Unpublished manuscript. Retrieved April 7, 2014, from http://people.umass.edu/~aizen/pdf/tpb.measurement.pdf.

Basman, C., Manfredo, M., Barro, S., Vaske, J., & Watson, A. (1996). Norm accessibility: an exploratory study of back country and front country recreational norms. *Leisure Sciences, 18,* 177-198.

British Columbia Ministry of the Environment. (2011). *Facts and figures.* Retrieved from http://www.env.gov.bc.ca/bcparks/aboutBCParks/fact_fig.html.

Brown, T. J., Ham, S. H., & Hughes, M. (2010). Picking up litter: An application of theory-based communication to influence tourist behaviour in protected areas. *Journal of Sustainable Tourism, 18*(7), 879-900.

Boon, P. I., Fluker, M., & Wilson, N. (2008). A ten-year study of the effectiveness of an educative programme in ensuring the ecological sustainability of recreational activities in the Brisbane Ranges National Park, South-eastern Australia. *Journal of Sustainable Tourism, 16*(6), 681-697.

Cohen, J. (1992). A power primer. *Psychological bulletin, 112*(1), 155.

Cole, D. N. (2004). Environmental impacts of outdoor recreation in wildlands. *Society and resource management: A summary of knowledge*, 107-116.

Cole, D. N., Hammond, T. P., & McCool, S. F. (1997). Information quantity and communication effectiveness: Low-impact messages on wilderness trailside bulletin boards. *Leisure Sciences, 19*(1), 59-72.

Cooper, C., Larson, L., Dayer, A., Stedman, R., & Decker, D. (2015). Are wildlife recreationists conservationists? Linking hunting, birdwatching, and pro-environmental behavior. *The Journal of Wildlife Management, 79*(3), 446-457.

Cordell, H. K., Green, G. T., & Betz, C. J. (2002). Recreation and the environment as cultural dimensions in contemporary American society. *Leisure Sciences, 24*(1), 13-41.

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.

De Silva, D. G., & Pownall, R. A. (2014). Going green: does it depend on education, gender or income? *Applied Economics, 46*(5), 573-586.

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale. *Journal of social issues, 56*(3), 425-442.

Dunlap, R. E. (2008). The new environmental paradigm scale: From marginality to worldwide use. *The journal of environmental education, 40*(1), 3-18.

Eggan, F. (1954). Social Anthropology and the Method of Controlled Comparison*. *American Anthropologist, 56*(5), 743-763. doi:10.1525/aa.1954.56.5.02a00020

Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. Journal of Marketing Research, 18(1), 382-388.

George, A. L., & Bennett, A. (2005). *Case studies and theory development in the social sciences*: Mit Press.

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

Hammitt, W. E., Cole, D. N., & Monz, C. A. (2015). *Wildland recreation: ecology and management*: John Wiley & Sons.

Horton, N. J., & Kleinman, K. P. (2012). Much ado about nothing. The American Statistician, 61(1): 79-90.

How2stats.com (2011). Little's Missing Completely at Random (MCAR) Test – SPSS. Downloaded June 22, 2015 from https://www.youtube.com/watch?v=22aR9ruSig4

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural equation modeling: a multidisciplinary journal, 6(1), 1-55.

Hutson, G. (2012). Does leave no trace make a difference beyond the scope of backcountry environmental practices. In Martin, B., & Wagstaff, M. (Eds). Controversial issues in adventure programming. Champaign, IL: Human Kinetics.

Horton, N. J., & Kleinman, K. P. (2012). Much ado about nothing. *The American Statistician*, *61*(1): 79-90.

J. Vaske, M. P. D., Daniel R. Williams, Sandra Jonker, Jerry. (2001). Demographic influences on environmental value orientations and normative beliefs about national forest management. *Society &Natural Resources, 14*(9), 761-776.

Jones, M. K., & Bruyere, B. (2004). *Frontcountry Leave No Trace Program Evaluation, City of Boulder Open Space and Mountain Parks.* Paper presented at the International Symposium on Society and Resource Management Keystone, Colorado.

Kaiser, F. G., Hübner, G., & Bogner, F. X. (2005). Contrasting the Theory of Planned Behavior With the Value-Belief-Norm Model in Explaining Conservation Behavior1. *Journal of Applied Social Psychology, 35*(10), 2150-2170.

