

# Recreate Responsibly

Grand County Trail Ambassador Program Evaluation  
Visitor Education and Behavior

November 14, 2023



# Executive Summary

This report provides the findings of a study exploring the influence of the Grand County Trail Ambassador program on visitor experience, pro-environmental knowledge, and trail behavior. Visitor intercept surveys and GPS tracks were collected at three high-use trails in Grand County where Trail Ambassadors provide visitor education and support. Survey efforts were split evenly between these three sites, and two treatments (with Trail Ambassador and without Trail Ambassador). This sampling design allowed the research team to evaluate visitor behavior and experiences on these trails when Trail Ambassadors were present, as well as when they were not present. The results of this study demonstrate positive influences of the Trail Ambassador program on visitors' current behavior, reported future behavior, and trail experience. Although the results show significant positive effects of the program, there is some room for refinement of breadth and depth of visitor education and targeted messaging for distinct user groups and management concerns at specific sites.

## Primary Findings

- **Produces a more knowledgeable visitor:** The Trail Ambassador program demonstrated measurable impacts on visitors' Responsible Recreation knowledge. The two knowledge areas with the highest increase were knowledge of biocrust and knowledge of archaeological sites. The percentage of visitors who reported no knowledge of the role of biocrust in dryland ecosystems and the impacts of recreation disturbance decreased by 11-15% after Trail Ambassador interaction. The percentage of visitors who reported no knowledge of how to identify archaeological sites decreased by 14%, and their knowledge of how to treat archaeological sites with respect increased by 7%. This indicates that Trail Ambassadors are reaching and educating a group with high potential for improved Responsible Recreation behavior. Future efforts should emphasize these topics and prioritize reaching these groups.
- **Reinforces sustainable recreation behavior and intentions:** There were statistically significant improvements in pro-environmental behavior between the group that had interacted with Trail Ambassadors and those who had not, albeit a slight practical significance (small effect sizes). When asked on a 5-point scale from extremely inappropriate (1) to extremely appropriate (5), visitors who had interacted with Trail Ambassadors felt that leaving litter on the trail was more inappropriate (Mean 1.2) than those who had not had a Trail Ambassador interaction (Mean 1.4). On a 5-point scale from never important (1) to always important (5), visitors who had interacted with Trail Ambassadors rated staying on trail as more important for reducing impacts (Mean 4.5) than those who had not (Mean 4.2).
- **Provides an improved visitor experience:** Overall, visitors felt very positive about their Trail Ambassador experience. Specifically, Trail Ambassador interaction improved trail experience for many respondents by reaffirming positive recreation behavior (86%), improving connections to place (77%), and teaching new things about protecting the land (77%). A minority (35%) indicated the Trail Ambassadors challenged their perspectives. The low amount of respondents indicating that the Trail Ambassadors challenged their perspectives may indicate that the respondents at certain sites already held pro-environmental views that were aligned with goals of the Trail Ambassador messaging. This could indicate that future Trail Ambassador messaging can go further in depth into pro-environmental behavior for visitors to practice while recreating at certain sites.
- **Experienced conditions are complex:** Respondents were asked to indicate conditions they may have experienced that are potentially problematic. Many of the conditions that were identified by the research team as potentially problematic were not identified by participants. The most frequently observed conditions were dogs off-leash (26%) and people off trail (16%). However, not all of the observed conditions were detractors from visitor experience. For example, 23% of respondents who had seen dogs running loose felt that the dogs improved their experience overall.

The observed conditions that detracted from visitor experiences the most were: dog waste(65%); noise from other trail users (43%), and graffiti (65%). Although off-leash dogs had a limited effect on the visitor experience, there are ecological implications that should be considered regarding dogs running off-trail in biocrust areas and disturbing wildlife.

- **Diverse visitor demographics:** Differences were present in demographics and visitor motivations across sites. Group size, group type, age, and activity varied between intercept sites with more hiking at Corona Arch and Grandstaff. These two sites also generally had smaller group sizes and older average ages compared to Mill Creek. Mill Creek represented more swimming and dog walking, with larger groups of users and younger average ages. Although the Trail Ambassadors are already cognizant of these differences between locations, further precision in site-specific messaging could be effective in addressing the varying motivations and knowledge levels of visitors.
- **Engaged and frequent visitors:** A majority of respondents were not first-time visitors (65%). Additionally, repeat visitor demonstrated high attachment to the site. Many respondents (64%) indicated that they somewhat or strongly agreed that being able to recreate at [site] means a lot to them, indicating a supportive audience exists for protecting these popular and frequently visited sites around Moab. This represents an opportunity to further engage with return visitors in stewardship and promoting and modelling Responsible Recreation norms.
- **A regional network of Responsible Recreation information:** Visitors were receiving recreate responsibly information from other public lands in the area. For example, many had visited Arches NP (29%) and received recreate responsibly education from there or other NPS visitor center (22%). Coordinated and uniform Responsible Recreation messaging would create consistent expectations for visitor behavior across the region. Additionally, respondents were reading trailhead kiosks (28%) to gather information on pro-environmental behavior which means these are effective places to provide Recreate Responsibly information when Trail Ambassadors are not present.

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**Summary:** This section provides context on the purpose of this study

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# Introduction

## 1.1. Introduction

Moab and its surrounding public lands provide unparalleled outdoor recreation opportunities to the city's residents, Utahans, and millions of visitors who travel to the state to spend time in southeastern Utah. Unfortunately, the past decade has seen increases in outdoor recreation use so substantial that it may threaten the ecological integrity of the region's ecosystems, the area's built and recreational infrastructure, and the quality of experiences visitors have come to expect and enjoy. Additionally, increased visitation to this area has led to increased safety issues and led to the Moab Search and Rescue team being one of the busiest in the state. As one method to address these potential threats and challenges, Grand County has implemented a Responsible Recreation program. This program uses an educational approach with visitors to encourage low ecological impact recreation that minimizes social conflicts between groups. Among other things, Trail Ambassadors explain why visitors are asked to hike only on designated trails, an action intended to reduce negative impacts on sensitive ecosystems such as biocrust, keeping recreation contained to managed space, and minimizing the geographic footprint of recreation. Additionally, Trail Ambassadors provide water, electrolytes, and trail information to visitors to help minimize Search and Rescue events. The three stated goals of this program are to teach people (1) how to protect themselves; (2) how to protect the environment; and (3) how to preserve positive experiences for other trail users. Through this research project, Grand County will gain a better understanding of the efficacy of the Trail Ambassador program. This study evaluates how the program influences ecological impacts and recreationists' behaviors at three high-use trail systems. The results presented in this report identify successes and areas for growth in the Trail Ambassadors program toward meeting goals of minimizing recreational impacts on the environment and educating the public about Responsible Recreation in the Moab area.

**Summary:** This section outlines the research approaches and methods for study design, data collection, and analysis.

## Study Approach & Methods

### 2.1. Study Methodology

To gain a better understanding of the efficacy of the Grand County Trail Ambassador program, this study employed two data collection methodologies (visitor survey and GPS tracks), at three high-use trails where Trail Ambassadors educate visitors, and with two experimental treatments (Trail Ambassador present and no Trail Ambassador present). The total sample size across sites was 451 respondents with an approximately even distribution between treatments. The response rate was very high, with some sites yielding a 100% response rate, and an overall response rate of 98%.

**Table 2.1:** Study treatments and response rates by site

| Site        | Treatment<br>(Trail Ambassadors Present?) | # of Survey<br>Responses | Survey<br>Response Rate |
|-------------|-------------------------------------------|--------------------------|-------------------------|
| Corona Arch | Yes                                       | 81                       | 100%                    |
| Corona Arch | No                                        | 70                       | 96%                     |
| Grandstaff  | Yes                                       | 75                       | 100%                    |
| Grandstaff  | No                                        | 79                       | 99%                     |
| Mill Creek  | Yes                                       | 73                       | 96%                     |
| Mill Creek  | No                                        | 73                       | 97%                     |
| Total       |                                           | 451                      | 98%                     |

### 2.2. Research Questions

The following research questions were explored in this study. Study results that address Research Question One are presented in this report, section 3. The results that address Research Question Two are presented in a supplementary report.

1. Do interactions with Trail Ambassadors lead to improvements in pro-environmental behavior?
2. Do interactions with Trail Ambassadors result in less ecological impact to targeted trail systems?

### 2.3. Sampling Procedures

The visitor survey was administered by Utah State University (USU) researchers March-June, 2023. Sampling days were split evenly between three popular Bureau of Land Management trailheads where Trail Ambassadors educate visitors. Sampling days were also split evenly between treatments to sample visitors when Trail Ambassadors were present, and when they were not. Respondents were asked when they were intercepted if they had taken part in the study at a different location previously, of that was the case these visitors were thanked for their time previously, and were asked not to repeat the study in an attempt to avoid sampling the same people on Trail Ambassador present, and no-Trail Ambassador present days. Respondents were intercepted at randomly selected minutes-on-the-hour throughout the sampling period. Garmin etrex GPS units were distributed as visitors began their hike

(for the trail behavior portion of the study). These visitors were then asked to complete a survey about their experience when they returned the GPS units. The results of the GPS unit component of this study are presented in a separate report. These survey responses were connected via a unique ID to the corresponding GPS track. Intercept times were generated daily using an online random number generator. Depending on the flow of visitors at that site, five numbers were generated per hour. If no one was present at the intercept time, that number was skipped. If the survey was rejected, the next group was intercepted.

The survey was conducted using Qualtrics offline software on an iPad tablet. Visitors who agreed to take the survey were provided a tablet to self-administer the survey or if requested a researcher would administer the survey to the respondent.

## **2.4. Survey Data Analysis**

After completion of the study, survey responses were downloaded from Qualtrics' servers and prepared for analysis. Data analysis was conducted using IBM SPSS software for initial data cleaning and statistical tests. Tableau was used for visualizations.

**Summary:** This section provides highlights of the survey results.

## Survey Results

### 3.1. Descriptive Results

#### 3.1.1 Visitor Characteristics

Visitor characteristics varied slightly between sites, reflecting differences in trail attributes. Because of these slight differences, the following section presents frequencies for visitor characteristics split by site. Chi-square tests of homogeneity revealed statistically significant differences between sites for some, but not all of the visitor characteristic variables. Statistically significant differences are marked with an asterisk indicating the level of significance ( $*=<.05$ ,  $**=<.01$ ,  $***=<.001$ ), and full chi-square test results are presented in the bottom right corner of the figure.

Overall, a majority of trail users were not first-time visitors to the Moab area. Corona Arch has the highest proportion of first-time visitors (44%) while Mill Creek has the lowest proportion of first-time visitors (26%) (Figure 3.1).

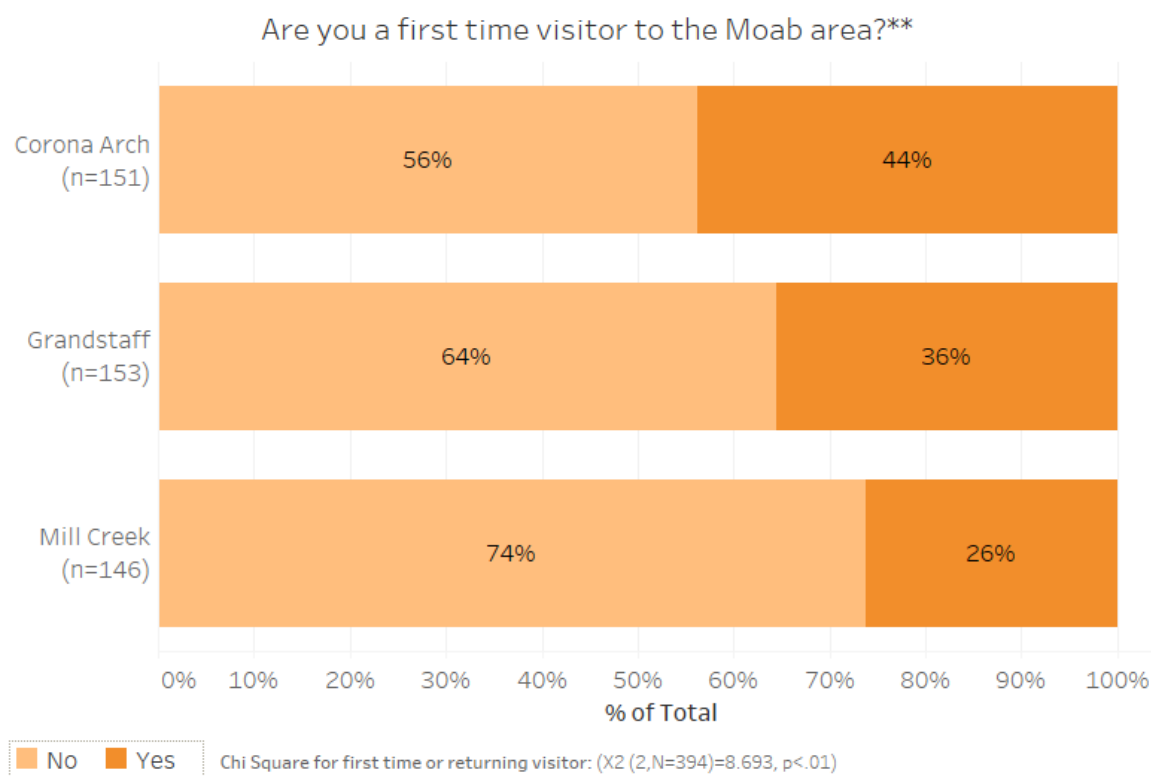


**Figure 3.1:** Percentage of visitors who are first-time versus returning to Moab

Group size and type also varied slightly between sites. Across sites, the majority of respondents reported groups of 1-2 people (60% at Grandstaff and Mill Creek, 59% at Corona Arch). However, the Mill Creek site experienced more groups of 6-10 people (13%) than Grandstaff and Corona Arch, where more visitors reported visiting in a group of 3-5 people (91%) (Figure 3.2). Mill Creek also had more groups that identified as friends (28%) than Corona Arch (21%) and Grandstaff (20%) did (Figure 3.3). These differences in group characteristics may reflect the types of activities and reasons for visiting each trail. For example, at Mill Creek, a portion of visitors were there to swim (9%) or walk dogs (15%) and only 70% reported hiking as the primary activity. At the Grandstaff and Corona Arch sites 87% and 84% reported hiking was their primary activity, respectively. Further, at Corona Arch visitors reported two types of activity more frequently than at other sites: rock art viewing (4%), and other activities (6%) (frequently described in comments as viewing Corona and Pinto Arches) (Figure 3.4).

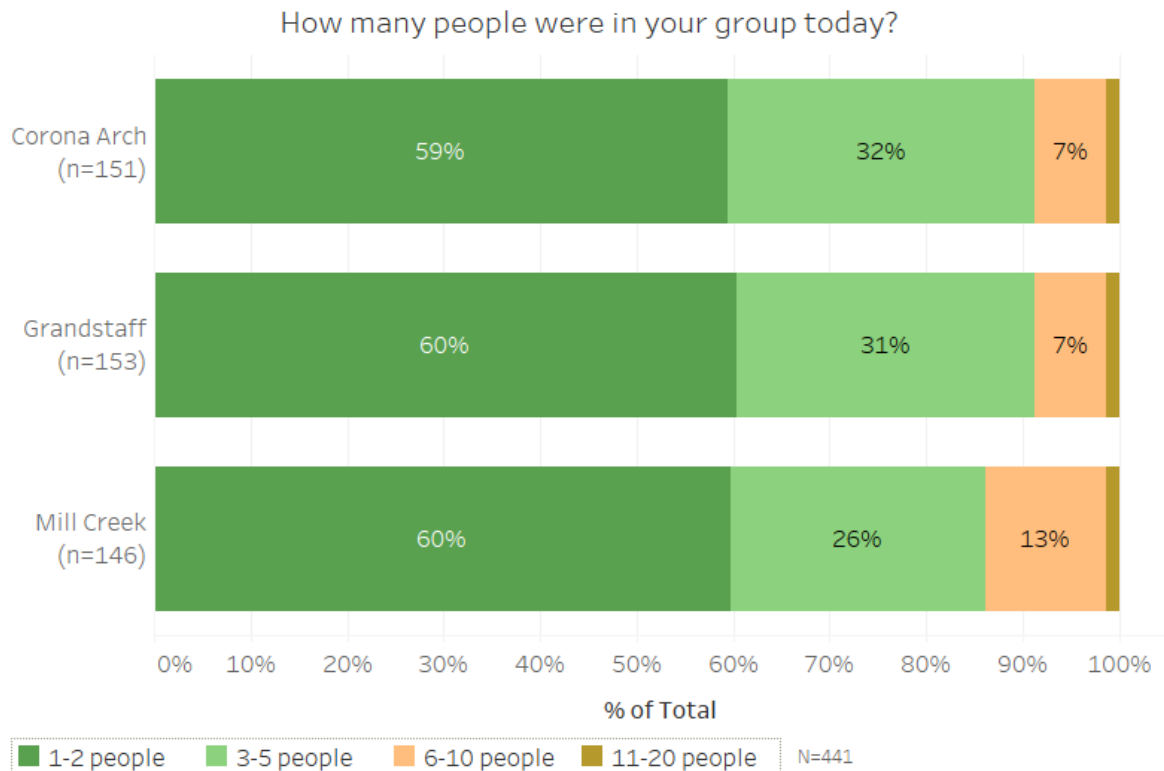


**Figure 3.2:** Size of personal group on current trip to site

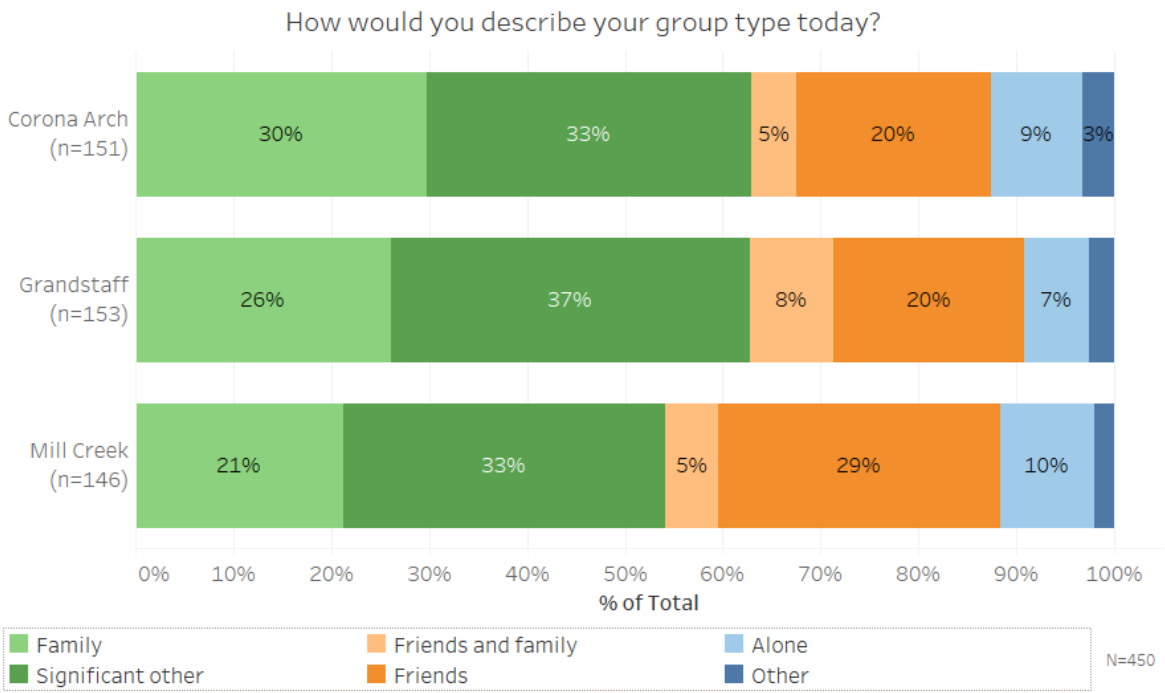


Figure 3.3: Type of personal group on current trip to site

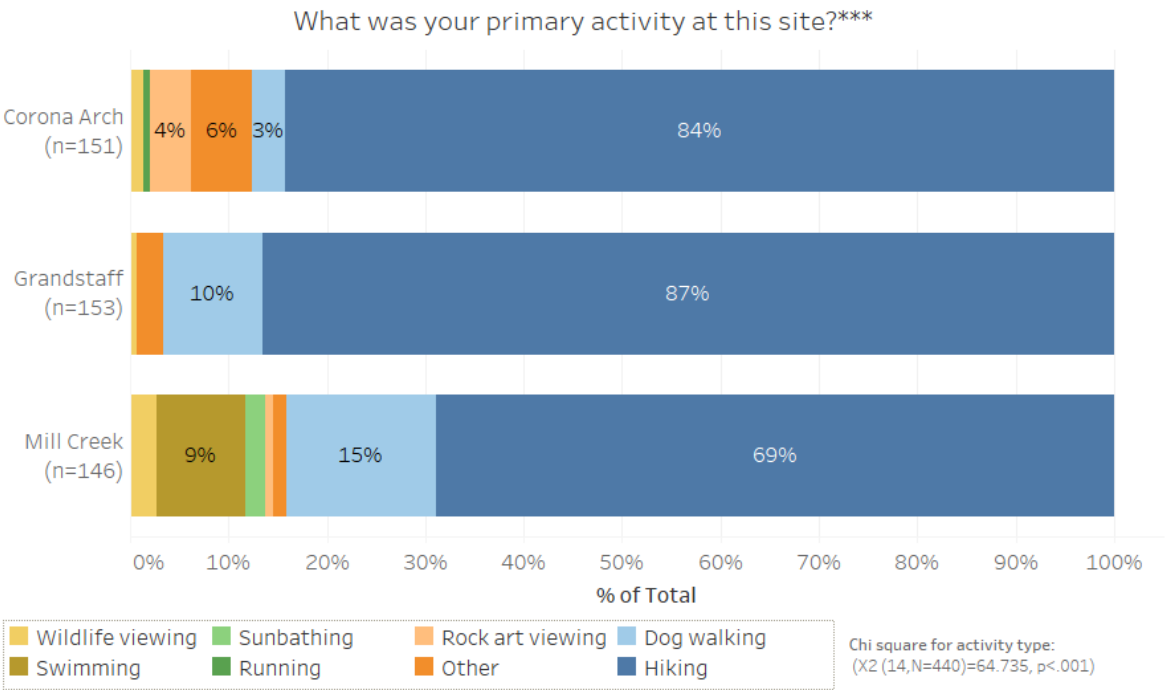


Figure 3.4: Primary activity participated in on visit to site

Weather varied across the data collection period, and influenced the primary activity participated in. A chi-square test of homogeneity was conducted to identify differences between temperature and primary activity ( $\chi^2(28, N=440)=56.404, p<.001$ ). Swimming emerged as a primary activity after temperatures reached 80 degrees or above with 14% of respondents on days with maximum temperatures above 80 degrees reporting this was their primary activity. Additionally, dog walking diminished as a primary activity after the daily maximum temperature reached 70 degrees (Figure 3.5).

