

Impact of a Responsible Recreation Trail Ambassador Program on Visitor Experiences and Behavioral Intentions

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Abstract

Understanding the efficacy of educational programs to influence visitors' behavior while recreating in Parks and Protected Areas has been a frequent focus of outdoor recreation research. In an era of escalating demand and scarce resources, tailoring educational programming to reduce biophysical impacts and improve visitor experiences is increasingly important. The Grand County Trail Ambassador Program in south-eastern Utah, United States represents an innovative partnership between a county-level government and federal land management agency to reduce recreation-related social and environmental impacts and visitor risks. This study uses a quasi-experimental design to evaluate how the Leave No Trace (LNT) focused Trail Ambassador program influences visitors' experiences and behavioral intentions to follow LNT principles. Our findings show that the presence of Trail Ambassadors improved visitors' experiences and influenced behavioral intentions to practice LNT principles in the future. Broadly, our findings support the effectiveness of the Grand County Trail Ambassador Program and suggest opportunities for further improvements to the program to influence visitors' LNT behaviors in the future.

Keywords

Leave No Trace, LNT, Theory of Planned Behavior, environmental education, visitor experience, depreciative behavior, responsible recreation

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Introduction

Outdoor recreation researchers and managers have identified tools to minimize the biophysical disturbance from outdoor recreation while maintaining the quality of recreationists' experiences. These tools include engineering, education, and enforcement (the three Es), frequently categorized on a spectrum from direct (i.e., regulation or law enforcement) to indirect (i.e., information and education). Indirect management strategies are often a preferred tool for reducing the impacts of visitors in Parks and Protected Areas (PPAs) by promoting positive behavior through information and behavioral encouragement rather than imposing restrictions or regulations. These approaches preserve visitor freedom while ideally reducing depreciative visitor behaviors (Manning, 2022; W. M. Vagias et al., 2014). Preserving visitor freedom during recreational activities has been focused on in research regarding visitor support for management actions because of the notion that this quality is important to positive visitor experiences (Lucas, 1982; Martin et al., 2009). Some examples of indirect management techniques include signs recommending positive behavior, educational programming, and interactions with PPA staff or volunteers. Despite being preferred, these techniques may be limited in their ability to address complex PPA visitation challenges in severe situations and over extended periods, with critics suggesting that indirect management actions "while effective perhaps, in the long run, may be the undoing of recreational wildlands in the short term" (McAvoy & Dustin, 1983, p. 16). The concern raised by McAvoy and Dustin (1983) is that the temporal scale of problems caused by visitation often does not align with the scale of remedies provided by indirect management techniques. This temporal mismatch is exacerbated in managing cultural resources, where there is no limit of acceptable change to absorb short-term impacts (Miller et al., 2021). Despite these concerns, educational programming has numerous experiential benefits in PPAs. For example, educational programs can increase repeat visit intention and improve visitor experiences in PPAs (Sim et al., 2018).

Studies examining how to overcome the temporal mismatch of management techniques and PPA outdoor recreation have shown that a combination of education, enforcement, and engineering is often the most effective. Educational signs alone have mixed results, with interaction with staff increasing effectiveness. For example, combining signs with management actions (such as barriers) has effectively mitigated undesigned trail use (Hockett et al., 2017; Schwartz et al., 2018). Another study found that passive signage was ineffective in reducing human waste and litter, while personal messages delivered by NPS rangers were more effective in minimizing these behaviors (Settina et al., 2020). Previous findings suggest that a person in uniform may be more important than someone officially working for a land management agency. For example, the presence of uniformed volunteers minimized depreciative petrified wood theft (Ward & Roggenbuck, 2003). At the heart of these studies evaluating the effectiveness of PPA visitor management techniques is understanding how to effectively encourage pro-environmental behavior of visitors. Pro-environmental behaviors are broadly defined as "behavior that consciously seeks to minimize the negative impact of one's actions on the natural and built world" (Kollmuss & Agyeman, 2002, p. 240).

Leave No Trace (LNT) is an international responsible recreation educational organization designed to encourage minimum-impact recreation on public lands (W. M. Vagias et al., 2014). Initially, LNT was focused on the behavior and experiences of backcountry visitors to Wilderness areas (Cole, 2018). However, over the past 30 years since the organization was founded, researchers and practitioners have expanded the scope, developing responsible recreation materials that are transferable across land designations and activity types. The primary educational components provided by LNT have been distilled into seven principles: plan ahead and prepare; travel and camp on durable surfaces; dispose of waste properly; leave what you find; minimize campfire impacts; respect wildlife; and be considerate of others (*The 7 Principles—Leave No Trace Center for Outdoor Ethics*, n.d.). As part of developing effective materials, a myriad of researchers have executed studies evaluating the messaging of LNT and the effects on visitor behavior and experiences. Previous studies have assessed the influence of LNT-focused educational materials on behavioral intent in national parks (Lawhon et al., 2013; Schafer et al., 2022); across land designations (i.e., NPS, USFS, state parks; Backman et al., 2018); and by experience type (i.e., day use and overnight; Taff et al., 2014); as well as the efficacy of LNT programming on youth (Schwartz et al., 2018). These studies have highlighted the success of LNT principles in encouraging positive visitor behavior and identified the most effective ways of disseminating LNT information (Settina et al., 2020; W. M. Vagias et al., 2014).

Theoretical Framework and Research Questions

The Theory of Planned Behavior (TPB) from the social psychology literature describes human behavior as influenced by intentions to engage the described behavior (Fishbein & Ajzen, 2011). In turn, behavioral intentions are a function of attitudes toward the behavior, norms established by others, and perceived individual behavioral control (Ajzen, 1991; Ajzen & Fishbein, 2000). This general theory has been adapted and used frequently in PPA social science research broadly and has been applied on numerous occasions to assess the efficacy of LNT messaging on visitor attitudes and behavioral intentions (Lawhon et al., 2013, 2017, 2019; Schafer et al., 2022; Taff et al., 2014; W. M. Vagias et al., 2014). Specifically, an abridged version of the TPB was applied to evaluate the influence of attitudes toward LNT messages on behavioral intentions to follow these principles (Lawhon et al., 2013, 2017, 2019). These researchers posited that changing visitor attitudes is critical to positively altering behavioral intent, “In order to create effective visitor education and communication tactics that can minimize overall recreational impact by influencing visitor behavioral intent, understanding visitor attitudes related to Leave No Trace is paramount” (Lawhon et al., 2013, p. 27). Variations of the TPB, while numerous in applications in outdoor recreation and PPA research, have weaknesses leading to critiques of the framework’s utility. For example, the TPB has often only explained 18% (Schafer et al., 2022) to 35% (Lawhon et al., 2017) of the variance in behavioral intentions in the context of LNT messaging. Additionally, the application of the TPB in conservation social science has been

criticized for assuming that behavioral intentions lead directly to behavior and for inconsistencies in how the components are articulated (Miller, 2017).

