
Visitor Use and Associated Thresholds at Theodore Roosevelt National Park

2016-2018

Research Report

Cooperative Ecosystem Studies Units (CESU)

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Final Project Report Prepared by (listed alphabetically):

Project Directors and Principle Investigators

Matthew T.J. Brownlee, Ph.D.¹

Ryan Sharp, Ph.D.²

Project Coordinators

Michael Blacketer, M.A.¹

Michael Brunson, M.S.²

Data Preparation and Analysis

John Nettles¹

Elizabeth Perry, Ph.D.¹

¹ Park Solutions Lab

Department of Parks, Recreation, and Tourism Management

Clemson University

Clemson, South Carolina

² Applied Park Science Lab

Department of Horticulture and Natural Resources

Kansas State University

Manhattan, Kansas

Substantial assistance in data processing and data organization provided by Brittany Lacy, Cole Little, Kaity Mitchell, and Scott Ogletree in the Park Solutions Lab at Clemson University. Additional assistance was provided by Tyler Cribbs in the Applied Park Science Lab at Kansas State University.



EXECUTIVE SUMMARY

Project Overview

The purpose of this research was to collect, analyze, and interpret information to help support visitor use management and associated planning at Theodore Roosevelt National Park (THRO). The objectives and activities of this study included: 1) Evaluating the frequency, type, density, and temporal and spatial distributions of visitor use at THRO during peak season; 2) administering quantitative questionnaires that captured park wide use patterns that also specifically measured uses and preferences; and 3) assessing experiential impacts associated with visitor use and determining visitor expectations.

A normative approach guided the research process, reliant on indicators and thresholds aligned with the Interagency Visitor Use Management Framework. This research report describes information about visitors who recreated in THRO's North, South and Elkhorn Ranch Units. The researchers used quantitative questionnaires, field and parking lot cameras (FCs and PLCs), infrared trail counters (TCs), GPS technology, and Geographic Information Systems (GIS) for mapping purposes.

Researchers distributed five quantitative visitor questionnaires in THRO's North and South Units. The first questionnaire identified indicators of experiential quality at select locations in THRO. The second questionnaire sought to evaluate visitors' thresholds regarding human and vehicular for some of these indicators. A third questionnaire sought to reproduce a 2001 visitor survey to compare changes in visitor preferences between 2001 and 2017. A fourth questionnaire investigated visitors' preferences for management actions in THRO. The fifth and final questionnaire examined visitors' preferences for and the use of technology in and outside of THRO.

Although the questionnaires were critical to capture visitor preferences for conditions, researchers additionally assessed objective visitor use levels by deploying high-resolution infrared cameras and infrared trail counters. Researchers used data from these instruments to compare the alignment (or lack thereof) between visitors' preferences from the questionnaires and observed conditions in specific areas.

The researchers stationed field cameras (hereafter referred to as FCs) at the River Bend Overlook (North Unit) and Boicourt Overlook (South Unit). The researchers deployed parking lot cameras (PLCs) at Oxbow Overlook, Caprock Coulee trailhead, Petrified Forest, Buck Hill, Wind Canyon Overlook, and the Elkhorn Ranch Unit parking lot. Lastly, researchers deployed trail counters (TCs) in the North Unit at Caprock Coulee; in the South Unit at Petrified Forest and Painted Canyon; and on the Maah Daah Hey Trail on U.S. Forest Service land adjacent to the Elkhorn Ranch Unit.

The report is organized as follows: 1) introduction, objectives, and descriptions of methods and analyses; 2) general research findings for the North and South units; 3) research findings specific to the North Unit; 4) research findings specific to the South Unit, 5) research findings for the Elkhorn Ranch Unit; and 6) appendices.

Key Recommendations

General

- Consider integrating the results and outcomes of this project into park planning and management efforts. This may include considering formal thresholds for the indicator variables investigated in this report. Results presented in this report offer a range of potential thresholds and triggers that might be used for each indicator. Also, consider designating responsibilities and schedules for future monitoring of indicators.
- Continue to develop detailed management alternatives in the instance monitoring suggests that thresholds are violated, or triggers are activated. Consider pilot testing potential management alternatives prior to their full implementation to gauge their effectiveness. This might include outside review/assistance by subject matter experts or developing a computer model to evaluate the outcomes of potential management alternatives.

Information and communication

- Consider continuing to use the NPS website and current and potential phone applications to communicate with park visitors before, throughout, and after their visits.
- Also continue to investigate the potential opportunities provided by visitors communicating important park messages as 83% of visitors agree that mobile devices helped them share their park experience with others.

Experiential conditions and improvements

- Because visitors continue to appreciate THRO for its clean environment (little litter, air or noise pollution), few human structures, wildlife, and opportunity to be away from crowds, continue to monitor both in park and out of park conditions related to important resources and experiences. As part of this effort continue to evaluate crowding and use levels as visitors report some potential increases in crowding since 2011, which coincides with increased visitation levels.
- Visitors also appreciate the ‘ruggedness’ of the park and desire that this characteristic does not change. When considering improvements and infrastructure, this visitor desire should be incorporated.
- Visitors report scenery and viewsheds are important. Continue to work with local entities outside the park boundaries to mitigate viewshed impacts.
- Because almost 90% of visitors reported participating in wildlife viewing and indicate that this experience was important to the quality of their visit, continue direct and indirect management of park wildlife and associated habitats.
- Continue an emphasis on park interpretation since interpretive signage about the park, geology, and Theodore Roosevelt rank highly with many visitors.
- Since most visitors spend a majority of their time driving on the park road and only venture approximately 1 mile from the road when hiking (on average), continue to view and manage the driving experience on the park road as a key focal point of the visitor experience.

Facilities and services

- Based on visitors' desires, consider a) adding new accessible restrooms in key locations, b) establishing a permanent visitor center in the North Unit, and c) providing more directional signage on some park trails. However, these recommendations are only based on visitors' desires and should be balanced with other management considerations.

Important indicators and associated thresholds

- When planning for management strategies and potential development in the region or park, consider visitor preferred conditions and thresholds for important indicators. However, these recommendations are only based on visitors' desires and should be balanced with other management considerations.
 - No more than 6 Human Structures on the Landscape (HSOL) within view at one time in the South Unit and no more than 2 HSOL within view at one time in North Unit.
 - No more than 12 minutes wait time to find parking at key attraction areas, overlooks, and scenic pull outs.
 - No more than 11 vehicles within one mile of road in the North Unit and no more than 19 vehicles within one mile of road in the South Unit (two-way traffic). These thresholds are particularly important near or at roadside attractions and congregation areas.
 - No more than 55 people at one time at River Bend Overlook, or similar overlooks in the North Unit. Since current conditions at Riverbend are beneath this threshold, carefully consider parking lot expansion.
 - No more than 34 people at one time at Boicourt Overlook and its trail, or similar overlooks in the South Unit. Since current conditions at Boicourt Overlook are beneath this threshold, carefully consider parking lot expansion.

Designated wilderness

- Visitors tend to travel almost exclusively on park trails in the Theodore Roosevelt Designated Wilderness. Consequently, continue to monitor trail conditions, encourage trail use, and highlight probable backcountry routes using the existing trail infrastructure.
- Consider focusing monitoring and/or improvement efforts, as well as staff-visitor interactions, in these key frequently used locations
 - South Unit wilderness entrance and exit locations: Peaceful Valley Ranch, Petrified Forest, and Jones Creek trailhead.
 - South Unit trails: Maah Daah Heh, Petrified Forest, Lone Tree, and Big Plateau.
 - North Unit wilderness entrance and exit locations: Juniper Picnic Area, Oxbow Overlook, and Buckhorn Trailhead.
 - North Unit trails: Achenbach, Caprock Coulee, and Buckhorn.

Monitoring Visitor Use

- As resources allow, consider following the monitoring of indicators described in this report. This would ensure that visitation changes resulting from management action are deliberately and appropriately evaluated for their efficacy.

- As resources allow, consider following appropriate monitoring protocols prior to and after management action to determine the efficacy of action on use levels and perceived crowding.
- If monitoring suggests that conditions are violating thresholds, or activating triggers, then responsible parties should consider management action. Management actions can include a variety of practices, including use limits, spatial or temporal redistribution of use, protection of the site from further impacts (e.g., site hardening), expansion of facilities or services, educating visitors in an attempt to reduce impacts, and direct mitigation (e.g., replanting areas of damaged vegetation). Monitoring of these indicators and their relationship to established thresholds and triggers needs to be a continuing process conducted by NPS staff. Alternatively, an external entity familiar with the site and methods, can conduct the monitoring.

