Journal of Outdoor Recreation and Tourism 29 (2020) 100258

Contents lists available at ScienceDirect

Journal of Outdoor Recreation and Tourism

journal homepage: www.elsevier.com/locate/jort

Do Canadians Leave No Trace? Understanding Leave No Trace attitudes of frontcountry and backcountry overnight visitors to Canadian provincial parks

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ARTICLE INFO

Keywords:
Park management
Outdoor recreation
Leave No trace
Environmental behaviours
Visitor management

ABSTRACT

Both Ontario and Alberta's provincial park systems receive more than 8 million visitors on an annual basis. Park managers must employ direct (e.g., rules and regulations) and indirect (e.g., education and interpretation programs) strategies to minimize negative environmental impacts caused by these visitors. 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 perceived LNT knowledge of Canadian provincial parks users as well as determine park visitors' attitudes towards LNT practices. Park visitors' knowledge of and attitudes towards LNT practices were measured to determine if there was a difference between (a) those who camped in the backcountry and frontcountry and (b) between those who camped in Alberta and Ontario provincial parks. Results suggest there are in fact statistical and substantive differences between frontcountry and backcountry over-night visitors as well as those who visited parks in Alberta and Ontario. While those who camped in the backcountry had higher self-reported levels of LNT knowledge, those who camped in the frontcountry expressed pro-environment behavioural attitudes that more closely aligned with LNT practices. Additionally, Alberta park visitors reported higher levels of LNT knowledge and consistently demonstrated pro-environment behavioural attitudes more in line with LNT practices than those of park visitors in Ontario.

Management implications: Understanding differences between park users' knowledge and attitudes, will help park managers develop more effective education programs designed to foster pro-environmental behaviours and attitudes with the goal of reducing the negative impacts associated with camping. There has been controversy in recent years related to the appropriateness and effectiveness of LNT, however, this research suggests that park visitors do in fact know what LNT is and hold attitudes largely in line with the principles, therefore suggesting it is still highly relevant. Significant differences in LNT attitudes and knowledge can be observed between users (i.e., backcountry and frontcountry), which may be explained by social demographics; education efforts should target the most common depreciative behaviours (e.g., dogs off leash) and be tailored to context and user group. Finally, this study suggests that perhaps the LNT brand is not enough, but rather consistent and tailored communication from park staff focusing on consequences of inappropriate behaviours and benefits to the park may be more effective at changing knowledge and attitudes than campaigns officially associated with the LNT brand.

1. Introduction

Outdoor recreation involves the interaction between humans and the natural environment. However, this interaction creates impacts on the natural environment, such as soil compaction and habitat fragmentation (Hammitt, Cole, & Monz, 2015). Hiking and camping on designated trails and campsites assigns visitor use impacts to these already impacted areas. However, when visitors venture off designated trials, hike and camp in remote sections, or simply do not use recreation areas correctly, negative effects can be devastating and possibly irreversible (Cole, 2004; Dearden, Rollins, & Needham, 2014; Pigram & Jenkins, 2006). Recreation settings are typically separated into two "types" or opportunities; frontcountry and backcountry. Frontcountry can be thought of as areas that are accessible by car whereas

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https://doi.org/10.1016/j.jort.2019.100258
Received 29 March 2017; Received in revised form 17 September 2019; Accepted 18 September 2019
Available online 30 September 2019

backcountry areas are typically accessed through hiking, biking, canoeing, skiing or kayaking. In response to the negative impacts that humans can cause while camping (either in frontcountry or backcountry areas) research has been conducted to investigate how backcountry overnight visitors mitigate these negative impacts through low-impact camping practices (Vagias & Powell, 2010). However, little research has focused on the millions of frontcountry overnight visitors.

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 [OMNR], 2011; Alberta Parks, 2009). Over 8.5 million people visit Alberta provincial 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 (OMNR, 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 (OMNR, 2011; Pigram & Jenkins, 2006).

In order to mitigate negative impacts caused by outdoor recreation, park managers must employ multiple strategies, including direct (e.g., enforcement of rules and regulations) and indirect methods (e.g., education and interpretation programs) (Leung & Marion, 2000; Hammit et al., 2015; Plummer, 2009). Education is an indirect management strategy for parks and protected areas mangers that aims to change visitors' behaviours to be more environmentally sustainable. Leave No Trace [LNT] is a widely accepted educational program designed to reduce environmentally depreciative behaviours and promote responsible outdoor recreation through low-impact camping practices (Marion & Reid, 2001; LNT Leave No Trace Canada, 2009a). While the principles identified by LNT were initially developed for the backcountry, the concepts can and are being applied to frontcountry camping areas (Leave No Trace Centre for Outdoor Ethics, 2012). Increased understanding of park visitors' attitudes may help to predict and encourage pro-environmental behaviours, therefore this study examines overnight visitors to Canadian provincial parks and their knowledge of and attitudes toward LNT practices (Ajzen, 1991; Pooley & o'Connor, 2000; Vagias & Powell, 2010). To address this agenda, this study compared both frontcountry and backcountry users within two Canadian provinces, Alberta and Ontario.

2. Literature review

2.1. Leave No Trace

LNT was developed in response to a sharp increase in recreational land use in The United States during the 1960s and 1970s (Marion & Reid, 2001). Its' seven principles are: (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 Leave No Trace Canada, 2009b). According to Leave No Trace Centre for Outdoor Ethics (2012) LNT principles are a tool for teaching people how to use and enjoy the natural environment in a responsible manner. However, LNT may be 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; 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).

Currently LNT has been used in all 50 US states and more than 30 countries around the world, including Canada (Leave No Trace Centre for Outdoor Ethics, 2012). In 2015, it was 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, 2012). 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; its' traveling trainers program has hosted over 30 events (Leave No Trace Canada, 2009a). The efficacy of LNT outreach has been assessed by several studies; these are outlined next.