In this study, a model is used based on the adaptation of the TPB by Lawhon et al. (2013, 2017, 2019; Figure 1). Notably, this model does not include the complete TPB, focusing on attitudes and omitting perceived behavioral control and the influence of norms. Replicating this model helps address previous criticisms of the TPB (Miller, 2017) by minimizing inconsistencies in operationalizing components. Previous studies using this adapted model (Lawhon et al., 2013, 2017) incorporated self-reported knowledge as a component that may directly influence behavioral intentions. This inclusion has had minimal impact on the power of these models to explain behavioral intentions. Instead of self-reported knowledge, we have included recreation motivations in the model to further this body of research and attempt to explain more of the variance in behavioral intentions using the TPB. We chose motivations as a contribution due to the variation in trails across the study location. The motivations of a visitor to come to that trail can influence the type of behavior they plan to participate in, their attitudes about regulations, and the relevancy of specific messaging provided. Therefore, we used a 28-item Recreation Experience Preferences (REP) psychometric scale to understand visitors' motivations for visiting the specific trail they were intercepted. Researchers developed the REP scales with the idea that recreational activities are chosen and participated in to achieve personal goals (Driver, 1983; Manfredi et al., 1996) research has drawn connections between motivations and pro-environmental behavior (Kil et al., 2014), between norms, motivations, and pro-environmental behavior (Needham & Rollins, 2005), and motivations and the TPB (Johnson et al., 2021).

This study addresses multifaceted research goals. The first goal is to evaluate the effectiveness of a Trail Ambassador program employed by Grand County, Utah (GCTA) at influencing visitor experiences and behavioral intentions to follow LNT principles. Trail Ambassador programs are increasing in utility by land managers and regional governments to mitigate the impacts of visitors on high-use public lands. In addition to the Grand County Trail Ambassadors, other notable examples include Durango, Colorado, and Missoula, Montana (Burney, 2024; Missoula Trail Ambassadors, 2023). These programs are partly in response to growing outdoor recreation demands and shrinking federal land management agency budgets. However, despite program proliferation and the presentation of LNT principles by these Trail Ambassadors, there has not been an empirical study of the effectiveness of these programs to influence visitor experiences and behavioral intentions.

The second goal is to build upon the model Lawhon et al. (2013, 2017, 2019) applied by incorporating motivations for visiting the site to determine if motivations for recreating can help better explain behavioral intentions to follow LNT principles. The attitudes to behavioral intentions model used by Lawhon et al. has returned promising results but has room for improvements in explainability. This research aims to build on the Lawhon et al. model and contribute to the body of literature evaluating LNT programming and messaging (e.g., Backman et al., 2018; Blye & Halpenny, 2020; Lawhon et al., 2013, 2017, 2019; Schwartz et al., 2018; Settina et al., 2020; W. Vagias & Powell, 2010). To address our study goals, we explore the following research questions:

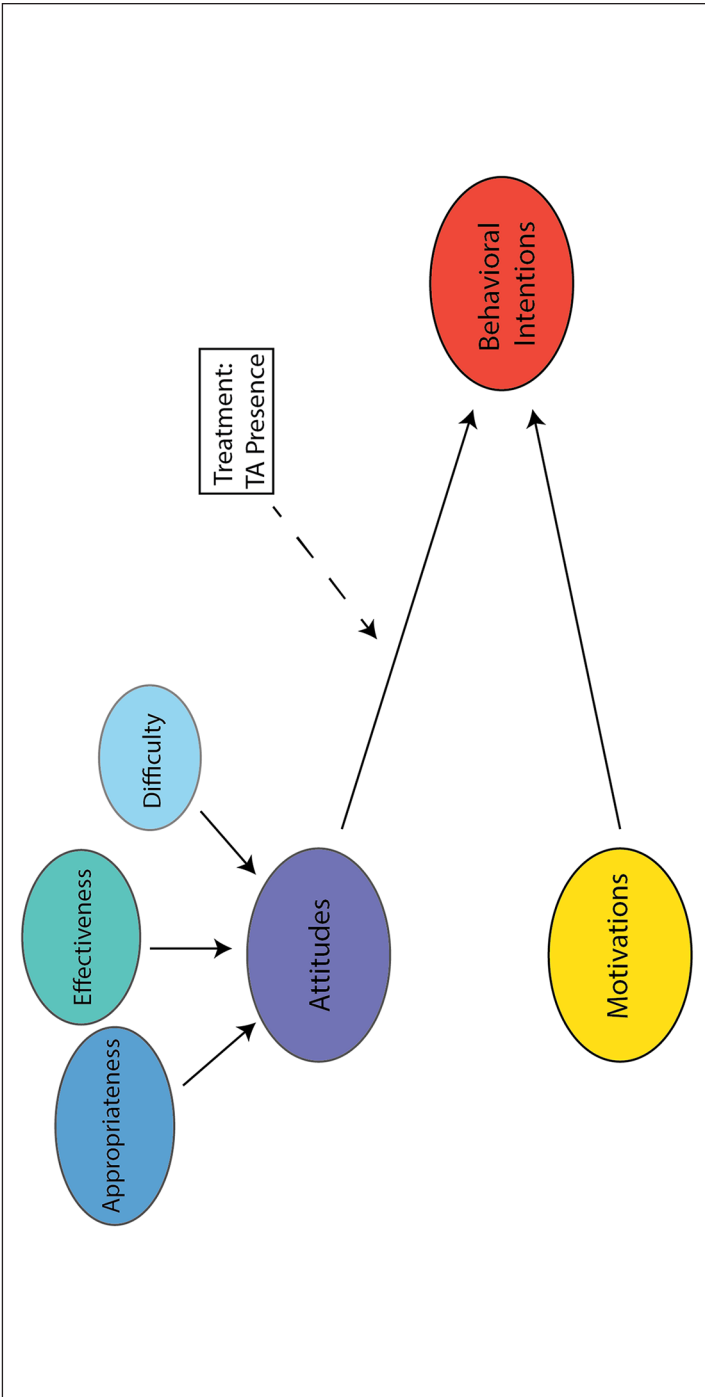


Figure 1. Theoretical diagram of components included in model.

1. Do Trail Ambassadors influence visitors' experiences?
2. Does the presence of Trail Ambassadors influence the relationship between attitudes and behavioral intentions of visitors?
3. Do visitors' recreation experience preferences influence their behavioral intentions?