Key Findings

Demographics

- On average, respondents were 51 years of age with gender near-evenly split between males and females.
- Overall, 30% of visitors reported receiving a graduate/professional degree, 15% received some college, and 28% received a four-year degree.
- Most respondents (84%) self-identified as white, 1.4% self-identified as Asian, and 1.4% self-identified as Hispanic or Latino/Latina.
- Respondents had varying levels of total household income.
- Most respondents were from the Upper Midwest.

Visitors' access to park information

- Visitors obtained information about THRO from family and friends, the NPS website, and travel books/guides, as well as deriving experience-based knowledge from prior visits to the park.
- Information regarding THRO through family/friend advice has increased 8% since 2001.¹
- Information regarding THRO through the NPS website has increased 18% since 2001.¹
- Information regarding THRO through previous experience has increased 21% since 2001.¹

Past use and trip characteristics

- Overall, 57% of visitors to THRO reported being first time visitors.
- Half of all visitors to THRO reported that their visit to the park was part of a larger trip.
- 18% of visitors identified both THRO and Medora as their primary destination.
- For 17% of visitors, THRO was their primary destination, compared to only 6% intending to expressly visit Medora.

Activities

- 86% of visitors reported their primary activity inside the park was wildlife viewing.
- 71% of visitors reported engaging in wildflower or general plant viewing.
- 65% of visitors reported hiking on designated trails.

¹ These comparisons should be interpreted with caution because 2001 and 2017 differed in sampling and completion methods, including sampling/intercept months, sampling locations, questionnaire completion medium, and question completion timeframe.

- Outside the park, 33% of visitors reported attending the Medora Musical as their primary activity in the area.
- 18% of visitors reported visiting local museums as their primary activity in the area.
- 13% of visitors reported the Chateau des Mores state historic site as their primary activity in the area.
- Fewer than one-quarter of respondents (22%) reported camping at THRO during their stay.
- The four park sites used most by visitors were Scenic Loop Drive, prairie dog town pullouts, and the visitor centers at Painted Canyon and the South Unit.

Changes in visitor activities between 2001 (May) and 2017 (September)²

- Visitors reported a 22% increase in trail hiking since 2001. ²
- Visitors reported a 15% increase in plant/wildflower viewing since 2001. ²
- Visitors reported a 10% increase in participation of ranger-led activities. ²
- Visitors reported an 8% increase in visitation to the Little Missouri National Grassland. ²
- Visitors reported a 25% decrease in viewing museum exhibits in the Visitor Center. ²
- Visitors reported a 14% decrease in shopping at the Visitor Center. ²
- Visitors reported a 5% decrease in visitation to Fort Union Trading Post National Historic Site and Fort Buford State Historic Site. ²
- Changes in site usage since 2001, include visitor reported decreases in visitation to the Medora visitor center, North Unit visitor centers, the North Unit scenic drive, Oxbow Overlook, and Juniper campground. ²

Enjoyment of various aspects of their THRO experience

- 40% of visitors reported most enjoying the scenery.
- 38% of visitors reported most enjoying the wildlife.
- 9% of visitors reported most enjoying hiking.
- 28% of visitors least enjoyed the lack of rest rooms/stops
- 10% of visitors least enjoyed the parks roads and pullouts
- 9% of visitors least enjoyed the weather.

² These comparisons should be interpreted with caution because 2001 and 2017 differed in sampling and completion methods, including sampling/intercept months, sampling locations, questionnaire completion medium, and question completion timeframe.

- Visitors identify the top five experiential aspects of THRO as its clean environment (low litter, air, and noise pollution), its few human structures, being away from crowds, and being able to view and learning about wildlife.
- Scenic overlooks and interpretive signage about the park, geology, and Theodore Roosevelt also rank highly with visitors.

Perceptions of Crowding & Experiential Detractions

- Visitors to THRO reported very low levels of crowding at all THRO locations.
- Slightly more crowding was reported by 2017 September visitors compared to 2001 May visitors, specifically at the Medora visitor center, North Unit visitor center, road-side pullouts by prairie dog towns, Cottonwood Campground, Juniper Campground, Caprock Coulee nature trail, the South Unit scenic loop drive, and Buck Hill.³
- Slight detractions to their quality of visitors' experience were reported as being related to the lack of restrooms, poor rules/regulations clarity, too little directional signage, seeing development outside THRO, and the potential for conflict with other visitors on park roads

Satisfaction with facilities and services

- The majority of visitors reported being satisfied with services including the park brochure, backcountry trail and guide map, the National Geographic park map, information and directional signs, interpretative signs near trail heads, ranger-led programs, assistance from park employees, and the overall quality of services at the park.
- Most visitors reported being satisfied with facilities including campgrounds, trail/scenic road conditions, exhibits/bookstore, picnic areas, and restrooms.
- Survey respondents in the North Unit report slightly less satisfaction than in the South Unit.
- From 2001 (October) to 2017 (May), visitors reported slight decreases in satisfaction with the bookstore, restrooms, overall quality of services, and trail/directional signs.³
- 11% of visitors stated that NPS should increase the number of bathrooms
- 8% of visitors reported the addition of signage at the top of their list of improvements.
- The top things that visitors did not want to change were the ruggedness of THRO's landscape (36%) and the accessibility of the park (9%).
- 36%-46% of visitors report that NPS should change nothing at THRO

³ These comparisons should be interpreted with caution because 2001 and 2017 differed in sampling and completion methods, including sampling/intercept months, sampling locations, questionnaire completion medium, and question completion timeframe.

Visitor opinions about potential management actions

- Support for most potential management actions has grown since 2001.⁴
- Over 43% of visitors report support for maintaining the size of horse and longhorn herds.
- 42% of visitors report NPS should collaborate with developers adjacent to the park to reduce visual impacts in the park, including through the use of visual buffers to screen development.
- 42% of visitors support more short-length hiking trails at THRO.
- 35% of visitors support increasing the number of backcountry or wilderness trails.
- 41% of visitors support more ranger-led programs.
- 45% of visitors support the provision more information for things to see and do in the area.
- 38% of respondents supported improving accessibility of park facilities.
- 31% of visitors support creating new or increased size or number of roadside pullouts and parking lots.
- 35% of visitors support constructing a permanent visitor center in the North Unit.
- 41% of visitors support improvement of campground restrooms
- 36% of visitors support construction of more restroom facilities in the park.

Visitor opinions of technology

- Most visitors reported that their ‘attitudes toward mobile devices,’ ranged from neutral position to strong agreement with statements regarding enhanced personal and work life or connectivity with friends and family, with 33% reporting that they like being constantly connected.
- 47% of visitors report that constant connection decreases their enjoyment of outdoor experiences.
- 63% of visitors agree that staying connected via devices allows more time to work away from the office.
- 84% of visitors use mobile devices to search for info about outdoor experiences.
- 47% of visitors agree that mobile devices enhance their outdoor experiences.
- 46% of visitors agree that mobile devices enhance their experience at THRO.
- 83% of visitors agree that mobile devices help them share their THRO experience with others.
- Very few visitors reported annoyance at others’ use of mobile devices at THRO.

Mobile device app use at THRO

⁴ These comparisons should be interpreted with caution because 2001 and 2017 differed in sampling and completion methods, including sampling/intercept months, sampling locations, questionnaire completion medium, and question completion timeframe.

- An average of 52% of visitors knew that national park sites have mobile apps, and 34% reported having downloaded them
- 49% reported using the NPS mobile app before coming to THRO, and 39% during their park visit.
- Following their visit, 75% of visitors reported that they planned to use NPS app, and 69% predicted accessing THRO websites after their park visit.
- 27% of respondents said that they used the NPS app once a day, 17% once a week, 24% once a month, and 64% only one time ever.
- During their visit, however, 9% reported using the NPS app more than once an hour, 29% once per hour, 9% every two hours, and 52% only once.
- Most visitors reported using Facebook (68%), Instagram (12%), and Twitter (6%)
- 70% of visitors used Facebook, Snapchat, and Instagram to access park information while visiting THRO, with 91% reporting using them at least once daily.

Threshold: Human structures on the landscape (HSOL)

- North and South Unit respondents reported experiencing one or fewer visible human structures on the landscape while visiting THRO.
- South Unit respondents reported their threshold for acceptability at approximately 6 HSOL, management action at 11 HSOL, and displacement at 12 HSOL.
- North Unit respondents reported their threshold for acceptability at approximately 2 HSOL, with management action at the 6 HSOL and displacement at 9 HSOL.

Threshold: Large animal sightings per hour (LASH)

- Survey respondents reported 7 LASH in the North Unit and 8 LASH in the South Unit.
- 39% of visitors agreed that seeing zero animals per hour was ‘neither acceptable nor unacceptable,’ while seeing 2-10+ animals per hour was ‘very acceptable.’
- Conditions at or near zero LASH warrant management action according to an average of 14% of visitors.
- 63% report that no level of LASH warrants management action.
- Zero large animal sightings per hour are unlikely to result in displacement in both units.
- 37% of visitors suggesting that zero large animal sightings per hour (0 LASH) warrant management action and would also displace 68% of visitors.