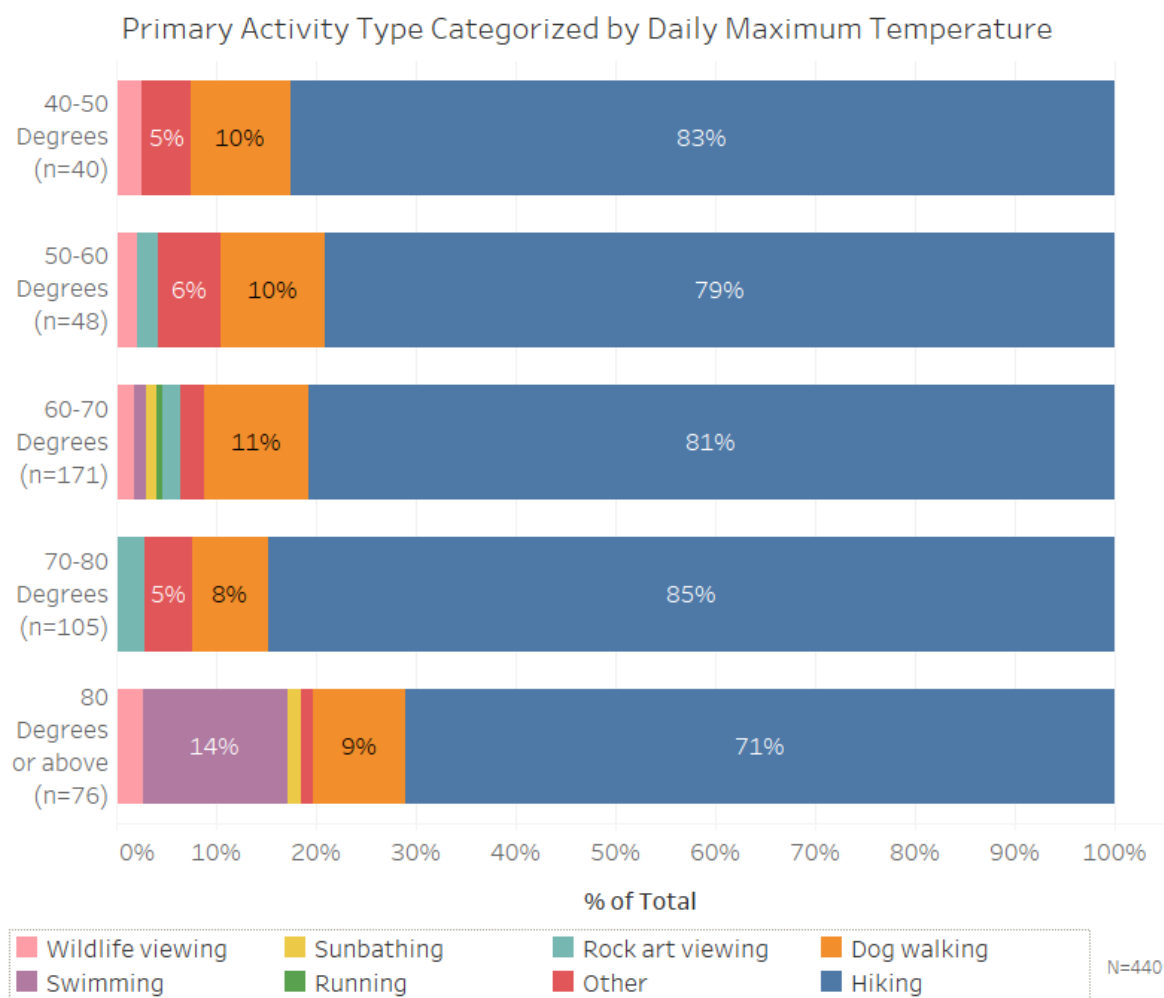


**Figure 3.5:** Primary activity participated in split by daily maximum temperature

At Mill Creek, respondents were more likely to have visited the site frequently than those responding at the other two locations. For example, 57% of respondents at Mill Creek reported 1-5 visits in the past 12 months, as opposed to 42% at Corona Arch, and 36% at Grandstaff (Figure 3.6).

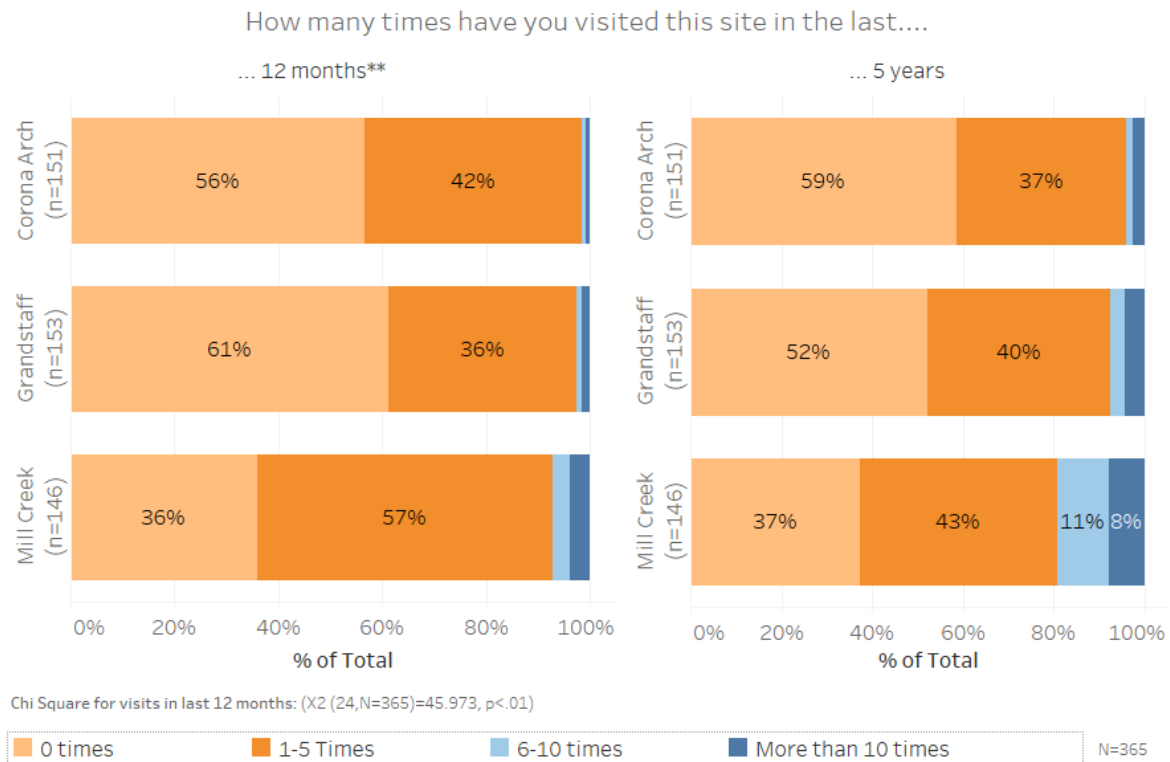


**Figure 3.6:** Number of site visits in past 12 months and 5 years

In addition to differences in the types of groups and activities participated in, there was variability in the income and education level of visitors across sites. Visitors to Grandstaff reported higher levels of formal education, with 20% of respondents at this site reporting a doctorate (PhD, EdD) or professional degree (MD, DD) compared to 10% or less at Corona Arch and Mill Creek (Figure 3.7). Further, the annual household income at Mill Creek was slightly lower than the other two sites, with only 32% of respondents reporting an income of \$100,000 or more, compared to 45% at Grandstaff and 43% at Corona Arch.

Similar to income and education level, age differed by site with Mill Creek visitors representing a much younger demographic than the other two sites. At Mill Creek 52% of respondents were under 35 years old, compared to 40% and 32% at Corona Arch and Grandstaff, respectively (Figure 3.9). This echoes other visitor characteristic differences, with this site providing a swimming location for larger groups of young friends compared to the other two sites serving an older hiking demographic.

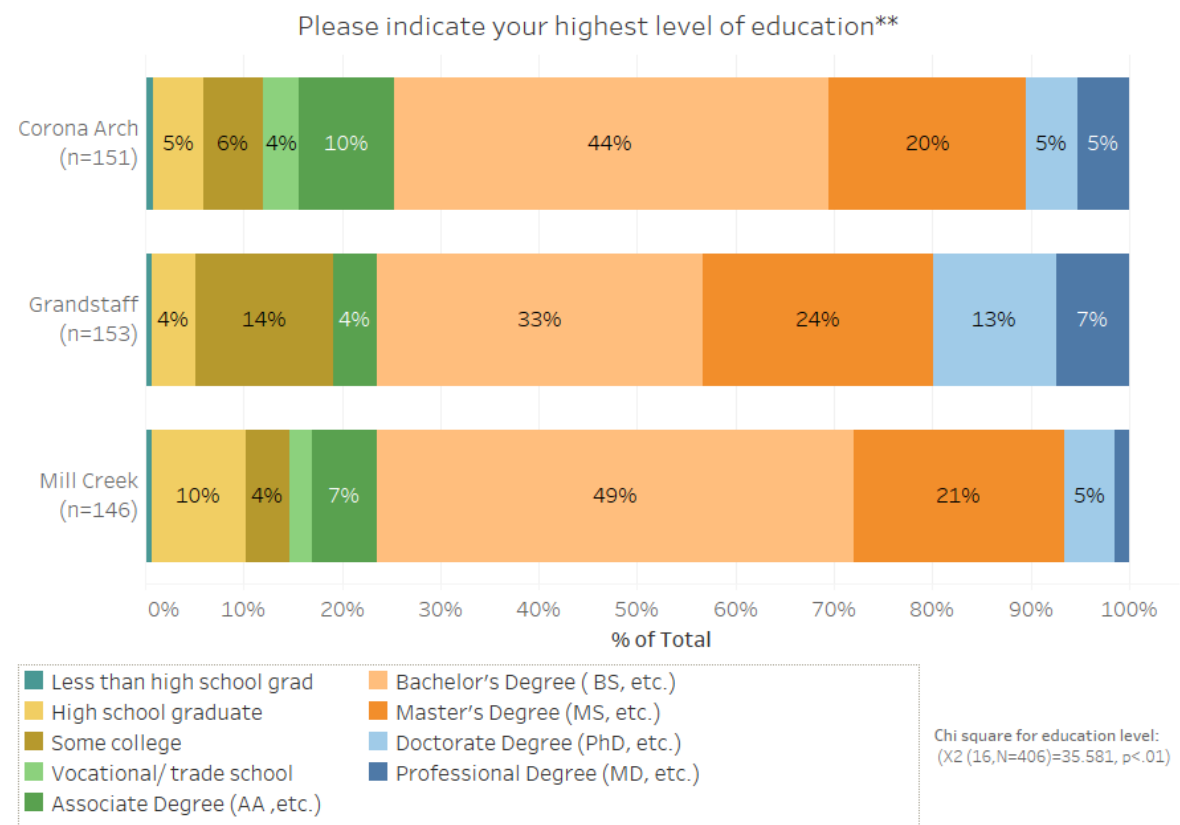


Figure 3.7: Respondent education level

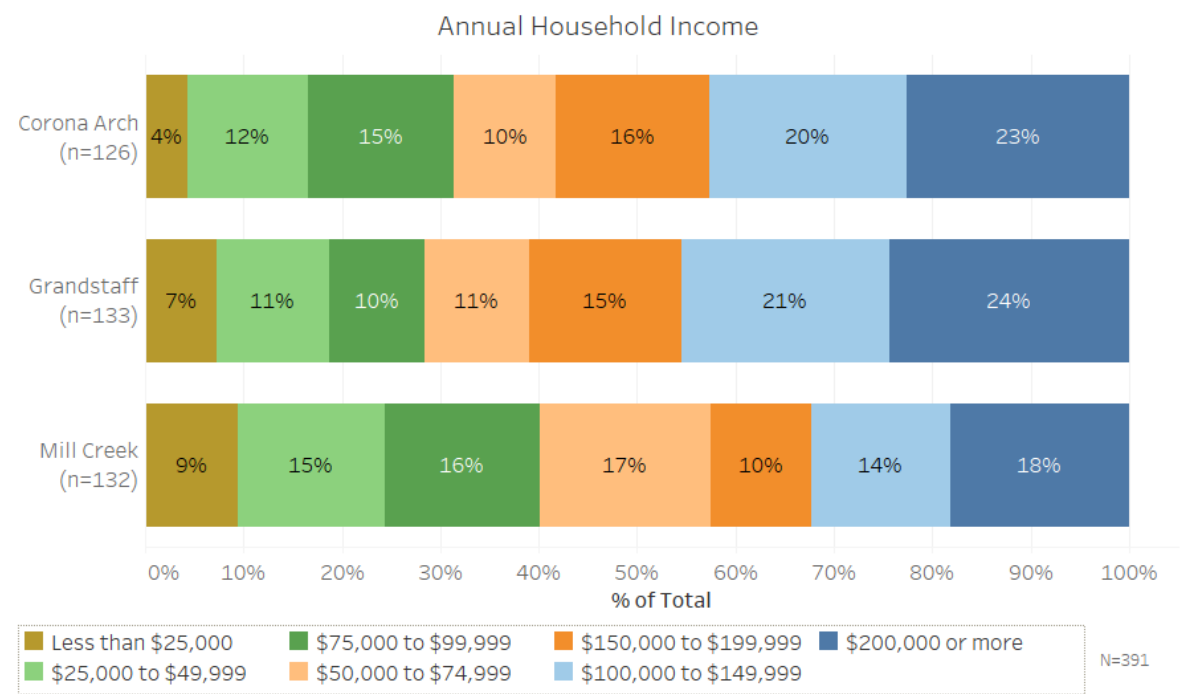


Figure 3.8: Respondents' annual household income

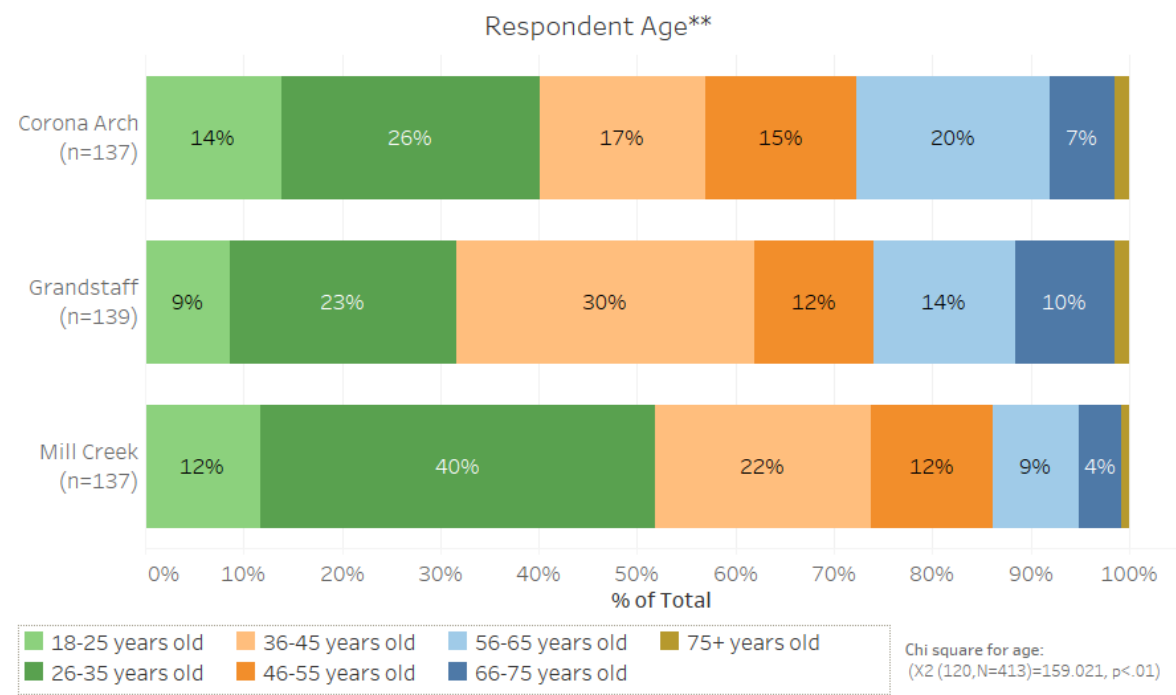


Figure 3.9: Respondents' age

A majority of respondents reported their state of residence was either Utah (30%) or Colorado (30%) The remainder of respondents had traveled from around the country with 5% residing in California (Figure 3.10).

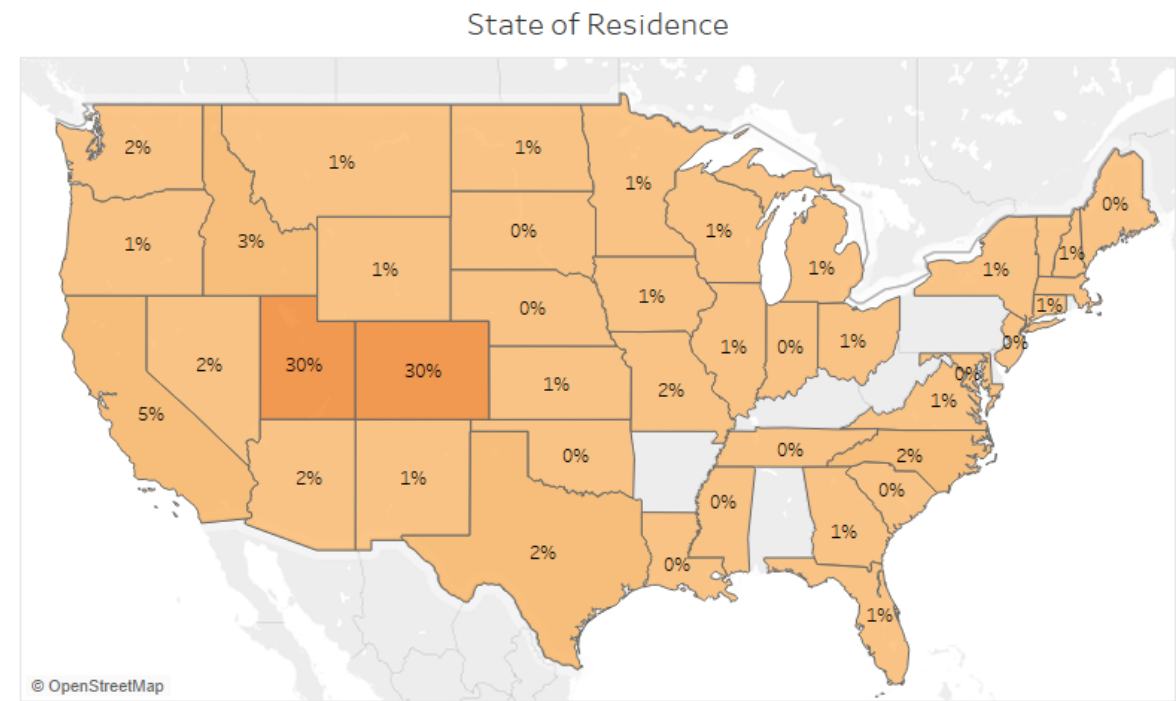


Figure 3.10: Respondents' state of residence

### 3.1.2 Information Sources

The following sections were combined across sites. For applicable questions, such as condition impacts, and technology used when recreating, chi-square tests of homogeneity were conducted and did not reveal statistically significant differences between sites. For other questions, small sample sizes for specific responses made splitting by site impractical.

A majority (52%) of respondents indicated that they had learned of the site they were visiting from word-of-mouth or previous visits (26% for each). Beyond these informal sources, electronic resources such as apps (14%) and websites (9%) were also used (Figure 3.11). For a list of the specific apps and websites listed by respondents see Appendix B Tables B.3 and B.4.

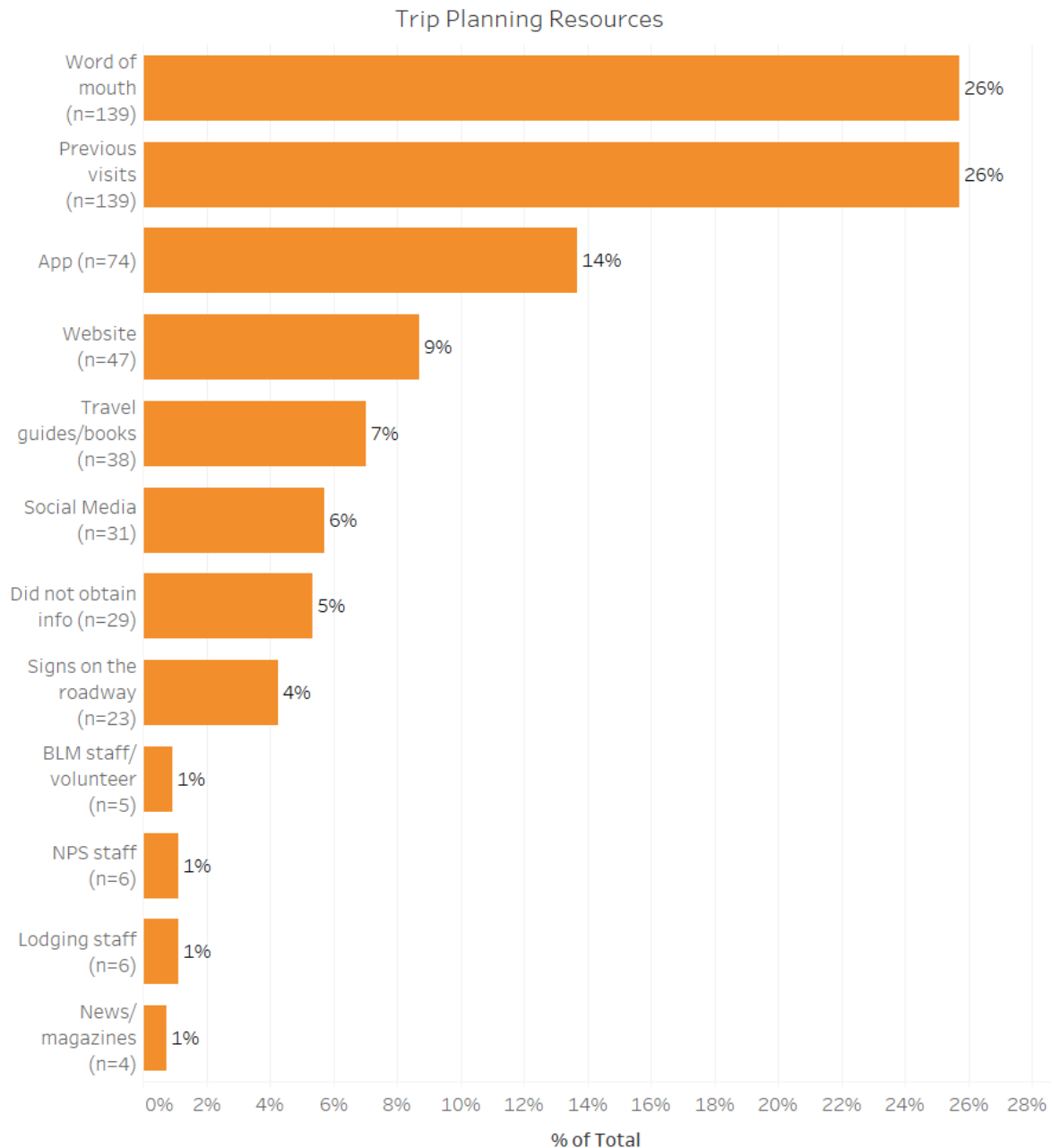


Figure 3.11: Information sources used for planning trip site

To better understand the types of technology used by visitors to these sites, respondents were asked to rate the frequency with which they used a series of technology/apps while recreating (on a 5-point Likert scale from (1) Never to (5) Always). The most frequently used technology was phone camera with 72% (Mean: 3.96 Std. dev: 0.991) of respondents using their camera very often or always when recreating. Another frequently used technology when recreating was a smartphone generally with 49% (Mean: 3.40 Std. dev: 1.199) of respondents very often or always bringing their smartphone (Figure 3.12 and Table 3.1).