Study Location

Moab, Utah, is centrally located within a region rich with recreational opportunities, making it an ideal setting for an outdoor recreation services community. Surrounding public lands include prominent national parks (Arches and Canyonlands), acres of Bureau of Land Management (BLM), and other public lands. Over the last 30 years, visitation to Moab has risen steadily, with a sharp increase in the last 10 years. The ecological sensitivity and conditions of the natural environment heighten the social and biophysical impacts of this increase in visitation. For example, due to hot and dry weather exacerbating heat stroke and dehydration, the Grand County Sheriff's Search and Rescue is one of the busiest in Utah (*Grand County Sheriff's Search & Rescue*, n.d.). Additionally, the arid ecosystem of the Colorado Plateau is comprised of biophysical resources with low resistance/resilience (Hammitt et al., 2015). This ecosystem is susceptible to recreation disturbance and the compounding pressures of energy production, grazing, and recreation (Winkler et al., 2018). For example, the red rock landscape features extensive cryptobiotic soil (biocrust) areas ecologically sensitive to trampling (Belnap, 1995; Cole, 1990). Finally, human waste left by visitors recreating on public lands has become a prolific problem in some locations, leading to concerns from regional land managers regarding human health (Bunton, 2023).

In the fall of 2021, Grand County launched a Responsible Recreation Trail Ambassador (GCTA) program due to increased visitation and the associated impacts. County staff (the Grand County Trail Ambassadors) are posted at popular BLM trailheads to provide minimum-impact recreation education to trail users. The primary focus of this initiative is to encourage responsible recreation practices and to mitigate social conflict between groups. These Trail Ambassadors communicate regulations' managerial and ecological relevance, for example, illustrating why visitors should hike only on designated trails. The three goals of this program, stated by the GCTA leadership team at study development meetings, are to teach people (1) how to plan ahead and prepare, (2) how to protect the environment, and (3) how to preserve positive experiences for other trail users. One of the components of this program that sets it apart from other community-led Trail Ambassador programs is that the GCTAs are paid and trained environmental educators rather than volunteers. All Trail Ambassadors are trained in Leave No Trace principles and the Authority of the Resource Technique, a method of addressing undesirable visitor behaviors by focusing on the impact that these behaviors have on the natural environment. Additionally, they are certified to educate visitors about resources specific to the Moab region, such as biocrust and local geology, by a local non-profit Science Moab (*Grand County Trail Ambassador Program—Leave No Trace*, n.d.). In 2023, the GCTAs received the Leave No Trace

Gold Standard Designation, a high form of recognition from the LNT organization for sites, organizations, and initiatives demonstrating excellence in visitor education and recreation-related impact minimization (*Gold Standard Sites*, n.d.).

The Trail Ambassadors set up booths at trailheads wearing conspicuous green clothing, under branded shade tents with large signs, with at least two staff working at a time providing resources to visitors such as water, electrolytes, and Waste Alleviation and Gelling (WAG) bags (for human waste). Trail Ambassadors also identify visitors participating in high-risk activities or who appear unprepared and provide specific resources and information to help minimize search and rescue events. For example, on hot days, visitors with bare feet or walking dogs are intercepted and informed of the current sand temperature using a laser thermometer. Visitors without visible packs or water bottles are encouraged to stop for a free water bottle and water. The Trail Ambassadors also keep biocrust in a container for hands-on demonstrations and provide stickers, a minimum-impact BINGO game, and other interactive materials for kids.

Methods

A quantitative onsite visitor intercept survey was designed to assess the above research questions, informed by previous studies that applied the TPB to PPA educational programming. We employed a quasi-experimental design with two treatments: Trail Ambassadors present, and Trail Ambassadors absent. Previous studies using an experimental design to understand the effect of education programs include a wildlife feeding information study in Zion National Park (Marion et al., 2008). In PPA research, quasi-experimental designs are applied when full experimental designs are not feasible. Examples include an equivalent control group design to evaluate the efficacy of LNT messaging with youth (Schwartz et al., 2018), quasi-experimental design to test recycling messaging in national parks (Taff et al., 2022); combinations of signs and interpretive information from rangers on camper behavior (Settina et al., 2020); and additive treatments designed to assess the efficacy of educational and site management actions on off-trail hiking (Hockett et al., 2017).

Measures Employed

Measures of Visitor Experience. Research question one, understanding the influence of Trail Ambassadors on visitor experience was measured using six experiential items: challenged my perspectives; helped me present the importance of proper recreational behavior to family or friends; made me feel safer; taught me something new about the landscape and protecting it; made me feel more connected to this place; and reaffirmed behavior I already try to practice. These items, presented on a five-point Likert scale where 1=strongly disagree, 3=neutral, and 5=strongly agree, were identified based on the educational and experiential goals of the GCTA leadership. Survey technicians asked these questions only on days when Trail Ambassadors were present.

Measures of Attitudes and Behavioral Intentions. To assess visitors' behavioral intentions during future outdoor recreation visits, we used four scales based on the TPB (Ajzen, 1991) applied in previous LNT and visitor behavioral intent studies (Lawhon et al., 2013, 2017). These scales measured visitor attitudes toward the perceived appropriateness, efficacy, and difficulty of behaviors that align with LNT principles, as well as the future behavioral intentions of respondents (Figure 1). Four behavioral categories, identified by GCTA leadership as central educational priorities of the program were assessed: preparing for all hazards and weather before getting on the trail (Weather); staying on designated or established trails (Trail); carrying out all litter, including human and dog waste (Litter); and carrying sufficient water (Water). These four categories were incorporated into a series of scales that emulated previous peer-reviewed research regarding LNT and attitudes toward outdoor recreation minimal impact practices (Lawhon et al., 2017, 2019; Schafer et al., 2022; Taff et al., 2014; W. M. Vagias et al., 2014). The primary difference between the items used in this study and the previous studies listed above is the inclusion of carrying sufficient water, reflecting the first LNT principle: plan ahead and prepare. Carrying sufficient water is particularly relevant in the Moab area due to the dry, hot desert conditions that lead to high incidences of heat stroke. Therefore, the GCTAs emphasize this item to minimize search and rescue pressures (*Grand County Sheriff's Search & Rescue*, n.d.).