2.2. Comparing frontcountry and backcountry users

Currently there is a paucity of research comparing frontcountry and backcountry overnight park visitors. Much of the current research comparing these 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. However, the two studies that exist on this topic, Taff (2012) and Basman, Manfredo, Barro, Vaske, and Watson (1996), show differences between these two user groups. Basman et al. (1996) found that frontcountry and backcountry user groups have distinct salient norms and therefore might interact with the natural environment in different ways, such as park visitors' willingness to practice LNT. The users in the backcountry setting found reducing their impact to be significantly more important than those in the frontcountry. However, it is important to note that the study's authors suggest their study was exploratory in nature and not representative of all backcountry and frontcountry norms, calling for additional visitor comparative research (Basman et al., 1996).

While not focused on comparing backcountry and front country visitors Lawhon, Taff, Newman, Vagias, and Miller (2019) explored frontcountry visitors' attitudes toward and support for LNT in three Wyoming state parks. Across all three parks visitors felt the LNT camping was effective at reducing environmental impacts; the study provided much needed insight into frontcountry visitors' use and attitudes towards LNT (Lawhon et al., 2019). However, when comparing visitors across different types of park (i.e. national park, national forest, and state parks) the visitors did report differences. National park visitors held attitudes more inline with LNT and had more supportive behavioural intentions than both the national forest and state park visitors (Backman et al., 2018). Further suggesting that park visitors differ in their attitudes towards LNT and calling for more research specifically focused on varied user groups.

Visited by many different user types, the Appalachian Trail is a recreation setting in which LNT practices are strongly encouraged. The Appalachian Trail provides interesting opportunities for comparisons of user types. These users are typically not considered frontcountry users, however, there is certainly a distinction between day hikers, section hikers, and thru hikers (Poff et al., 2013). Different types of users on the Appalachian Trail follow LNT in varying degrees (Newman et al., 2002; Poff et al., 2013). Studies of Appalachian Trail hikers 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. These studies highlight the need for continued research on frontcountry overnight visitors and a better understanding for how

these park visitors might differ from others such as backcountry or day use visitors. The research presented here sought to further insights into park visitors by exploring the potential differences in users based on the setting of their current park visit (backcountry vs frontcountry). Additionally, to address calls for more internationally diverse study settings, this research focused on the under-researched Canadian park visitor.

2.3. LNT knowledge, attitudes, and environmental behaviours

At its core, environmental education seeks to educate in, about, and for the environment, and as such aims to ensure that both the learner and the environment are better because of the educational experience (Donaldson & Donaldson, 1958). Therefore, environmental education focusing on pro-environmental behaviours such as LNT practices ultimately should provide knowledge to learners and the tools to engage in pro-environmental behaviours. 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 can be environmentally significant (Stern, 2000), not just minimizing negative impacts, but engaging in pro-active stewardship such as donations and volunteerism (Halpenny, 2010). Pro-environmental behaviours can also be thought of as goal driven behaviours, in which an individual acts in a pro-environmental manner for 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).

Environmental education programs attempting to increase pro-environmental behaviours such as LNT have 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; Schwartz et al., 2018). However, it is widely believed that education alone does not influence behaviours (Kollmuss & Agyeman, 2002; Lawhon, Taff, Newman, Vagias, & Newton, 2017). Knowledge and education can have some effects on behavioural change, although in the case of LNT and environmental behaviours, the effects are relatively small. Jones and Bruyere (2004) conducted a pre and post education campaign study of frontcountry recreationists in Boulder. Following a five-month educational program of park signage, brochures, local public access videos, and newspaper articles results indicated only a 2% gain in overall LNT knowledge. Youth participating in the Leave No Trace centre for Outdoor Ethics PEAK program increased their LNT knowledge immediately following the program, however, retention after 8-months significantly decreased (Miller, Shellman, Hill, Ramsing, & Lawhon, 2014). Furthermore Lawhon et al. (2013) found that delivering new information was not as successful as programs that focus on the effectiveness of LNT and the benefits to parks. Similarly, longer duration of programs, and a combination of field work and in classroom time have been shown to be the ideal combinations for effective LNT education (Daniels & Marion, 2005). In addition, Daniels and Marion's (2005) study suggested that LNT messaging should target individuals' ethics (i.e. *a fed bear is a dead bear*). Simply providing information is no longer enough, LNT education must include the why behind the actions.

Recent criticism of environmental education suggests that too much emphasis has been placed on education 'in and about the environment' rather than education focused on 'being for the environment' (Davis, 2005). In addition, research has tended to focus on knowledge as the predictor for environmental behaviours rather than attitudes. However, it is attitudes rather than knowledge that are better predictors of behaviour (Ajzen, 1991, 2011). Attitudes are understood as the level or degree of favorableness or unfavourableness with respect to a psychological object, such as a behaviour (Ajzen & Fishbein, 2000). When seeking to understand park visitor's likelihood to engage in LNT behaviours, attitudes have become a more accepted measure (Lawhon et al., 2019; Schwartz et al., 2018; Sharp, Maples, & Gerlaugh, 2018; Taff, Newman, Vagias, & Lawhon, 2014; Vagias & Powell, 2010; Vagias, Powell, Moore, & Wright, 2014). Attitudes develop through the attainment of information and knowledge about an object or topic, they evolve and change as new information influences beliefs (Ajzen & Fishbein, 2000). Therefore, park managers can in fact change or alter attitudes, and influence visitors LNT attitudes through persuasive, effective communication and education. It is for these reasons that this research focuses on understanding park visitors' self-reported level of LNT knowledge and attitudes towards LNT practices.

3. Methods

The goal of this study was to understand Canadian provincial park visitors' attitudes towards LNT practices and assess perceived LNT knowledge levels of overnight park visitors. Park visitors' knowledge of and attitudes towards LNT practices were measured to determine if there was a difference between those who camped in the backcountry and frontcountry and within provincial parks located in Alberta and Ontario. Attitudes towards LNT principles and practices were considered salient as attitudes towards environmental behaviours are an important determinant of pro-environmental behaviours and intentions.

3.1. Study sites

The two parks examined were Algonquin Provincial Park (APP) in Ontario and Peter Lougheed Provincial Park (PLPP) in Alberta (see Fig. 1 for location on map). These parks are culturally comparable, have high visitation numbers, offer similar backcountry and frontcountry camping opportunities, and are characterized by a broad representation of visitors to provincial parks in Canada. APP 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, PLPP does not employ formal LNT materials or content and uses in-house generated messaging to promote low-impact camping.