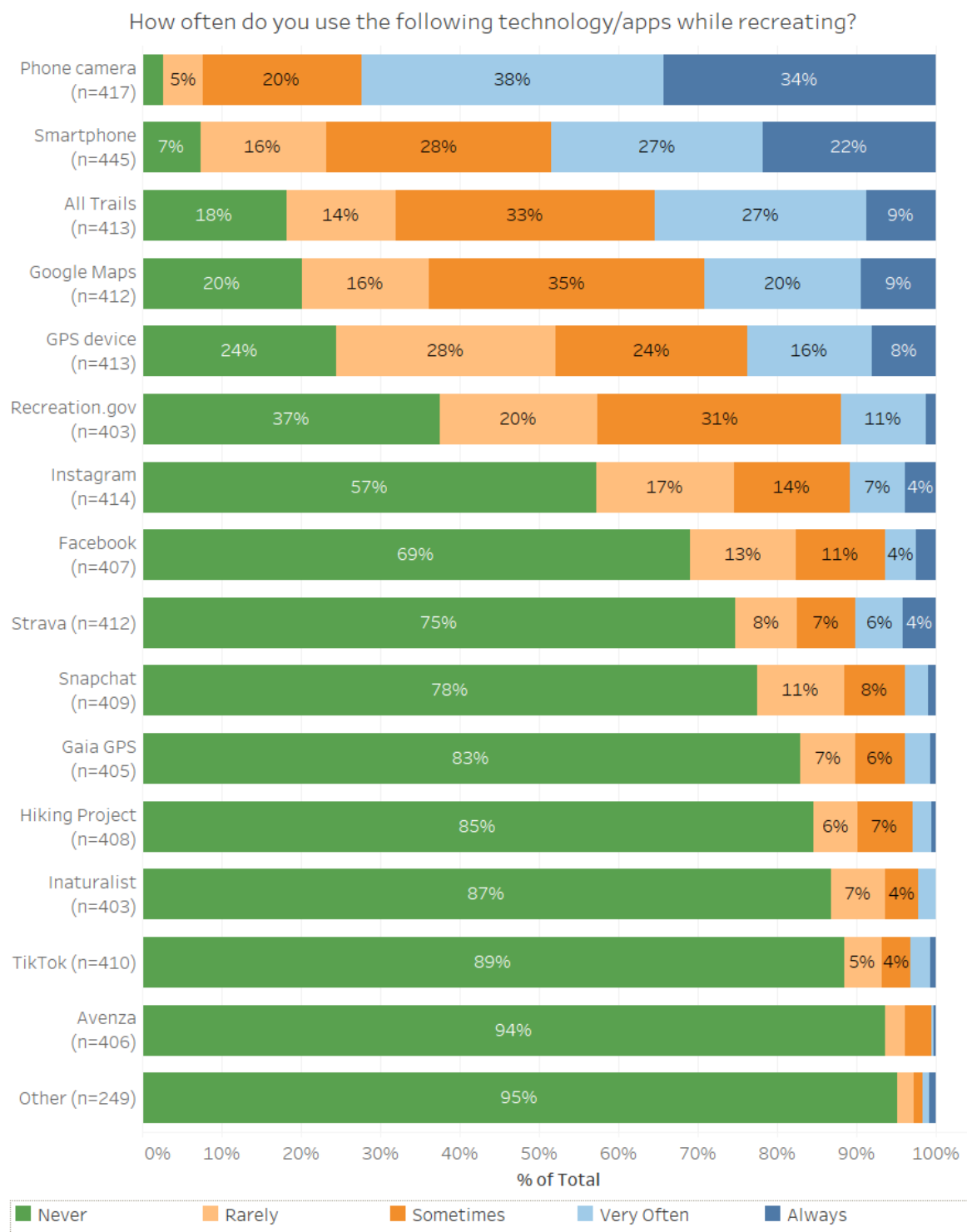


**Figure 3.12:** General frequency and type of technology use while recreating

**Table 3.1:** Descriptive statistics for technology used when recreating (1 = Never, 5 = Always)

| Technology        | N   | Mean | Min | Max | Std. Dev. |
|-------------------|-----|------|-----|-----|-----------|
| Smartphone camera | 417 | 3.96 | 1   | 5   | 0.991     |
| Smartphone        | 445 | 3.4  | 1   | 5   | 1.199     |
| All Trails        | 413 | 2.94 | 1   | 5   | 1.216     |
| Google Maps       | 412 | 2.82 | 1   | 5   | 1.23      |
| GPS device        | 413 | 2.55 | 1   | 5   | 1.239     |
| Recreation.gov    | 403 | 2.18 | 1   | 5   | 1.091     |
| Instagram         | 414 | 1.83 | 1   | 5   | 1.149     |
| Facebook          | 407 | 1.57 | 1   | 5   | 1.002     |
| Strava            | 412 | 1.57 | 1   | 5   | 1.119     |
| Snapchat          | 409 | 1.39 | 1   | 5   | 0.827     |
| Gaia GPS          | 405 | 1.32 | 1   | 5   | 0.79      |
| Hiking Project    | 408 | 1.29 | 1   | 5   | 0.741     |
| TikTok            | 410 | 1.22 | 1   | 5   | 0.694     |
| iNaturalist       | 403 | 1.22 | 1   | 4   | 0.625     |
| Avenza            | 406 | 1.11 | 1   | 5   | 0.461     |
| Other             | 249 | 1.1  | 1   | 5   | 0.51      |

While the Grand County Trail Ambassador program provides visitors with valuable Responsible Recreation information, visitors may have some knowledge of Responsible Recreation principles from other sources prior to interacting with Trail Ambassadors. Respondents were asked to identify other types and sources of information on specific Responsible Recreation topics received in the Moab region.

The most frequently identified information type was staying on the trail, with 25% of respondents indicating they had received information of this kind (Figure 3.13). When asked where they received the information presented in the previous question, the most frequently referenced information sources were trailhead kiosks (28%) and a National Park Service visitor center (22%) (Figure 3.14).

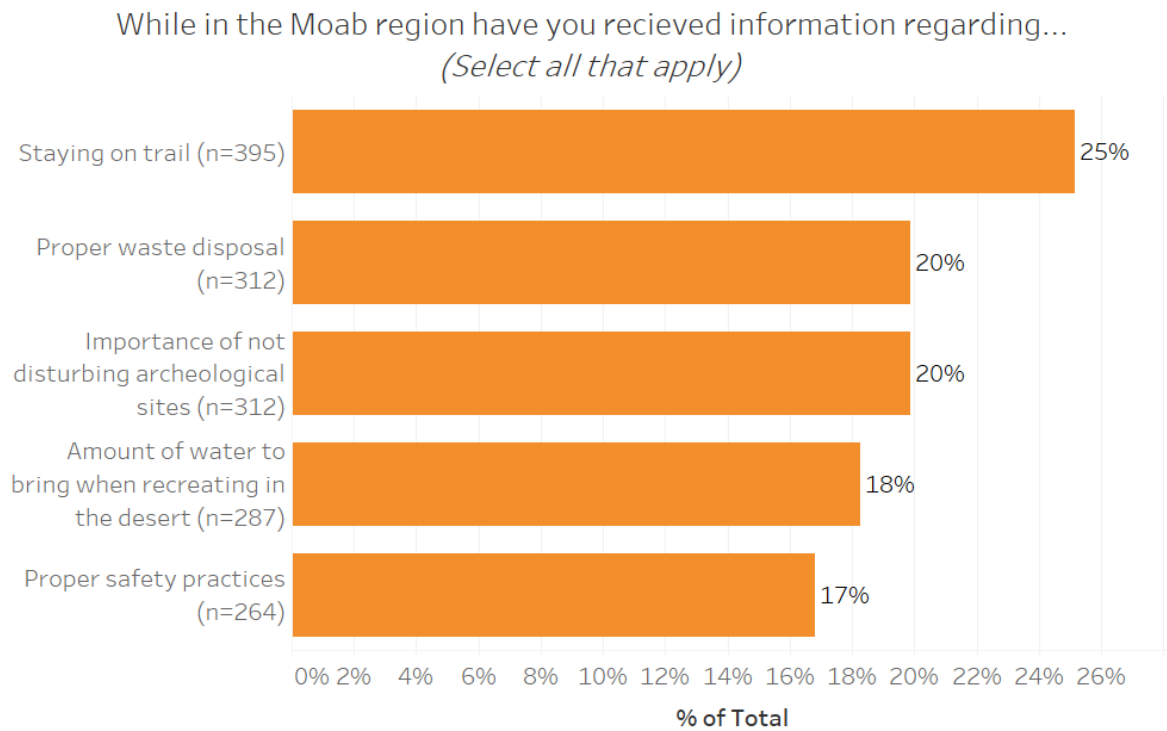


**Figure 3.13:** Previous information received on Responsible Recreation

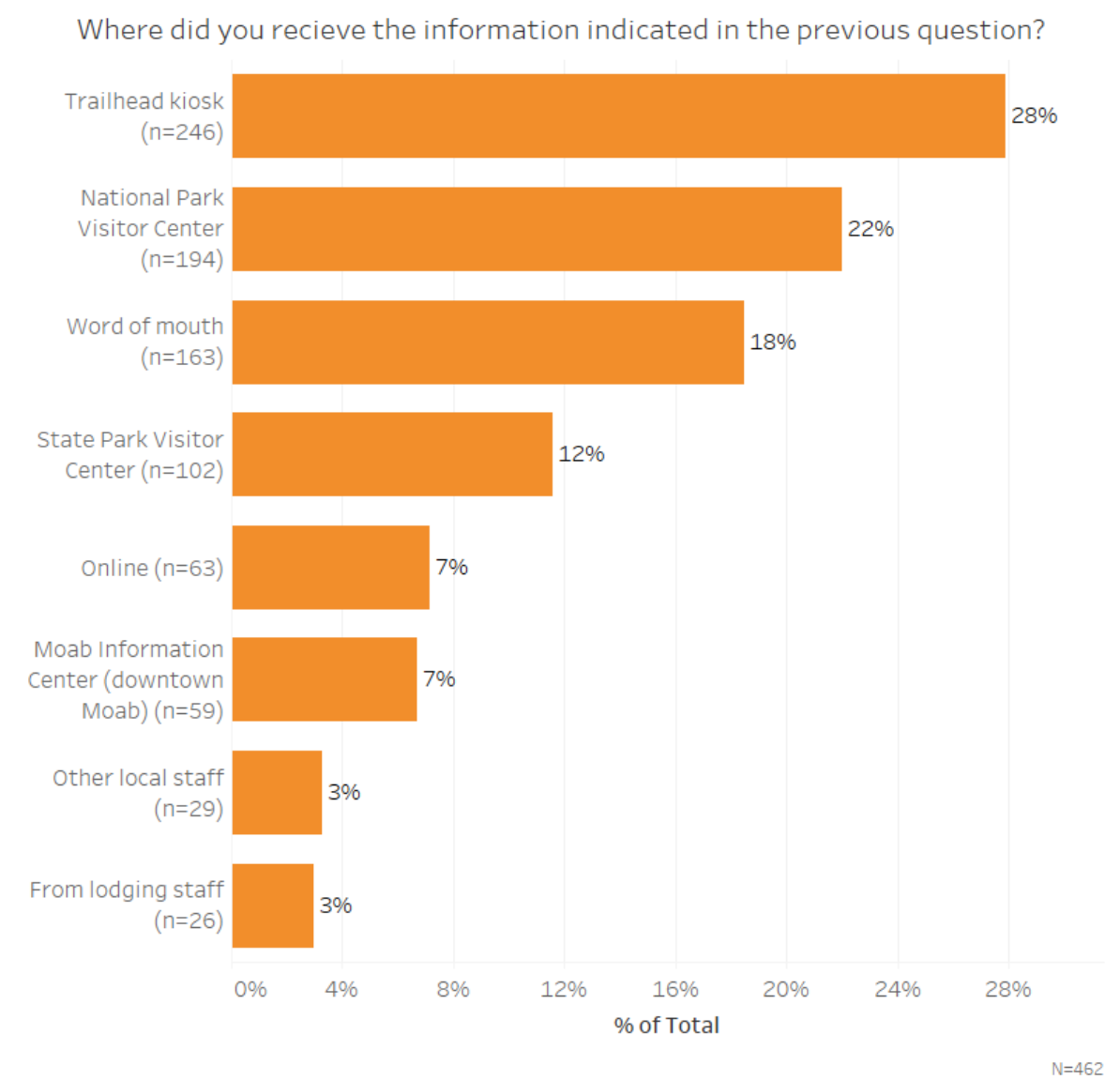


Figure 3.14: Sources of previous information on Responsible Recreation

### 3.1.3 Local Recreation

Survey respondents who did not have a zip code from the Moab region were asked where else they recreated on their trip to the Moab area. Many respondents indicated they had also visited Arches National Park (29%), Canyonlands National Park (20%), and other Bureau of Land Management trailheads generally (18%) (Figure 3.15). Arches National Park was not only the most frequently visited other site but the most frequently indicated first stop on their visit to the Moab area (38%) (Figure 3.16). The numerous respondents who had visited an NPS or other protected area first when they arrived highlights the importance of regional Responsible Recreation messaging.

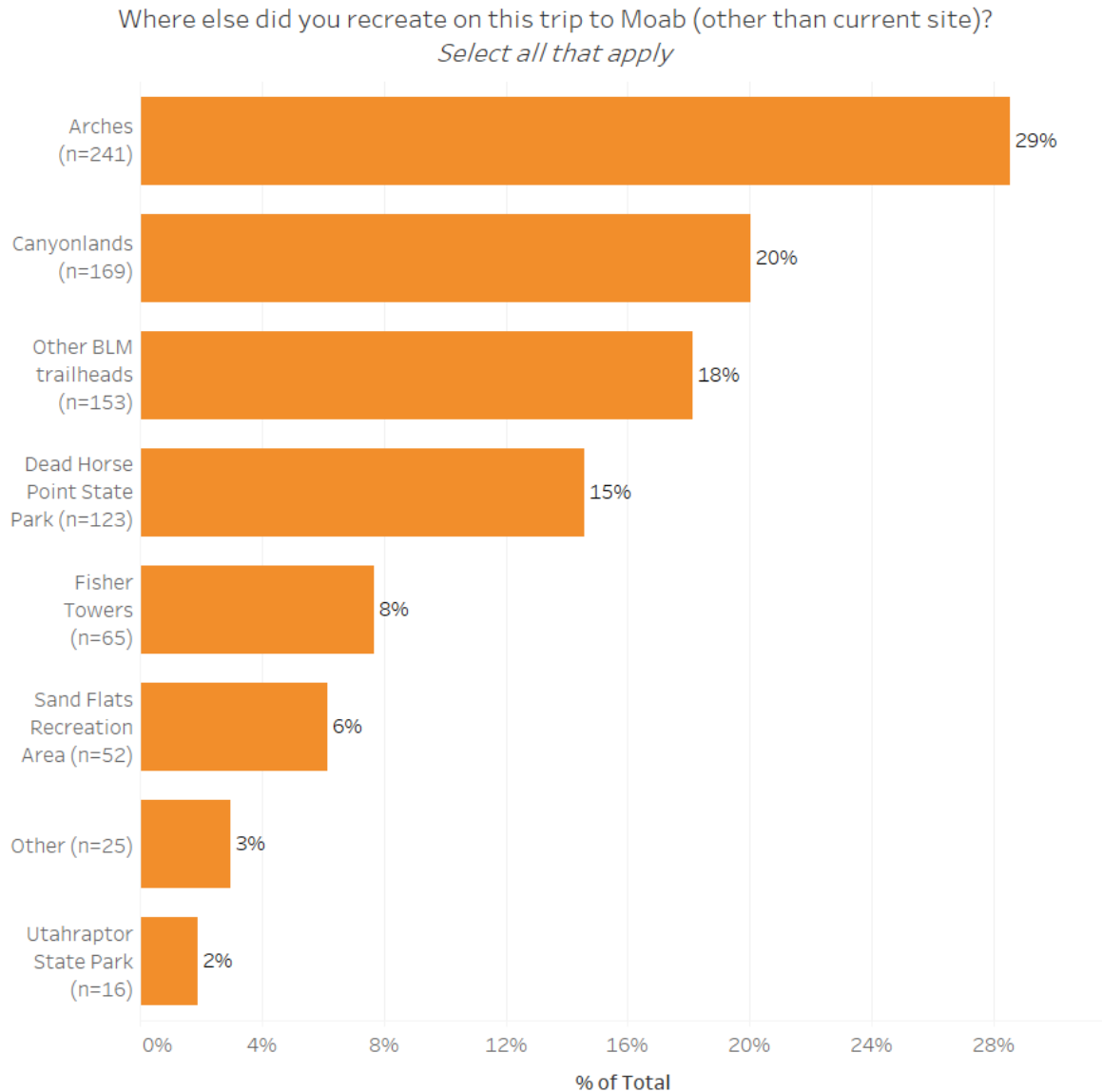


**Figure 3.15:** Other local recreation sites visited on current trip to the Moab region

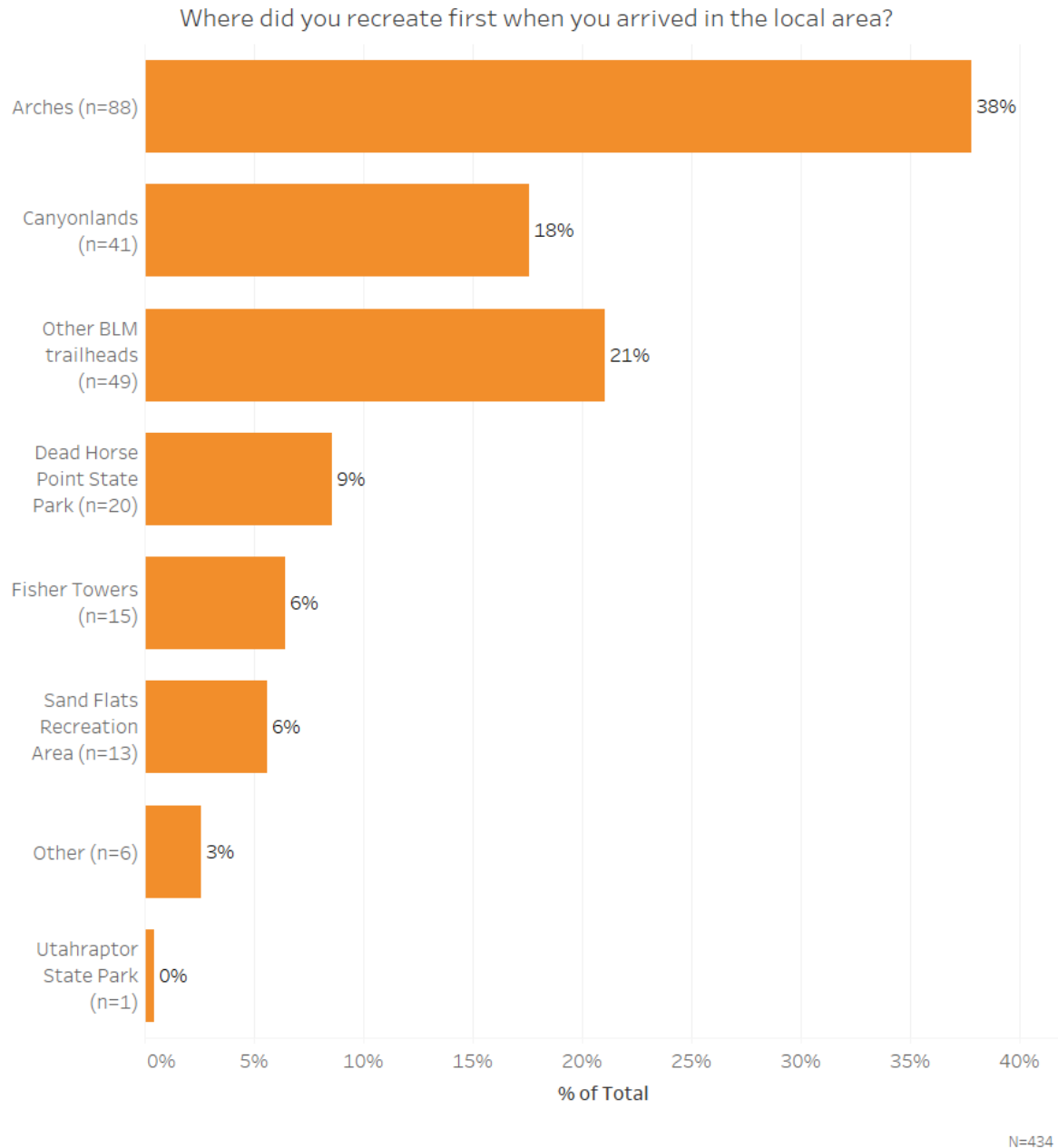


**Figure 3.16:** First local recreation sites visited on current trip to the Moab region

Respondents from areas outside of the Moab region were also asked to indicate the last place they were before traveling to Moab. Interpretation of this question varied (n=338), with some respondents indicating the last national park they were at, others listed specific cities or states and others said home was their last location (n=27). The most frequently listed cities were Salt Lake City, Utah (n=40) and Denver, Colorado (n=15). See Appendix B Figure B.10 for all the listed last places visited.

### 3.1.4 Condition Evaluations

Respondents were asked to indicate conditions they may have experienced while recreating at that site, that are potentially problematic to visitors or land managers, and the influence that these conditions had on their recreation experience.

The most frequently identified condition was dogs running loose (28%) followed by people off trail (18%) and soil erosion (17%) (Figure 3.17). In the survey instrument, there were 11 items included, items with less than 5% of respondents indicating they experienced it were excluded from Figure 3.17 and Figure 3.18. The items excluded were: disruptive trail behavior (n=34, 4%); other people not being prepared (n=20, 2%); human waste (n=19, 2%); archaeological site damage (n=5, 1%); and disruptive parking lot behavior (n=3, 0%).

After indicating the conditions they experienced, respondents were asked to rate how each condition affected their experience on a 5-point Likert scale from making their experience (1) Much worse to (5) Much better. Interestingly, despite being the most frequently cited condition, dogs running loose was reported to make experiences somewhat or much better by 23% of respondents who experienced that condition (Mean: 3.17 Std. dev: 0.924). Other conditions were consistently negative such as graffiti, which worsened the experience of 65% of visitors who indicated observing this condition (Mean: 2.13 Std. dev: 0.767) (Figure 3.18 and Table 3.2).