The first three scales measured attitudes toward the four GCTA educational priorities (i.e., Weather, Trail, Litter, Water). The fourth scale measured behavioral intentions to participate in these behaviors. First, surveyors asked visitors to rate the appropriateness of depreciative behaviors on a five-point Likert scale with 1 = extremely inappropriate, 3 = neither appropriate nor inappropriate, and 5 = extremely appropriate. This scale is the only one asking visitors to evaluate the appropriateness of depreciative behavior (e.g., the appropriateness of leaving litter on the trail). Next, respondents rated how often these actions effectively minimize recreational impacts (i.e., staying on the trail) on a five-point Likert scale with 1 = never, 3 = about half the time, and 5 = every time. We assessed visitors' perceptions of the difficulty of participating in the action using a five-point Likert scale with 1 = extremely easy, 3 = neither difficult nor easy, and 5 = extremely difficult. Finally, we measured behavioral intentions by asking visitors how likely they were to participate in the positive behaviors during future recreational activities on a five-point Likert scale with 1 = extremely unlikely, 3 = neither likely nor unlikely, and 5 = extremely likely.

Measures of Recreation Experience Preferences. Visitor REP motivations were measured using a 28-item scale developed from previous research. Respondents rated the importance of a series of recreation motivations in their experience on that trail (Driver, 1983; Manfredo et al., 1996). We measured experience preferences on a five-point Likert scale with 1 = not at all important, 3 = moderately important, and 5 = extremely important. Dimension reduction using Principal Axis Factoring reduced the components of REP into five latent constructs. We used Promax Oblique rotation because we expected a correlation between scale items (Osborne et al., 2008). Cronbach's alpha reliability coefficients were used to assess scale reliability (Vaske et al., 2017). Finally,

Kaiser-Meyer-Olkin (KMO) measured sampling adequacy (0.8 or higher), and Bartlett's Test of Sphericity (<0.001) assessed the significance of the correlation matrix. We applied a factor loading cut-off point of 0.4 for retaining items in a component (Kaiser, 1974).

Data Collection Procedures

The survey occurred during the Trail Ambassador's Spring 2023 season (March–June) at three high-use trails (Corona Arch, Grandstaff, and Mill Creek), where GCTA staff routinely educate visitors. These trails were prioritized due to their proximity to Moab and their significant recent popularity increases.

To evaluate the influence of the GCTAs on the overall trail experience and behavioral intentions of visitors, we employed two conditions: (1) Trail Ambassadors present (TA present) and (2) Trail Ambassadors absent (TA absent). Sampling days were split evenly between sites and conditions throughout the Trail Ambassador season. Days of the week and time of day were also rotated throughout the sampling period to increase variability (e.g., to ensure all TA present samples were not on weekends). Survey technicians positioned themselves between the GCTA tent and the trailhead, intercepting respondents after interacting with the GCTA and before they began their hike at randomly selected minutes-on-the-hour, determined at the beginning of each sampling period using a random number generator. Survey technicians intercepted visitors before their hike, gave them a GPS unit (for a study component not described in this article), and asked them to complete an exit survey when they returned the GPS unit. Visitors who agreed to take the survey were given a tablet to self-administer it using Qualtrics software when they returned from their hike. We excluded intercepted visitors who had taken the survey at a different location from participating at a second location. The total sample size across all sites was 451 respondents with an approximately even distribution between conditions (229 TA present, 222 TA absent). The response rate was very high, with 98% of intercepted visitors agreeing to complete the exit survey.

Data Analysis

Data were analyzed using IBM Statistical Packages for Social Science (SPSS) 29. All data were screened and assessed for relevant assumptions before further analysis. To handle missing values, we employed listwise deletion, eliminating responses with missingness. With caution, Likert-type variables were treated as continuous, an approach identified as suitable for Likert scale data provided the scale contains five or more categories (Vaske, 2019).

Hierarchical Multiple Regression Model Methods. To assess the influence of Trail Ambassador's presence on the relationship between behavioral intentions and attitudes and to understand the influence of visitors' motivations for visiting the site on these intentions, we specified hierarchical multiple regression models with dichotomous

moderator variables for each behavioral item. For each model, one item from the intentions scale represented the dependent variable (i.e., intentions to participate in positive behavior in the future). Predictor variables were the corresponding components from the other three TPB scales (appropriateness of depreciative behavior, perceptions of effectiveness, and perceptions of difficulty). We also included a binary GCTA presence variable (0 = TA absent, 1 = TA present) and the five recreation motivation factors in each model. The TPB attitude scales (i.e., appropriateness, effectiveness, and difficulty) were centered using variable centering to aid in interpreting the interaction terms in the model coefficients (Afshartous & Preston, 2011). Following this step, we transformed the centered variables into 12 interaction terms representing the interactions between each TPB scale item and GCTA presence (e.g., TA present X perceived effectiveness of staying on the trail).

Results

Visitor Characteristics

The average age of respondents was 42 years old. Most respondents (60%) were residents of Colorado (30%) or Utah (30%), with a small percentage of respondents from 41 other states. A large proportion of the visitors were repeat visitors to the Moab area (64%), and their primary activities included hiking (80%) and dog walking (10%). Most visitors were hiking at Corona Arch (84%) and Grandstaff (87%) as their primary activity. While hiking was the predominant activity at Mill Creek (69%), a notable portion of visitors were also there to walk dogs (15%) and swim (9%).

Recreation Experience Preferences—Visitor Motivations

We eliminated 10 items from the 28-item REP scale due to low Cronbach's alpha or failing to load on a factor at $\alpha > .4$ level during the analysis's reliability assessment and dimension reduction stages. Through Principal Axis Factoring dimension reduction, we reduced 18 of the 28 items in the REP motivations scale into five latent constructs: Physical Fitness/Nature, Escape Pressures/Introspection, Risk-Taking, Family Togetherness, and New People. The Physical Fitness/Nature component ($\alpha = .838$) included physical fitness, enjoy nature learning, and escape role overload items from Driver's (1983) REP list (Table 1). The Escape Pressures/Introspection component ($\alpha = .765$) included five items from escaping physical pressures, escaping personal-social pressures, and introspection categories. The Risk-Taking component ($\alpha = .756$) included three items from the risk-taking and stimulation categories. The Cronbach's alpha for this component would have improved slightly if the item to test your abilities was removed. Due to the conceptual importance of this item it was retained (Hoekstra et al., 2019). Spearman-Brown Coefficients were calculated and reported for the two factors with only two items to assess reliability rather than Cronbach's Alpha (Eisinga et al., 2013). The Family Togetherness (Spearman-Brown = 0.863) and New People (Spearman-Brown = 0.838) components reflected the family togetherness and new

Table 1. Recreation Experience Preferences – Motivations for Visit.