Algonquin is the oldest provincial park in Canada, founded in 1893 as Algonquin National Park, the name was changed to Algonquin Provincial Park in 1913 (Killan, 1993; OMNR, 1998). Algonquin is located in the province of Ontario, and encompasses 772,300 ha of provincially significant natural and cultural heritage (OMNR, 1998).

Due to the high level of biodiversity within the park, APP is classified as a Natural Environment Park (OMNR, 1998). The park boasts many recreational opportunities including backpacking, snow-shoeing, canoeing, camping, swimming, cross-country skiing, hiking, bird watching and more. In 2010, APP hosted 830,899 visitors, of which 219,991 were day use, close to 250,000 were backcountry users, and approximately 400,000 overnight visitors made use of the parks' 1330 frontcountry or auto accessible campsites (OMNR, 2011). In addition, APP contains over 2000 km of canoeing routes and hiking trails with over 1900 backcountry campsites (Friends of Algonquin Park, 2012).

In 2011, APP 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), posted on the park's website, and is found within both canoe route and backcountry hiking maps. The park also produced large placard board signs for all access point and permit offices (see Appendix A).

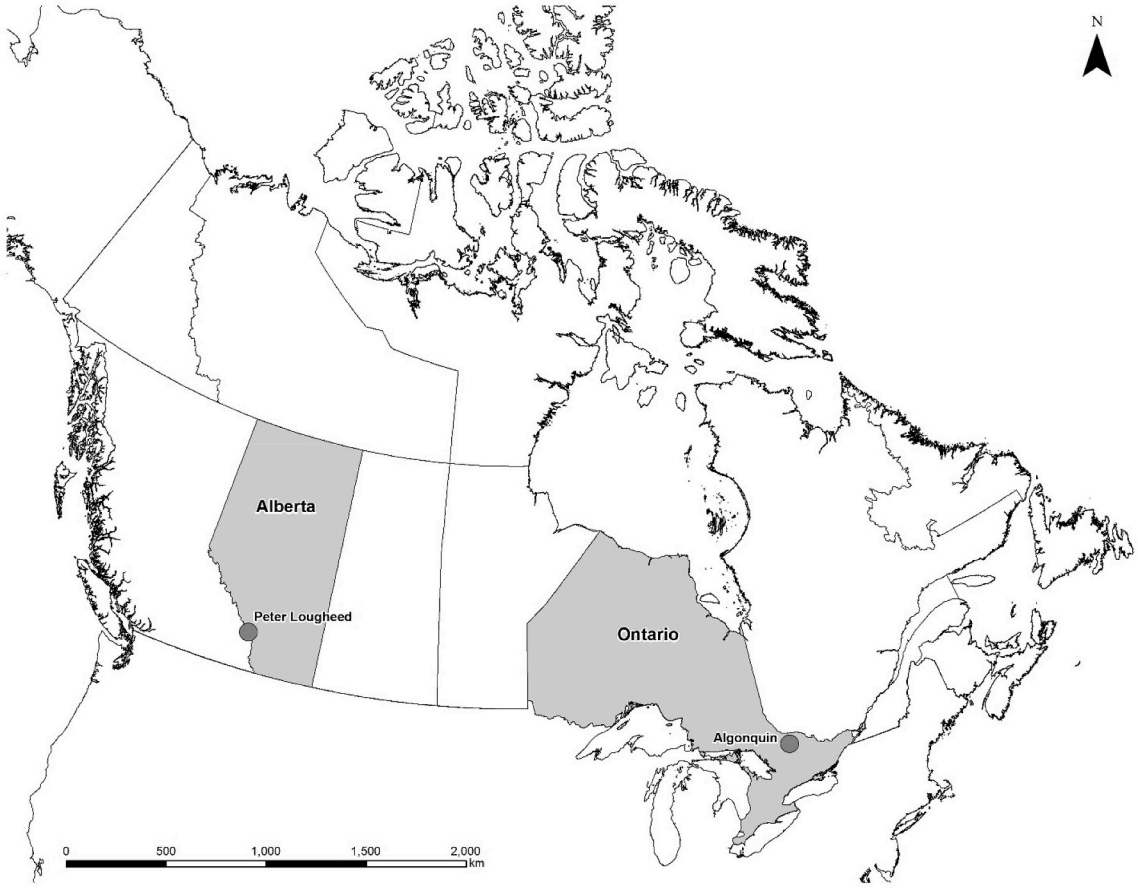


Fig. 1. Study sites overview map (DMTI, 2019).

Provincial parks in Alberta have a much later history than in Ontario, Peter Lougheed Provinical Park was established in 1977 in conjunction with the Kananaskis Country parks system, and covers 50,142 ha of land (AMERD, 2006). The park is located in the Alberta Bow River watershed, near the Great Divide in the Front Ranges of the Rocky Mountains. 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). Along with important ecological features, PLPP also supports a wide variety of recreational opportunities including camping, hiking, boating, fishing, swimming, and cross country skiing.

Within PLPP, there are 546 regular frontcountry or vehicle 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).

3.2. Comparing the two study sites

The major difference in low-impact camping messaging between the two parks is that APP uses the LNT logo and wording, whereas PLPP uses Alberta Parks' in-house developed low-impact messaging. APP has a formal contract and partnership with LNT Canada, PLPP does not. At PLPP the messaging is context rich, focusing on priority management issues such as being bear aware and fire smart safety: for example, "… use bear-proof bins to dispose of garbage" (Alberta Tourism, Parks, and Recreation, 2014). The pro-environmental behaviour messaging at APP is dominated by LNT generic best practices such as "Keep noise levels at a minimum" and "Use designated portages and campsites only."

In terms of differences in methods of delivery, messages are distributed in person in APP at permit office, where campers check in prior to setting up camp. Alberta Parks campers at PLPP can choose to print permits prior to arrival and go directly to their campsites or speak with non-park staff at the park's campground stores to print site permits. As a result, pro-environmental messaging is generally delivered digitally with PLPP visitors, as they confirm the reservations online, while APP visitors tend to review their information through print publications.