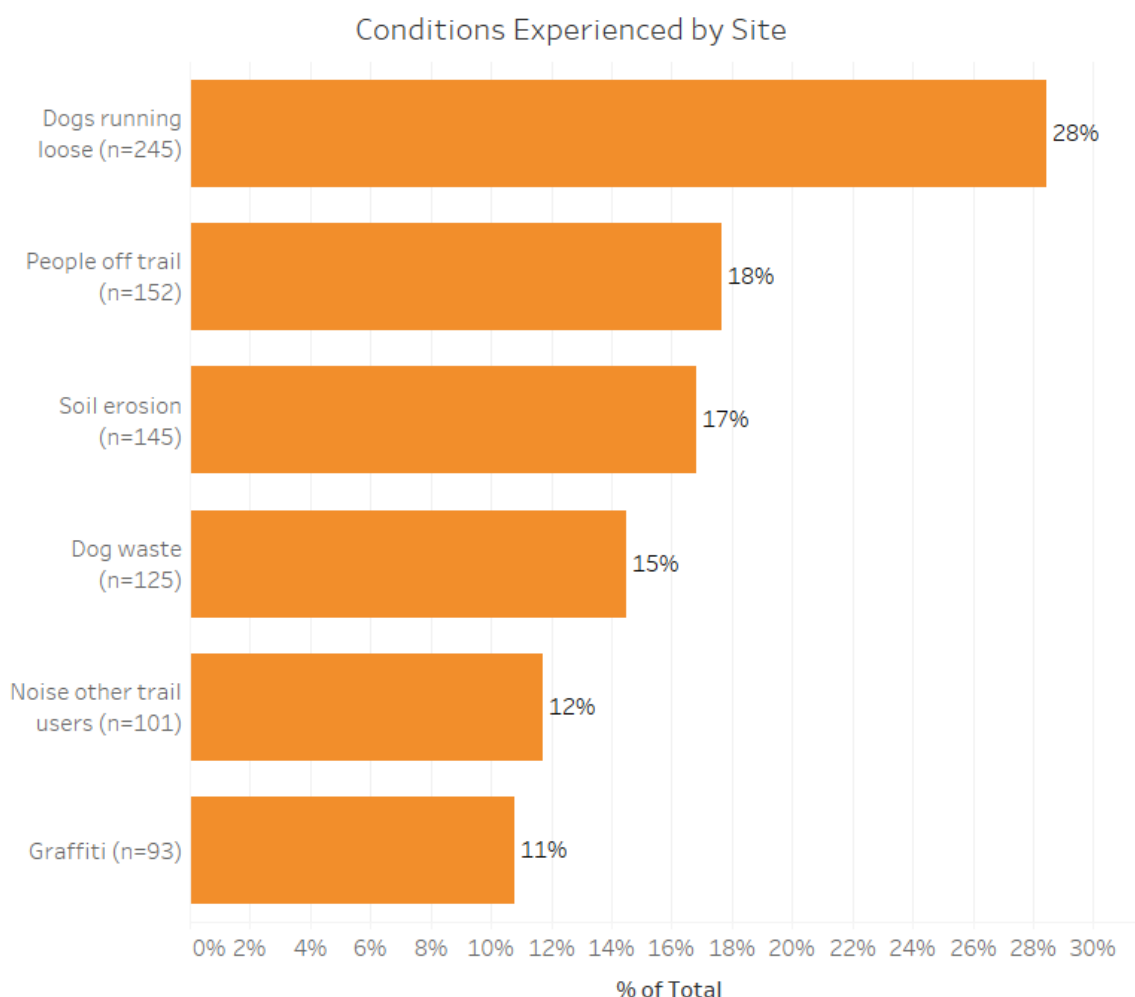


**Figure 3.17:** Frequency of potentially problematic conditions on-site visit

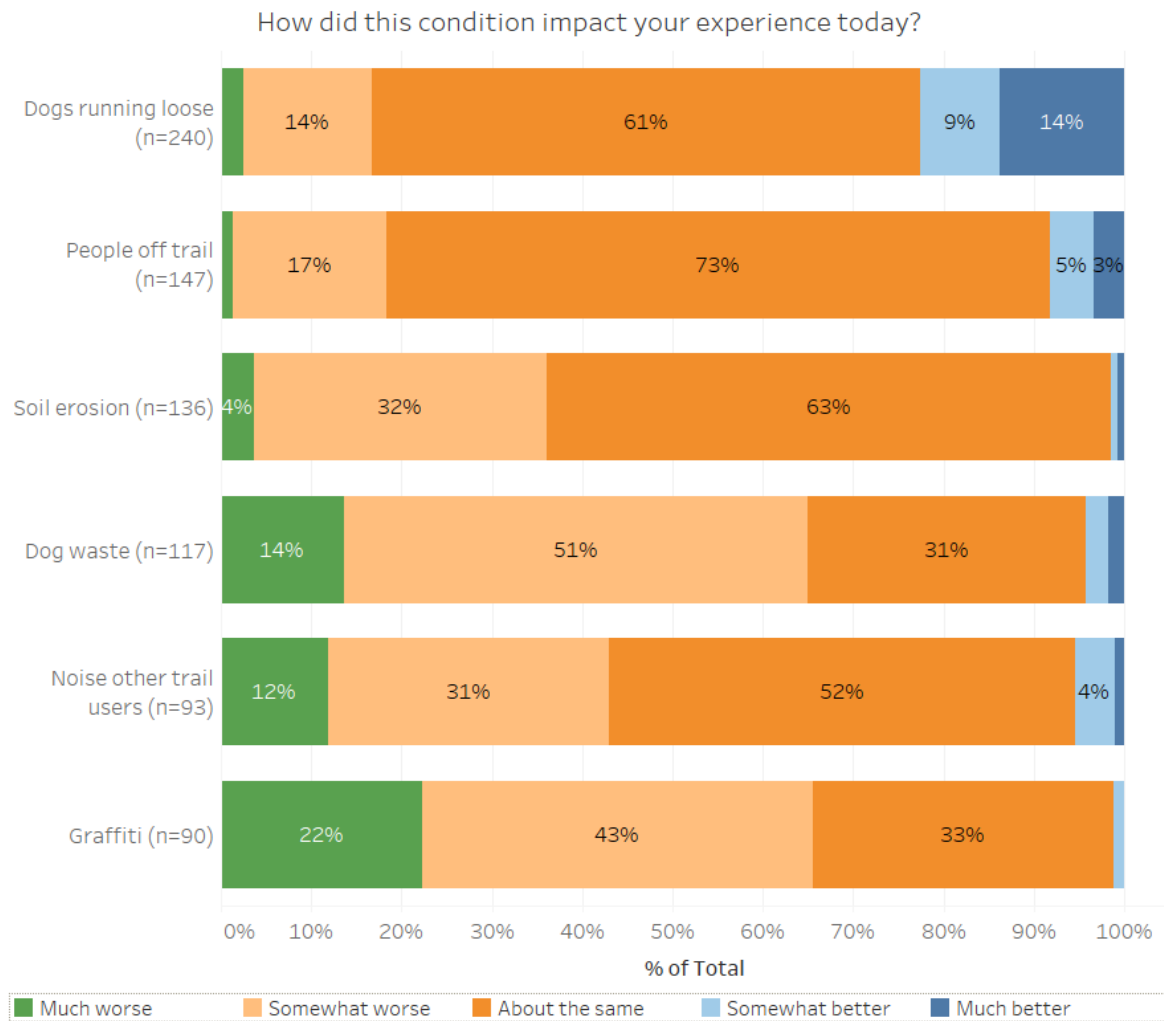


**Figure 3.18:** Impact of potentially problematic conditions on-site visit

**Table 3.2:** Descriptive statistics for conditions influence on experience (1 = Much worse, 5 = Much better)

| Condition                         | N   | Mean | Min | Max | Std. Dev. |
|-----------------------------------|-----|------|-----|-----|-----------|
| Dogs running loose                | 240 | 3.17 | 1   | 5   | 0.924     |
| People off trail                  | 147 | 2.92 | 1   | 5   | 0.636     |
| Soil erosion                      | 136 | 2.62 | 1   | 5   | 0.608     |
| Improper disposal of dog waste    | 117 | 2.27 | 1   | 5   | 0.795     |
| Noise caused by other trail users | 93  | 2.52 | 1   | 5   | 0.802     |
| Graffiti                          | 90  | 2.13 | 1   | 4   | 0.767     |

### 3.1.5 Trail Ambassador Program Impact on Knowledge

To assess the influence of an interaction with the Trail Ambassadors on visitors' Responsible Recreation knowledge, on days when Trail Ambassadors were present, respondents were asked to self-report their levels of understanding regarding various Responsible Recreation items before they talked with Trail Ambassadors on a 5-point Likert scale from (1) Not knowledgeable at all to (5) Extremely knowledgeable. Respondents were then asked to rate their levels of understanding after their Trail Ambassador interaction on the same knowledge scale as before they talked to Trail Ambassadors. This question set was only asked of respondents on days when the Trail Ambassadors were present at the survey site, and both knowledge questions were self-reported levels of knowledge collected at the end of their visit (after their Trail Ambassador interaction). Similar to other survey question categories, chi-square tests of homogeneity were conducted to assess differences in knowledge between sites. These tests yielded no statistically significant results; therefore sites were combined.

To understand the statistically significant differences in knowledge before and after the Trail Ambassador interaction, paired samples t-tests were conducted. This statistical test compares the means of two variables from the same group. In this case the paired samples t-test tells us whether there is a statistically significant difference in mean levels of knowledge for respondents before and after they talked with a Trail Ambassador. The pairs with significant increases in average knowledge ratings after talking to Trail Ambassadors are presented in Table 3.3.

The Responsible Recreation information areas with the largest increases in mean knowledge level were biocrust and archaeological site items. The largest increases were presented in knowledge of biocrust's role in the local environment and how to identify archaeological sites. The impacts that foot-steps have on biocrust and how to treat archaeological sites with respect also presented significant increases in knowledge. With the exception of how to treat archaeological sites with respect, which had small practical significance, all of these items presented a moderate level of practical significance.

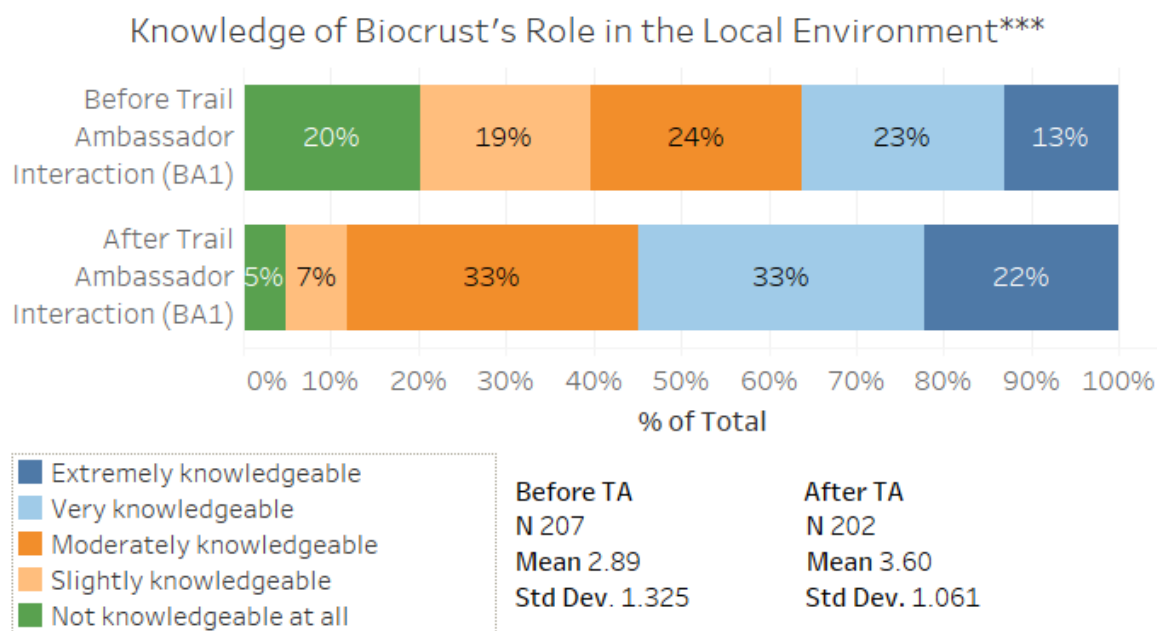
For the biocrust's role in the local environment topic, 20% reported no knowledge at all before they talked with a Trail Ambassador and 36% of respondents rated themselves as very or extremely knowledgeable (Mean: 2.89 Std. dev: 1.325). The frequency of respondents with no knowledge at all dropped to 5% after Trail Ambassador interaction, and the respondents rated themselves as very or extremely knowledgeable increased to 55% (Mean: 3.60 Std. dev: 1.061) (Figure 3.19). For knowledge of how to identify archaeological sites, 23% reported no knowledge at all before they talked with a Trail Ambassador and 30% of respondents rated themselves as very or extremely knowledgeable (Mean: 2.52 Std. dev: 1.168). The frequency of respondents with no knowledge at all dropped to 9% after Trail Ambassador interaction, and the respondents rated themselves as very or extremely knowledgeable increased to 41% (Mean: 3.23 Std. dev: 1.169) (Figure 3.21). These results represent an improvement in baseline knowledge and in level of knowledge after Trail Ambassador interactions.

Descriptive results for all knowledge groups are presented in Figures 3.19- 3.25. Knowledge items with statistically significant differences before and after Trail Ambassador interaction are indicated in Figures 3.19 - 3.22 with asterisks representing the significance level (\*=<.05, \*\*=<.01, \*\*\*=<.001). Figures 3.23 - 3.25 present knowledge items without statistically significant differences.

**Table 3.3:** Paired samples t-test for Responsible Recreation knowledge before and after TA interaction

| Pair                                           | Trail Ambassador Interaction Timing | Mean | Std. Dev | t       | sig    | df  |
|------------------------------------------------|-------------------------------------|------|----------|---------|--------|-----|
| Biocrust's role in the local environment       | Before                              | 2.89 | 1.325    | -8.688  | p<.001 | 201 |
|                                                | After                               | 3.60 | 1.061    |         |        |     |
| The impacts that footsteps have on biocrust    | Before                              | 3.08 | 1.309    | -7.581  | p<.001 | 189 |
|                                                | After                               | 3.67 | 1.058    |         |        |     |
| How to identify archaeological sites           | Before                              | 2.52 | 1.168    | -10.574 | p<.001 | 190 |
|                                                | After                               | 3.23 | 1.169    |         |        |     |
| How to treat archaeological sites with respect | Before                              | 3.47 | 1.209    | -1.958  | p<.05  | 187 |
|                                                | After                               | 3.62 | 1.053    |         |        |     |

### Knowledge of various Responsible Recreation components before and after Trail Ambassador interaction

**Figure 3.19:** Knowledge of biocrust's role in the local environment before and after TA interaction

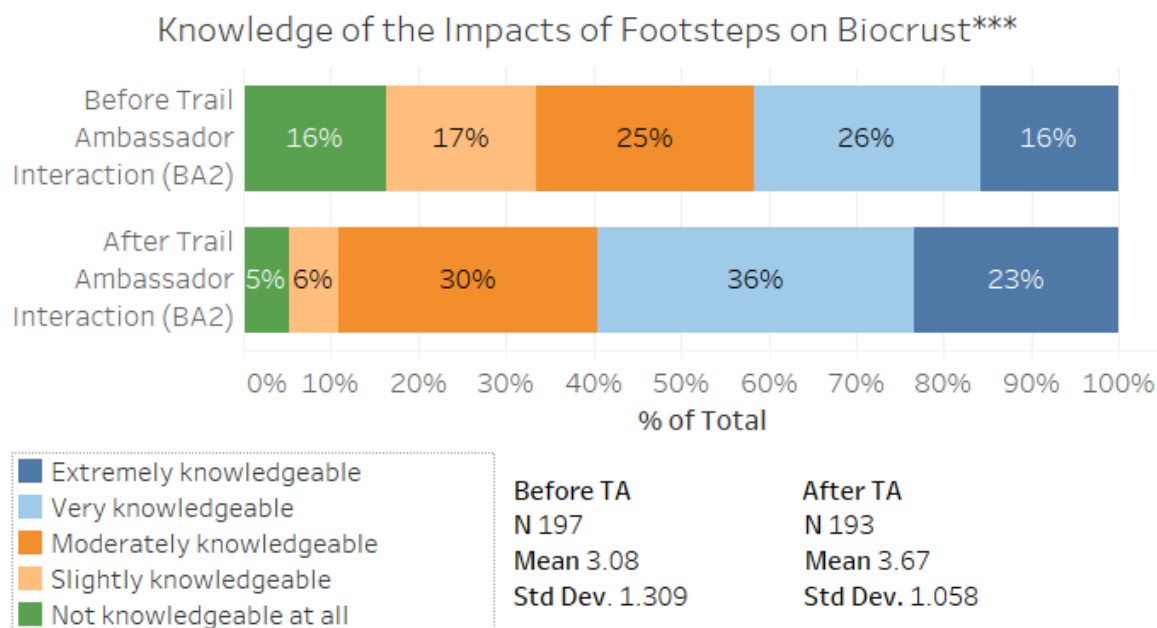


**Figure 3.20:** Knowledge of the impacts of footsteps on biocrust before and after TA interaction

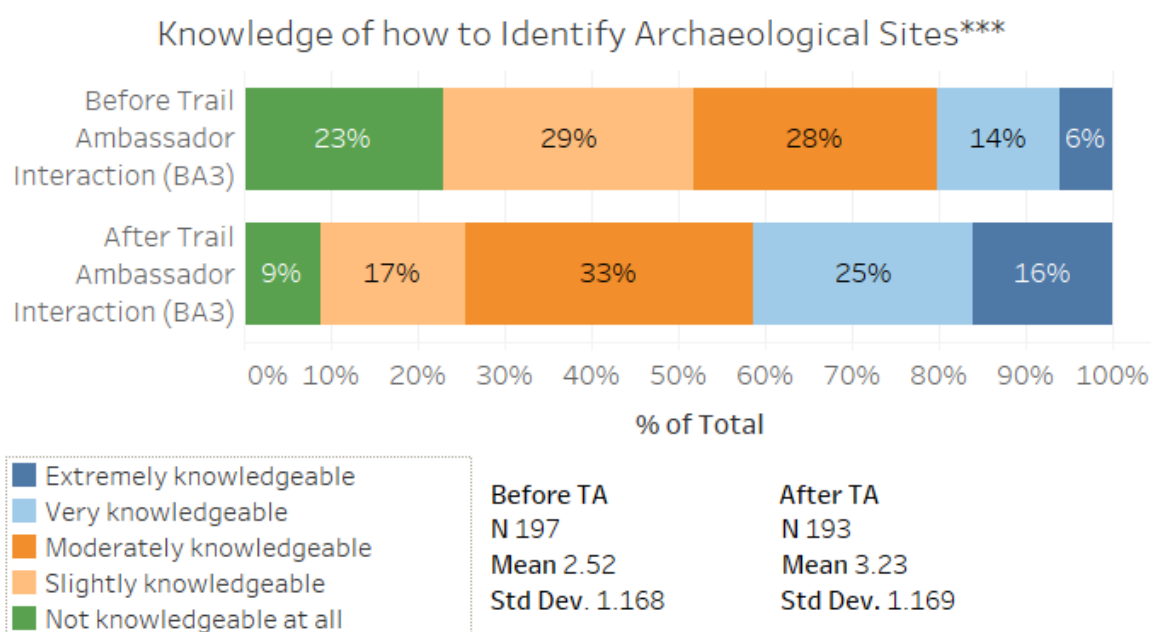


**Figure 3.21:** Knowledge of how to identify archaeological sites before and after TA interaction

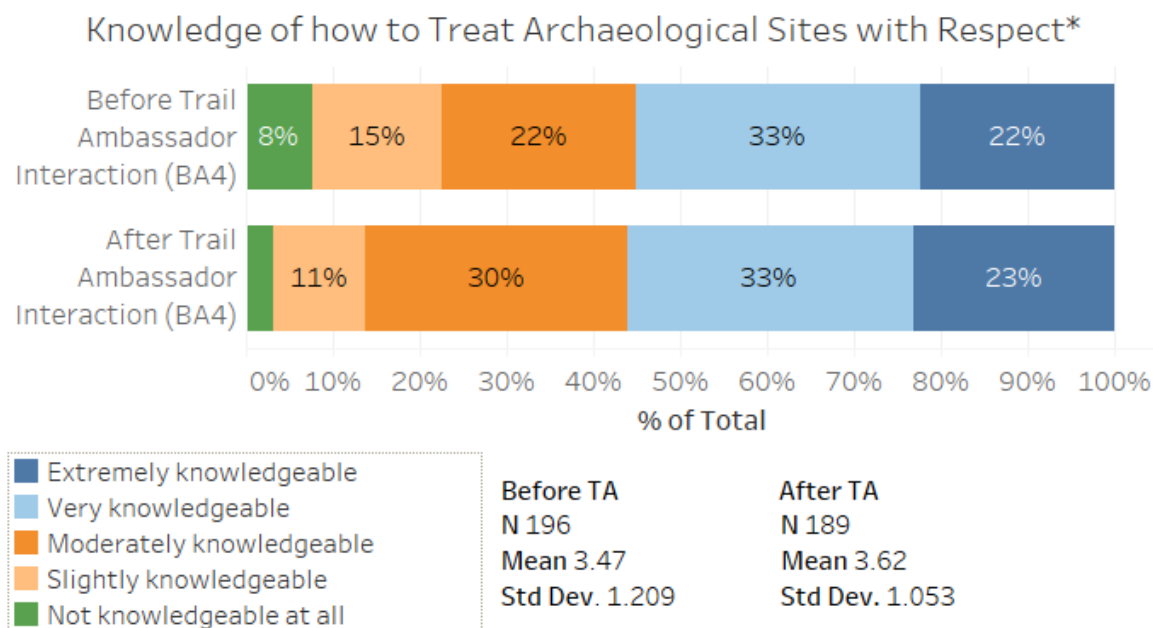


**Figure 3.22:** Knowledge of how to treat archaeological sites with respect before and after TA interaction

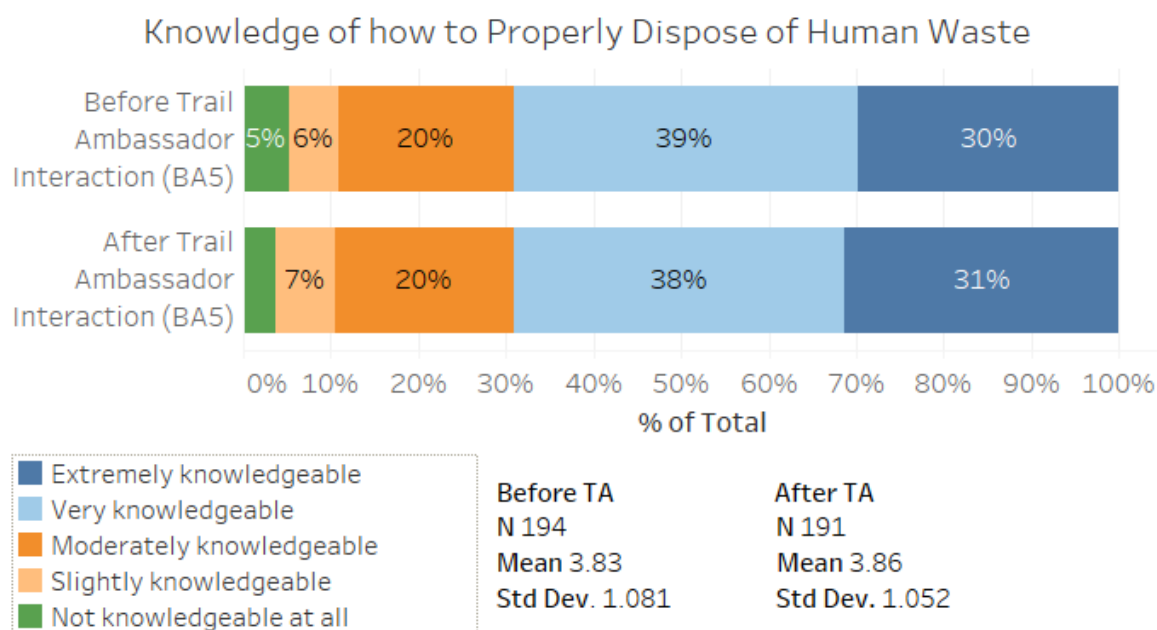


**Figure 3.23:** Knowledge of how to properly dispose of human waste before and after TA interaction

### Knowledge of the Amount of Water to Carry when Hiking in the Desert

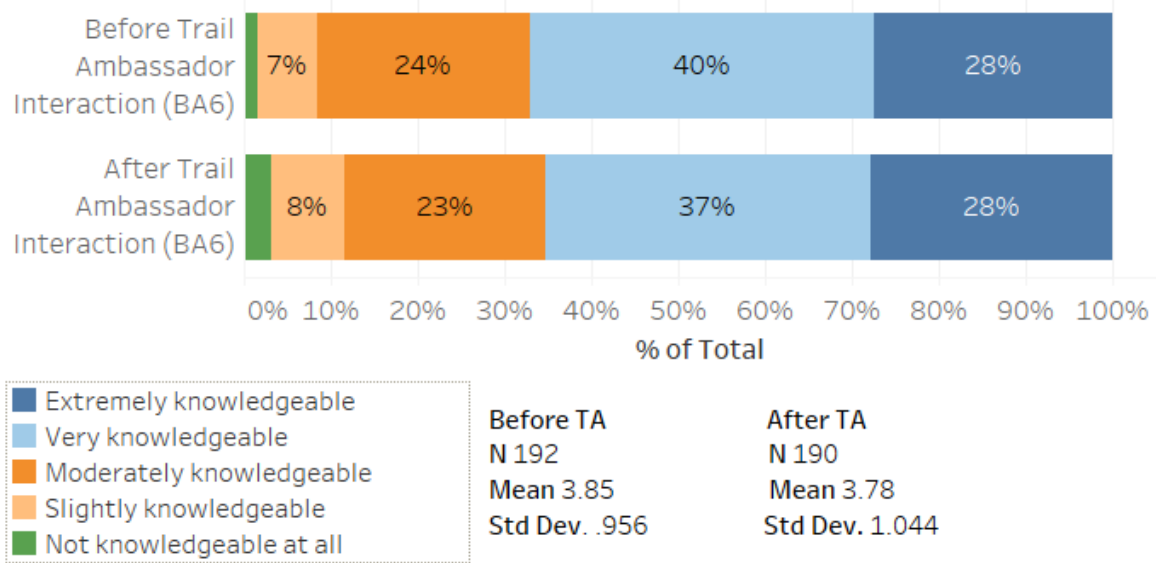


**Figure 3.24:** Knowledge of proper water amounts to carry when hiking in the desert before and after TA interaction

### Knowledge of Weather and Hazards to Prepare for in the Local Area

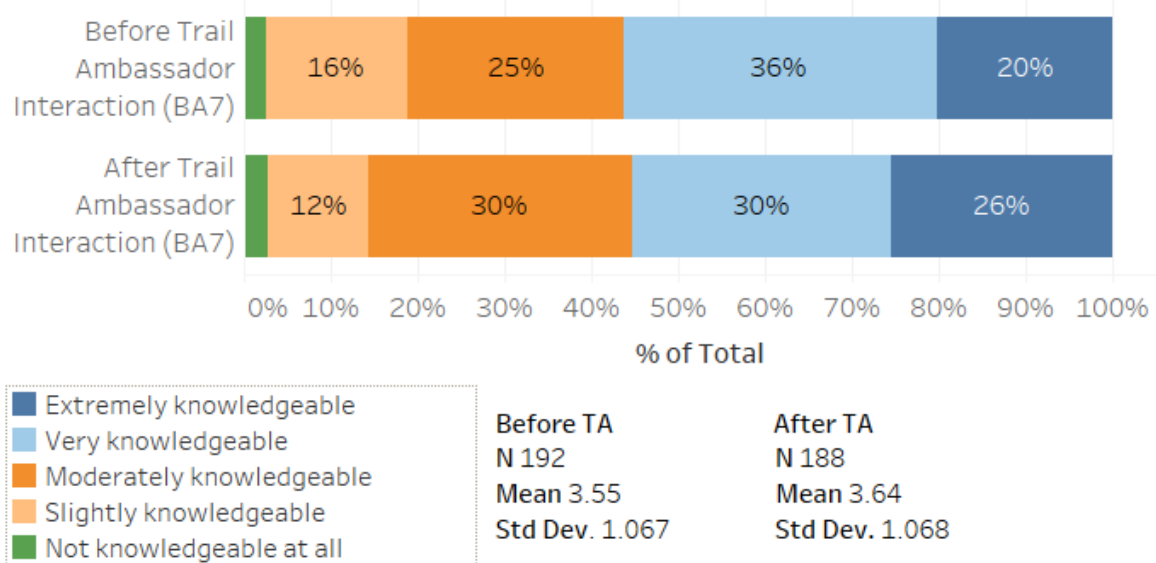


**Figure 3.25:** Knowledge of weather and other hazards to prepare for in the local area before and after TA interaction

### **Interpretations of the Trail Ambassador Impact on Knowledge Results**

One potential explanation for the significant improvements in knowledge for biocrust and archaeological site variables is the pervasiveness of this messaging by Trail Ambassadors across sites and temperatures. The information presented by the Trail Ambassadors differs depending on the temperature, and corresponding risks associated with hiking in the desert. For example, information regarding the proper amount of water to carry in the desert is focused on more when temperatures, and the associated risks of dehydration, increases. To better explain the differences in Responsible Recreation knowledge reported by respondents, chi-square tests of homogeneity were used to compare ratings of knowledge with the high temperature on the day that respondents completed the survey. The only Responsible Recreation item that showed a statistically significant difference in ratings of knowledge after talking to Trail Ambassadors when compared with temperature was proper water amounts to carry when hiking in the desert ( $\chi^2(16, N=190)=30.344, p<.05$ ).