Threshold: Wait times for parking (WTP)

- Data for WTP at THRO indicates decreasing levels of acceptability as wait times for parking increase, with the threshold for acceptability at approximately 12 minutes of waiting.
- An average of 48% of visitors indicate their short experienced WTP ‘extremely increased’ the quality of their experience at THRO.
- WTP at or near 20 minutes warrants management action.
- WTP of 24 minutes was likely to result in displacement in both units.
- An average of 15% of visitors reported no amount of waiting (up to 2 hours) for parking would displace them.

Threshold: Vehicles at one time (VAOT)

- On average, visitors report a threshold of 11 and 19 vehicles in the North and South Units, respectively.
- Visitors reported seeing two or fewer vehicles with the majority agreeing this number of vehicles ‘increased’ or ‘extremely increased’ the quality of their experience.
- Visitors reported that management action should occur at 18 VAOT.

Threshold: People at one time (PAOT) at River Bend Overlook (North Unit)

- On average, visitors report a threshold of approximately 55 people at one time (55 PAOT).
- Survey respondents reported an average of 7 PAOT at River Bend.
- 65% of visitors stated that their experienced level of PAOT ‘increased’ or ‘extremely increased’ the quality of their visit.
- Visitors report that management action should occur when PAOT reaches 54.
- Visitors report they would not return to the site when there are 63 people present (63 PAOT).
- 25% of visitors reported that PAOT at River Bend should never be limited
- Field camera (FC) at River Bend indicated that average weekday (2 PAOT), weekend (3 PAOT), and holiday (4 PAOT) from 7:00 am to 7:00 pm are within the acceptable range (0 to 55 PAOT).

Field and parking lot camera data for Oxbow Overlook (North Unit)

- A field camera (FC) mounted at the same location was lost to a lightning strike.
- The parking lot camera (PLC) at Oxbow indicated that average weekday, weekend, and holiday vehicle counts never reached lot capacity of 15 spaces from 7:00 am to 7:00 pm.

Field and parking lot camera data for Caprock Coulee (North Unit)

- The PLC at Caprock indicated that maximum weekday and weekend vehicle counts frequently exceeded lot capacity during midday.
- Average trail use collected by TC #1 shows an average of 17 daily users, with a monthly average of 535 trail users from June through September.
- Average trail use recorded by TC #2 (on the Nature Trail) shows an average of 45 daily users, with a monthly average of 1,540 trail users from June through September.

Spatial and Temporal Distributions for Day Use Visitors (North Unit)

- Visitors stay at the park for approximately 2 hours and 39 minutes and drive 28 miles during their stay.
- Approximately 29% of visitors stop at the North Unit Visitor Center and stay approximately 10 minutes, on average.
- Approximately 69% of visitors venture away from the road and hike approximately 1 mile during their visit at overlooks (e.g., Riverbend) and on official trails.
- Approximately 91% of visitors visit at least one official park overlook or pull out during their visit.
- On average, visitors spend approximately 18% of their total visit time at official park overlooks or pull outs.
- Results reveal that 79% of visitors stop at Riverbend Overlook, 73% stop at Oxbow Overlook, and 44% use the picnic areas, which represents the three most used official park overlooks in the North Unit by day visitors.
- Results indicate that visitors spend most of their time driving on the park road and stopping at official park overlooks or pullouts

Use of Theodore Roosevelt Designated Wilderness Area (North Unit)

- Visitors frequent the Achenbach Trails, Caprock Coulee Trail, and the Buckhorn Trail. This also reveals that most of the wilderness trails in the North Unit are used by wilderness visitors.
- The two areas of highest use density in the North Unit are 1) Sperati Point near Oxbow Overlook and the Achenbach Trail near the Little Missouri River, and 2) the Achenbach Trail just below the River Bend Overlook.
- The top five of wilderness entry locations—in order of decreasing percentage of visitor ingress—were the Juniper Picnic Area (23.2%), Oxbow Overlook (18.5%), Buckhorn Trailhead, (15.7%), the Cannonball pullout (10.2%), and the Caprock Coulee trailhead (7.4%).

Threshold: People at one time (PAOT) at Boicourt Overlook (South Unit)

- On average, visitors report a threshold of approximately 34 people at one time (34 PAOT).
- Survey respondents reported an average of 7 PAOT at Boicourt.
- 33% of visitors stated that their experienced level of PAOT ‘increased’ or ‘extremely increased’ the quality of their visit.
- Visitors report that management action should occur when PAOT reaches 53.
- Visitors report they would not return to the site when there are 59 people present (59 PAOT).
- The field camera (FC) data at Boicourt indicated that average weekday (1-2), weekend (2-3), and holiday (1) PAOT from 7:00 am to 7:00 pm are within the acceptable range (0 to 34 PAOT).
- The parking lot camera (PLC) data indicated that average (1-2) weekday, weekend, and holiday vehicle counts never reached lot capacity from 7:00 am to 7:00 pm.
- Weekday and weekend vehicle maximums approach and occasionally threaten to exceed the parking lot’s capacity of nine spaces.

Parking lot camera data for Wind Canyon (South Unit)

- PLC data for Wind Canyon was distributed due to multiple wildlife distributions and the data is only partially completed. Partial results indicated that average weekday, weekend, and holiday vehicle counts remained at or below half of lot capacity from 7:00 am to 7:00 pm.
- Weekday and weekend vehicle maximums occasionally approach and threaten to exceed the parking lot’s capacity of 15 spaces.

Field and parking lot camera for Buck Hill (South Unit)

- PLC data for Buck Hill indicated that average (2-3) weekday, weekend, and holiday vehicle counts remained at or below half of lot capacity from 7:00 am to 7:00 pm.
- Weekday and weekend vehicle maximums occasionally approach and threaten to exceed the parking lot’s capacity of 15 spaces.

Field camera, parking lot camera, and trail counter data for Petrified Forest (South Unit)

- PLC data for the Petrified Forest in 2017 indicated that average (~6) weekday, weekend, and holiday vehicle counts remained well below half of lot capacity from 7:00 am to 7:00 pm.
- 2017 weekday and weekend vehicle maximums occasionally approach and exceed the parking lot’s capacity of 18 spaces.
- The 2018 PLC data indicated that both the average of maximum number of vehicles remained below lot capacity of 18 spaces.

- Average trail use at Petrified Forest shows an average of 4-5 daily users, with a monthly average of 136 trail users from June through September.

Spatial and Temporal Distributions for Day Use Visitors (South Unit)

- On average, visitors stay at the park for approximately 2 hours and 45 minutes and drive 35 miles during their stay.
- Approximately 42% of visitors stop at the South Unit Visitor Center and stay approximately 24 minutes, on average.
- Approximately 50% of visitors venturing away from the road and hike approximately 1 mile during their visit.
- Distance away from the road constitutes approximately 12% of their total visit time.
- Results reveal that 39% of visitors use the Skyline Vista Trail, 30% use the Wind Canyon Trail, and 23% use the Old East Trail.
- Results indicate that visitors spend most of their time driving on the park road and stopping at official park overlooks or pullouts
- Approximately 68% of visitors visit at least one official park overlook during their visit.
- On average, visitors spend approximately 18% of their total visit time at official park overlooks.
- Results reveal that 56% of visitors stop at Johnson's Plateau, 46% stop at Badlands Overlook, and 32% use Buck Hill Overlook, which represents the three most used official park overlooks in the South Unit by day visitors.

Use of Theodore Roosevelt Designated Wilderness Area (South Unit)

- Visitors tend to use the Maah Daah Heh Trail, both Petrified Forest Trails, the Lone Tree Trail, and the Big Plateau Trail.
- Two areas reveal higher densities of use: Petrified Forest and Big Plateau.
- The top five of wilderness entry locations—in order of decreasing percentage of visitor ingress—Peaceful Valley Ranch (32.4%), Petrified Forest (22.4%), the Jones Creek trailhead (8.9%), Halliday Well (3.9%) and the Paddock Creek trailhead near the Painted Canyon VC (3.9%).

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INTRODUCTION

Project Rationale



• Project Objectives



• Description of Methods



• Description of Analyses



Introduction and Rationale

The National Park Service's (NPS) enabling legislation (the Organic Act of 1916) mandates park managers protect and maintain the natural and scientific values of the park and to provide for public enjoyment, education, and inspiration (NPS, 2016). This protection-visitor use dual mandate is applicable to all NPS units, including Theodore Roosevelt National Park. Theodore Roosevelt National Park (THRO) features natural, cultural, and recreational resources that invite a diverse population of visitors.