3.3. Survey design

A survey questionnaire was used to collect data. There is no single tool or standard empirical method for assessment of pro-environmental behaviours or LNT knowledge and practices. However, measuring pro-environmental behaviours has been accomplished through similar, yet context-specific scales (Halpenny, 2010; Larson Whiting, & Green, 2011; Okada, Okamura, & Zushi, 2013; Oreg & Katz-Gerro, 2006; Stern, 2000; Van Riper & Kyle, 2014). Similar techniques for investigating LNT attitudes, awareness, 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, 2012). The survey instrument was developed from measures found in these studies.

The questionnaires contained five distinct sections, general information about their current trip, LNT awareness and knowledge,

factors relating to the creation and prediction of pro-environmental behaviours, 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 recreation contexts and relevant for both Alberta and Ontario park settings. Assisting in this process was the lead author's LNT expertise. She holds a LNT trainer certificate, providing even more in-depth understanding of the LNT principles and how they apply to all contexts.

Perceived LNT knowledge was asked with one question ("how would you describe your knowledge of Leave No Trace practices"), using a self-reported level of knowledge scale ranging from 1 (no knowledge) to 7 (expert) (all options in between included descriptive level and number; no knowledge [1], very limited knowledge [2], limited knowledge [3], average knowledge [4], above average knowledge [5], extensive knowledge [6], expert [7]). LNT attitudes variables reflected the seven LNT principles and contained three "practices" for each principle; respondents were asked to indicate the "appropriateness" of each practice. Examples included "*take a break off the trail so that others may pass*" and "*keep a single small item like a rock or feather as a souvenir.*" The attitude measures were drawn from Vagias et al.'s (2012) Leave No Trace Attitudinal Inventory and Measurement (LNTAIM). Although not reported here, ecological worldviews were also measured using the New Ecological Paradigm (NEP) as described by Dunlap, Van Liere, Mertig, and Jones (2000). Based on recommendations presented in a meta-analytic review of NEP studies (Hawcroft & Milfont, 2010), a 5-point Likert scale was used to measure NEP items. To provide consistency in response options, the LNT attitude items were also measured using a 5-point scale; this is in contrast to previous LNT studies that used a 7-point scale. Considerable debate exists among methodologists regarding the optimal number of points to use on a Likert-type scale; a comprehensive review and study by Dawes (2008) suggests small differences exists, but no one approach is perfect.

3.4. Survey deployment

The questionnaire was developed and administered to overnight park visitors in both frontcountry and backcountry camping areas. Surveys were conducted between June 17th, 2015 and September 13th, 2015, on weekends 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 = 458 (230 visitors in Alberta and 228 in Ontario, of which 220 reported camping in the frontcountry and 238 reported camping in the backcountry). The questionnaires were completed on-site and returned to the lead author upon completion. Data was collected using both paper-based questionnaires and Android tablets, with an off line software tool, *Droid Surveys*.

3.5. Scale assessment

The initial LNT knowledge scale was developed to represent a single factor measurement of overnight park visitors' attitudes towards LNT. A low, but adequate Cronbach's alpha score suggested modest internal consistency of the 21 item scale (i.e., $\alpha = 0.752$). 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 factor. 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 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 attitudes.

3.6. Analysis

Data was analyzed using Statistical Package for the Social Sciences (SPSS) Version 23. Data were first 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, outliers, and multicollinearity. The distributions of both park visitors and type of overnight visitors failed the statistical tests for normality (i.e. non-significant results of the Kolmogorov-Smirnov test). However, Pallant (2013) suggests this is not uncommon for large sample sizes. Responses to most questions were either positively or negatively skewed – this was expected, in alignment with results anticipated for the constructs (i.e., knowledge and attitudes) being studied. All cases with more than 5% missing data from the main variables were deleted (Tabachnick & Fidell, 2013). One error in the administration of the tablet-based questionnaire resulted in the variable "age" not being recorded in the digital surveys and as a result only 140 respondents' age was recorded. As a result of this error the age data was removed from subsequent analysis. Ten of the LNT attitude items were reverse coded to facilitate analysis.

As the primary focus of this study was to compare backcountry and frontcountry overnight park visitors, as well as the two parks, Mann Whitney U tests were used to determine if there were statistical differences between groups with regard to self-reported LNT knowledge and attitudes towards LNT. A Mann Whitney *U* test is considered the most appropriate non-parametric test to measure differences between two independent samples when the assumption of normality has failed (Field, 2018; Pallant, 2013). The p-value for statistical significance was set at 0.05. In addition, to determine if demographic variables, namely gender, income, and education played a role in the relationship between parks and user groups regarding knowledge of LNT, ANCOVAs were conducted (Field, 2018). Effect size was determined by calculating r values ((r = z/sqrt(N)) and using Cohen's measure of effect size as suggested by Field (2018) where 0.1 is small, 0.3 is medium, and. 5 is large (Cohen, 1992).

4. Results

4.1. Respondent characteristics

Overall, the participants were predominantly male (56%) under the age of 40 with some form of post-secondary education (see Table 1). Both in Alberta and Ontario male respondents (53% and 59% respectively) outnumbered females. Male visitors (64.6%) outnumbered females (35.4%) in the backcountry; however, the reverse was true in the frontcountry (46.8% and 52.7% respectively). Respondents tended to be highly educated, over 70% having some form of post-secondary education. Those who camped in Alberta were more highly educated (38.7% had completed a university degree) than those from Ontario, and Albertans reported higher household incomes with 43.9% earning $100,000[1] or more compared to 30.8% of Ontarians. Income levels reported for backcountry and frontcountry users were similar and relatively high, which is consistent with park visitor statistics. The majority of visitors spent on average 2 nights in the parks and camped with family and friends in relatively small group sizes (< 5 per group 54.4%).

4.2. Self-reported LNT knowledge of park visitors

Parks visitors were asked to rate their perceived level of LNT knowledge. Results indicated a small effect, although still significant difference between user groups in terms of self-reported knowledge of LNT (frontcountry: *Md* = 4; backcountry: *Md* = 4) U = 20014,

[1] Equivalent to USD $91,628 in 2015.

Table 1
Socio-demographic characteristics of overnight park visitors (percentages).