Another possible explanation for the lack of significance in the human waste disposal and water carrying components could partially be attributed to these items being better understood to be an issue prior to their visit by respondents than staying on trail and respecting archaeological sites. Overall, the means were higher for these items than the biocrust and archaeological site items before talking with a Trail Ambassador. For example, 69% of respondents rated themselves as very or extremely knowledgeable about: How to properly dispose of human waste, before they interacted with a Trail Ambassador (Mean: 3.83 Std. dev: 1.081). Additionally, 68% rated themselves as very or extremely knowledgeable of: The proper amount of water to carry in the desert, before talking with Trail Ambassadors (Mean: 3.85 Std. dev: 1.044). These findings could indicate that visitors felt their level of understanding of these items was high before they talked to a Trail Ambassador, which could leave less room for improvement after Trail Ambassador interactions.

Another interesting note in the results of the before and after Trail Ambassador interaction items was found in a drop of knowledge ratings regarding the proper amount of water to carry in the desert. Although the difference was not statistically significant, the average level of knowledge regarding proper amounts of water to carry in the desert did drop after Trail Ambassador interaction (Mean: 3.85 to Mean: 3.78). One possible explanation for this is that people underestimated the proper amount of water they should carry before they spoke with a Trail Ambassador, and this interaction demonstrated their lack of knowledge causing a decline in ratings of knowledge.

**Trail Ambassador Influence on Recreation Experience**

Beyond changes in the understanding of specific Responsible Recreation educational categories, there is the possibility that respondents may receive other positive benefits from their interaction with the Trail Ambassadors. To assess this, the research team asked respondents who had interacted with a Trail Ambassador to rate their agreement with a series of statements on a 5-point Likert scale from (1) Strongly disagree to (5) Strongly agree. Like other questions, chi-square tests of homogeneity were also conducted to assess differences between sites. These tests yielded no statistically significant results, therefore responses were combined.

Overall, respondents indicated high levels of agreement regarding the positive influence of Trail Ambassador interactions on their trail experience. Many visitors indicated that their interaction with a Trail Ambassador reaffirmed recreation behavior they already tried to practice, with 86% of respondents either somewhat or strongly agreeing with this statement (Mean: 4.37 Std. dev: 1.129). The least agreed-upon statement was: Challenged my perspectives, with only 35% of respondents somewhat or strongly agreeing with this (Mean: 3.23 Std. dev: 1.105). In this context challenging perspectives was referring to whether the information provided by Trail Ambassadors conflicted with previous knowledge or beliefs the respondent held. The low levels of agreement to this statement could indicate that the messaging of the Trail Ambassadors was in line with personal beliefs and perspectives of many respondents.

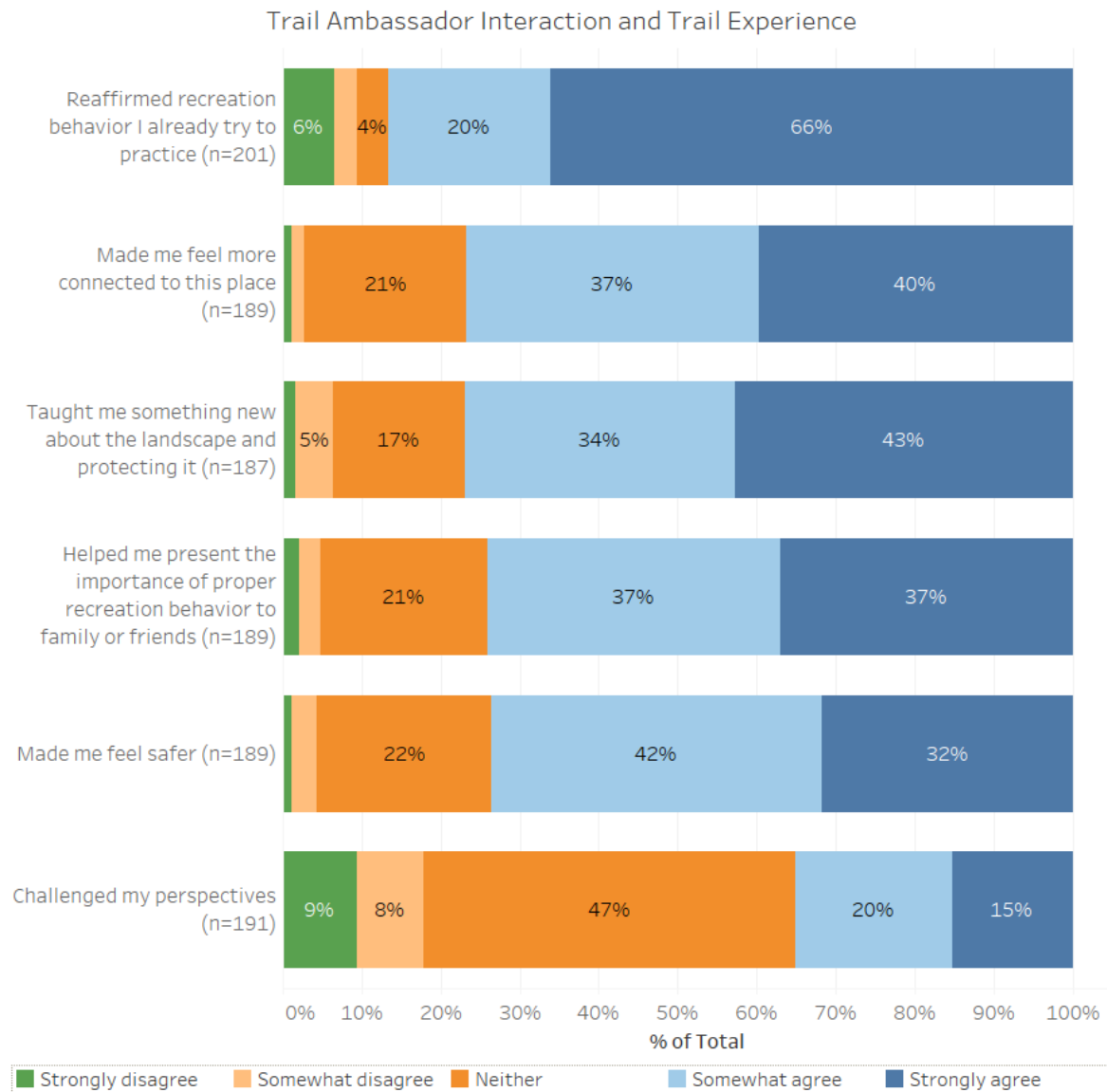


**Figure 3.26:** Influence of respondents' interaction with the Trail Ambassadors on-site experience

**Table 3.4:** Descriptive statistics for Trail Ambassador influence on experience (1 = Strongly disagree, 5 = Strongly agree)

| Trail Ambassador Experience                                                         | N   | Mean | Min | Max | Std. Dev. |
|-------------------------------------------------------------------------------------|-----|------|-----|-----|-----------|
| Reaffirmed recreation behavior I already try to practice                            | 201 | 4.37 | 1   | 5   | 1.129     |
| Made me feel more connected to this place                                           | 189 | 4.13 | 1   | 5   | 0.866     |
| Taught me something new about the landscape and protecting it                       | 187 | 4.12 | 1   | 5   | 0.96      |
| Helped me present the importance of proper recreation behavior to family or friends | 189 | 4.04 | 1   | 5   | 0.939     |
| Made me feel safer                                                                  | 189 | 4    | 1   | 5   | 0.875     |
| Challenged my perspectives                                                          | 191 | 3.23 | 1   | 5   | 1.105     |

### 3.1.6 Recreation Experience Preferences

Respondents were asked to rate a series of statements regarding their motivations for visiting the site where they were intercepted. Question-sets like this one are often included in recreation and visitor experience studies to understand how differing preferences and motivations influence an individual's experience or other survey responses (Manning, 2022). This series asked visitors to rank the importance of various statements in their desired experience for that site. A review of the relevant literature yielded 28 statements, measuring 14 possible motivations on a 5-point Likert from (1) Not at all important to (5) Extremely important.

In addition to presenting frequencies and descriptive statistics for each statement individually, the research team reduced the number of individual motivation items by conducting a Principal Component Analysis (PCA). A PCA is one method used to reduce multiple related survey items into combined variables that capture the underlying meaning of this collection of statements. This analysis yielded three combined recreation motivation variables: Fitness and Escape to Nature, Personal Challenge and Exploration, and Social/Family. The three combined variables were used to organize the 28 recreation motivation statements below. More information on the methods used and PCA results can be found in Appendix C. The frequencies and descriptive statistics for the 28 statements are organized below into the three combined-meaning variables, statements that did not load into one of these three variables are included in Figure 3.30 and Table 3.8.

The category that appeared to be the most important motivation for respondents was Fitness and Escape to Nature. This category included statements with the highest mean importance ratings, and the lowest standard deviations. All of the statements included in this group had an average importance higher than 4.00 (i.e. very important), with the exception of experiencing new and different things (Mean: 3.96 Std dev: .975) which was very close. The most important experience for visitors across sites was viewing the scenery with 63% of respondents (Mean: 4.5 Std. dev: .741) reporting this as an extremely important component of their experience. This experience preference was followed by three equally important statements feeling good after being physically active, getting exercise, and enjoying the smells and sounds of nature; all of which were extremely important to 42% of respondents. The statements included in the social/family, personal challenges and exploration, and the other groups all varied in their importance across respondent groups with averages below 4.0 and higher standard deviations.

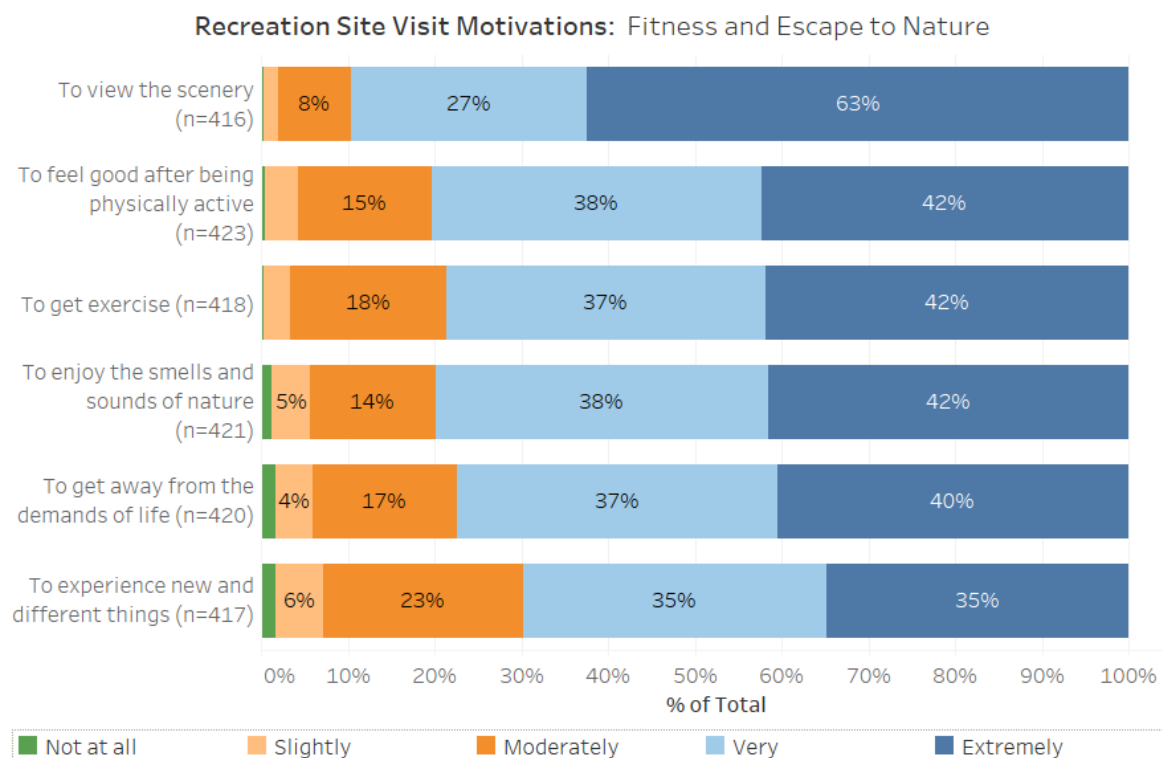


**Figure 3.27:** Distribution of responses for nature-based fitness variables

**Table 3.5:** Descriptive statistics for nature-based fitness motivation variables (1 = Not at all important, 5 = Extremely important)

| Motivation                                 | N   | Mean | Min | Max | Std. Dev. |
|--------------------------------------------|-----|------|-----|-----|-----------|
| To view the scenery                        | 416 | 4.5  | 1   | 5   | 0.741     |
| To feel good after being physically active | 423 | 4.18 | 1   | 5   | 0.86      |
| To get exercise                            | 418 | 4.17 | 1   | 5   | 0.847     |
| To enjoy the smells and sounds of nature   | 421 | 4.14 | 1   | 5   | 0.91      |
| To get away from the usual demands of life | 420 | 4.1  | 1   | 5   | 0.94      |
| To experience new and different things     | 417 | 3.96 | 1   | 5   | 0.975     |

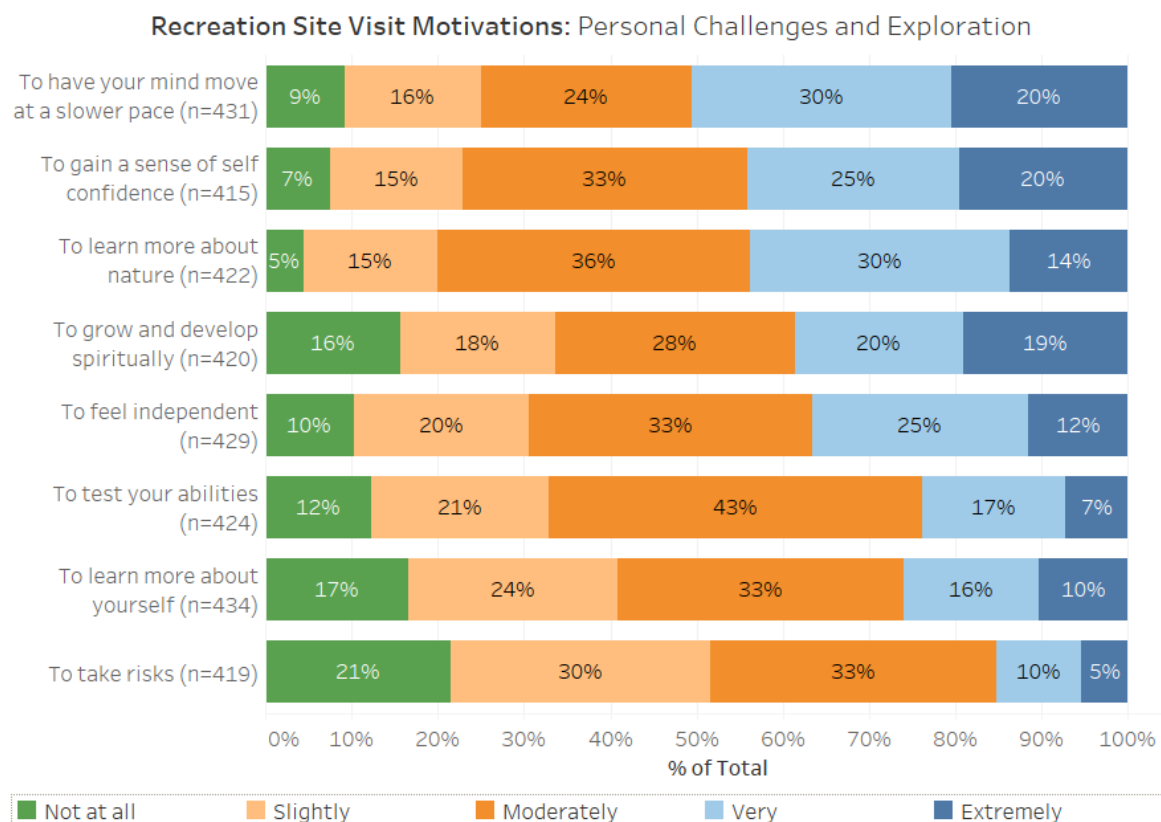


**Figure 3.28:** Distribution of responses for personal challenges and exploration motivation variables

**Table 3.6:** Descriptive statistics for personal challenges and exploration motivation variables (1 = Not at all important, 5 = Extremely important)

| Motivation                              | N   | Mean | Min | Max | Std. Dev. |
|-----------------------------------------|-----|------|-----|-----|-----------|
| To have your mind move at a slower pace | 431 | 3.37 | 1   | 5   | 1.231     |
| To gain a sense of self confidence      | 415 | 3.33 | 1   | 5   | 1.171     |
| To learn more about nature              | 422 | 3.33 | 1   | 5   | 1.038     |
| To grow and develop spiritually         | 420 | 3.08 | 1   | 5   | 1.327     |
| To feel independent                     | 429 | 3.07 | 1   | 5   | 1.152     |
| To test your abilities                  | 424 | 2.86 | 1   | 5   | 1.066     |
| To learn more about yourself            | 434 | 2.79 | 1   | 5   | 1.198     |
| To take risks                           | 419 | 2.48 | 1   | 5   | 1.099     |

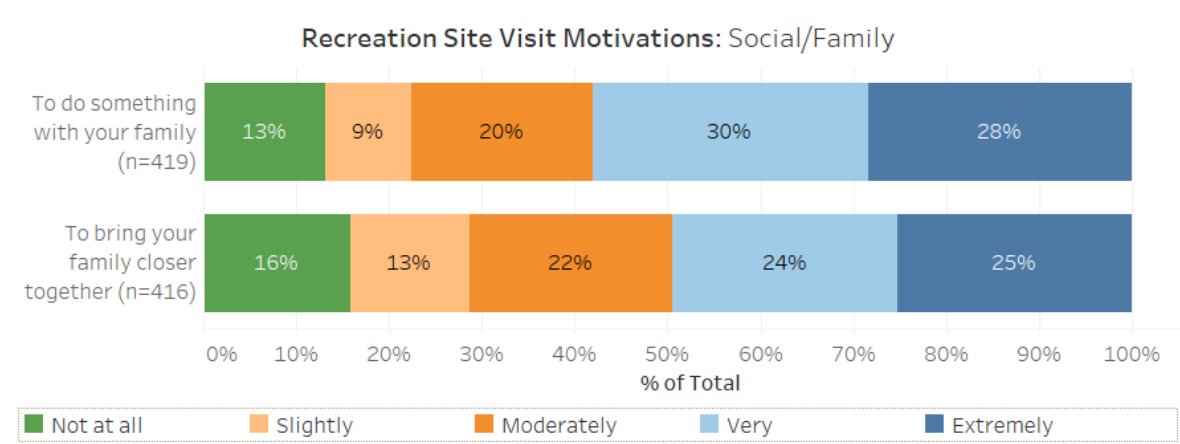


**Figure 3.29:** Distribution of responses for social/family variables

**Table 3.7:** Descriptive statistics for social/family motivation variables (1 = Not at all important, 5 = Extremely important)

| Motivation                           | N   | Mean | Min | Max | Std. Dev. |
|--------------------------------------|-----|------|-----|-----|-----------|
| To do something with your family     | 419 | 3.51 | 1   | 5   | 1.34      |
| To bring your family closer together | 416 | 3.3  | 1   | 5   | 1.388     |