Motivation components ^a	Mean	SD	Loading ^b	α if deleted
<i>Physical fitness/nature ($\alpha = .838$, $n = 413$)</i>				
To feel good after being physically active	4.2	0.83	0.901	.792
To get exercise	4.2	0.84	0.805	.806
To get away from the usual demands of life	4.1	0.93	0.628	.806
To view the scenery	4.5	0.73	0.591	.818
To experience new and different things	4.0	0.97	0.548	.824
To enjoy the smells and sounds of nature	4.2	0.91	0.523	.825
<i>Escape pressures/introspection ($\alpha = .765$, $n = 406$)</i>				
To have your mind move at a slower pace	3.4	1.22	0.824	.691
To experience tranquility	3.8	1.02	0.673	.709
To learn more about yourself	2.8	1.20	0.485	.715
To be alone	3.6	1.17	0.456	.744
To be away from crowds of people	2.5	1.31	0.446	.750
<i>Risk-taking ($\alpha = .756$, $n = 414$)</i>				
To take risks	2.5	1.10	0.810	.577
To experience risky situations	2.1	1.07	0.730	.663
To test your abilities	2.9	1.07	0.522	.766
<i>Family togetherness (Spearman-Brown^c = .863, $n = 416$)</i>				
To do something with your family	3.5	1.34	0.934	—
To bring your family closer together	3.3	1.39	0.834	—
<i>New people (Spearman-Brown^c = .838, $n = 419$)</i>				
To meet new people	2.1	1.08	0.884	—
To meet other people in the area	2.1	1.07	0.837	—

^aREP motivations latent variable scale 1 = not at all important, 3 = moderately important, and 5 = extremely important.

^bEFA loadings Principal Axis Factoring with Promax Oblique rotation. Loadings smaller than 0.40 are not displayed.

^cSpearman-Brown Coefficients were calculated for the two factors with only two items (Eisinga et al., 2013).

people categories (Table 1). The total variance of these five REP motivation factors explained was 67.33% (Table 2).

Visitor Experiences With the Trail Ambassador Program

Overall, respondents indicated high levels of agreement regarding the positive influence of GCTA interactions on their trail experience. Many visitors specified that their interaction with a GCTA reaffirmed recreation behavior they already tried to practice, with 86% of respondents either somewhat or strongly agreeing with this statement ($M = 4.4$, $SD = 1.13$). Respondents were neutral about the program challenging their perspectives, with 47% indicating neutrality regarding this statement ($M = 3.2$,

Table 2. Eigenvalues, Percentages of Variance and Cumulative Percentages for Recreation Experience Preferences Factors.

Factor	Eigenvalue	% of Variance	Cumulative %
Physical fitness/nature	5.70	31.65	31.65
Escape pressures/ introspection	2.39	13.28	44.92
Risk-taking	1.82	10.12	55.04
Family togetherness	1.19	6.59	61.63
New people	1.03	5.70	67.33

SD=1.11). The other four experiential items presented means of 4.0 or higher and standard deviations under 1.0, indicating a high level of agreement with the positive influence of GCTA on experiences (Figure 2).

Influence of Trail Ambassador Presence on Behavioral Intentions

The four hierarchical multiple regression sets we performed showed that visitor attitudes regarding the appropriateness, effectiveness, and difficulty of the associated LNT principle-based behavior influenced behavioral intent. These four models were Weather, Trail, Litter, and Water, corresponding with preparing for all hazards and weather before getting on the trail; staying on designated or established trails; carrying out all litter, including human and dog waste; and carrying sufficient water. The explanatory power of models ranged from an *R* squared of .23 (Weather Model 1; Table 3) to .42 (Litter Model 2; Table 3). We also found that the presence of Trail Ambassadors moderated the effect of the independent variables (i.e., attitudes and motivations) on behavioral intent in two of the four behavioral items: staying on designated or established trails and picking up all litter (Figure 3, Tables 3 and 4). The other two models (Weather and Water) failed to present statistically significant improvements when Trail Ambassadors were present (Figure 3, Tables 3 and 4).

The Trail Ambassador’s presence significantly improved respondents’ behavioral intentions to stay on the trail and refrain from littering. In the Trail model, the Trail Ambassador’s presence moderated the effect of attitudes toward staying on designated or established trails, or motivations for visiting, on behavioral intentions to stay on the trail in the future. There was a statistically significant 2.7% increase in the total variance explained, $F(3,345)=4.707, p<.005$. The model without the moderating variable explained 30% of the variance in behavioral intentions to stay on the trail in the future. With the moderating variables, this model explained 32% of the variance. In the Litter model, the Trail Ambassador’s presence moderated the effect of attitudes toward carrying out all litter, including human and dog waste, or motivations for visiting, on behavioral intentions to carry out all litter in the future. There was a statistically significant 3.3% increase in the total variance explained, $F(3,343)=6.775, p<.001$. The model without the moderating variable explained 39% of the variance in