Kidd, A. M., Monz, C., D'Antonio, A., Manning, R. E., Reigner, N., Goonan, K. A., & Jacobi, C. (2015). The effect of minimum impact education on visitor spatial behavior in parks and protected areas: An experimental investigation using GPS-based tracking. *Journal of environmental management, 162*, 53-62.

King, L. J. (2015). The role of tour operators in delivering a Leave No Trace program: a case study of Algonquin Provincial Park. *Leisure/Loisir, 39*(1), 107-134.

Kline, R. B. (2011). Principles and practice of structural equation modeling. New York, NY: Guilford Press

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.

Larson, L. R., Whiting, J. W., & Green, G. T. (2011). Exploring the influence of outdoor recreation participation on pro-environmental behaviour in a demographically diverse population. *Local Environment, 16*(1), 67-86.

Lawhon, B., Newman, P., Taff, D., Vaske, J., Vagias, W., Lawson, S., & Monz, C. (2013). Factors Influencing Behavioral Intentions for Leave No Trace Behavior in National Parks. *Journal of Interpretation Research, 18*(1), 23-38.

Leave No Trace Canada (2009a). *Leave No Trace Programs.* Retrieved from http://www.leavenotrace.ca/leave-no-trace.

Leave No Trace Canada (2009b). *Leave No Trace Principles.* Retrieved from http://www.leavenotrace.ca/principles.

Leave No Trace Centre for Outdoor Ethics (2012). *Leave No Trace For the Front Country.*Retrieved from: https://lnt.org/teach/outdoor-ethics-frontcountry

Little, R. J. A. (1988). A Test of Missing Completely at Random for Multivariate Data with Missing Values. Journal of the American Statistical Association, 83(404), 1198-1202

Marion, J. L., & Reid, S. E. (2001). The Development of the US Leave No Trace Program: An Historical Perspective.

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.

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

Martin, B., Cashel, C., Wagstaff, M., & Breunig, M. (2006). Outdoor ledership: Theory and practice. Champaign, Ill: Human Kinetics

Meyer, A. (2015). Does education increase pro-environmental behavior? Evidence from Europe. *Ecological economics, 116*, 108-121.

Mobley, C., Vagias, W., & DeWard, S. (2010). Exploring additional determinants of environmental behavior: The role of environmental literature and environmental attitudes. *Environment and Behavior, 42*(4), 420-447.

Moghimehfar, F. (2016). *Predicting pro-environmental behavioural intentions of front-country campers* (Doctoral dissertation) . Retrieved from ProQuest Digital Dissertations.

Newman, P., Manning, R., Bacon, J., Graefe, A., & Kyle, G. (2002). An evaluation of Appalachian Trail hikers' knowledge of minimum impact skills and practices.

Nunnally J.C. (1978). Psychometric Theory, 2nd ed. New York: McGraw-Hill.

Okada, M., Okamura, T., & Zushi, K. (2013). The Effects of In-Depth Outdoor Experience on Attitudes toward Nature. *Journal of Outdoor Recreation, Education, and Leadership, 5*(3), 192-209.

Ontario Ministry of Natural Resources. (1998). Algonquin Provincial Park management plan. Retrieved from http://www.algonquinpark.on.ca/pdf/management_plan.pdf.

Ontario Ministry of Natural Resources. (2010). Ontario Provincial Parks Statistics 2010. Retrieved from http://www.ontarioparks.com/pdf/statistics/2010_park_statistics.pdf

Ontario Ministry of Natural Resources. (2011). State of Ontario's Protected Areas Report. Retrieved from http://www.mnr.gov.on.ca/en/Business/SORR/Publication/STDPROD_085570.html

Oreg, S., & Katz-Gerro, T. (2006). Predicting proenvironmental behavior cross-nationally values, the theory of planned behavior, and value-belief-norm theory. *Environment and Behavior, 38*(4), 462-483.

Pallant, J. (2005). SPSS survival manual: A step guide to data analysis using SPSS. Chicago: Open University Press

Poff, R., Cleinmark, J., Stenger-Ramsey, T., Ramsing, R., & Gibson, F. (2013). Outdoor Ethics and Appalachian Trail Hikers: An Investigation of Leave No Trace Practices. *Kentucky Association of Health, Physical Education, Recreation and Dance*, 155.