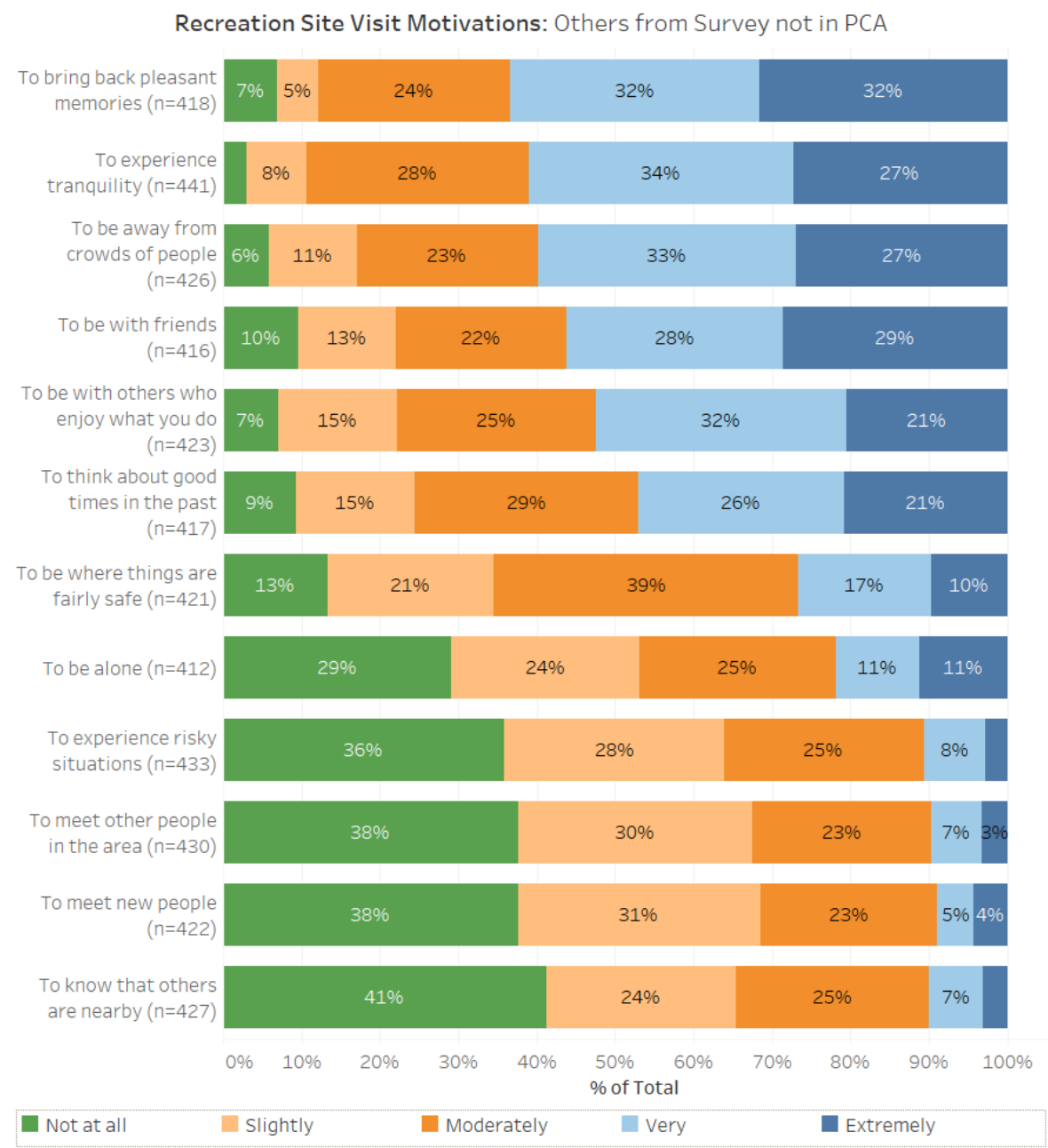


**Figure 3.30:** Distribution of responses for other motivation variables

**Table 3.8:** Descriptive statistics for other motivation variables (1 = Not at all important, 5 = Extremely important)

| Motivation                                         | N   | Mean | Min | Max | Std. Dev. |
|----------------------------------------------------|-----|------|-----|-----|-----------|
| To bring back pleasant memories                    | 418 | 3.76 | 1   | 5   | 1.157     |
| To experience tranquility                          | 441 | 3.75 | 1   | 5   | 1.033     |
| To be away from crowds of people                   | 426 | 3.64 | 1   | 5   | 1.162     |
| To be with friends                                 | 416 | 3.53 | 1   | 5   | 1.285     |
| To be with others who enjoy the same things you do | 423 | 3.44 | 1   | 5   | 1.178     |
| To think about good times you've had in the past   | 417 | 3.34 | 1   | 5   | 1.228     |
| To be where things are fairly safe                 | 421 | 2.89 | 1   | 5   | 1.137     |
| To be alone                                        | 412 | 2.51 | 1   | 5   | 1.312     |
| To experience risky situations                     | 433 | 2.14 | 1   | 5   | 1.077     |
| To meet other people in the area                   | 430 | 2.08 | 1   | 5   | 1.075     |
| To meet new people                                 | 422 | 2.07 | 1   | 5   | 1.083     |
| To know that others are nearby                     | 427 | 2.07 | 1   | 5   | 1.101     |

### 3.1.7 Place Attachment

Respondents were asked about their attachment to the site they were recreating at as a place. The purpose of this question-set was to better understand how attachment to the trail impacted other ratings of their visit. Respondents were asked to rank their agreement with a series of statements regarding their attachment to the site on a 5-point Likert scale from (1) Strongly disagree to (5) Strongly agree. These questions were asked because place attachment has been indicated in the literature to be related to various components of recreation experience including sensitivity to and being critical of resource and social conditions (Manning, 2022). Like other questions, chi-square tests of homogeneity were conducted to assess differences between sites. These tests yielded no statistically significant results, therefore responses were combined.

The most frequently agreed upon place attachment statement was: Being able to recreate in [site] means a lot to me, with 64% of respondents (Mean: 3.71 Std. dev: 1.213) either somewhat or strongly agreeing with this statement. The least agreed upon place attachment statement was: Many important family memories are tied to [site] with 60% of respondents either somewhat or strongly disagreeing with this statement (Mean: 2.19 Std. dev: 1.348).

Additionally, independent samples t-tests were conducted comparing levels of place attachment between treatments (Trail Ambassador interaction or no Trail Ambassador interaction) and site visit history (first time or returning visitor). No statistically significant differences in attachment to the site were demonstrated between groups who had talked to Trail Ambassadors, and those who had not. There were differences demonstrated in level of place attachment according to site visit history for six of the eight place attachment statements. The attachment statements with statistically significant differences between first time and returning visitors are presented in Table 3.10. As one might expect, returning visitors indicated higher levels of attachment to the site.

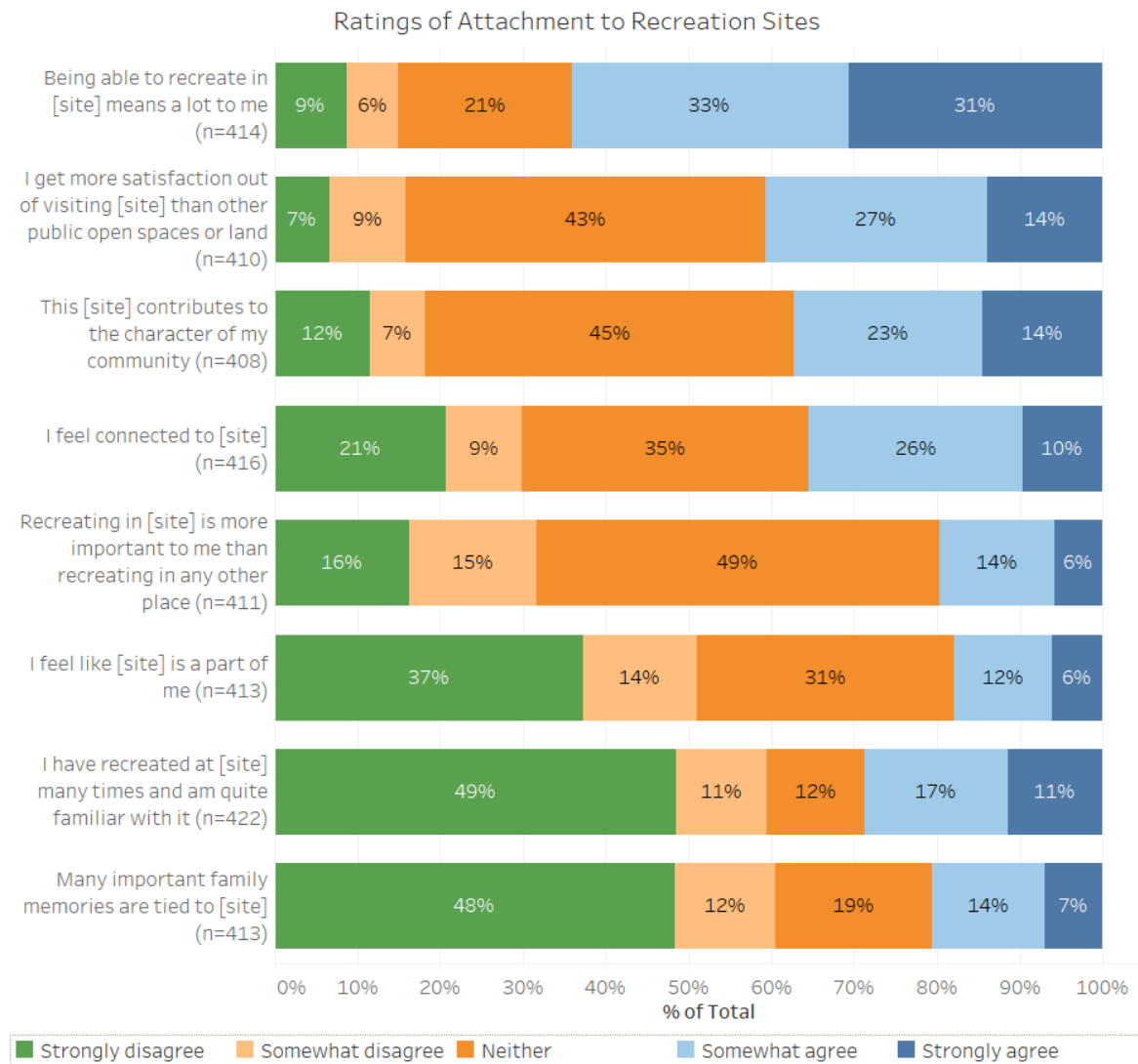


**Figure 3.31:** Levels of agreement with place attachment to recreation site statements

**Table 3.9:** Descriptive statistics for place attachment (1 = Strongly disagree, 5 = Strongly agree)

| Place Attachment                                                                      | N   | Mean | Min | Max | Std. Dev. |
|---------------------------------------------------------------------------------------|-----|------|-----|-----|-----------|
| Being able to recreate at [site] means a lot to me.                                   | 414 | 3.71 | 1   | 5   | 1.213     |
| I get more satisfaction out of visiting [site] than other public open spaces or land. | 410 | 3.32 | 1   | 5   | 1.039     |
| This [site] contributes to the character of my community.                             | 408 | 3.22 | 1   | 5   | 1.135     |
| I feel connected to [site].                                                           | 416 | 2.95 | 1   | 5   | 1.25      |
| Recreating in [site] is more important to me than recreating in any other place.      | 411 | 2.78 | 1   | 5   | 1.063     |
| I feel like [site] is a part of me.                                                   | 413 | 2.36 | 1   | 5   | 1.257     |
| I have recreated at [site] many times and I am quite familiar with it.                | 422 | 2.32 | 1   | 5   | 1.491     |
| Many important family memories are tied to [site].                                    | 413 | 2.19 | 1   | 5   | 1.348     |

**Table 3.10:** Independent Samples T-Test for Place Attachment and Site Visit History Questions

| Variable                                                               | Use History | Mean | Std Dev | t      | sig    | df      |
|------------------------------------------------------------------------|-------------|------|---------|--------|--------|---------|
| Being able to recreate at [site] means a lot to me.                    | First-time  | 3.48 | 1.207   | -2.606 | p<.01  | 367     |
|                                                                        | Returning   | 3.82 | 1.17    |        |        |         |
| This site contributes to the character of my community.                | First-time  | 2.99 | 1.083   | -2.438 | p<.05  | 268.897 |
|                                                                        | Returning   | 3.29 | 1.126   |        |        |         |
| I feel connected to [site].                                            | First-time  | 2.75 | 1.216   | -2.031 | p<.05  | 369     |
|                                                                        | Returning   | 3.02 | 1.256   |        |        |         |
| I feel like [site] is a part of me.                                    | First-time  | 2.09 | 1.137   | -2.564 | p<.01  | 286.688 |
|                                                                        | Returning   | 2.42 | 1.279   |        |        |         |
| I have recreated at [site] many times and I am quite familiar with it. | First-time  | 1.63 | 1.111   | -6.810 | p<.001 | 337.550 |
|                                                                        | Returning   | 2.57 | 1.507   |        |        |         |
| Many important family memories are tied to [site]                      | First-time  | 1.8  | 1.191   | -3.774 | p<.001 | 293.800 |
|                                                                        | Returning   | 2.33 | 1.379   |        |        |         |

### 3.1.8 Future Planned Behavior Question Series

Respondents were asked to review four sets of statements regarding components of Responsible Recreation that were identified as central to the Grand County Trail Ambassador's educational materials: picking up all trash (including dog waste); carrying sufficient water; preparing for hazards and weather; and staying on trail. The statement sets were based on an adaptation of the Theory of Planned Behavior model (Ajzen, 1991) modified by (Vagias et al., 2014). The Theory of Planned Behavior is a psychological theory that helps explain why people make certain choices or engage in specific behaviors (Ajzen, 1991). In simple terms, it suggests that our intentions to perform an action are the best predictors of our actual behavior and are influenced by three main factors:

- Attitudes: How we feel about the behavior. If we have a positive attitude toward it, we're more likely to do it.
- Subjective Norms: Our perceptions of what other people think about the behavior. If we believe others approve of it, especially those we respect or care about, we're more likely to do it.
- Perceived Behavioral Control: Our belief in our ability to perform the behavior. If we think it's easy and within our control, we're more likely to do it.

This question series was designed to address the following: visitors' attitudes towards each action using a 5-point Likert scale from (1) Extremely inappropriate to (5) Extremely appropriate; the perceived effectiveness of these actions on reducing trail use impacts using a 5-point Likert scale from (1) Never to (5) Every time; the perceived behavioral control that a visitor might have in reducing trail impacts in these ways using a 5-point Likert scale from (1) Extremely difficult to (5) Extremely easy; and finally the respondents intentions to do the above listed Responsible Recreation items in the future using a 5-point Likert scale from (1) Extremely unlikely to (5) Extremely likely. Chi-square tests of homogeneity were conducted to assess differences in responses between sites. Of the 16 planned behavior statements, only two yielded statistically significant differences; the appropriateness of leaving litter on the trail ( $\chi^2(8, N=409)=16.728, p<.05$ ), and the appropriateness of hiking without water ( $\chi^2(8, N=4060)=18.893, p<.01$ ). These two items have been indicated below with an asterisk, but this question was not split up by site due to the small proportion of statistically significant differences.

The following section of the report presents descriptive statistics and frequencies for each of the Responsible Recreation components across the question sets. An analysis of differences in these four-question sets between treatment groups (Trail Ambassador present or no Trail Ambassador present) is provided and discussed further at the end of this section in Table 3.15.

#### Picking up all Trash

This statement set received ratings across the question sets in the categories of: importance; effectiveness; control; and intentions from respondents. The majority (87%) of respondents identified that leaving litter on the trail was extremely inappropriate (Mean: 1.28 Std. dev: 0.832) (Figure 3.32 and

Table 3.11). There was also agreement among many respondents (82%) that carrying out litter would reduce the impacts of recreation (Mean: 4.68 Std. dev: 0.802) (Figure 3.33 and Table 3.12). Respondents generally reported high levels of control over this action (74%) by reporting that carrying out all litter would be extremely easy (Mean: 4.60 Std. dev: 0.776) (Figure 3.34 and Table 3.13). Finally, a majority (84%) of respondents indicated intentions to carry out all litter in the future (Mean: 4.69 Std. dev: 0.823) (Figure 3.35 and Table 3.14).

### **Carrying Sufficient Water**

Respondents did not feel that hiking without plenty of water was as inappropriate as leaving litter on the trail, although a majority (65%) indicated that hiking without plenty of water was extremely inappropriate (Mean: 1.59 Std. dev: 1.009) (Figure 3.32 and Table 3.11). Carrying plenty of water was also acknowledged by a majority of respondents as an effective way to reduce the impacts of recreation (Mean: 4.47 Std. dev: 0.961) (Figure 3.33 and Table 3.12). Of all the components prioritized in the Grand County Recreate Responsibly educational materials, carrying water was identified as the easiest thing to do by 77% of respondents (Mean: 4.68 Std. dev: 0.655) (Figure 3.34 and Table 3.13) and the action they were most likely to take in the future (84% Mean: 4.72 Std. dev: 0.762) (Figure 3.35 and Table 3.14).

### **Preparing for Hazards and Weather**

This component had the highest variability in responses, and the lowest averages across the planned behavior categories. One reason for this may be the broad and complex nature of preparing for hazards compared to the other components which were more specific in nature. A minority (39%) of respondents felt that getting on the trail without preparing for hazards was extremely inappropriate (Mean: 2.21 Std. dev: 1.339) (Figure 3.32 and Table 3.11). Respondents were also less in agreement about the effectiveness of preparing for all hazards every time to reduce the impacts of recreation (32% Mean: 3.79 Std. dev: 1.122) (Figure 3.33 and Table 3.12). This component was the most difficult to control from the perspective of respondents with only 38% indicating this would be extremely easy and another 30% indicating it would be somewhat easy (Mean: 4.0 Std. dev: 1.019) (Figure 3.34 and Table 3.13). Despite these behavioral limitations, a majority of respondents (67%) indicated high intentions to prepare for hazards in the future (Mean: 4.46 Std. dev: 0.939) (Figure 3.35 and Table 3.14).

### **Staying on Trail**

Respondents were slightly less adamant about the significance of staying on trail, than they were about picking up litter and carrying water, but were more in agreement about the importance than they were about preparing for all hazards. A slight majority of respondents (55%) reported that traveling off designated or established trails was extremely inappropriate (Mean: 1.83 Std. dev: 1.174) (Figure 3.32 and Table 3.11). Similarly, a slight majority (56%) indicated that staying on trail every time was effective in reducing recreation related impacts (Mean: 4.35 Std. dev: 0.898) (Figure 3.33 and Table 3.12). Half of respondents felt that staying on trail would be extremely easy (50%) and another 28% felt it would be somewhat easy (Mean: 4.17 Std. dev: 1.019) (Figure 3.34 and Table 3.13). These responses may reflect the difficulty of finding the established trail in portions of these trails due to the slick-rock and desert canyon environments. Despite any doubts, or perceived limitations, a majority of respondents (67%) indicated high intentions to stay on the designated trail in the future (Mean: 4.48 Std. dev: 0.911) (Figure 3.35 and Table 3.14).

How APPROPRIATE or INAPPROPRIATE do you think the following activities are for a visitor to do on this trail?



**Figure 3.32:** Reported attitudes towards appropriateness of specific trail behaviors

**Table 3.11:** Descriptive statistics for attitudes towards specific trail behaviors (1 = Extremely inappropriate, 5 = Extremely appropriate)

| Attitude                                                                                  | N   | Mean | Min | Max | Std. Dev. |
|-------------------------------------------------------------------------------------------|-----|------|-----|-----|-----------|
| Leaving litter on the trail, including human and dog waste                                | 409 | 1.28 | 1   | 5   | 0.832     |
| Hiking without water to drink                                                             | 406 | 1.59 | 1   | 5   | 1.009     |
| Getting on the trail without preparing for all types of weather, hazards, and emergencies | 420 | 2.21 | 1   | 5   | 1.339     |
| Traveling off of designated or established trails                                         | 406 | 1.83 | 1   | 5   | 1.174     |

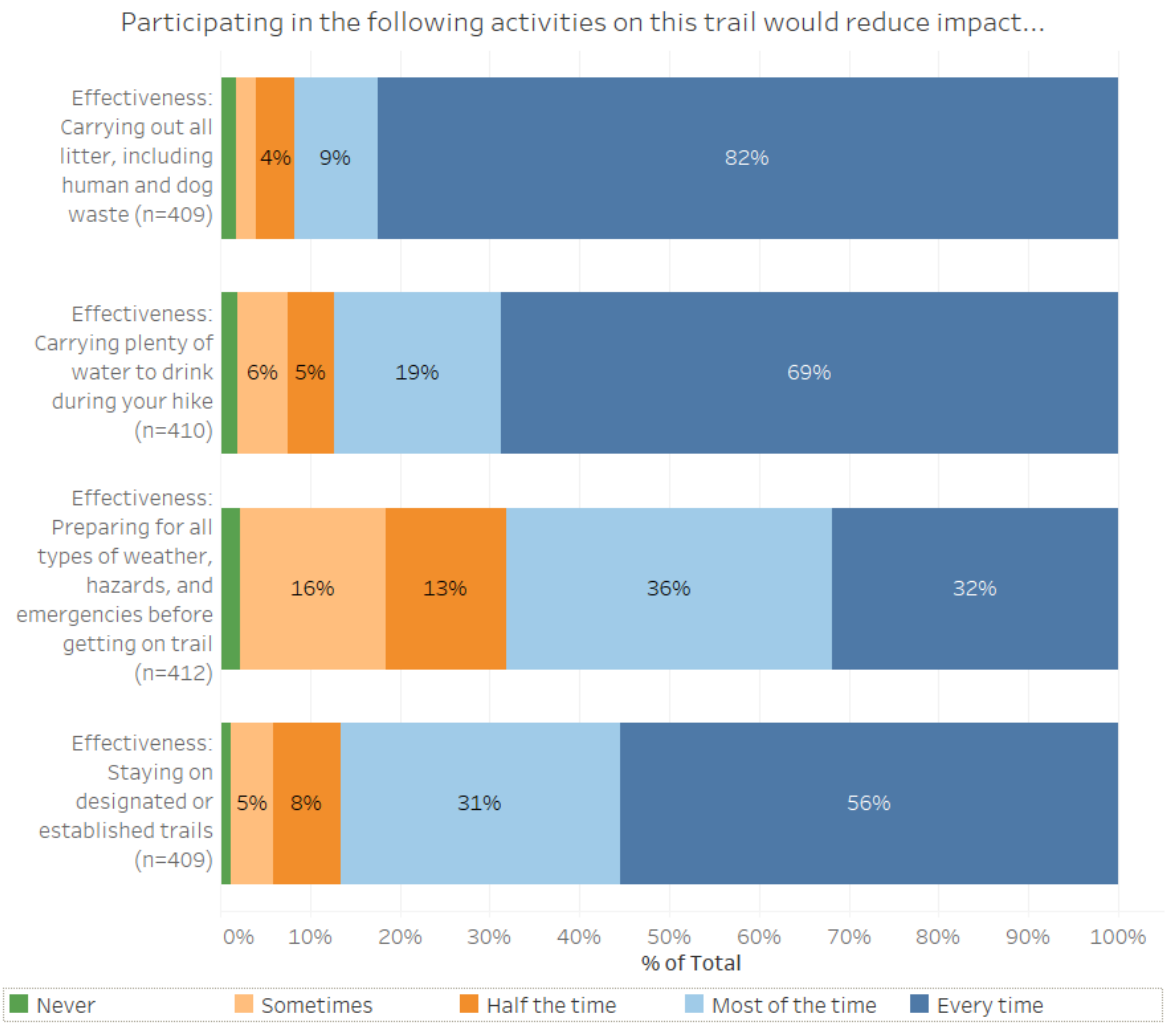


Figure 3.33: Perceived effectiveness of specific trail behaviors to reduce impacts of recreation

Table 3.12: Descriptive statistics for perceived effectiveness of trail behavior to reduce impacts (1 = Never, 5 = Every time)

| Effectiveness                                                                      | N   | Mean | Min | Max | Std. Dev. |
|------------------------------------------------------------------------------------|-----|------|-----|-----|-----------|
| Carry out all litter, including human and dog waste                                | 409 | 4.68 | 1   | 5   | 0.802     |
| Carrying water to drink during your hike                                           | 410 | 4.47 | 1   | 5   | 0.961     |
| Prepare for all types of weather, hazards, and emergencies before getting on trail | 412 | 3.79 | 1   | 5   | 1.122     |
| Stay on designated or established trails                                           | 409 | 4.35 | 1   | 5   | 0.898     |

Please indicate how DIFFICULT you think each of the following would be for a visitor to do on this trail...