Named to honor the memory of Theodore Roosevelt, this national park comprises 70,447 acres of land in three separate units in Billings and McKenzie counties in North Dakota. After becoming president in 1901, Roosevelt used his authority to protect wildlife and public lands by creating the United States Forest Service (USFS) and establishing 150 national forests, 51 federal bird reserves, 4 national game preserves, 5 national parks, and 18 national monuments by enabling the 1906 American Antiquities Act. During his presidency, Roosevelt protected approximately 230 million acres of public land.

The park's South and Elkhorn Ranch Units were established in 1947 as Theodore Roosevelt National Memorial Park and the North Unit was added in 1948. In 1978 Congress designated the area as Theodore Roosevelt National Park and also established the 29,920-acre Theodore Roosevelt Wilderness within the park's North and South Units. The park's highest visitation in the past four decades was in 2016 with 753,880 people (NPS, 2016).

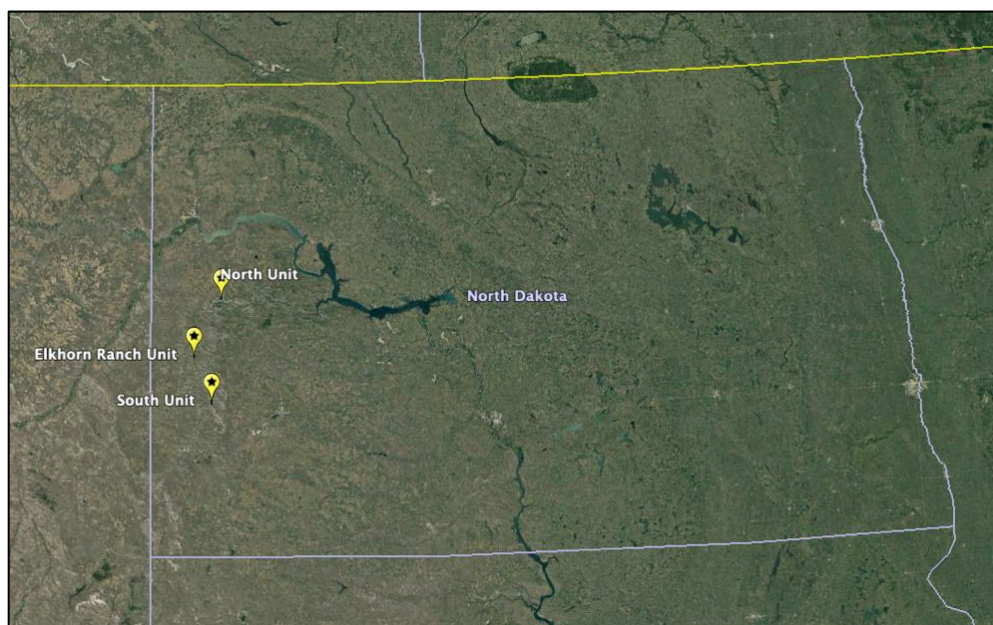


Figure 1. Approximate location of Theodore Roosevelt National Park Units in North Dakota
(Google Earth, 2018)

Figure 2. Overview map of Theodore Roosevelt National Park's 3 units

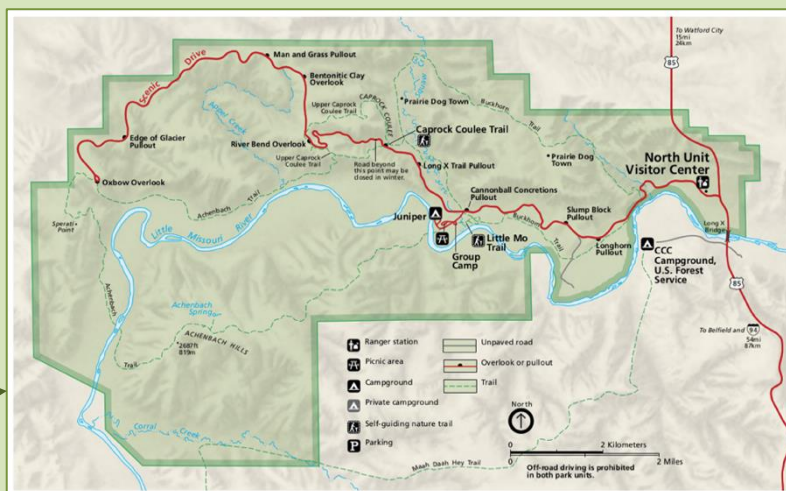
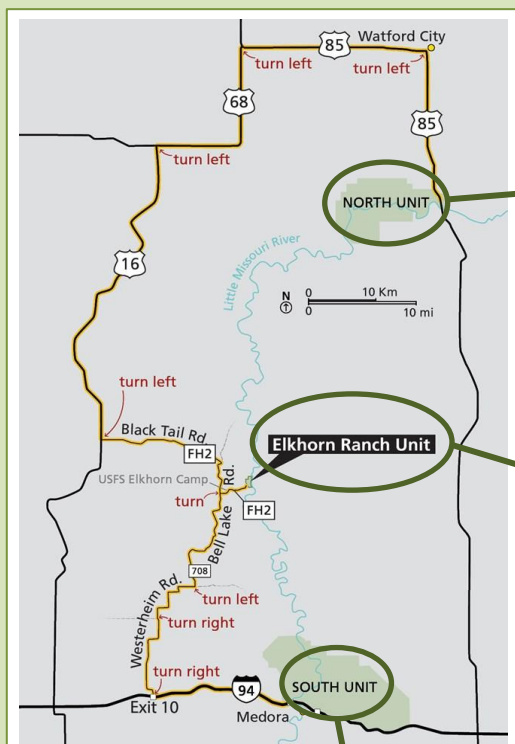


Figure 3. Detailed map of Theodore Roosevelt National Park's North Unit

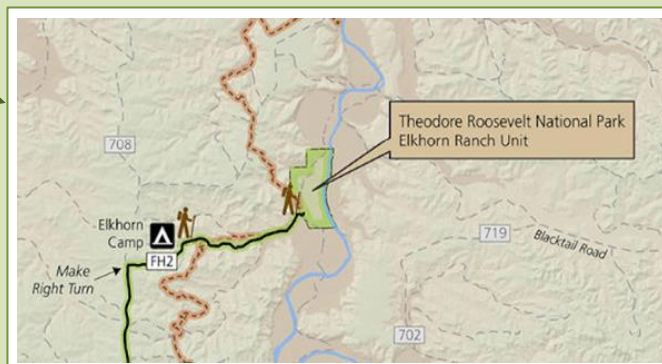


Figure 4. Detailed map of Theodore Roosevelt National Park's Elkhorn Ranch Unit



Figure 5. Detailed map of Theodore Roosevelt National Park's South Unit

Public land management occurs in a complicated environment that bridges social and environmental factors (Manning, 2010). While scientists and managers usually make decisions based on scientific evidence, visitors and stakeholders often respond to issues based on emotional attachments (Rikoon, 2006). Consequently, identifying visitors' perceptions and attitudes towards current issues is critical to anticipate public responses to the possibility of changing conditions (Arnberger, Eder, Alex, Sterl, & Burns, 2012; Kyle, Graefe, Manning, & Bacon, 2004; Eagly & Chaiken, 1993). This research can provide managers with information about visitors' opinions that directly inform the design of interpretation and public outreach in an intentional and prescriptive manner (Borrie, Davenport, Freimund, & Manning, 2002; McLaughlin & Paradise, 1980). Management decisions are further reinforced when informed through the concurrent evaluation of human values and ecological conditions as seen with this research science (Monz, Cole, Leung & Marion 2009).

Objectives

The primary purpose of this research was to provide data to aid future management guidance of visitor use at THRO. The objectives and activities of this study included: 1) Evaluating the frequency, type, density, and temporal and spatial distributions of visitor use at THRO during peak season; 2) Administration of quantitative questionnaires that captured park wide use patterns that also specifically measured use and preferences; and 3) Assess experiential impacts associated with visitor use and determine visitor expectations.

Description of Methods and Analyses

Visitor Questionnaires

Researchers administered the Indicators, Comparative, and Management questionnaires during September 22-25, 2017. The following year, the Thresholds and Technology questionnaires were distributed May 26-30 and August 10-14, 2018. For each of these sampling periods, researchers intercepted THRO visitors at three North Unit parking lots—River Bend, Oxbow, and Caprock Coulee—and at the Medora entrance/exit station in the South Unit. These five different survey types were designed to help researchers and managers understand visitors' perceptions of 1) human crowding, 2) vehicular crowding, 3) human structures on the landscape, 4) number of hourly large animal sightings, 5) wait times for parking, 6) use of technology in the park, and 7) general visitor preferences for management actions.