Schwartz, S. H. (1977). Normative influences on altruism. *Advances in experimental social psychology*, *10*, 221-279.

Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in experimental social psychology*, *25*, 1-65.

Steg, L., Bolderdijk, J. W., Keizer, K., & Perlaviciute, G. (2014). An integrated framework for encouraging pro-environmental behaviour: The role of values, situational factors and goals. *Journal of Environmental Psychology, 38*, 104-115.

Stern, P. C. (2000). New environmental theories: toward a coherent theory of environmentally significant behavior. *Journal of social issues, 56*(3), 407-424.

Stern, P., Dietz, T., Abel, T., Guagnano, G. A., & Kalof, L. (1999). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review, 6*(2), 81-97.

Stern, P., Kalof, L., Dietz, T., & Guagnano, G. A. (1995). Values, Beliefs, and Proenvironmental Action: Attitude Formation Toward Emergent Attitude Objects1. *Journal of Applied Social Psychology, 25*(18), 1611-1636. doi:10.1111/j.1559-1816.1995.tb02636.x

Tabachnick, B. G., & Fidell, L. S. (2007). Using multivariate statistics, 5th. *Needham Height, MA: Allyn & Bacon.*

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.

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

Takahashi, B., & Selfa, T. (2015). Predictors of Pro-Environmental Behavior in Rural American Communities. *Environment & Behavior*, *47*(8), 856-876. doi:10.1177/0013916514521208

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

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.

van Riper, C., & Kyle, G. T. (2014). Understanding the internal processes of behavioral engagement in a national park: A latent variable path analysis of the value-belief-norm theory. *Journal of Environmental Psychology, 38*, 288-297. doi:10.1016/j.jenvp.2014.03.002

Vaske, J., Donnelly, M., Williams, D., & Jonker, S. (2001). Demographic influences on environmental value orientations and normative beliefs about national forest management. *Society &Natural Resources*,*14*(9), 761-776.

Wynveen, C. J., Kyle, G. T., & Sutton, S. G. (2013). Environmental worldview, place attachment, and awareness of environmental impacts in a marine environment. *Environment and Behavior*, 0013916513484325.

Wynveen, C. J., Wynveen, B. J., & Sutton, S. G. (2015). Applying the Value-Belief-Norm Theory to Marine Contexts: Implications for Encouraging Pro-Environmental Behavior. *Coastal Management, 43*(1), 84-103.

Yin, R. K. (2014) *Case study research : design and methods.* 5 edition. Los Angeles, CA: Sage.

APPENDIX A: Algonquin LNT placard

APPENDIX B: Questionnaire

Park Visitor Environmentally Friendly Camping Survey

Dear park visitor:
This survey is designed to document park visitors' environmental friendly camping behaviours, attitudes towards nature and understanding of Leave No Trace principles. There are no "correct or "incorrect" answers in this survey so please feel free to answer honestly and openly. Information will be shared with Ontario and Alberta Parks to help improve understanding and management of park visitors.

This research is being conducted by Clara-Jane Blye at the University of Alberta under the supervision of Dr. Elizabeth Halpenny (elizabeth.halpenny@ualberta.ca). This survey should take approximately 10-15 minutes to complete. By agreeing to complete this survey, you are giving your consent for us to use the data you provide. Additional information about this survey is available in the Participant Information Letter provided to you by Clara-Jane Blye (clarajan@ualberta.ca). Thank you in advance for taking the time to complete this survey.

Section A: Your Current Trip

We would like to know the specifics of your current visit to this park.

1. How often do you visit this park? (Check only one box.)

- ☐ once or twice every 1-5 years
- ☐ once or twice a year
- ☐ 3-4 times per year
- ☐ More than 5 times per year
- ☐ This is my first time in this park

2. When you camp, how often do you camp in the back-country vs the front-country? (Check only one box)

- ☐ 0% in the back-country and 100% in the front-country.
- ☐ 20% in the back-country and 80% in the front-country.
- ☐ 40% in the back-country and 60% in the front-country.
- ☐ 60% in the back-country and 40% in the front-country.
- ☐ 80% in the back-country and 20% in the front-country
- ☐ 100% in the back-country and 0% in the front-country.