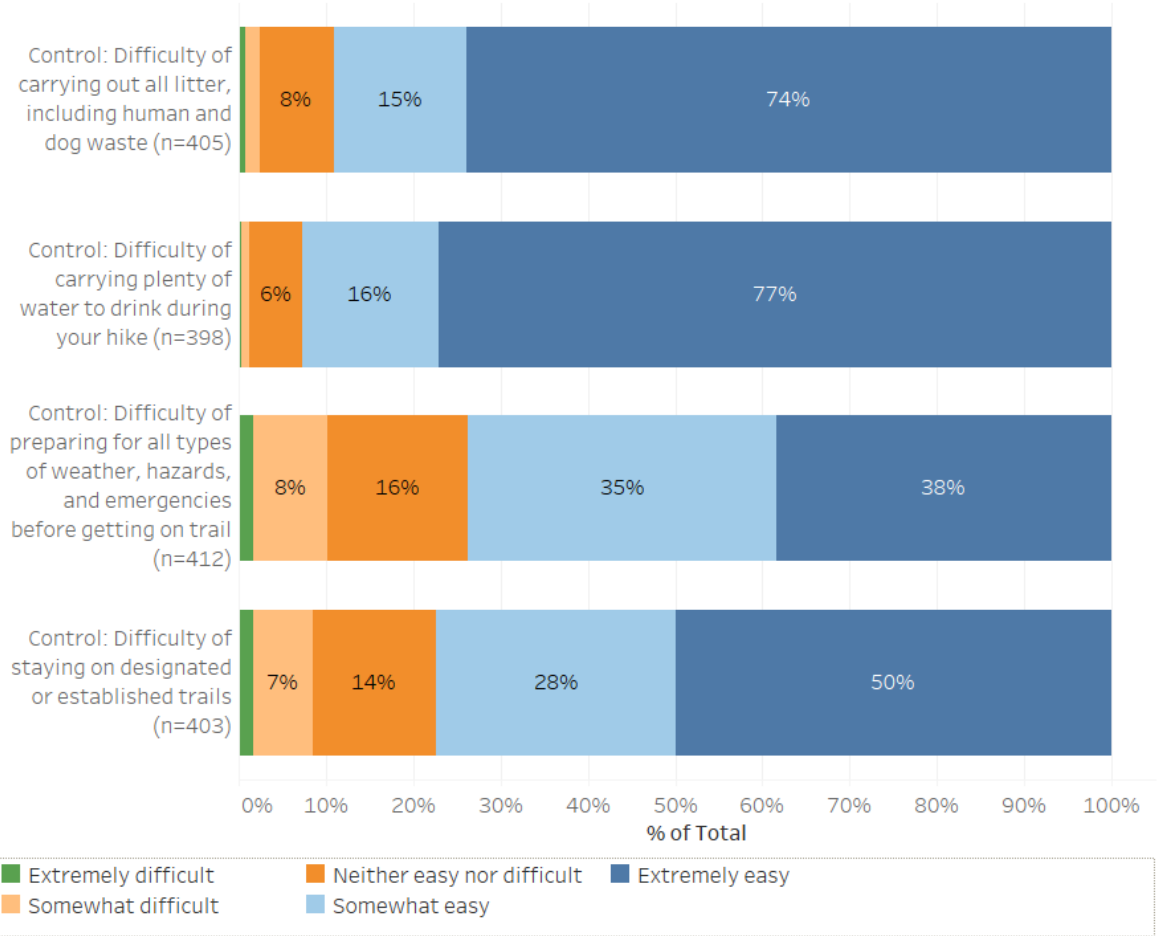


Figure 3.34: Perceived difficulty of following the specific trail behaviors

Table 3.13: Descriptive statistics for perceived behavioral control (1 = Extremely difficult, 5 = Extremely easy)

| Control                                                                            | N   | Mean | Min | Max | Std. Dev. |
|------------------------------------------------------------------------------------|-----|------|-----|-----|-----------|
| Carry out all litter, including human and dog waste                                | 405 | 4.6  | 1   | 5   | 0.776     |
| Carrying water to drink during your hike                                           | 398 | 4.68 | 1   | 5   | 0.655     |
| Prepare for all types of weather, hazards, and emergencies before getting on trail | 412 | 4    | 1   | 5   | 1.019     |
| Stay on designated or established trails                                           | 403 | 4.17 | 1   | 5   | 1.019     |

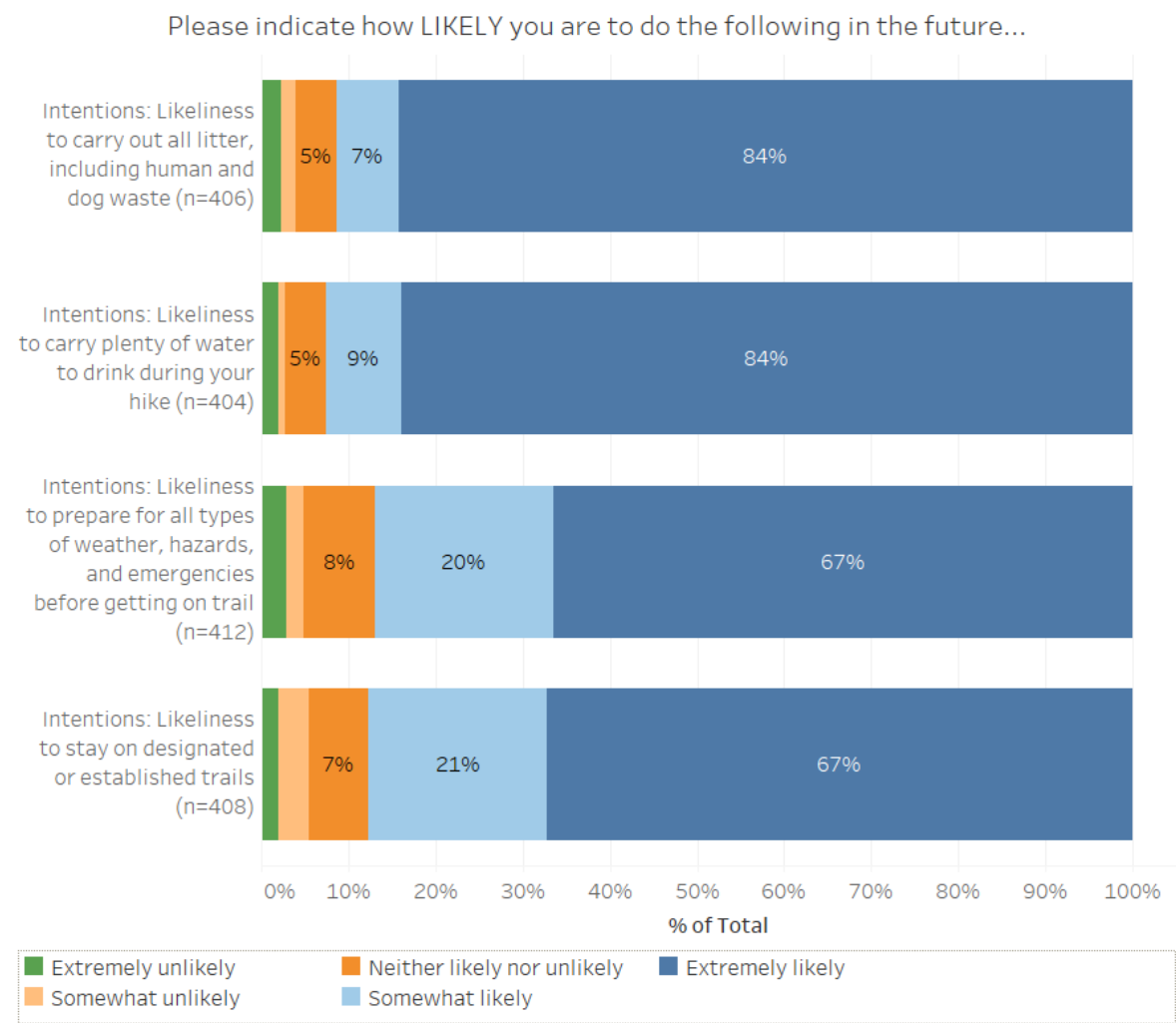


Figure 3.35: Intention to follow proper trail behaviors in the future

Table 3.14: Descriptive statistics for behavioral intentions (1 = Extremely unlikely, 5 = Extremely likely)

| Intentions                                                                         | N   | Mean | Min | Max | Std. Dev |
|------------------------------------------------------------------------------------|-----|------|-----|-----|----------|
| Carry out all litter, including human and dog waste                                | 406 | 4.69 | 1   | 5   | 0.823    |
| Carrying water to drink during your hike                                           | 404 | 4.72 | 1   | 5   | 0.762    |
| Prepare for all types of weather, hazards, and emergencies before getting on trail | 412 | 4.46 | 1   | 5   | 0.939    |
| Stay on designated or established trails                                           | 408 | 4.48 | 1   | 5   | 0.911    |

### The Effect of Trail Ambassador Interaction on Future Planned Behavior

Comparisons were conducted to determine if there were statistically significant differences in response types for the behavior question sets between respondents who received the Trail Ambassador messages immediately before their hike and those who did not. Independent samples t-tests were run using IBM SPSS software to compare the means of responses between groups. The results of these tests show increases in attitudes regarding how inappropriate it is to leave litter on the trail. Visitors also reported increases in the effectiveness of preparing for all types of hazards and staying on trails to reduce the impacts of recreation activities on the environment. Finally, respondents indicated an increase in personal control over staying on trails, and higher intentions to stay on trails in the future. The only component with a decrease after Trail Ambassador interaction was personal control over preparing for all types of hazards (Table 3.15). This decrease in ratings of control in preparing for all types of hazards after talking with a Trail Ambassador may reflect increased awareness of what is required to be adequately prepared, and increased awareness of the types and severity of regional hazards. Although there were statistically significant differences in means between groups, the Cohen's d effect size was small for all statements in this section.

**Table 3.15:** Independent samples t-test for future planned behavior questions

| Variable                                                                                           | Trail Ambassador Interaction | Mean | Std. Dev | t      | sig    | df      |
|----------------------------------------------------------------------------------------------------|------------------------------|------|----------|--------|--------|---------|
| Attitudes - Leaving litter on the trail, including human and dog waste                             | Yes                          | 1.36 | 1.212    | 1.954  | p<.05  | 359.037 |
|                                                                                                    | No                           | 1.20 | 1.133    |        |        |         |
| Effectiveness - Prepare for all types of weather, hazards, and emergencies before getting on trail | Yes                          | 3.94 | 1.030    | 2.559  | p<.005 | 404.568 |
|                                                                                                    | No                           | 3.66 | 1.191    |        |        |         |
| Effectiveness - Stay on designated or established trails                                           | Yes                          | 4.47 | .728     | 2.760  | p<.005 | 374.355 |
|                                                                                                    | No                           | 4.23 | 1.024    |        |        |         |
| Control - Prepare for all types of weather, hazards, and emergencies before getting on trail       | Yes                          | 3.89 | 1.059    | -2.183 | p<.01  | 405.302 |
|                                                                                                    | No                           | 4.11 | .969     |        |        |         |
| Control - Stay on designated or established trails                                                 | Yes                          | 4.29 | .986     | 2.302  | p<.01  | 399.629 |
|                                                                                                    | No                           | 4.05 | 1.040    |        |        |         |
| Intentions - Stay on designated or established trails                                              | Yes                          | 4.56 | .823     | 1.905  | p<.05  | 397.373 |
|                                                                                                    | No                           | 4.39 | .984     |        |        |         |

**Summary:** This section provides a description of the implications this study's key findings may have on management, and the limitations of this study design.

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## Management Implications and Future Research

### 4.1. Management Implications

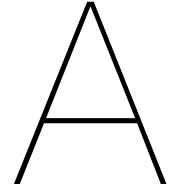
1. Many of the visitors with limited knowledge demonstrated significant improvements in knowledge regarding biocrust and staying on designated trails. Significant improvement in knowledge of the importance of biocrust and archaeological site protection indicates success in improving knowledge that could reduce archaeological site damage and off-trail travel impacts. This indicates that Trail Ambassadors are reaching and educating a group with high potential for improved Responsible Recreation behavior. Future efforts should emphasize these topics and prioritize reaching these groups.
2. High levels of baseline pro-environmental knowledge reported by visitors indicates that the Trail Ambassador messaging could go further. The results of the Trail Ambassador influence on recreation experience section suggests that while the audience is already familiar with topics covered by Trail Ambassadors, the program has a positive effect on reaffirming Responsible Recreation behaviors at the site. The only component that respondents did not agree strongly with was 'challenged my perspectives' which may indicate that the respondents at certain sites already held pro-environmental views that were aligned with goals of the Trail Ambassador messaging. This could indicate that future Trail Ambassador messaging can go further in depth into pro-environmental behavior for visitors to practice while recreating at certain sites.
3. Condition evaluations showed that many of the items identified as a concern in the survey development phase were not perceived as concerns by a majority of visitors. Among the conditions that were observed by visitors, the influence on their experience was not always negative. For example, visitors frequently observed off-leash dogs, but it did not always detract from the quality of their experience. Although off-leash dogs had a limited effect on the visitor experience, there are ecological implications that should be considered regarding dogs running off-trail in biocrust areas and disturbing wildlife.
4. The differences in recreation motivations, activities, demographics, and group size between sites indicates there may be differences in baseline knowledge or types of problematic behavior. Although the Trail Ambassadors are already cognizant of these differences between locations, further precision in site-specific messaging could be effective in addressing the varying motivations and knowledge levels of visitors.
5. High levels of returning and frequent visitors, and high levels of attachment to place for these returning visitors indicates support for protecting these recreation sites. This represents an opportunity to further engage with return visitors in stewardship and promoting and modelling Responsible Recreation norms.
6. Participants indicated that other recreation sites they visited in the region are providing Recreate Responsibly information. Coordinated and uniform Responsible Recreation messaging would create consistent expectations for visitor behavior across the region. Participants also indicated that they had noticed information kiosks and read the signs which means these are effective places to provide Recreate Responsibly information when trail ambassadors are not present.

## 4.2. Limitations and Future Research

- Though sampling days were split between Trail Ambassador present and no Trail Ambassador present days there were likely respondents in the no Trail Ambassador sample who had interacted with a Trail Ambassador on a previous day or at a previous site.
- Temperature data was collected and may explain some of the differences in activity type and behavior such as carrying water, between sites and seasons. However, the sampling design was developed to represent a variety of months, sites, and treatments (Trail Ambassador or no Trail Ambassador). Because temperature was not a primary component of the sampling design, the split of sites by temperature are not evenly distributed between sites and activities and therefore further analysis was not conducted.
- The water and hazard preparedness components were perhaps not best captured in a survey instrument of this type. During data collection the research team observed trail ambassadors provided key route finding and hazard information to visitors, the self reported levels of knowledge regarding water and hazards was high leading to little statistically significant improvements.

# References

- Ajzen, I. (1991). The theory of planned behavior [ISBN: 0749-5978 Publisher: Elsevier]. *Organizational behavior and human decision processes*, 50(2), 179–211.
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## Appendix A: Survey Instrument

# RR Grand County

Pre-Survey Survey technician answer the first three questions before handing the tablet to respondent.

---

Site name

- ☐ Corona Arch (1)
- ☐ Mill Creek (2)
- ☐ Grandstaff (3)

treatment Was there a trail ambassador present today?

- ☐ Yes (1)
- ☐ No (2)

agreetosurvey “Hello, I am working with Utah State University to conduct an 8-minute survey to understand visitor experiences on this trail. May I ask you questions about your experience?”

- ☐ Yes (1)
- ☐ No (2)

**Q3.1 Non-Response Survey ID Label**

---

**NRB1 What is the primary activity you planned to participate in on your visit to this site?**

- ☐ Hiking (1)
- ☐ Running (2)
- ☐ Dog walking (3)
- ☐ Swimming (4)
- ☐ Sunbathing (5)
- ☐ Wildlife viewing (6)
- ☐ Rock art viewing (7)
- ☐ Other (please specify) (8)

---

**NRB2 How many people were in your group for this visit?**

▼ 1 (1) ... 25+ (26)

**Survey ID Label**

---

Informed Consent "Before we begin, I would like to let you know that this survey has been approved by the Bureau of Land Management and Utah State University IRB. Secondly, your participation is voluntary, and your name will never be connected with your individual responses. This survey will only take about 8 minutes of your time today."

- ☐ Yes (1)
- ☐ No (2)

**What is the primary activity you planned to participate in on your visit to this site?**

- ☐ Hiking (1)
  - ☐ Running (2)
  - ☐ Dog walking (3)
  - ☐ Swimming (4)
  - ☐ Sunbathing (5)
  - ☐ Wildlife viewing (6)
  - ☐ Rock art viewing (7)
  - ☐ Other (please specify) (8)
- 

---

**How many people were in your group for this visit?**

▼ 1 (1) ... 25+ (26)

**Please describe your group type:**

- ☐ Alone (1)
  - ☐ Significant other/spouse (2)
  - ☐ Family (3)
  - ☐ Friends (4)
  - ☐ Friends and family (5)
  - ☐ Other (please specify) (6)
- 

**When planning your trip to [\\${Site/ChoiceGroup/SelectedChoices}](#), how did you obtain information about this site? *(Select all that apply)***

- ☐ Did not obtain information prior to this visit (1)
- ☐ Previous visits (2)
- ☐ Friends/relatives/word of mouth (3)
- ☐ BLM staff/volunteer (4)
- ☐ National Park Service staff (5)
- ☐ Signs on the roadway (6)
- ☐ Travel guides/tour books (7)
- ☐ Newspapers/magazines (8)
- ☐ Radio (9)
- ☐ Social media (10)
- ☐ Lodging staff (11)
- ☐ App(s) (please specify) (12)

---

☐ Website(s) (please specify) (13)

---

**How often do you use the following technology/apps while recreating?**

|                                             | Never (1)             | Rarely (2)            | Sometimes (3)         | Very Often (9)        | Always (10)           |
|---------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Smartphone (1)                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Smartphone camera (2)                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| GPS device (3)                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Facebook (4)                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Instagram (5)                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Snapchat (6)                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| TikTok (7)                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Strava (8)                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Hiking Project (9)                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Avenza (10)                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Gaia GPS (11)                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Google Maps (12)                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Recreation.gov (13)                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| All Trails (14)                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| iNaturalist (or other naturalist apps) (15) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Other (please specify) (16)                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**While in the Moab region have you received information regarding...(Select all that apply)**

- ☐ Staying on trail (1)
- ☐ Proper waste disposal (2)
- ☐ Importance of not disturbing archeological sites (3)
- ☐ Proper safety practices (4)
- ☐ How much water to bring when recreating in the desert (5)

**Where did you receive the information provided in the previous question? (Select all that apply)**

- ☐ National Park visitor center (1)
  - ☐ State Park visitor center (2)
  - ☐ Trailhead kiosk (3)
  - ☐ Moab Information Center (in downtown Moab) (4)
  - ☐ From lodging staff (5)
  - ☐ Word of mouth (i.e. other trail users) (6)
  - ☐ Online (please specify) (7)
- 
- ☐ Other local staff (please specify) (8)
-

**Did you see any of the following on this trail today? (*Select all that apply*)**

☐

Dogs running loose (1)

☐

People off trail (2)

☐

Soil erosion (3)

☐

Improper disposal of human waste (4)

☐

Improper disposal of dog waste (5)

☐

Graffiti (6)

☐

Noise caused by other trail users (7)

☐

Disruptive behavior of other visitors on the trail (please explain) (8)

---

☐

Disruptive behavior of other visitors in the parking lot (please explain) (9)

---

☐

Other archeological site damage (please explain) (10)

---

☐

Other people not being prepared (please explain) (11)

---

**How did those actions impact your experience?**

|                                                   | Much worse<br>(1)     | Somewhat<br>worse (2) | About the<br>same (3) | Somewhat<br>better (4) | Much better<br>(5)    |
|---------------------------------------------------|-----------------------|-----------------------|-----------------------|------------------------|-----------------------|
| Dogs running loose (1)                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| People off trail (2)                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Soil erosion (3)                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Improper disposal of human waste (4)              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Improper disposal of dog waste (5)                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Graffiti (6)                                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Noise caused by other trail users (7)             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Behavior of other visitors on the trail (8)       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Behavior of other visitors in the parking lot (9) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Other archeological site damage (10)              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |
| Other people not being prepared (11)              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> |

TA Interaction Did you interact with a Grand County Trail Ambassador (dressed in green) on your visit to [\\${Site/ChoiceGroup/SelectedChoices}](#) today?

☐ Yes (1)

☐ No (2)

**Before your arrival at the trail today, how would you describe your knowledge of the following?**

|                                                                | Not<br>knowledgeable<br>at all (1) | Slightly<br>knowledgeable<br>(2) | Moderately<br>knowledgeable<br>(3) | Very<br>knowledgeable<br>(4) | Extremely<br>knowledgeable<br>(5) |
|----------------------------------------------------------------|------------------------------------|----------------------------------|------------------------------------|------------------------------|-----------------------------------|
| Biocrust's role in the local environment (1)                   | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| The impacts that footsteps have on biocrust (2)                | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| How to identify archeological sites (3)                        | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| How to treat archeological sites with respect (4)              | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| How to properly dispose of human waste (5)                     | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| Proper water amounts to carry when hiking in the desert (6)    | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| Weather and other hazards to prepare for in the local area (7) | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |

**After you talked to a trail ambassador today, how would you describe your knowledge of the following?**

|                                                                | Not<br>knowledgeable<br>at all (1) | Slightly<br>knowledgeable<br>(2) | Moderately<br>knowledgeable<br>(3) | Very<br>knowledgeable<br>(4) | Extremely<br>knowledgeable<br>(5) |
|----------------------------------------------------------------|------------------------------------|----------------------------------|------------------------------------|------------------------------|-----------------------------------|
| Biocrust's role in the local environment (1)                   | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| The impacts that footsteps have on biocrust (2)                | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| How to identify archeological sites (3)                        | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| How to treat archeological sites with respect (4)              | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| How to properly dispose of human waste (5)                     | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| Proper water amounts to carry when hiking in the desert (6)    | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |
| Weather and other hazards to prepare for in the local area (7) | <input type="radio"/>              | <input type="radio"/>            | <input type="radio"/>              | <input type="radio"/>        | <input type="radio"/>             |

**Indicate your agreement with the following statements regarding the impact of trail ambassadors on your experience today.**

|                                                                                         | Strongly disagree (1) | Somewhat disagree (2) | Neither agree nor disagree (3) | Somewhat agree (4)    | Strongly agree (5)    |
|-----------------------------------------------------------------------------------------|-----------------------|-----------------------|--------------------------------|-----------------------|-----------------------|
| Reaffirmed recreation behavior I already try to practice (1)                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| Challenged my perspectives (3)                                                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| Made me feel safer (4)                                                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| Made me feel more connected to this place (5)                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| Helped me present the importance of proper recreation behavior to family or friends (6) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| Taught me something new about the landscape and protecting it (7)                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |

**Below is a list of possible experiences you may want (prefer) to have while visiting [\\${Site/ChoiceGroup/SelectedChoices}](#). For each item, please indicate how important each experience is to you during your visit.**

|                                                    | Not at all<br>(1)     | Slightly (2)          | Moderately<br>(3)     | Very (4)              | Extremely<br>(5)      |
|----------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| To experience tranquility                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To experience risky situations                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To learn more about yourself                       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To have your mind move at a slower pace            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To meet other people in the area                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To feel independent                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To know that others are nearby                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To be away from crowds of people                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To test your abilities                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To learn more about nature                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To be with others who enjoy the same things you do | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To enjoy the smells and sounds of nature           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To meet new people                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To get away from the usual demands of life         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

|                                                  |                       |                       |                       |                       |                       |
|--------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| To feel good after being physically active       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To grow and develop spiritually                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To be where things are fairly safe               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To take risks                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To do something with your family                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To bring back pleasant memories                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To experience new and different things           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To be with friends                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To bring your family closer together             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To get exercise                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To think about good times you've had in the past | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To view the scenery                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To gain a sense of self confidence               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To be alone                                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

**Please indicate the extent to which you agree or disagree with the following statements regarding [site].**

|                                                                                           | Strongly disagree (1) | Somewhat disagree (2) | Neither agree nor disagree (3) | Somewhat agree (4)    | Strongly agree (5)    |
|-------------------------------------------------------------------------------------------|-----------------------|-----------------------|--------------------------------|-----------------------|-----------------------|
| I have recreated at [site] many times and I am quite familiar with it. (1)                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| Many important family memories are tied to [site]. (2)                                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| I feel like [site] is a part of me. (3)                                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| I feel connected to [site] (4)                                                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| Being able to recreate in [site] means a lot to me. (5)                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| I get more satisfaction out of visiting [site] than other public open spaces or land. (6) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| Recreating in [site] is more important to me than recreating in any other place. (7)      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |
| [site] contributes to the character of my community. (8)                                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>          | <input type="radio"/> | <input type="radio"/> |