Questionnaires were administered via a tablet computer, specifically a Samsung Galaxy Tablet A6 with a 7" display running Android 5.1.1. The questionnaires were designed using Qualtrics Survey Software version 1.3.01 and uploaded to each tablet to be used in the field. Qualtrics software provides intuitive design that is easy for questionnaire participants to use. Furthermore, Qualtrics compiles the data for efficient data management.

Responses from the questionnaires were entered into SPSS 18.0 Statistical Software Package for analysis. Standard calculations for leverage, kurtosis, and skewness were used to identify statistical outliers and to verify univariate and multivariate normality of the data (Tabachnick & Fidell, 2001). The researchers then addressed the research objectives using social norm curves,

descriptive statistics, cross tabulations, and means testing. An alpha level of 0.05 was used for all statistical comparisons.

Questionnaire Sampling Locations and Timing

For all five questionnaires, researchers used standard best practices for survey construction, such as those set forth by Vaske (2008) and Dillman (2011). To ensure a representative sample at specific locations, researchers used a stratified random sampling procedure (stratified across time of day, day of the week, and season; Vaske, 2008) to intercept day visitors at THRO's North and South Units. Trained research assistants approached each day visitor, informed them about the study, and invited them to participate. One respondent from each traveling group (e.g., family) completed a questionnaire; if more than one person in each group was willing to participate, they were given different questionnaire types to complete, avoiding a nested data structure. The percentage of day visitors who agreed to complete the questionnaire was recorded. A trained survey administrator was available to provide assistance or clarification to respondents.

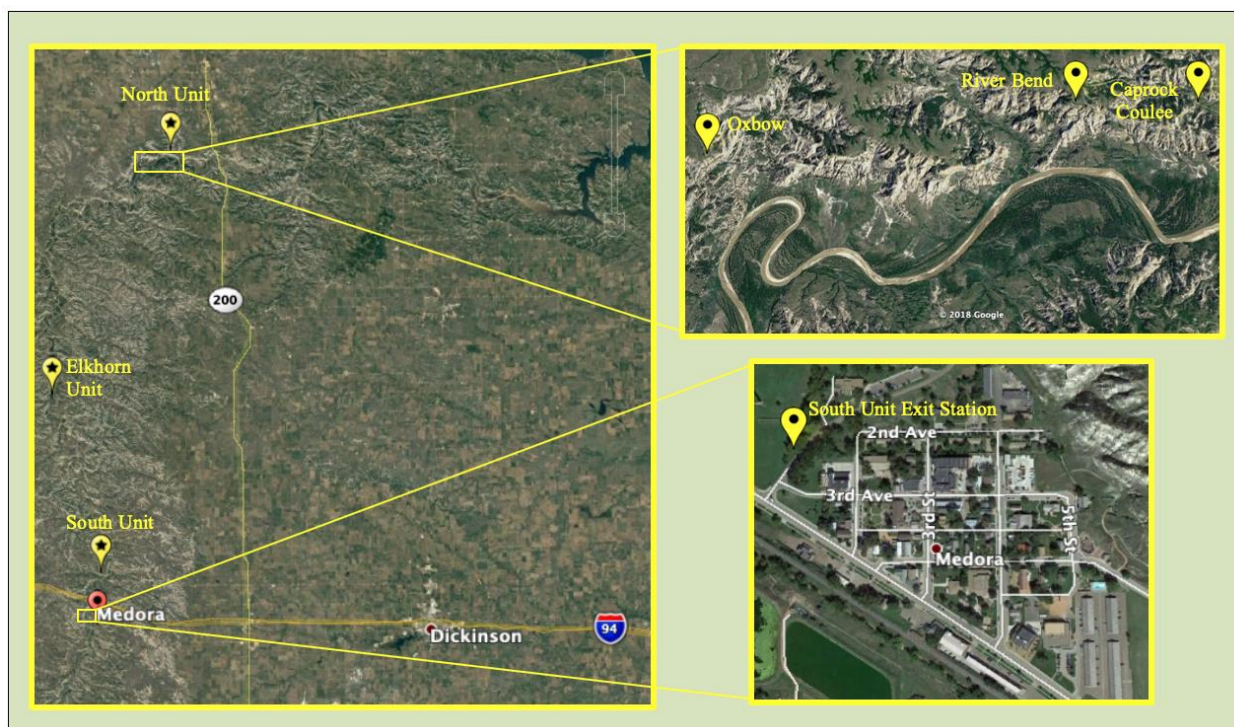


Figure 6. Researchers distributed surveys at North Unit parking lots for Oxbow Overlook, River Bend Overlook, and Caprock Coulee. For the South Unit, visitors were intercepted in their vehicles while passing through the park exit station in Medora, with the exception of one sampling day spent at the visitor center during heavy road construction traffic moving through the exit station.

Management Questionnaire

The Management Questionnaire asked participants to assess questions about various current and potential management actions at THRO. Visitors completed a series of quantitative questions related to contemporary management issues or potential management actions at THRO, along with additional questions of importance or curiosity not included on the other surveys. Survey

construction was informed by consultation with THRO managers. This questionnaire's potential management actions consisted of the following:

- Maintain the herd of longhorn steers in the North Unit of the park
- Maintain the herd of horses in the South Unit of the park
- Increase size of roadside pullouts and parking areas
- Create new roadside pullouts and parking areas
- Construct a permanent visitor center at the North Unit
- Improve existing restroom facilities at park campgrounds
- Use buffers to screen outside development such as oil & gas sites and cell phone towers
- Reduce maximum trailer length at campgrounds
- Increase the maximum trailer length at campground
- Work with developers adjacent to the park to reduce visual impacts in the park
- Provide more information for visitors about things to see and do in the area
- Increase the number of backcountry trails (wilderness trails)
- Provide more short hiking trails
- Provide more ranger-led programs
- Provide more restroom facilities
- Provide more parking spaces at pullouts and parking areas along scenic drives
- Expand campground loop by creating additional camping spots
- Install water, sewer, and electrical hookups in campgrounds
- Provide running water and showers at restroom facilities at campgrounds
- Create new reserved group campgrounds
- Improve accessibility at existing park facilities
- Expand existing campgrounds by providing larger loops, larger pull-offs, and additional RV sites

Respondents rated questions on a 7-point Likert scale ranging from - 3 (strongly oppose) to + 3 (strongly support), with a neutral point of 0. Visitors also assigned 100 preference points to these actions, with points segmented and assigned according to the most preferred actions. Additionally, respondents indicated the management action that they preferred the most if only one management action was available.

Comparative Questionnaire (2001-2017; Appendix X)

The *Comparative Questionnaire* endeavored in 2017 to reproduce the 2001 visitor survey that collected detailed data about:

- Who visits the park;
- Distribution and amount of use in the park;
- Type and number of user groups recreating in the park (generalized by activity);
- Visitor behavior, including
 - Reasons for visiting,
 - Attachment to the park,
 - The held importance of recreation experiences, and
 - Attainment of benefits flowing from their visit;

- Visitor perceptions of crowding, conflicts, and other problems;
- Visitor perceptions of park management options;
- Visitor perceptions of local development related impacts; and,
- Overall satisfaction with facilities, services, and experience.

Beyond providing comparative information about the park's visitors between 2001 and 2017, this study provided researchers and park managers with guidance for developing and implementing appropriate indicators and standards to monitor resource impacts and visitor experiences.

Technology Questionnaire

Visitors completed a series of quantitative and qualitative questions regarding their use and preferences for technology at the park. Management insight, past studies, and technology interviews at the park informed construction of the technology questionnaire. Using a five-point Likert scale ranging from -2 (strongly disagree) to +2 (strongly agree), with a neutral point of 0, visitors were able to express the importance of technology in their general lives and specifically in regard to the experience at THRO.

Indicators and Thresholds Questionnaires

To gauge visitors' preferences for conditions and crowding, the research team used a norm-based approach underpinned by Normative Theory, which suggests that park visitors have shared beliefs about important aspects of their experiences, including desired experiential, managerial, and ecological conditions (Manning, 2010). These preferences for conditions and 'how things ought to be,' are often referred to as norms (Shelby, Vaske, & Donnelly, 1996). Norms are typically identified in protected area research by asking visitors and/or other stakeholders to identify important aspects of their experience (e.g., what they liked or did not like) and then asking them to rate the acceptability of a range of conditions for that aspect of their experience.