3. If you are camping in the back-country, is the backcountry camping permit registered in your name?

- ☐ Yes, the permit is registered in my name.
- ☐ No, it is registered in someone else's name in my group.
- ☐ No, we do not have a registered back-country permit.
- ☐ Not applicable, we are camping in the front-country.

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4. Including yourself, how many individuals are in your current group? (write number)

_____

5. Which of the following best describes the type of group you are with? (Check only one box.)

- ☐ Alone/By-myself.
- ☐ Family/Friends.
- ☐ Organised group (scouts, summer camp, school group).
- ☐ Commercial group (professionally guided).
- ☐ Other

6. During this trip how many nights will you spend in back-country and or the front-country? (write number)

_____ Number of nights in the back-country

_____ Number of nights in the front-country

7. Have you ever heard of the concept Leave No Trace?

- ☐ Yes
- ☐ No

8. What does Leave No Trace mean to you?

_____

_____

_____

9. How would you describe your knowledge of Leave No Trace practices? (check one)

- ☐ No Knowledge (1)
- ☐ Very Limited Knowledge (2)
- ☐ Limited Knowledge (3)
- ☐ Average Knoweldge (4)
- ☐ Above Average Knowledge (5)
- ☐ Extensive Knowledge (6)
- ☐ Expert (7)

Section B: Environmentally Friendly Camping Practices

10. During your time spent camping please select the response that most closely corresponds to your behaviour. Please rate each statement on the 5 point scale using 1 inappropriate to 5 appropriate.

	Inappropriate	Slightly inappropriate	Neutral	Slightly appropriate	Appropriate	
Have a campfire where there is no existing fire pit.	1	2	3	4	5	N/A
Let fire wood burn completely prior to leaving the site.	1	2	3	4	5	N/A
Use twigs and brush for small fires.	1	2	3	4	5	N/A
Feed wildlife.	1	2	3	4	5	N/A
Hang food or store in proper container.	1	2	3	4	5	N/A
Allow your dog off leash.	1	2	3	4	5	N/A
Take breaks off the trail so that others may pass.	1	2	3	4	5	N/A
Leave all areas of the park in a better state.	1	2	3	4	5	N/A
Keep noise levels to a minimum.	1	2	3	4	5	N/A
Alter a campsite so that it is more desirable.	1	2	3	4	5	N/A
Build a shelter or structure.	1	2	3	4	5	N/A
Travel on established trails.	1	2	3	4	5	N/A
Place a tent in an undisturbed spot, when camping in heavily used areas.	1	2	3	4	5	N/A
Camp in groups of 10 or more people.	1	2	3	4	5	N/A
Repack food to eliminate waste.	1	2	3	4	5	N/A
Urinate on vegetation.	1	2	3	4	5	N/A
Burying toilet paper if no facilities are available.	1	2	3	4	5	N/A
Plan meals to minimize fuel consumption.	1	2	3	4	5	N/A
Read the park policies before arriving at the park.	1	2	3	4	5	N/A
Develop travel plans to avoid poor campsite selection.	1	2	3	4	5	N/A
Keep a single small item like a rock or feather as a souvenir.	1	2	3	4	5	N/A

Section C: Environmental Attitudes

11. Listed below are statements about the relationship between humans and the environment.
Please indicate how you would feel about the following statements on the 5 point scale using 1 strongly disagree to 5 strongly agree.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
We are approaching the limit of the number of people the earth can support.	1	2	3	4	5
Humans have the right to modify the natural environment to suit their needs.	1	2	3	4	5
When humans interfere with nature it often produces disastrous consequences.	1	2	3	4	5
Human ingenuity will ensure that we do not make the earth unlivable.	1	2	3	4	5
Humans are severely abusing the environment.	1	2	3	4	5
Plants and animals have as much right as humans to exist.	1	2	3	4	5
The earth has plenty of natural resources if we just learn how to develop them.	1	2	3	4	5
Despite their special abilities humans are still subject to the laws of nature.	1	2	3	4	5
The so-called "ecological crisis" facing humankind has been greatly exaggerated.	1	2	3	4	5
The earth is like a closed system with very limited room and resources.	1	2	3	4	5
Humans are meant to rule over the rest of nature.	1	2	3	4	5
The balance of nature is very delicate and easily upset.	1	2	3	4	5
Humans will eventually learn enough about how nature works to be able to control it.	1	2	3	4	5
If things continue on their present course we will soon experience a major ecological catastrophe.	1	2	3	4	5
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	1	2	3	4	5