**How APPROPRIATE or INAPPROPRIATE do you think the following activities are for a visitor to do on this trail?**

|                                                                                               | Extremely<br>inappropriate<br>(1) | Somewhat<br>inappropriate<br>(2) | Neither<br>appropriate<br>nor<br>inappropriate<br>(3) | Somewhat<br>appropriate<br>(4) | Extremely<br>appropriate<br>(5) |
|-----------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------|-------------------------------------------------------|--------------------------------|---------------------------------|
| Getting on the trail without preparing for all types of weather, hazards, and emergencies (1) | <input type="radio"/>             | <input type="radio"/>            | <input type="radio"/>                                 | <input type="radio"/>          | <input type="radio"/>           |
| Traveling off of designated or established trails (2)                                         | <input type="radio"/>             | <input type="radio"/>            | <input type="radio"/>                                 | <input type="radio"/>          | <input type="radio"/>           |
| Leaving litter on the trail, including human and dog waste (3)                                | <input type="radio"/>             | <input type="radio"/>            | <input type="radio"/>                                 | <input type="radio"/>          | <input type="radio"/>           |
| Hiking without water to drink (4)                                                             | <input type="radio"/>             | <input type="radio"/>            | <input type="radio"/>                                 | <input type="radio"/>          | <input type="radio"/>           |

**Participating in the following activities on this trail would reduce impact...**

|                                                                                        | Never (1)             | Sometimes (2)         | About half the time (3) | Most of the time (4)  | Every time (5)        |
|----------------------------------------------------------------------------------------|-----------------------|-----------------------|-------------------------|-----------------------|-----------------------|
| Prepare for all types of weather, hazards, and emergencies before getting on trail (1) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   | <input type="radio"/> | <input type="radio"/> |
| Stay on designated or established trails (2)                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   | <input type="radio"/> | <input type="radio"/> |
| Carry out all litter, including human and dog waste (3)                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   | <input type="radio"/> | <input type="radio"/> |
| Carrying water to drink during your hike (4)                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>   | <input type="radio"/> | <input type="radio"/> |

**Please indicate how DIFFICULT you think each of the following would be for a visitor to do on this trail...**

|                                                                                        | Extremely<br>easy (1) | Somewhat<br>easy (2)  | Neither easy<br>nor difficult<br>(3) | Somewhat<br>difficult (4) | Extremely<br>difficult (5) |
|----------------------------------------------------------------------------------------|-----------------------|-----------------------|--------------------------------------|---------------------------|----------------------------|
| Prepare for all types of weather, hazards, and emergencies before getting on trail (1) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>                | <input type="radio"/>     | <input type="radio"/>      |
| Stay on designated or established trails (2)                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>                | <input type="radio"/>     | <input type="radio"/>      |
| Carry out all litter, including human and dog waste (3)                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>                | <input type="radio"/>     | <input type="radio"/>      |
| Carrying water to drink during your hike (4)                                           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>                | <input type="radio"/>     | <input type="radio"/>      |

**Please indicate how LIKELY you are to do the following in the future...**

|                                                                                        | Extremely<br>unlikely (1) | Somewhat<br>unlikely (2) | Neither likely<br>nor unlikely<br>(3) | Somewhat<br>likely (4) | Extremely<br>likely (5) |
|----------------------------------------------------------------------------------------|---------------------------|--------------------------|---------------------------------------|------------------------|-------------------------|
| Prepare for all types of weather, hazards, and emergencies before getting on trail (1) | <input type="radio"/>     | <input type="radio"/>    | <input type="radio"/>                 | <input type="radio"/>  | <input type="radio"/>   |
| Stay on designated or established trails (2)                                           | <input type="radio"/>     | <input type="radio"/>    | <input type="radio"/>                 | <input type="radio"/>  | <input type="radio"/>   |
| Carry out all litter, including human and dog waste (3)                                | <input type="radio"/>     | <input type="radio"/>    | <input type="radio"/>                 | <input type="radio"/>  | <input type="radio"/>   |
| Carrying water to drink during your hike (4)                                           | <input type="radio"/>     | <input type="radio"/>    | <input type="radio"/>                 | <input type="radio"/>  | <input type="radio"/>   |

**What is your zip code?**

\_\_\_\_\_

**How often have you visited this site in the past...**

☐ 12 months (1) \_\_\_\_\_

☐ 5 years (2) \_\_\_\_\_

**Are you a first-time visitor to the Moab area?**

☐ Yes (1)

☐ No (2)

**Where was the last place you stayed at before coming to the Moab area?**

\_\_\_\_\_

**Where else did you recreate on this trip to Moab?**  
***(Select all that apply)***

- ☐ Arches (1)
  - ☐ Canyonlands (2)
  - ☐ Other BLM trailheads (3)
  - ☐ Mill Creek (4)
  - ☐ Corona Arch (5)
  - ☐ Grandstaff (6)
  - ☐ Dead Horse Point State Park (7)
  - ☐ Utahraptor State Park (Willow Springs camping area) (8)
  - ☐ Fisher Towers (9)
  - ☐ Sand Flats Recreation Area (10)
  - ☐ Other (please explain) (11)
-

**Where did you recreate first when you arrived in the local area?**

- ☐ Arches (1)
  - ☐ Canyonlands (2)
  - ☐ Other BLM trailheads (3)
  - ☐ Mill Creek (4)
  - ☐ Corona Arch (5)
  - ☐ Grandstaff (6)
  - ☐ Dead Horse Point State Park (7)
  - ☐ Utahraptor State Park (Willow Springs camping area) (8)
  - ☐ Fisher Towers (9)
  - ☐ Sand Flats Recreation Area (10)
  - ☐ Other (please explain) (11)
- 

**What year were you born?**

▼ 2005 (18) ... 1930 (93)

**Which category best represents your annual household income?**

▼ Less than \$25,000 (1) ... Do not wish to answer (8)

**What is the highest degree or level of school you have completed?**

▼ Less than high school/ some high school (1) ... Doctorate Degree (PhD, EdD, etc.) (9)

# B

## Appendix B: Open-Ended Question Responses

| Other Activity Type | Frequency |
|---------------------|-----------|
| Canyoneering        | 1         |
| Climbing            | 1         |
| Corona arch         | 1         |
| Mountain biking     | 1         |
| Photography         | 3         |
| Seeing Corona Arch  | 1         |
| Wildflowers         | 1         |
| Total               | 9         |

**Table B.1:** Other Activities

| Other Group Type            | Frequency |
|-----------------------------|-----------|
| Behavioral Health Center    | 1         |
| Church                      | 1         |
| Dog                         | 7         |
| Employment training         | 1         |
| Group travel                | 1         |
| Students (here for a class) | 1         |
| Total                       | 12        |

**Table B.2:** Other Group Types

| Trip Planning Apps | Frequency |
|--------------------|-----------|
| AllTrails          | 59        |
| Facebook           | 1         |
| GaiaGPS            | 1         |
| Google maps        | 4         |
| Hiking project     | 1         |
| I'm local          | 1         |
| Instagram          | 2         |
| Road Trip Ryan     | 1         |
| Strava             | 1         |
| Tik tok            | 2         |
| Total              | 73        |

**Table B.3:** Trip Planning Apps Used

| Trip Planning Websites                             | Frequency |
|----------------------------------------------------|-----------|
| 10 best hikes in Moab non-touristy                 | 1         |
| AllTrails                                          | 3         |
| BLM                                                | 2         |
| Chat GPT                                           | 1         |
| Family found hike on YouTube                       | 1         |
| Girlonahike.com                                    | 2         |
| Google                                             | 20        |
| Google-dog                                         | 2         |
| Moabwithkids                                       | 1         |
| Several                                            | 1         |
| Trip advisor                                       | 1         |
| Various blogs about exploring Moab with young kids | 1         |
| Visit utah and pet friendly                        | 1         |
| Total                                              | 37        |

**Table B.4:** Trip Planning Websites Used

| Other Tech Used     | Frequency |
|---------------------|-----------|
| Apple Watch         | 1         |
| Caltopo             | 2         |
| Far out             | 1         |
| Farming Explorer    | 1         |
| Fitbit              | 1         |
| Garmin              | 2         |
| Google earth        | 1         |
| Guidealong          | 1         |
| Harming watch       | 1         |
| Inreach             | 1         |
| LinkedIn            | 1         |
| Maps me             | 1         |
| Merlin Bird ID      | 2         |
| Mountain project    | 1         |
| MTB Project         | 2         |
| National Geographic | 1         |
| OnXRoad             | 3         |
| Paper map           | 2         |
| Seek                | 2         |
| Somewhere           | 1         |
| Topo Maps           | 1         |
| Trailsoffroad.com   | 1         |
| Weather             | 1         |
| YouTube             | 2         |
| Total               | 33        |

**Table B.5:** Other Tech Used

| RR Information<br>Online Sources      | Frequency |
|---------------------------------------|-----------|
| Airbnb host                           | 1         |
| Alltrails                             | 7         |
| BLM                                   | 1         |
| Blogs                                 | 1         |
| Fiery Furnace video                   | 1         |
| Google                                | 2         |
| Hiking permits                        | 1         |
| National park                         | 1         |
| Nps website                           | 1         |
| Rec.gov                               | 1         |
| Retired land<br>management specialist | 1         |
| Signage                               | 1         |
| Tik tok                               | 1         |
| Tub training                          | 1         |
| Visit utah                            | 1         |
| Websites                              | 6         |
| YouTube                               | 1         |
| Total                                 | 29        |

**Table B.6:** Recreate Responsibly Information Other Online Sources

| RR Information<br>Local Staff Sources | Frequency |
|---------------------------------------|-----------|
| Billboard, podcasts                   | 1         |
| BLM                                   | 1         |
| CFI field trips as a kid              | 1         |
| Climbing guide                        | 1         |
| I live here                           | 1         |
| I used to live here                   | 1         |
| I was a teacher                       | 1         |
| I'm a former guide                    | 1         |
| Jacob                                 | 1         |
| Lives here                            | 1         |
| Local climbing community              | 1         |
| Obtained knowledge<br>over the years  | 1         |
| Sand rock camping                     | 1         |
| Signs on the trail                    | 2         |
| Trail ambassador                      | 11        |
| Trail staff                           | 1         |
| We now what to do                     | 1         |
| Total                                 | 28        |

**Table B.7:** Recreate Responsibly Information Local Staff Sources

| Condition                                                                   | Frequency |
|-----------------------------------------------------------------------------|-----------|
| A kid grabbing a handful of crust.                                          | 1         |
| All over and loud                                                           | 1         |
| Carving rocks                                                               | 3         |
| Child hurling rocks at cactus plants                                        | 1         |
| Climbing on top of corona Aich                                              | 1         |
| Drinking at the swimming hole                                               | 1         |
| Drones                                                                      | 10        |
| Guy repelling yelling                                                       | 1         |
| Heard moaning .....                                                         | 1         |
| Large loud drunk groups                                                     | 1         |
| Litter                                                                      | 1         |
| Looked like a shotgun blast on pictographs                                  | 1         |
| Loud and obnoxious                                                          | 1         |
| Loud constant screaming loud no stopping barking from their dogs            | 1         |
| Loud music                                                                  | 2         |
| Loud shouting; arch climbing; dropping off the top of the arch              | 1         |
| Parked across two spaces                                                    | 1         |
| My car was broken into while here                                           | 1         |
| People playing loud music, crowding of some users in narrow/technical areas | 1         |
| People trying to walk and cut in front of you on a tight trail              | 1         |
| Retractable leashes getting tangled together                                | 1         |
| Shouting for echos                                                          | 1         |
| Someone had a speaker playing music                                         | 1         |
| Splashing baby birds with water                                             | 1         |
| Threw a rope down from the top of the arch without warning                  | 1         |
| Throwing stuff off top of arch and screaming                                | 1         |
| Very poor hiking etiquette                                                  | 1         |
| Yodeling                                                                    | 1         |
| Total                                                                       | 40        |

**Table B.8:** Other Conditions

| Recreation Location                   | Frequency |
|---------------------------------------|-----------|
| 4wd roads                             | 1         |
| Bow tie arch                          | 1         |
| Capitol Reef                          | 1         |
| Capn Ahab                             | 1         |
| Colorado river                        | 4         |
| Courthouse Rock                       | 1         |
| Doughbird                             | 1         |
| EarT out                              | 1         |
| Faux Falls                            | 2         |
| First stop                            | 1         |
| Green River                           | 1         |
| Hunter canyon. Jug handle. Potash rd. | 1         |
| Keep Arch                             | 1         |
| La Sal Mountains                      | 2         |
| Many                                  | 1         |
| Nowhere                               | 1         |
| Passing through from Bears Ears trip  | 1         |
| Porcupine rim                         | 1         |
| Slick rock and river rafting          | 1         |
| Total                                 | 24        |

**Table B.9:** Other Recreation Locations

| Last Place Before Moab                                      | Frequency |
|-------------------------------------------------------------|-----------|
| Bryce Canyon                                                | 1         |
| Parachute                                                   | 1         |
| Akumal Mexico                                               | 1         |
| Albuquerque NM                                              | 1         |
| Allisonia, VA                                               | 1         |
| Arches National Park                                        | 6         |
| Arizona                                                     | 4         |
| Aspen                                                       | 1         |
| Australia                                                   | 1         |
| Bearlake                                                    | 1         |
| Bears Ears                                                  | 1         |
| Big Bend NP                                                 | 1         |
| Bismarck, ND                                                | 1         |
| Blanding                                                    | 4         |
| Bluff, UT                                                   | 1         |
| Boise, ID                                                   | 1         |
| Boulder, CO                                                 | 5         |
| Breckenridge                                                | 1         |
| Bryce canyon                                                | 3         |
| Camping (BLM, River road, Willow Springs, Canyonlands Road) | 11        |
| Canyonlands                                                 | 4         |
| Capitol Reef                                                | 5         |
| Carbon County                                               | 1         |
| Carbondale                                                  | 1         |
| Casper, WY                                                  | 1         |
| Castle valley                                               | 1         |
| Cedar City, UT                                              | 1         |
| Coeur dAlene ID                                             | 1         |
| Colorado                                                    | 13        |

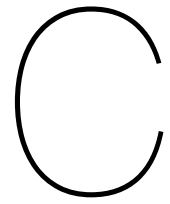
| Last Place Before Moab   | Frequency |
|--------------------------|-----------|
| Corona arch              | 1         |
| Crested Butte            | 1         |
| Dallas Texas (road trip) | 1         |
| Denver                   | 15        |
| Dewey                    | 2         |
| Disneyland               | 1         |
| Dixon, WY                | 1         |
| Dominica                 | 1         |
| Duck Creek               | 1         |
| Durango, CO              | 5         |
| Eagle, CO                | 1         |
| Elko, NV                 | 1         |
| Escalante                | 2         |
| Estes Park, CO           | 1         |
| Fairbanks, AK            | 1         |
| Farmington, NM           | 1         |
| Finger Lakes, NY         | 1         |
| Fisher Towers            | 1         |
| Fraser, CO               | 1         |
| Friends                  | 1         |
| Fruita, CO               | 5         |
| Georgia State Parks FDR  | 1         |
| Glen Ellen, CA           | 1         |
| Glenwood Springs, CO     | 1         |
| Goblin valley            | 2         |
| Golden, CO               | 1         |
| Goose Island             | 2         |
| Granby, CO               | 1         |
| Grand Canyon NP          | 2         |
| Grand Junction           | 8         |
| Grand Tetons             | 1         |
| Green River, UT          | 4         |
| Gunnison, CO             | 1         |
| Heber City, UT           | 1         |
| Helper, UT               | 1         |
| Home                     | 27        |
| Hyatt                    | 1         |
| Idaho                    | 2         |
| Indian Creek             | 1         |
| Jackson, WY              | 2         |
| Joshua Tree NP           | 1         |
| Kanab                    | 2         |
| Kayenta                  | 1         |
| Las Vegas                | 1         |
| Live nearby in CO        | 2         |
| Loa, UT                  | 1         |
| Logan, UT                | 2         |
| London                   | 1         |
| Mainstays                | 1         |
| Malad City, ID           | 1         |
| Mammoth Lakes, CA        | 1         |
| Maze                     | 1         |
| Mesa                     | 1         |
| Mexico                   | 2         |
| Milford, CT              | 1         |

| Last Place Before Moab   | Frequency |
|--------------------------|-----------|
| Missouri                 | 1         |
| Moab                     | 2         |
| Mohave                   | 1         |
| Montana                  | 2         |
| Monticello               | 1         |
| Monument Valley          | 5         |
| Moored                   | 1         |
| Morro Bay, CA            | 1         |
| N/A                      | 3         |
| Needles                  | 2         |
| New Mexico               | 2         |
| North Carolina           | 1         |
| Ogden, UT                | 1         |
| Orem, UT                 | 1         |
| Ouray, UT                | 1         |
| Page, AZ                 | 1         |
| Pagosa Springs, CO       | 1         |
| Palisade, CO             | 1         |
| Palm Desert, CA          | 1         |
| Panamint Valley, CA      | 1         |
| Parachute, CO            | 1         |
| Park City, UT            | 8         |
| Phoenix                  | 1         |
| Pine View reservoir      | 1         |
| Potash Road              | 1         |
| Price, UT                | 1         |
| Provo, UT                | 3         |
| Radcliffe hotel          | 2         |
| Rocky Mountain           | 1         |
| Ruby horse thief rafting | 1         |
| San Diego                | 1         |
| Sand Flats               | 3         |
| Sand Island              | 1         |
| Scottsdale, AZ           | 3         |
| Sedona, AZ               | 1         |
| SLC, UT                  | 40        |
| Smoky Mountains          | 1         |
| South Weber, UT          | 1         |
| St George, UT            | 6         |
| St Louis                 | 1         |
| Steamboat Springs, CO    | 2         |
| Sun outdoors             | 2         |
| Tahoe, CA                | 2         |
| Taos, NM                 | 1         |
| Telluride, CO            | 1         |
| Texas                    | 1         |
| The west                 | 1         |
| Torrey, UT               | 1         |
| Tucson, AZ               | 1         |
| Twin Meadows             | 1         |
| Uintahs                  | 2         |
| Vail, CO                 | 1         |
| Valley of Fire           | 1         |
| Washington DC            | 1         |
| White Sands, NM          | 1         |

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| Last Place Before Moab | Frequency |
|------------------------|-----------|
| Yellowstone NP         | 1         |
| Yosemite NP            | 3         |
| Zion NP                | 8         |

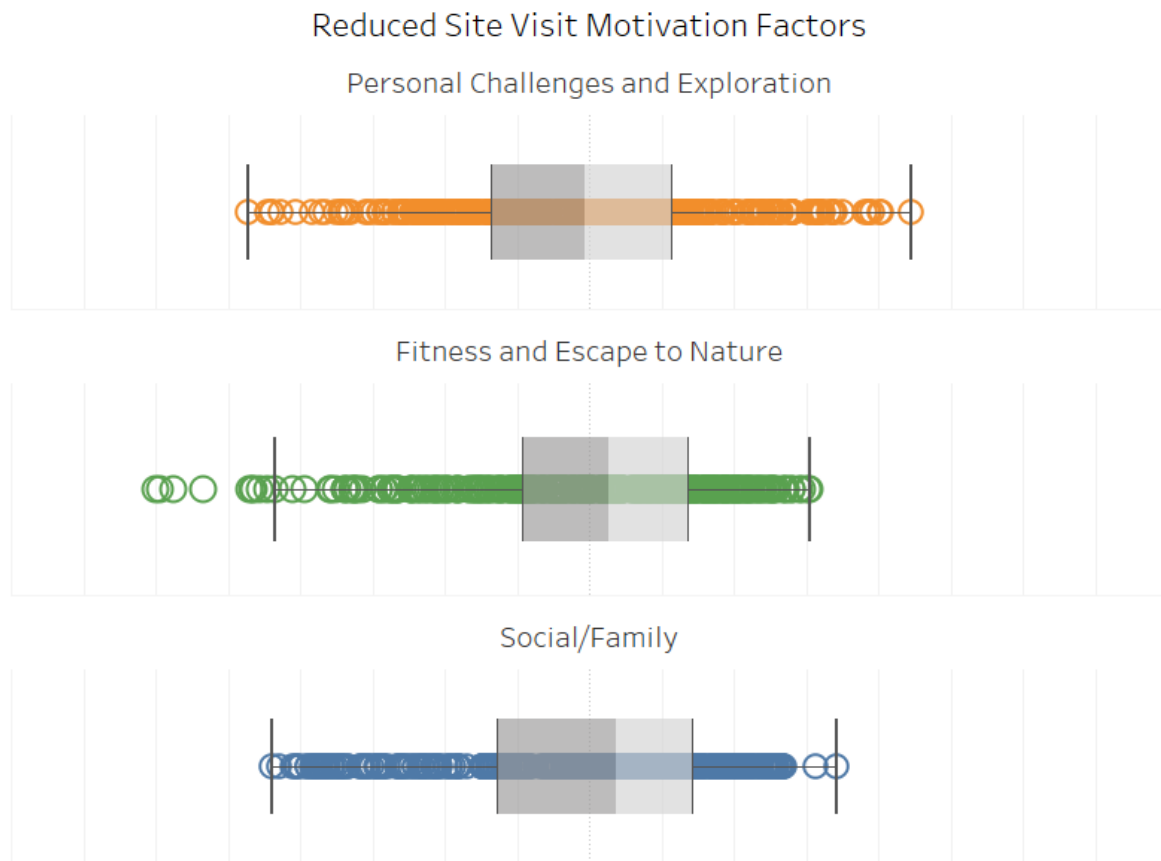
**Table B.10:** List of Locations Previous to Moab



## Appendix C: PCA Methods

### C.1. Description of Principal Component Analysis

A Principle Component Analysis (PCA) was run for the 28-question recreation experience preferences series to reduce the dimensions from many statements, to several primary constructs. Prior to conducting the PCA, assumptions were tested to assess suitability. The data set met assumptions of linearity, did not have outliers, and all variables had at least one correlation coefficient greater than 0.3. Additionally, the Kaiser-Meyer-Olkin (KMO) measure was determined to be a sufficient for sampling adequacy (KMO .959) and suitable for data reduction (Bartlett's test of sphericity <.001). Following several rounds of analysis, the final model produced three factors comprised of 16 variables (see Table C.1). The final model used factor analysis with a maximum likelihood extraction method, Varimax rotation, and a 0.5 cutoff. The PCA revealed three components with eigenvalues greater than one, which explained 33.5%, 10.2%, and 7.5% of the total variance. Visual inspection of the scree plot indicated that three components should be retained. Based on this and the interpretation of the factor loading categories, variables were forced into three visitor motivation groups using forced factor extraction. These visit motivation groups were categorized as Personal Challenge and Exploration, Fitness and Escape to Nature, and Social/Family. A reliability analysis was conducted and the Cronbach's Alpha for these items was .883, indicating a high level of reliability. See Figure C.1 for a visualization of the reduced recreation experience preferences.

**Figure C.1:** Recreation motivation variables grouped by factor**Table C.1:** Principal Component Analysis for dimension reduction of motivation variables

| Variables                                  | Personal Challenges and Exploration | Nature-based Fitness | Social/Family |
|--------------------------------------------|-------------------------------------|----------------------|---------------|
| To learn more about yourself               | 0.813                               |                      |               |
| To learn more about nature                 | 0.697                               |                      |               |
| To feel independent                        | 0.642                               |                      |               |
| To test your abilities                     | 0.599                               |                      |               |
| To grow and develop spiritually            | 0.572                               |                      |               |
| To gain a sense of self confidence         | 0.568                               |                      |               |
| To take risks                              | 0.550                               |                      |               |
| To have your mind move at a slower pace    | 0.528                               |                      |               |
| To feel good after being physically active |                                     | 0.813                |               |
| To get exercise                            |                                     | 0.719                |               |
| To get away from the usual demands of life |                                     | 0.632                |               |
| To view the scenery                        |                                     | 0.571                |               |
| To enjoy the smells and sounds of nature   |                                     | 0.529                |               |
| To experience new and different things     |                                     | 0.521                |               |
| To bring your family closer together       |                                     |                      | 0.864         |
| To do something with your family           |                                     |                      | 0.851         |