	All visitors	Backcountry visitors	Frontcountry visitors	PLPP	APP
Gender %					
Male	56.0	64.6	46.8	53	59.0
Female	43.8	35.4	52.7	47	40.5
N	458	238	220	230	228
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	458	238	220	230	228
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	458	238	220	230	228

*Age of tablet administered survey respondents was not recorded.

$z = -3.218$, $p = .001$, $r = -0.154$ (Table 2); 23% of the backcountry park visitors reported having extensive or expert knowledge of LNT, while only 12% of frontcountry campers reported expert knowledge. A medium effect sized significant difference between park visitors was also observed between PLPP and APP visitors' perceived knowledge of LNT (Table 3), 21% of Alberta based campers reported having extensive or expert knowledge of LNT, where as only 13% of Ontario based visitors reported similar levels. Those who camped in PLPP reported a higher level of LNT knowledge than those who camped in APP (PLPP: *Md* = 4; APP: *Md* = 4) $U = 17526$, $z = -5.144$, $p = < .001$, $r = -0.247$. In sum, statistically significant differences of self-assessed LNT knowledge were small between backcountry and frontcountry visitors, with backcountry visitors believing they were more knowledgeable; the differences between PLPP and APP visitors were significantly more, with PLPP visitors believing they were more knowledgeable about LNT practices than APP visitors.

Moderator analysis using ANCOVAS was conducted to determine if socio-demographic variables could account for the differences between perceived levels of LNT knowledge for both user groups (backcountry vs frontcountry) and park visited (APP vs PLPP). Gender, income, and level of education were controlled for. All demographic variables were non-significant covariates.

4.3. LNT attitudes of backcountry and frontcountry park visitors

Frontcountry ($n = 237$; APP $n = 102$; PLPP $n = 120$) and backcountry ($n = 220$; APP $n = 126$; PLPP $n = 110$) park visitors were sorted based on the location of their current camping trip. Their responses are displayed in Table 4. Significant differences (with small and medium effect sizes) were found for a number of the LNT practices; frontcountry visitors were significantly more in agreement with 10 of the 21 LNT practices. This was especially true for practices related to LNT principle #2: Travel and camp on durable surfaces and LNT principle #4: Leave what you find. The only LNT practice backcountry visitors demonstrated more statistically significant support for was this practice: "*use twigs and brush for small fires*" (frontcountry: *Md* = 2; backcountry: *Md* = 4), $U = 15423.5$, $z = -7.49$, $< p = .001$, $r = -0.352$. While statistically significant differences were revealed for more than half of the LNT practices, only two demonstrated noteworthy, medium effect sizes: Frontcountry users' displayed much stronger approval of the reverse coded item "*placing a tent in an undisturbed spot, when camping is heavily used areas*" (frontcountry: *Md* = 5; backcountry:

Table 2
Self-reported LNT knowledge of backcountry and frontcountry users.

	All visitors		Backcountry		Frontcountry		Backcountry & frontcountry compared			
	N	Median (Md)	N	Median (Md)	N	Median (Md)	U	Z	p-value	R
LNT self-reported knowledge	433	4	224	4	209	4	20014	−3.218	.001	-.154

Note: Measured with a Likert-type scale where 1 = no knowledge to 7 = expert.

Table 3
Self-reported LNT knowledge of APP and PLPP.

	All visitors		APP		PLPP		APP & PLPP compared			
	N	Median (Md)	N	Median (Md)	N	Median (Md)	U	z	p-value	r
LNT self-reported knowledge	433	4	218	4	215	4	17526	−5.144	< .001	-.247

Note: Measured with a Likert-type scale where 1 = no knowledge to 7 = expert.

Table 4
Backcountry and frontcountry LNT perceived appropriateness.

	All Visitors		Backcountry		Frontcountry					
	N	Median (Md)	N	Median (Md)	N	Median (Md)	U	z	p	r
LNT principle 1: Plan ahead and prepare										
Plan meals to minimize fuel consumption*	457	4	238	4	219	5	–	–	–	–
Read the park policies before arriving at the park*	456	5	238	5	219	5	–	–	–	–
Develop travel plans to avoid poor campsite selection* (e.g. Undesignated camp site)	455	5	238	5	217	5	–	–	–	–
LNT principle 2: Travel and camp on durable surfaces										
Travel on established trails*	**458**	**5**	**238**	**5**	**220**	**5**	**23139.5**	**−2.60**	**.009**	**-.123**
Placing a tent in an undisturbed spot, when camping in heavily used areas[r]	**453**	**4**	**238**	**4**	**215**	**5**	**18704**	**−5.08**	**.000**	**-.250**
Camp in groups of 10 or more people [r]	449	3	237	3	212	3	–	–	–	–
LNT principle 3: Dispose of waste properly										
Repack food to eliminate waste*	458	5	238	5	220	5	–	–	–	–
Urinate on vegetation [r]	**458**	**4**	**238**	**3**	**220**	**4**	**19169.5**	**−4.98**	**.000**	**-.237**
Burying toilet paper If no facilities are available [r]	451	2	236	2	215	2	–	–	–	–
LNT principle 4: Leave what you find										
Keep a single small item like a rock or feather as a souvenir [r]	**455**	**3**	**238**	**3**	**217**	**4**	**21765**	**−2.83**	**.005**	**-.134**
Alter a campsite so that it is more desirable [r]	**452**	**4**	**237**	**4**	**215**	**4.5**	**20926.5**	**−3.27**	**.001**	**-.155**
Build a shelter or structure [r]	**452**	**4**	**238**	**4**	**214**	**4.5**	**19261**	**−4.51**	**.000**	**-.214**
LNT principle 5: Minimize campfire impacts										
Have a campfire where there is no existing fire pit [r]	**430**	**5**	**227**	**4**	**203**	**5**	**22037.5**	**−2.47**	**.013**	**-.117**
Let fire wood burn completely prior to leaving the site*	**457**	**5**	**238**	**5**	**219**	**5**	**18567**	**−3.05**	**.002**	**-.145**
Use twigs and brush for small fires*	**455**	**3**	**238**	**4**	**217**	**2**	**15423.5**	**−7.49**	**.000**	**-.352**
LNT principle 6: Respect wildlife										
Feed wildlife [r]	456	5	237	5	219	5	–	–	–	
Hang food or store in proper container*	456	5	238	5	218	5	–	–	–	
Allow your dog off leash [r]	**443**	**4**	**234**	**4**	**209**	**5**	**19850.5**	**−3.53**	**.000**	**-.168**
LNT principle 7: Be considerate of other visitors										
Taking breaks off the trail so that others may pass*	456	4	238	4	218	4	-	-	-	
Leave all areas of the park in a better state*	458	5	238	5	220	5	–	–	–	
Keep noise levels to a minimum*	**458**	**5**	**238**	**4**	**220**	**5**	**22108**	**−2.99**	**.003**	**-.140**