Section D: Camping Behaviours and Attitudes

The following questions relate to your attitudes regarding nature, parks, and camping practices. Please tell us about your attitude towards the natural environment and camping. Rate each question on the scale as described.

12. Engaging in low-impact camping practices is:

Useful	1	2	3	4	5	Useless
Fulfilling	1	2	3	4	5	Unfulfilling
Pleasant	1	2	3	4	5	Unpleasnt
Easy	1	2	3	4	5	Hard

13. When camping, protecting the natural environment is:

Useful	1	2	3	4	5	Useless
Fulfilling	1	2	3	4	5	Unfulfilling
Pleasant	1	2	3	4	5	Unpleasnt
Easy	1	2	3	4	5	Hard

14. Having parks for future generations to enjoy is:

Useful	1	2	3	4	5	Useless
Fulfilling	1	2	3	4	5	Unfulfilling
Pleasant	1	2	3	4	5	Unpleasnt
Easy	1	2	3	4	5	Hard

15. When camping, keeping noise levels to a minimum is:

Useful	1	2	3	4	5	Useless
Fulfilling	1	2	3	4	5	Unfulfilling
Pleasant	1	2	3	4	5	Unpleasnt
Easy	1	2	3	4	5	Hard

16. When camping, minimizing impact on wildlife is:

Useful	1	2	3	4	5	Useless
Fulfilling	1	2	3	4	5	Unfulfilling
Pleasant	1	2	3	4	5	Unpleasnt
Easy	1	2	3	4	5	Hard

17. The following questions ask your opinions about protecting natural environments such as parks and campsites.
Please indicate how you would feel about the following statements on the 5 point scale using 1 strongly disagree to 5 strongly agree.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
It is expected of me that I follow low-impact camping practices.	1	2	3	4	5
I feel social pressure to act responsibly towards the natural environment.	1	2	3	4	5
Other members of my group feel it is important to pack out all litter and waste.	1	2	3	4	5
I believe I have complete control over protecting the natural environment.	1	2	3	4	5
For me it is easy to follow low-impact camping practices.	1	2	3	4	5
It is difficult to pack out all litter and waste.	1	2	3	4	5
It is mostly up to me to protect the natural environment when camping.	1	2	3	4	5
It is easy to minimize my impact on wildlife.	1	2	3	4	5
I intend to learn about the park prior to my visit.	1	2	3	4	5
I intend to stay on designated and established trails.	1	2	3	4	5
I intend to bring home a keep sake from my trip.	1	2	3	4	5
I intend to keep my fire as small as possible.	1	2	3	4	5
The people whose opinions I value would approve of my efforts to practice low impact camping.	1	2	3	4	5
I intend to enjoy wildlife at a safe distance.	1	2	3	4	5
I intend to keep noise levels at a minimum.	1	2	3	4	5
Most people who are important to me think I should protect the natural environment.	1	2	3	4	5
I intend to pack out litter and waste.	1	2	3	4	5

18. The following questions ask your opinions about protecting natural environments such as parks and campsites.
Please indicate how you would feel about the following statements on the 5 point scale using 1 strongly disagree to 5 strongly agree.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
I feel a shared responsibility for protecting the wildlife in this park.	1	2	3	4	5
I feel a shared responsibility for negative environmental impacts due to camping.	1	2	3	4	5
I feel bothered by the amount of negative environmental impact I have on the park.	1	2	3	4	5
I feel a shared responsibility for the erosion of shore lines or trails in this park.	1	2	3	4	5
I feel a personal responsibility to act in an environmental friendly manner while camping.	1	2	3	4	5