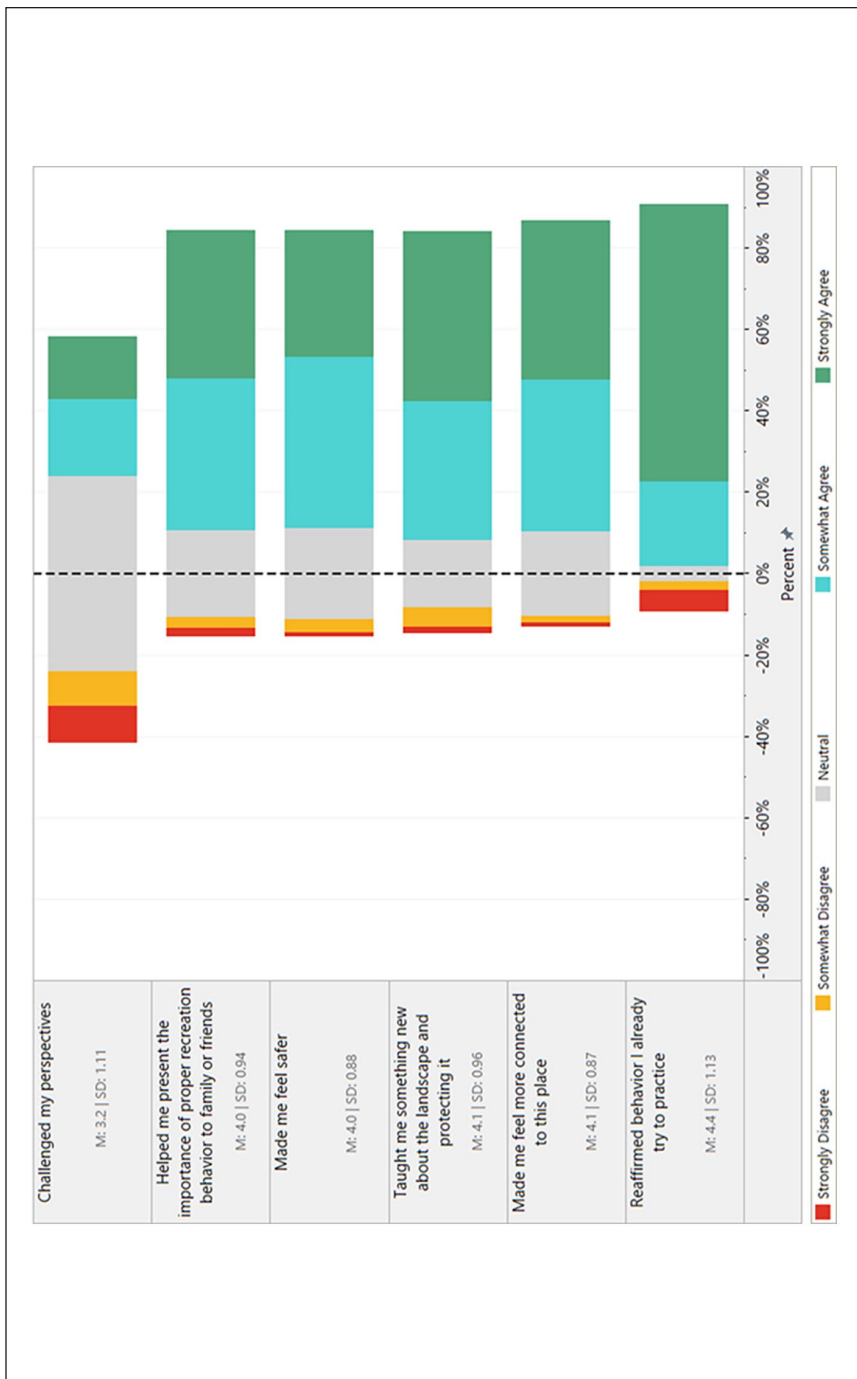


Figure 2. Influence of trail ambassador interaction on experience components.

Table 3. Regression Model Comparisons With and Without Treatment.

Educational item ^a	Model ^b	Adjusted R square	R square change	F change	Sig. F change	N
Weather	Model 1	.23	.251			348
	Model 2	.23	.004	0.658	.578	345
Trail*	Model 1	.30	.320			348
	Model 2	.32	.027	4.707	.003	345
Litter**	Model 1	.39	.401			346
	Model 2	.42	.033	6.775	<.001	343
Water	Model 1	.35	.364			344
	Model 2	.35	.004	0.755	.520	341

^aAsterix indicate statistical significance of differences between models * $p < .05$, ** $p < .001$.

^bModel 1 is the control (no TA presence variable), Model 2 is the treatment (TA presence variable added).

behavioral intentions to litter in the future. With the moderating variables, this model explained 42% of the variance (Table 3).

We found no significant influence of Trail Ambassadors on respondents' behavioral intentions to prepare for hazards or carry water. In the Weather model, Trail Ambassador presence did not moderate the effect of attitudes toward preparing for all hazards and weather before getting on the trail, or motivations for visiting, on behavioral intentions to prepare for hazards and weather in the future. There was a 0.4% change in the R squared between the Trail Ambassador present interaction term and Trail Ambassador absent model, which was not statistically significant ($F(3,345)=0.658$, $p=.578$). Overall, attitudes and motivations explained 23% of the variance in behavioral intentions to prepare for all hazards and weather in the future. In the Water model, the Trail Ambassador's presence did not moderate the effect of attitudes toward carrying sufficient water or motivations for visiting on behavioral intentions to carry water in the future. A 0.4% change in the R squared between models was not statistically significant ($F(3,341)=0.755$, $p=.520$). This model explained 35% of the variance in behavioral intentions to carry water in the future (Table 3).

Regardless of the Trail Ambassador's presence, respondents' attitude toward the effectiveness of participating in LNT principle-based behaviors on minimizing recreation-related impacts was a strong predictor for all behavioral intention items. Perceived effectiveness was the strongest predictor of intentions for the Weather ($\beta=.302$, $p<.001$), Trail ($\beta=.299$, $p<.001$), and Litter models ($\beta=.287$, $p<.001$). The perceived difficulty of participating in positive behavior was also a significant predictor for the Weather ($\beta=-.253$, $p<.001$) and Water models ($\beta=-.258$, $p<.001$). In the case of preparing for all hazards and weather and carrying sufficient water, behavioral intentions decreased as perceived difficulty increased. The perceived appropriateness was a strong predictor in the Trail model ($\beta=-.283$, $p<.001$); as the perceived appropriateness of leaving the trail increased, the respondents' behavioral intentions to stay on the trail in the future decreased (Figure 3, Table 4).

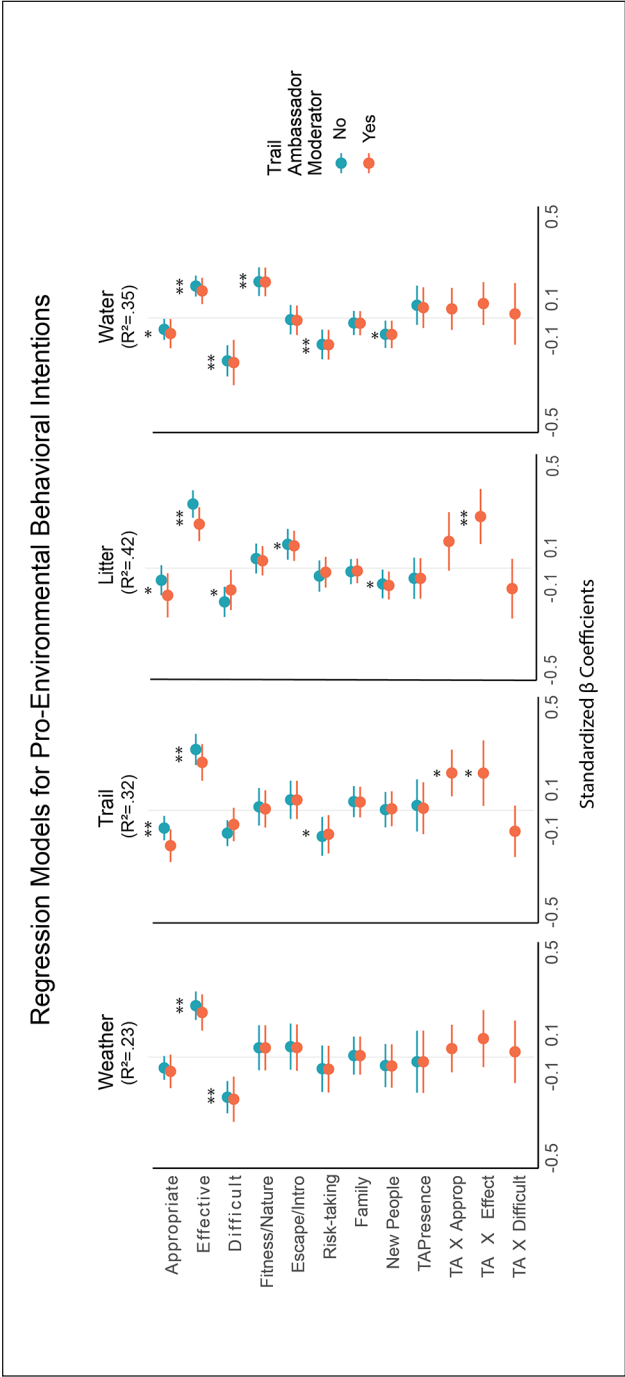


Figure 3. Comparison of standardized beta coefficients across models.