Note: Measured with a Likert-type scale where 1 = not appropriate and 5 = very appropriate. Rows that are bolded indicate a statistically significant difference between groups. * indicates the items that are correct (or align with LNT principles) and [r] indicates what items were reverse coded for analysis.

Md = 4) U = 18704, Z = −5.08, < *p* = .000, *r* = −0.250, and the previously reported "*use twigs and brush …"* item. A medium size effect signals elevated substantive differences between front country and backcountry users relating to these practices; frontcountry visitors expressed stronger disagreement with (incorrect opinions about) LNT recommended practices for tent placement and sources for fire fuel. Again, moderator analysis using ANCOVAS were conducted to determine if socio-demographic variables could account for the differences in attitudinal support of LNT practices however, all demographic variables were non-significant covariates.

4.4. LNT attitudes of Algonquin Provincial park and Peter Lougheed provincial parks visitors

The items measuring attitudes towards LNT practices of park visitors were also compared (see Table 5). Again effect sizes were small, however, PLPP visitors reported attitudes and perceptions more congruent with LNT practices for two of the variables in Principle #4 - Leave what you find: "*keep a single item like a rock or feather as a souvenir*" (PLPP *Md = 4*; APP *Md* = 4) U = 18692.5, *z = -5.136, p = < .001, r* = −0.244 *and "alter a campsite so that it is more desirable*" (PLPP *Md = 4*; APP *Md* = 4) U = 21338, *z = -2.996, p = .003, r* = −0.142. Park visitors also differed in their support of LNT Principle #6 - Minimize campfire impacts with regard to the behaviours: "*let fire wood burn completely prior to leaving the site*" (PLPP *Md* = 5; APP *Md* = 5) U = 22190, z = −2.953, *p* = < .003, *r* = −0.140 and "*use twigs and brush for small fires*" (PLPP *Md = 3*; APP *Md* = 4) U = 18789, z = −5.042, *p* = < .001, *r* = −0.236. Those who camped at PLPP in Alberta again displayed more supportive attitudes. Other significant differences in attitudes towards LNT practices were observed for: "*placing a tent in an undisturbed spot, when camping in heavily used areas," "feeding wildlife is appropriate,"* and "*allowing your dog off leash.*" While substantive differences were all small effect sizes, PLPP visitors were more approving of 7 of the 21 LNT practices than those who visited APP in Ontario, suggesting that PLPP visitors hold attitudes more in line with LNT principles. Moderator analysis using ANCOVAS were conducted to determine if socio-demographic variables could account for the differences in attitudinal support of LNT practices however, all demographic variables were non-significant covariates.

5. Discussion

5.1. Management implications

Understanding park visitors' similarities and differences is integral to effective park management. Not all visitors in Canadian parks hold the same attitudes towards LNT and not all visitors possess an equal level of LNT knowledge. While backcountry visitors professed higher levels of self-reported LNT knowledge, frontcountry visitors demonstrated greater attitudinal support for LNT practices. Alberta-based PLPP visitors more frequently expressed support of LNT practices and reported higher levels of self-assessed or perceived knowledge of LNT principles compared to those Ontario-based APP visitors. This was surprizing as the Ontario park system had run an officially sanctioned LNT communications campaign in APP during the five years prior to this study. We speculate these results may be explained by socio-

Table 5
Alberta and Ontario park visitor LNT perceived appropriateness.

	All Visitors		PLPP Visitors		APP Visitors					
	N	Median (Md)	N	Median (Md)	N	Median (Md)	U	z	p	r
LNT principle 1: Plan ahead and prepare										
Plan meals to minimize fuel consumption*	457	4	230	4	227	4	–	–	–	–
Read the park policies before arriving at the park*	456	5	230	4	226	5	–	–	–	–
Develop travel plans to avoid poor campsite selection* (e.g. Undesignated camp site)	455	5	230	5	225	5	–	–	–	–
LNT principle 2: Travel and camp on durable surfaces										
Travel on established trails*	458	5	230	5	228	5	–	–	–	–
Placing a tent in an undisturbed spot, when camping in heavily used areas ᵣ	**453**	**4**	**230**	**4**	**223**	**4**	**20614.5**	**−3.635**	**.000**	**-.173**
Camp in groups of 10 or more people ᵣ	449	3	229	3	219	3	–	–	–	–
LNT principle 3: Dispose of waste properly										
Repack food to eliminate waste*	458	5	230	3	229	3	–	–	–	–
Urinate on vegetation ᵣ	458	4	230	4	228	4	-	-	-	-
Burying toilet paper If no facilities are available ᵣ	451	2	230	2	221	2.5	–	–	–	–
LNT principle 4: Leave what you find										
Keep a single small item like a rock or feather as a souvenir ᵣ	**455**	**3**	**230**	**4**	**225**	**3**	**18692.5**	**−5.136**	**.000**	**-.244**
Alter a campsite so that it is more desirable ᵣ	**452**	**4**	**230**	**4**	**222**	**4**	**21338**	**−2.996**	**.003**	**-.142**
Build a shelter or structure ᵣ	452	4	230	4	222	4	–	–	–	-
LNT principle 5: Minimize campfire impacts										
Have a campfire where there is no existing fire pit ᵣ	430	5	205	5	225	5	–	–	–	-
Let fire wood burn completely prior to leaving the site*	**457**	**5**	**230**	**5**	**227**	**5**	**22190**	**−2.953**	**.003**	**-.140**
Use twigs and brush for small fires*	**455**	**3**	**229**	**3**	**226**	**4**	**18789**	**−5.042**	**.000**	**-.236**
LNT principle 6: Respect wildlife										
Feed wildlife	**456**	**5**	**229**	**5**	**227**	**5**	**21804**	**−4.411**	**.000**	**-.210**
Hang food or store in proper container*	456	5	226	5	230	5	–	–	–	–
Allow your dog off leash ᵣ	**443**	**4**	**225**	**4**	**218**	**4**	**20916.5**	**−2.743**	**.006**	**-.130**
LNT principle 7: Be considerate of other visitors										
Taking breaks off the trail so that others may pass*	456	4	228	4	228	4	–	–	–	–
Leave all areas of the park in a better state*	458	5	230	5	228	5	–	–	–	–
Keep noise levels to a minimum*	458	5	230	4	228	4	–	–	–	–