19. The following questions ask your opinions about protecting natural environments such as parks and campsites.
Please indicate how you would feel about the following statements on the 5 point scale using 1 strongly disagree to 5 strongly agree.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
I feel morally obligated to minimise human impact on the natural environment while camping.	1	2	3	4	5
I would feel guilty if I were responsible for negative environmental impacts while camping.	1	2	3	4	5
I feel a sense of personal obligation to not litter while camping.	1	2	3	4	5
I would feel guilty if I did not follow low-impact camping practices.	1	2	3	4	5
Regardless of what others think I feel obligated to act responsibly while camping.	1	2	3	4	5
I have a negative impact on the natural environment while camping in this park.	1	2	3	4	5
The creation of unofficial trails by park users is a problem.	1	2	3	4	5
Erosion of shore lines and trails is a problem in this park.	1	2	3	4	5
Insecure food storage can harm wildlife.	1	2	3	4	5
A small campfire is better for the natural environment.	1	2	3	4	5

20. The following questions ask your opinions about natural environments such as parks and campsites.
Please indicate the level of importance the following statements hold to you on the 5 point scale using 1 not important to 5 very important .

	Not important	Slightly Important	Neutral	Important	Very Important
Sharing the park with other visitors.	1	2	3	4	5
Ensuring parks are available for future generations to enjoy.	1	2	3	4	5
Protecting park wildlife.	1	2	3	4	5
Minimizing my impact on the natural environment while camping.	1	2	3	4	5
Having command over nature.	1	2	3	4	5
Having influence over the environmental behaviours of others in my camping group.	1	2	3	4	5
Having a campfire even if there is no existing fire ring.	1	2	3	4	5
Being in control of planning and preparing for this trip.	1	2	3	4	5

Section E: Demographics
This section will give us a better understanding of people who took part in our study

21. Where do you normally live?

- ☐ Alberta
- ☐ Ontario
- ☐ Another Canadian province _____
- ☐ USA
- ☐ A country other than USA or Canada please name _____

22. Gender?

- ☐ Male
- ☐ Female
- ☐ Other

23. What is your postal code or zip code (for US and Canadian respondents) _____

24. What year were you born in?_____

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

- ☐ Elementary school
- ☐ High school
- ☐ College diploma
- ☐ University bachelor degree
- ☐ University graduate degree

26. What is your total household income (before taxes)?

- ☐ Under $50 000
- ☐ $50 000-$99 999
- ☐ $100 000- $149 999
- ☐ More than $150 000
- ☐ I choose not to answer

Section F: Follow up Survey and Request for Results Summary
We would like to conduct a 5 minute online follow up survey that will be e-mailed to you 4 weeks after today. Please provide your contact information if you are willing to participate in this brief follow up survey. Additionally, if you would like to receive a summary of this research project's findings, please provide your contact information below

__Yes I am willing to participate in the Follow Up Survey

__Yes I would like a Summary of the Study's Results.

Name: _____

Email: _____

Telephone: _____

Thank you very much for your time.

APPENDIX C: Follow up survey

UNIVERSITY OF ALBERTA
FACULTY OF PHYSICAL
EDUCATION AND RECREATION

Environmental Behaviors, Attitudes, and Low-Impact Camping

* 1. Think back to your recent camping trip in either Algonquin Provincial Park or Peter Lougheed Provincial Park and select the response that most closely corresponds to your behaviors while camping.
For example: On your most recent camping trip did you stay on designated trails? Answer: 3 (sometimes), or whatever BEST fits with your behaviors while on your camping trip.

We have provided space for comments if you would like to clarify what you did or explain why you did it.

	1 – Never	2 – Occasionally	3 – Sometimes	4 – Frequently	5 – Always	NA – Not applicable/Does not Apply
Develop travel plans to avoid poor campsite selection.	○	○	○	○	○	○
Read the park policies before arriving at the park.	○	○	○	○	○	○
Plan meals to minimize fuel consumption.	○	○	○	○	○	○
Bury toilet paper when no facilities were available.	○	○	○	○	○	○
Urinate on vegetation.	○	○	○	○	○	○
Repack food to eliminate waste.	○	○	○	○	○	○
Camp in groups of 10 or more people.	○	○	○	○	○	○
Place a tent in an undisturbed spot, when camping in heavily used areas.	○	○	○	○	○	○
Travel on established trails.	○	○	○	○	○	○