Identifying and quantifying norms for ecological, experiential, and managerial conditions often incorporates the concept of indicators and thresholds. According to the Interagency Visitor Use Management Framework (2016), an indicator is a measurable, manageable variable that helps define the quality of a recreation experience, whereas a threshold (or standard) of quality is the minimum acceptable level of an indicator. Applications of normative theory in outdoor recreation management often use 'evaluative dimensions' other than 'acceptability' to determine potential thresholds. For example, visitors to an area may be asked to report norms regarding the conditions they would 'prefer to experience,' the conditions they think 'managers should maintain,' and the conditions under which they would 'no longer visit the area' (i.e., displacement).



a) South Unit exit station intercept; visitors were approached while driving through the station and if they agreed to participate, they then completed surveys in their vehicles.



b) South Unit Visitor Center intercept (used only during road construction activities); this scenario of offering a tent and chairs was also used in the North Unit parking lots where visitors were intercepted.

Figure 7a & 7b. Visitors completing questionnaires at Theodore Roosevelt national Park

Normative theory has helped formulate norm-based thresholds in many contexts with park visitors, including thresholds for the number of snorkelers in key areas at the Great Barrier Reef (Inglis, Johnson, & Ponte, 1999), encounters among snorkelers, divers, and boats at coral reef sites in the Florida Keys (Loomis, Anderson, Hawkins, & Paterson, 2008), visitors and frequency of ferry service to Boston Harbor Islands (Manning, Leung, and Budruk, 2005), vehicles driving on the beach at Cape Cod National Seashore (Hallo and Manning, 2013), and the waiting time to see wildlife (Anderson, Manning, Valliere, & Hallo, 2010).

A threshold and associated evaluative dimensions are often displayed on a *social norm curve* (see Manning, 2013 for a review). Specifically, the evaluation of various conditions (e.g., acceptability level) are displayed on the y-axis whereas a range of indicator conditions are represented on the x-axis (see Figure 8 for an example social norm curve). Generally, the highest point on the curve represents the preferred or optimal condition. Researchers and managers often consider the neutral line on the social norm curve a threshold, or minimal acceptable condition. All points above the neutral line are often considered the range of acceptable conditions, while points below the neutral line represent conditions that are unacceptable or violate the threshold of the indicator.

The agreement about a norm is referred to as norm crystallization or the amount of consensus about the norm (Manning, 2013). If a stakeholder group has a moderate to high level of agreement about a norm, then data derived from normative investigations can be quite useful for informing management decisions (Krymkowski, Manning, & Valliere, 2009).

In this study, researchers used the Potential for Conflict Index (PCI2) to evaluate 'norm crystallization,' or the level of agreement regarding visitors' evaluation of site conditions (Vaske, Beaman, Barreto, & Shelby, 2010). The PCI2 spans from zero (maximum agreement; or minimal

potential for conflict) to one (minimal agreement; or maximum potential for conflict) and was used to describe the variable's central tendency and dispersion using visuals (bubbles) incorporated into the social norm curve. According to Vaske et al. (2010), researchers and managers can represent the PCI2, or the extent of agreement or consensus regarding a norm, using the size of bubbles. Simply identified by Marin et al. (2011), a small bubble represents less conflict (high consensus) and a larger bubble represents more conflict (less consensus) regarding a norm. Ultimately, if a sample has a moderate to high level of agreement about a norm (medium to small PCI2 bubble), then managers can use the information from the normative investigations for management decisions (Krymkowski, Manning, & Valliere, 2009).

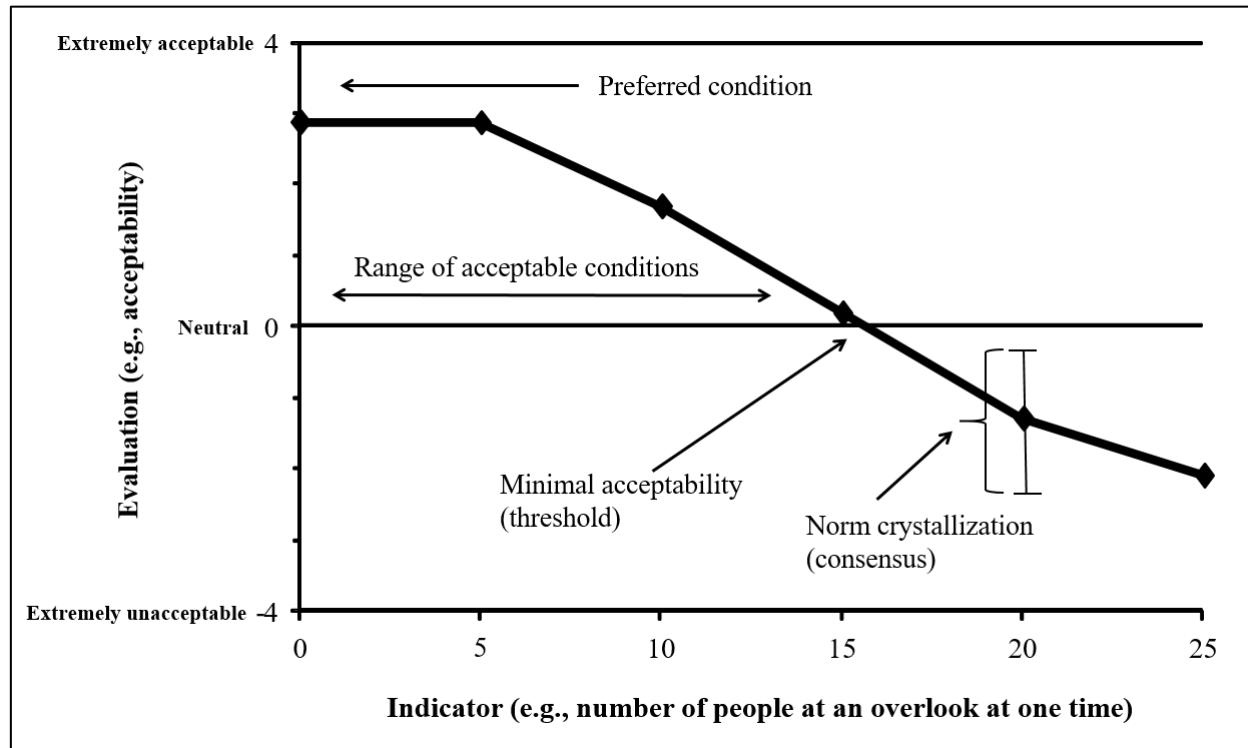


Figure 8. Example of social norm curve showing a threshold for number of people at one time.

Visual approaches to measuring thresholds were employed using computer-generated photographs to represent a range people at one time (PAOT), number of vehicles at one time (VAOT), and number of human structures within view on the landscape. Photos were used in the study because they may better communicate or focus attention on the variables intended for evaluation by respondents, particularly when these variables are difficult or awkward to describe in a narrative format (Hallo & Manning, 2009; Manning & Freimund, 2004). Researchers often use visual methods, in the form of pictures, to help identify outdoor recreationists' normative thresholds (Bullock & Lawson, 2008; Krymkowski, Manning, & Valliere, 2009). Typically, outdoor recreationists evaluate social and ecological conditions by viewing computer-altered photographs depicting varying levels of impacts (Laven & Krymkowski, 2005; Manning, Valliere, & Wang, 1999). Photographs have been found to be useful in determining normative thresholds because they are suggestive surrogates when classifying different impact levels (Newman, Marion, & Cahill, 2001). Furthermore, Manning & Freimund (2004) suggest that the use of photographs for

identifying normative thresholds easily and more accurately represents current or possible conditions beyond narrative descriptions.

Identifying Indicators

During an April 2018 conference call, the research team presented 2017 data to THRO. The meeting consisted of discussing visitor use management and planning priorities. After this meeting and analyzing 2017 data, the research team and THRO selected six indicators of quality for the study (an indicator is a measurable, manageable variable that helps define the quality of a recreation experience):

1. Human structures on the landscape
 - a. Operationalized as number of built structures visible in the landscape
2. Large animal sightings
 - a. Operationalized as the number of animals encountered per hour at THRO
3. Wait times for parking
 - a. Operationalized as the number of wait minutes to obtain a parking space
4. Human crowding at the River Bend Overlook
 - a. Operationalized as people at one time
5. Human crowding at the Boicourt Overlook
 - a. Operationalized as people at one time
6. Vehicular Congestion at prairie dog town viewing areas
 - a. Operationalized as vehicles at one time along the road

Identifying Thresholds

When measuring visitors' preferences and thresholds for crowding at THRO, visitors were asked to a) study multiple photographs that depicted a range of conditions from solitude (e.g., no people or no cars) to saturation (e.g., large amount of people or large number of cars), or b) respond to text-only questions for indicators that did not require photos (e.g., wait time for parking). Researchers constructed study photographs by taking baseline photographs of popular overlooks with and without visitors. These photographs were aggregated, layered, and modified in Adobe Photoshop to depict a range of conditions that occur or could occur at THRO. The research team paid special attention to depict crowding and congestion at THRO, using both people and vehicles in the photo panels to simulate real conditions.