Note: Measured with a Likert-type scale where 1 = not appropriate and 5 = very appropriate. Rows that are bolded indicate a statistically significant difference between groups. * indicates the items that are correct (or align with LNT principles) and ᵣ indicates what items were reverse coded for analysis.

demographic characteristics, low-impact camping education campaigns, and park characteristics.

First, Alberta respondents were more formally educated and had higher household incomes. However, gender, education, and income were not significant covariates in explaining LNT knowledge differences between PLPP and APP visitors or between user groups. It should also be noted that this research did not collect participants' race or ethnicity and studies have shown that these variables can be highly correlated with income and education levels, and may be related to pro-environmental behaviours (Kollmuss & Agyeman, 2002; Larson, Whiting, & Green, 2011; Meyer, 2015; Vagias et al., 2014).

Second, the very nature of the low-impact camping messaging may have also influenced the level of respondents' expressed level of LNT knowledge and attitudinal support towards LNT practices. We did not conduct a systematic comparison of communications materials provided to visitors at each park, however, content analysis of message text and in-depth interviews with visitors regarding their reactions to specific messages would also do much to inform the efficacy of future messaging (Stern, Powell, & Hill, 2014). Examples of studies that have identified best practices in pro-environmental messaging advocate for the use of personal stories (Schweizer, Davis, & Thompson, 2013), evocation of emotions (Barrett & Mowen, 2014) and personal ethics (Daniels & Marion, 2005), use of positive or hopeful tone, and the provision of tips for taking proactive action (Goldberg et al., 2018). While Alberta Parks does not use the trademarked branding of LNT and cannot use the exact language, the park does promote low-impact camping, bear awareness, and fire safety. Within the park there is signage, messaging, pamphlets, and interpretive programs as well as regular communications from parks staff. Digital messages are provided when campers make reservations online. As previously described, APP's messaging is more generic than PLPP's, adhering to LNTs standardized text. This lack of place-based specificity may have reduced the efficacy of APP's messages (Barrett & Mowen, 2014). Lawhon et al. (2013) found that low-impact camping messaging is most effective when it relates to benefits to the park itself. For example, minimizing campfire impacts will reduce the risk of forest fires and practicing "bear aware" behaviours protect bears just as much as humans – supporting conservation goals. The Alberta Parks messaging may be more tailored to the PLPP context and protection of its natural heritage than the more general LNT principles applied in APP – thus potentially being more effective.

Relatedly, the threats of grizzly bears and fires are much more prevalent in Alberta parks and protected areas. Previous research suggests 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, higher perceived risks of not following certain LNT practices such as proper food storage may combine with messaging to produce a greater influence on attitudes and awareness. These results may also suggest that perhaps LNT as a brand is not as important or useful as previously believed.

Fourth, as noted earlier, APP has been implementing a LNT educational campaign for a number of years and uses official logos and wording, however evidence of an active educational campaign is sparse. Even tourism operators within the park appeared unaware of the LNT partnership and mention of LNT on park webpages and social media was observed as absent (King, 2015). Therefore, Algonquin is

potentially missing essential opportunities to communicate LNT education to over-night park visitors.

It is interesting to note that it was the frontcountry users (not the backcountry group as originally hypothesized) who expressed the highest levels of agreement with LNT practices. LNT has developed best practices designed for frontcountry and urban areas (Leave No Trace Centre for Outdoor Ethics, 2012) although these specific LNT principles are not used in Canadian parks or promoted through any formal education within Ontario or Alberta. Previous studies focusing on day users and frountcountry park visitors' attitudes have also demonstrated a high level of knowledge and awareness of the principles (Lawhon et al., 2019). Jones and Bruyere (2004) and Lawhon et al.'s (2013) results showed users were extremely likely to practice LNT in the future, however, understanding of specific principles is still deficient. While it remains unclear in this study as to the exact reason why frontcountry users were more supportive than backcountry users regarding LNT practices, future studies should investigate these two user groups.

5.2. Limitations

Several challenges characterized this study. First, it was not possible to identify park visitors that are exclusively backcountry or frontcountry visitors. Most park visitors alternate the camping context they choose to engage in, their choices affected by who they are traveling with, the time of year, access to equipment, and availability of campsites or permits. Respondents were asked to complete the questionnaire based on the camping location they were using during their current trip, however this does not mean they use these types of locations for all their visits to parks. Thus, claims of difference between user groups in this study may be overstated. We considered this limitation and also asked respondents to indicate what percentage of camping they do in the frontcountry versus backcountry. However, using this data to develop camping context groups failed to reveal differences in user groups self-reported LNT knowledge or attitudes towards LNT principles.