Table 4. Regression Coefficients for Model 2.

Regression component ^a	Weather ^b	Trail	Litter	Water
Appropriate	-0.114	-0.283**	-0.170*	-0.135*
Effective	0.302**	0.299**	0.287**	0.230**
Difficult	-0.253**	-0.102	-0.137*	-0.258**
Physical fitness/nature	0.054	0.009	0.058	0.307**
Escape pressures/ introspection	0.053	0.066	0.166*	-0.019
Risk-taking	-0.065	-0.151*	-0.030	-0.214**
Family togetherness	0.009	0.055	-0.021	-0.044
New people	-0.050	0.010	-0.132*	-0.136*
TA presence	-0.014	0.007	-0.042	0.046
TAX appropriate	0.048	0.204*	0.128	0.058
TAX effective	0.081	0.026*	0.212**	0.076
TAX difficult	0.023	-0.100	-0.092	0.018
R squared	.23	.32	.42	.35

^aCell entries are standardized regression coefficients * $p < .05$, ** $p < .001$.

^bWeather = Preparing for all hazards and weather; Trail = Staying on designated or established trails; Litter = Picking up all litter, including human and dog waste; Water = Carrying sufficient water.

Explanatory Power and Influence of REP on the Interpretation of TPB Models

For most regression sets, REP motivations were weak and non-significant predictors, except for the behavioral item carrying sufficient water (Table 4). The results of this model were interestingly different from the others. Motivation items such as physical fitness and nature ($\beta = .307, p < .001$) and risk-taking ($\beta = -.214, p < .001$) were strong predictors of intentions to carry sufficient water, with motivations of physical fitness and nature increasing behavioral intentions to carry sufficient water in the future, and risk-taking decreasing behavioral intentions to carry sufficient water in the future. The Trail and Litter models also had statistically significant motivation predictors. For example, respondents motivated by risk-taking were less likely to indicate behavioral intentions to stay on designated or established trails in the future ($\beta = -.151, p < .05$). Respondents motivated by escaping pressures and introspection were more likely to indicate behavioral intentions to carry out all litter in the future ($\beta = .166, p < .05$; Figure 3, Table 4).

Discussion

Influence of Trail Ambassadors on Experience

This study aimed to assess how the presence of GCTA presenting LNT-oriented messages influences visitors' experiences and behavioral intentions. The results suggest that the presence of GCTA was highly positive on the experience of recreationists.

After interacting with Trail Ambassadors', visitors felt safer, more confident in presenting proper recreation behaviors to their family or friends, that they had learned something new about the landscape and protecting it, more connected to the place, and the GCTA had reaffirmed behavior they already tried to practice. The high means and relatively low standard deviations for most items signify that these perceptions are generally shared among respondents, pointing to the effectiveness of GCTA in enhancing the trail experience and promoting existing stewardship behaviors. The only component that respondents did not agree strongly with was that information shared by GCTAs challenged my perspectives, which may indicate that some respondents already held views that aligned with the goals of the GCTA messaging. Previous research has identified a connection between place attachment and awareness of environmental impacts of recreation (Wynveen et al., 2014), which could aid in understanding this result. Many of the survey respondents were returning visitors to these sites, which could indicate a high baseline level of place attachment. The addition of Trail Ambassadors who made respondents feel more connected to the place could indicate increased attachment and subsequent awareness of environmental impacts.

The results of this study suggest that the presence of GCTA may reaffirm positive attitudes and help reduce perceived barriers to modeling these behaviors. For example, the experience item with the highest mean was *reaffirmed the behavior that I already try to practice* ($M=4.4$), suggesting the positive effect of GCTAs even among visitors with a high level of pre-existing LNT principle knowledge. The GCTA program reiterates information visitors have heard elsewhere and provides positive affirmation in group settings for participating in responsible recreation behavior. This affirmation and repetition are important components of LNT messaging efficacy (Marion & Reid, 2001; Thomas et al., 2024).

Behavioral Intentions Assessment

The assessment of behavioral intentions applied an abridged TPB with the addition of REP motivation scales, emulating Lawhon et al.'s previous research (2013, 2017, 2019). These models explore the influence of perceived appropriateness, effectiveness, difficulty, and various motivational factors such as physical fitness and nature, escaping pressures and introspection, risk-taking, family togetherness, and meeting new people on trail-related future behavioral intentions. Examining the motives for visiting, using the REP provides insight into why people use these trails. Seeking physical fitness in a natural environment was the dominant motivation set, followed by motivations to escape pressures and participate in introspection, take risks, create family togetherness, and meet new people. Lower scores for risk-taking and meeting new people imply that these are less common motivations for visiting the study sites. These differences in motivations for using these trails, with some people visiting for physical fitness while others visiting to escape pressures, underscore the importance of offering various opportunities to visitors. For example, this could mean providing sufficient length and trail difficulty that encourages various levels of physical activity, as well as stopping points for groups to accommodate family bonding (Vogelsohn et al., 1998).

Previous research on encouraging general pro-environmental behaviors identifies a gap between attitudes and behaviors (Blake, 1999). Our results suggest that in the context of behavioral intentions to adopt LNT principle, if visitors believe the actions will make a difference and are not too difficult, the behaviors are more likely to be adopted. These behavioral intentions are indicated by survey items on perceived effectiveness and difficulty of carrying out pro-environmental behaviors, which showed a statistically significant relationship with many of the behavioral intentions. The appropriateness of leaving designated trails decreased, represented by a more substantial negative coefficient for appropriateness and a stronger statistically significant positive coefficient for the GCTA presence/appropriateness interaction term. Additionally, there was an increase in the perceived effectiveness of staying on the trail and carrying out litter, indicating that the presence of Trail Ambassadors may help lower perceived barriers associated with positive behaviors that visitors are already trying to practice. This finding is particularly significant because of the important role of barriers in pro-environmental decisions (Kollmuss & Agyeman, 2002; Moghimehfar & Halpenny, 2016). Another explanation for the effectiveness of Trail Ambassadors' at influencing behavioral intentions is that Trail Ambassadors are increasing the awareness of visitors regarding the impacts of their behavior. For example, in the context of National Marine Sanctuary stakeholders, increasing awareness of impacts through educational programs was found to increase pro-environmental behavioral intentions (Wynveen et al., 2015).