Photographs were presented to visitors within a three-ring binder and ordered randomly and sequentially, depending on the binder. While viewing the photographs, visitors rated each photo by indicating how acceptable it was based on the conditions displayed. Respondents rated photos on a nine-point Likert scale ranging from - 4 ("very unacceptable") to + 4 ("very acceptable"), with a midpoint of 0. Respondents were also asked to indicate the photo showing the level of crowding or congestion that a) management action should occur, b) visitor use should be limited, and c) they would no longer use the area (displacement).



Photo 1: 0 people



Photo 2: 15 people



Photo 3: 30 people



Photo 4: 45 people



Photo 5: 60 people

Figure 9. Example of photo series showing people at one time (PAOT) presented to visitors as numbering from 0 to 60 people on the trail to assess preferences for crowding on trails. Results of the crowding studies will be addressed in the North Unit and South Unit sections.

Field Cameras and Parking Lot Cameras

The locations of the field cameras (FCs) and parking lot cameras (PLCs) are shown in this report's North Unit South Unit sections and in this report's appendix. Data pertaining to these cameras will also be addressed in those sections. The researchers stationed FCs at River Bend Overlook and Boicourt Overlook. PLCs were deployed Oxbow Overlook, Caprock Coulee trailhead, Petrified Forest parking lot, Wind Canyon Overlook, Elkhorn parking lot, and Buck Hill.

The researchers used a combination of cameras: Spypoint D11 cameras and Moultrie M-888 cameras. Both camera types have a long battery life enabling the cameras to continually take pictures in the field for months. These cameras took high definition photos of visitor use conditions every 15 minutes from sunrise to sunset. Each photo point (i.e., field camera location) was selected

to represent a broad viewshed of the area that allows for use levels to be visually depicted, specifically people at one time (PAOT), and vehicles at one time (VAOT). The cameras stored data on SD memory cards (16GB capacity), which were downloaded approximately every two months to a laptop computer using a USB 3.0 SD card reader. In the lab, each photograph was visually inspected by a team of research assistants using TimeLapse2 software (Timelapse2, 2016). This software package enabled research assistants to inspect each photo for number of people, and efficiently record how many visitors were found in each picture. The software determines locational changes in each picture and has a magnifying tool for quickly zooming to inspect each photo for people. The TimeLapse2 software saves the photo identifier, date, time, and number of people in a MS Excel spreadsheet.

Infrared Trail Counters

The researchers used TRAFx infrared trail counters (TCs) to gather temporal patterns of use in three THRO units. In the North Unit, two trail counters were placed at Caprock Coulee; in the South Unit at Petrified Forest and Painted Canyon; and adjacent to the Elkhorn Ranch Unit on the Maah Daah Hey trail. The location information and corresponding data for these TCs will be addressed in this report's North Unit, South Unit, and Elkhorn Ranch Unit sections.

TRAFx trail counters have a long battery life (up to four years) and are suitable to be left outside, even during inclement weather; TRAFx trail counters can function from -40F – 131F. The TRAFx trail counters detect an infrared signature of a warm moving object (TRAFx Research Ltd., 2011) crossing the infrared beam emitted by the unit. Each moment an infrared signature is detected the trail counter records a count with a timestamp on its internal hard drive. All six trail counters were calibrated via observational methods, periodically checked throughout the year for proper positioning, battery assessment, and downloading of trail counter data. The data was downloaded as a spreadsheet (.csv), which can be opened in MS Excel. The researchers used MS Excel to analyze the exported spreadsheets from each trail counter. The researchers analyzed hourly, seasonal, and annual data patterns.

GPS Visitor Tracking

Researchers distributed Canmore GT-740FL Sport GPS data loggers to both day users at THRO as well as wilderness and backcountry overnight visitors. White, Brownlee, Furman, and Beeco (2012) compared the Canmore GT-740FL to three other GPS data loggers, and achieved the highest accuracy, durability, and ease of use compared to the other receivers tested (Garmin Oregon 600, GlobalSat DG-100, and GlobalSat DG-200). These loggers have also been used successfully several previous studies (e.g., Sharp & Brownlee, 2016; Peterson, Brownlee, & Sharp, 2016). The Canmore GT-740FL has extended battery capabilities, is approximately 2.5 x 1.3 centimeters, and is equipped with a power button but no LCD interface. The few buttons and absence of an LCD screen limits device tampering by research participants. The GPS data loggers were configured to record a waypoint in decimal degrees and a timestamp at 15-second intervals. The 15-second interval setting has proven useful in past research tracking pedestrians (e.g., walkers, hikers, runners) (Beeco & Hallo, 2014; D'Antonio & Monz, 2016; D'Antonio et al., 2010; Kidd et al., 2015). The Canmore GPS data loggers must be analyzed retroactively, preventing the

research team from evaluating visitor travel patterns in real-time. This was communicated to visitors at the intercept location as an assurance of real-time privacy.



Figure 10. Canmore GT-740FL Sport GPS data logger used during this study

The researchers imported GPS data into MS Excel and performed an initial cleaning of the data in preparation for upload to ArcMap and organization in ArcCatalog. In ArcMap, following the procedures described by Beeco et al. (2014), we used four primary considerations to clean data influenced by technical error: 1) distance from former and next point; 2) physical feasibility (e.g., could humans actually be in that location); 3) acceptable level of error; and 4) pattern of GPS point trail (e.g., are the points consistent with human behavior). Once the data had been cleaned, we clipped all the data to appropriate analysis areas.

In ArcMap, researchers analyzed these data two ways: 1) kernel density analysis by seasonal and hourly temporal scales, and 2) statistical analysis of the characteristics of distribution based on the farthest campsite used during a visit. We used the Kernel Density tool in ArcMap because the Kernel density estimation focuses on locational data and does not need an associated attribute value. Kernel density displays have a smoothing effect that produces a clean display and is a non-parametric process in which each point is analyzed uniquely with no underlying distribution assumed (Mugdadi & Ahmad, 2004). To analyze each of the GPS tracks recorded at THRO, we clipped the data from each logger to produced shapefiles. Next, we exported the attribute tables for each zone from ArcMap to MS Excel to identify the average visit time, miles driven and hiked, percent of time at overlooks and away from the road, and spatial distributions.

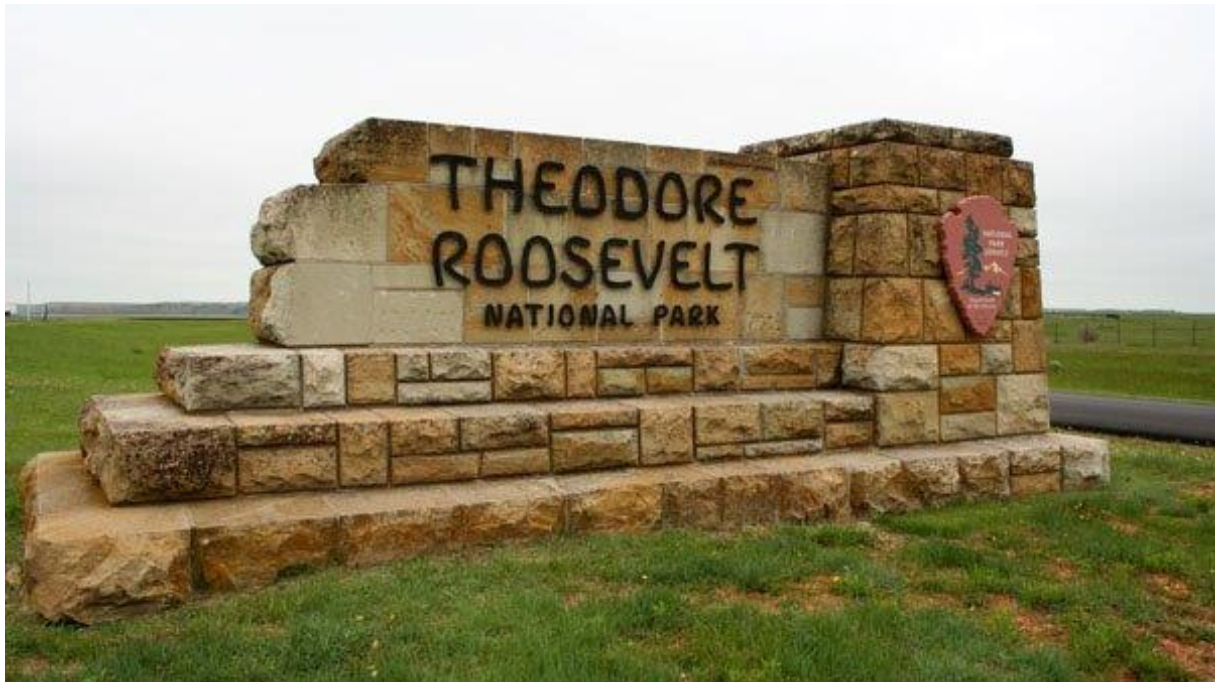
GPS Sampling Design and Locations

The researchers used a stratified random sampling procedure (stratified across time of day, day of the week, and season; Vaske, 2008) to intercept day and wilderness visitors. We used an entrance intercept to distribute the GPS data loggers to visitors entering THRO through the North and South Unit entrance stations. Wilderness users were intercepted when retrieving their wilderness permit at the North or South visitor centers. Both day and wilderness visitors were asked to carry a GPS data logger during their visit and return it before leaving THRO by placing it in a drop box on their way out of the park.