Second, including both camping contexts also added to the difficulty of accurately assessing LNT support, as some actions are more applicable and acceptable in certain settings. We were aware of this challenge as we developed the survey instrument and attempted to select LNT items that were appropriate in both contexts, however in retrospect at least two items may have not been appropriate: (a) "using twigs and brush for small fires" is not permitted in some frontcountry contexts, and (b) "keeping noise to a minimum" is not encouraged for hikers in backcountry areas located within grizzly bear habitat. In regards to measuring LNT, using factor analysis we explored the possibility of measuring LNT as a unidimensional construct and found that our 21 item scale lacked congruency and internal measurement reliability. As such we feel that based on this study and others (Taff et al., 2014; Vagias et al., 2012) perhaps a scale designed to capture LNT as a unidimensional construct is not an effective way to measure LNT attitudes. A tool assessing actual practices through observation and survey data that documents singular LNT practices or uses seven distinct scales designed to represent the seven LNT sub-principals may be more effective. Future research is still needed to address the gap in knowledge of frontcountry over-night park visitors and their low-impact camping practices. While Canadian parks see millions of overnight visitors annually, much is still unknown in regards to frontcountry park visitors and their knowledge, attitudes, and overall motivations for engaging in low-impact camping (Halpenny, 2010; Moghimehfar & Halpenny, 2016; Walker & Chapman, 2003). Additional research will help park agencies better manage visitor use and their inevitable impacts.

6. Conclusion

In conclusion, this study extends our knowledge of LNT attitudes of overnight park visitors and adds to the literature a better understanding of the differences and similarities between overnight park visitors. Specifically, highlighting those who are camping in the frontcountry and backcountry as well as differences and similarities of those who visit parks in Ontario, and are therefore exposed to LNT branded messaging and those who visit parks in Alberta, and are not exposed to LNT branded messaging. The findings suggest a distinct difference between APP and PLPP visitors, with PLPP visitors demonstrating higher levels of agreement with LNT practices. While those who camped in the backcountry had higher self-reported levels of LNT knowledge, those who camped in the frontcountry expressed pro-environment behavioural attitudes that more closely aligned with LNT practices. In addition to the impact of factors such as user group sociodemographic differences, the environmental education at these two parks and their park systems may also play a role. More in depth study of the efficacy of these education campaigns, but in particular the LNT communication efforts in APP is needed to inform improved practice and assess the effectiveness of the LNT brand partnerships.

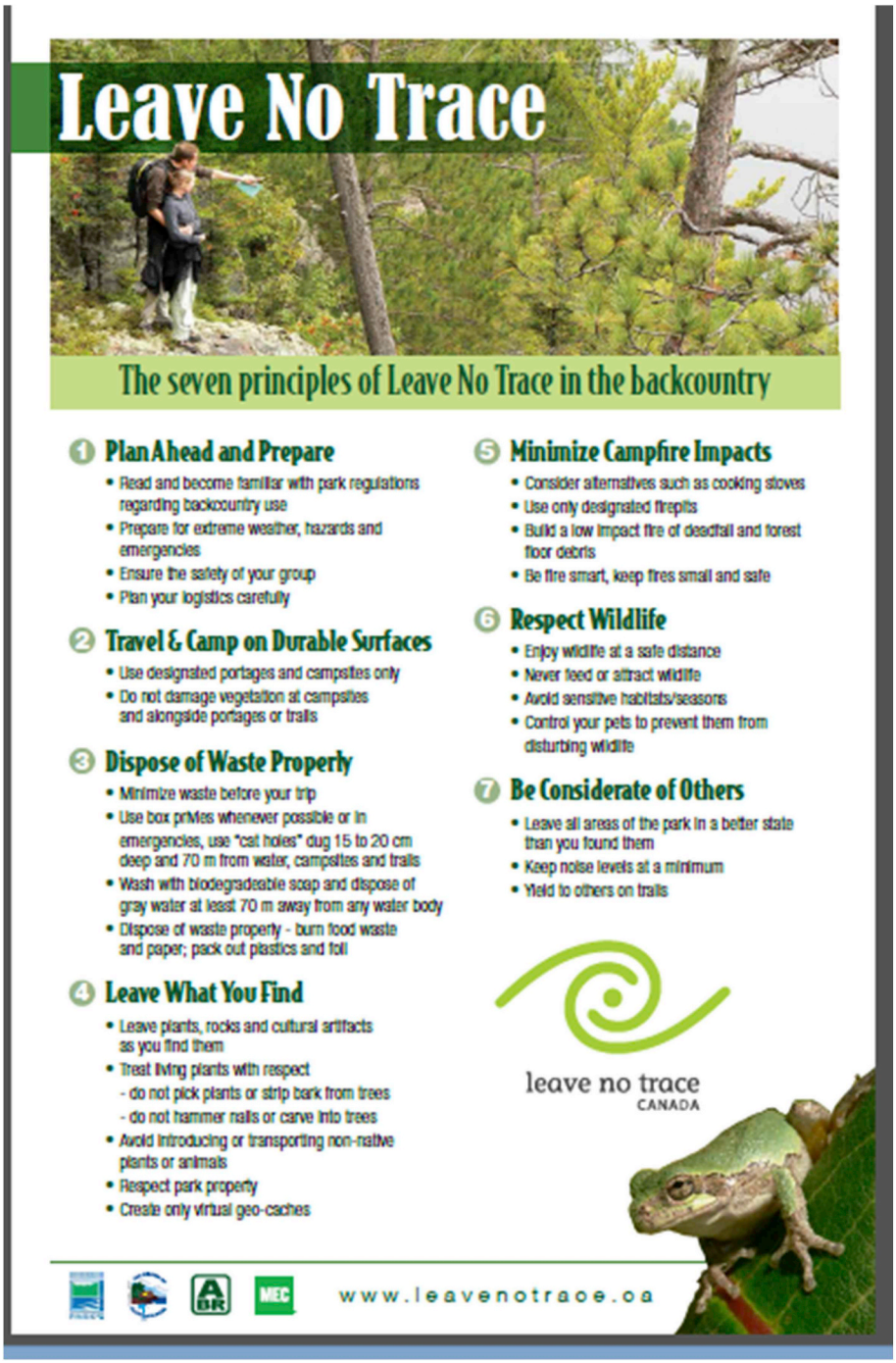
Funding

Funding provided by a Joseph-Armand Bombardier Canada Graduate Scholarship from the Social Science Research Council of Canada.

Acknowledgements

We thank the editor and the anonymous reviewers whose comments helped to improve the manuscript. We would also like to thank both Alberta Parks and Ontario Parks for their support in this research. Finally, we would like to acknowledge that this research was supported by the Social Sciences and Humanities Research Council of Canada.

APPENDIX A. Algonquin Provincial Park LNT placard



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