The hierarchical multiple regression models, including motivations, were able to explain a modest amount of the variation in responses (23%–42%) more than previous LNT TPB studies. Nevertheless, motivations did not substantially improve explanatory power overall. Interestingly, two items with significant levels of future behavioral intentions (staying on trails and carrying out all litter) in this study were also the most significant in a previous study in state parks (Lawhon et al., 2017). In Lawhon et al.'s (2013) national park study using similar methods, the items where attitudes explained the most variance were staying on trails and preparing for weather and hazards (Lawhon et al., 2013). The types of deprecative behaviors and visitor attitudes of the BLM/GCTA sample may be more closely related to those of the state parks study (Lawhon et al., 2017) than the national park visitors (Lawhon et al., 2013). The Water model ($R^2 = .35$) further justifies the inclusion of motivations in TPB education models. Visitors who had visited the site for physical fitness or nature exploration were more likely to carry water in the future. This finding makes practical sense, as these respondents may also be more likely to be hiking/running further distances or exerting more effort than respondents with other motivations. Intrinsic motivations and associated practical factors beyond attitudes, such as distance and exertion, may influence behavioral intentions. The finding that people motivated by physical fitness and nature are more likely to express behavioral intentions to carry sufficient water while hiking is interesting. However, Lawhon et al. (2013, 2017) did not include carrying water as an item, which limits comparisons of behavioral intentions.

Implications for Practice

Two components of the GCTA stand out as exemplary and should be considered by a regional government or PPA considering a similar program. First, most of the Trail Ambassadors are paid employees of the county and trained environmental educators. While some volunteers work in the program, they are alongside the paid employees and do not represent the bulk of the GCTA presence, minimizing volunteer burnout and ensuring a consistency of messaging provided to visitors. Additionally, the GCTA program is a county-run and funded initiative. However, Trail Ambassadors are stationed at BLM trailheads. In a time of uncertain federal land management agency budgets, a partnership between the regional government and federal agencies like this could help achieve common goals of facilitating positive visitor experiences while minimizing resource impacts and safety concerns. Organizations like LNT provide an opportunity to facilitate and support partnerships with agencies such as the BLM through the establishment of Memorandums of Understanding.

Information provided in this study regarding the types of management concerns that the GCTAs most effectively addressed could help tailor the delivery of minimum-impact messaging in areas considering Trail Ambassador programs. Specifically, the finding that Trail Ambassador interaction emboldens visitors to present the importance of sustainable recreation behavior to family and friends could be used to develop programming that enables previous Trail Ambassador contacts to distribute information or resources, expanding the educational program's impact. Additionally, GCTAs were most effective at influencing behavioral intentions to stay on trails and carry out all litter. One of the reasons for this effectiveness could be that these actions can be altered after arriving at the trailhead, more so than carrying sufficient water or preparing for hazards and weather that may occur during the trip planning phase. Therefore, practitioners may focus educational programming on behaviors that can be altered during the activity to achieve the most impact.

Limitations and Future Research

The sampling strategy limited the independence of the sample, which may have confounded the interpretation of the effect of the presence of Trail Ambassadors. Though we split sampling days between GCTA present or absent days, there were likely respondents in the Trail Ambassador absent sample who had interacted with a Trail Ambassador on a previous day or at a previous site.

The BLM constructs kiosks at trailheads and includes information regarding how to responsibly recreate in the area. Therefore, the Trail Ambassador absent group may still receive some LNT info. We anticipate this limitation to be minimal because previous studies have shown that passive signage has limited efficacy (Schoenleber et al., 2022; Settina et al., 2020). Future research could include more treatments and the experimental removal of information from the study to create a variety of situations (e.g., TA absent and sign; TA present and sign; TA present and no sign; and TA absent

and no sign). Because the Trail Ambassadors travel on the trails and provide information at the trailheads, assessing on-trail versus at-trailhead information and behavioral intentions could be beneficial. Additionally, further research should examine the provision of resources such as WAG bags and water/electrolytes to minimize the perceived difficulty of participating in LNT principle-based behaviors.

Related constructs to recreation motivations, such as recreation specialization (Lee & Lee, 2021) and leisure identity salience (Thomas et al., 2024), have been applied to understanding LNT-related behaviors and could be considered as additional model components, to help improve the explainability of the model. Additionally, it is possible that the relationship between attitudes and behavioral intentions could be mediated by motivations. Future models could test this relationship. Finally, other researchers using the TPB to measure the efficacy of indirect management actions have included observed behavioral measurements (Esfandiar et al., 2021; Settina et al., 2020). In the context of evaluating a Trail Ambassador program such as the GCTA, observing off-trail behavior using cameras could be considered. These methods have been accentuated as important in using the TPB in human dimensions research (Miller, 2017) because there is sometimes a mismatch between a person's knowledge, intentions, and actual behavior (Kollmuss & Agyeman, 2002).

Conclusions

This study found that community-led Trail Ambassador programs, as an indirect management technique, can positively affect visitor experience and assist in educating visitors about the importance of responsible behavior in reducing recreation impacts. They also reaffirm existing behavior for visitors familiar with minimum-impact recreation. Despite many positive improvements in attitudes, the effect of GCTA presence was not uniform in improving behavioral intentions. Regardless, in the region around Moab, where the community faces challenges associated with increased tourism and public land outdoor recreation, these improvements to experience and behavioral intentions should not be trivialized. Even a slight improvement among the millions of visitors to the Moab area could reduce search and rescue resources, minimize irreversible impacts to sensitive biocrust, and improve interactions between visitors. Programs like this can lead to better land stewardship and encourage a community of environmental stewards in an era of escalating PPA outdoor recreation demand.

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Data Availability Statement

The participants of this study did not give written consent for their data to be shared publicly, therefore supporting data is not available.

Declaration of Conflicting Interests

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Ethical Approval and Informed Consent Statements

The visitor intercept survey used in this study was approved under an expedited procedures (Expedited Category 7) by the Utah State University Institutional Review Board (Protocol # 13346). Informed consent to participate was provided by participants on the Qualtrics survey. The Letter of Intent was provided with agreement to participate buttons prior to the rest of the survey. No identifying information was collected from participants.

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