Trained research assistants approached each visitor, informed them about the study, and invited them to participate. When possible, one respondent from each traveling group (e.g., family) completed a questionnaire. If more than one person in a travel party was willing to participate, they were invited to take a different survey than their travel partner(s), as there were five different surveys to choose from during 2018 data collection. The percentage of visitors who agreed to complete the questionnaire was recorded. A trained survey administrator was available to provide assistance or clarification to respondents.

Additional Visitor Information Captured in Surveys

In all questionnaires, researchers also captured visitors' past use history (PUH; or past visits) at THRO, outdoor recreation activities engaged in at THRO, and general demographics using standard U.S. Census Bureau categories. General demographics included a) zip code of primary residency, b) age, c) race, d) income, and e) education level. In accordance with institutional and federal policy, researchers used question formats from the National Park Service's Pool of Known Questions (NPS, 2015) and the Office of Management and Budget approved the questionnaires (OMB# 1024-0224). Both Kansas State University and Clemson University approved the research methods after review from each Institutions' Internal Review Board (IRB).



RESULTS

Overall Results with Table and Figures

**Visitor
Demographics**

•

**Past Use
History**

•

**Visitor
Activities**

•

**Opinions of
Management
Actions**



Visitor Demographics

During sampling, 1,474 visitors completed a questionnaire, yielding a response rate of 64.5% and achieving a 2.55% confidence interval (C.I.) at the 95% confidence level. Across different questionnaires, 204 visitors completed the comparative and management survey (6.86% C.I. each), 251 completed the technology survey (6.18 C.I.), 387 completed the indicators survey (4.98 C.I.), and 428 completed the threshold survey (4.74 C.I.). During GPS logger distribution, 450 visitors elected to participate, yielding a 94% response rate and achieving a 4.62% C.I. The sampling stratification procedures, high response rate, and low confidence intervals suggest that the resulting sample is robust and appropriately represents the visiting population of THRO.

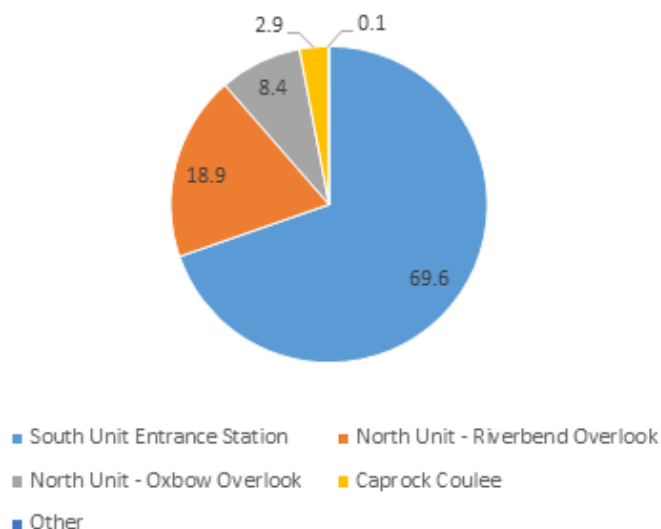


Figure 11. Overall distribution of questionnaires by survey location

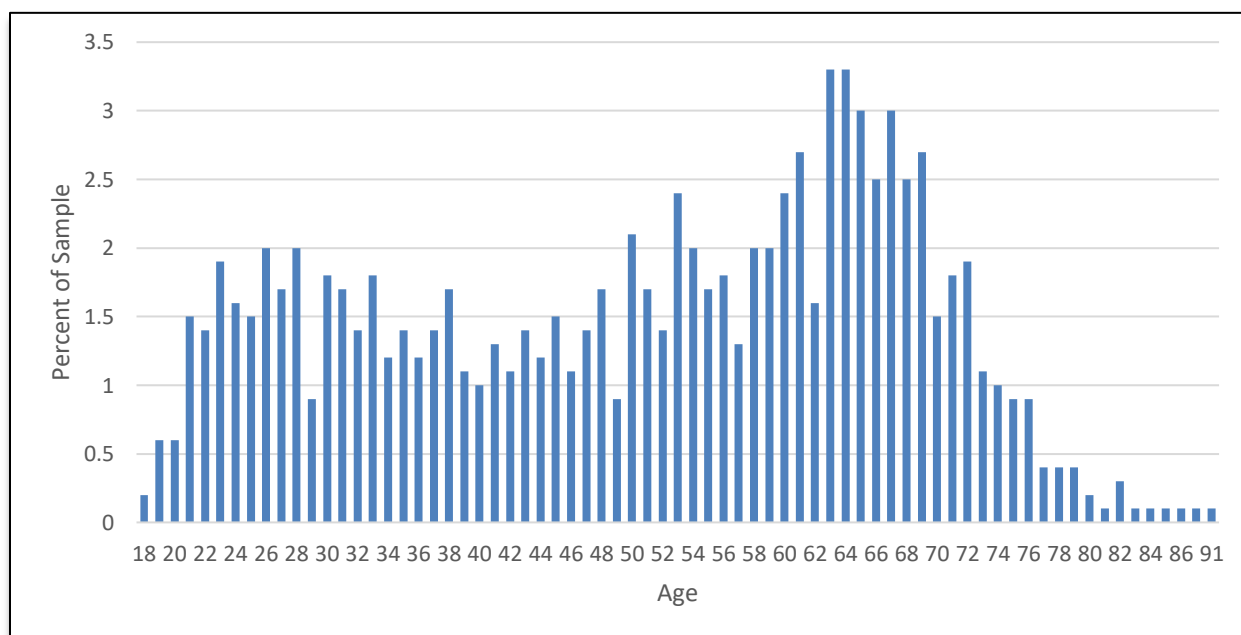


Figure 12. Overall age distribution among surveyed visitors across all survey locations ($M = 51$)

There were no statistically significant differences in demographics between visitors responding to questionnaires in the North and South Units ($p > 0.05$). Visitors to THRO reported an average age of 51 and gender orientation was evenly split with 52.1% respondents identifying as male, 47.7% identifying as female, and .2% declaring ‘other.’ The sample had varying educational levels, with most participants choosing the following three levels of obtained education: 14.9% completed some college, 27.5% received a four-year degree, and 30% reported receiving a graduate or professional degree. Visitors also had varying levels of annual household income, with most choosing the following three levels: 15.5% reported a household income of \$50,000 to \$74,999, 14.0% reported a household income of \$75,000 to \$99,999, 19.7% reported a household income of \$100,000 to \$149,999, and 17.4% declining to answer. Many respondents (84.2%) self-identified as white, 1.8% as Asian, and 1.4% as Hispanic or Latino/Latina, with the rest of participants self-identified as other races, except for 3.6% who declined to answer).

Table 1. *Visitor demographics across all surveys by survey location. Statistically significant differences marked with *($p < 0.05$).*

	Location	Mean (SD)	Min, Max	t-test
Age	N	51 (16.3)	18, 86	t (1379) = -1.049 $p = 0.294$
	S	50 (17)	16, 91	
Education	N	5.87 (1.58)		t (1404) = 0.853 $p = 0.394$
	S	5.79 (1.57)		
Income	N	5.41 (2.88)		t (1377) = -1.329 $p = 0.184$
	S	5.59 (2.32)		
Gender	N	1.49 (0.5)		t (1404) = -1.9 $p = 0.058$
	S	1.54 (0.5)		

Note: For Location: N = North Unit, S = South Unit. For Gender: 1 = Male, 2 = Female, 3 = Other.

For Education: 1 = less than high school, 2 = some high school, 3 = high school graduate, 4 = some college, 5 = 2 year degree, 6 = 4 year degree, 7 = graduate or professional degree, 8 = doctoral degree, 9 = do not wish to answer.

For Income: 1 = Less than \$24,999, 2 = \$25,000 to \$34,999, 3 = \$35,000 to \$49,999, 4 = \$50,000 to \$74,999, 5 = \$75,000 to \$99,999, 6 = \$100,000 to \$149,999, 7 = \$150,000 to \$199,999, 8 = \$200,000 or more, 9 = do not wish

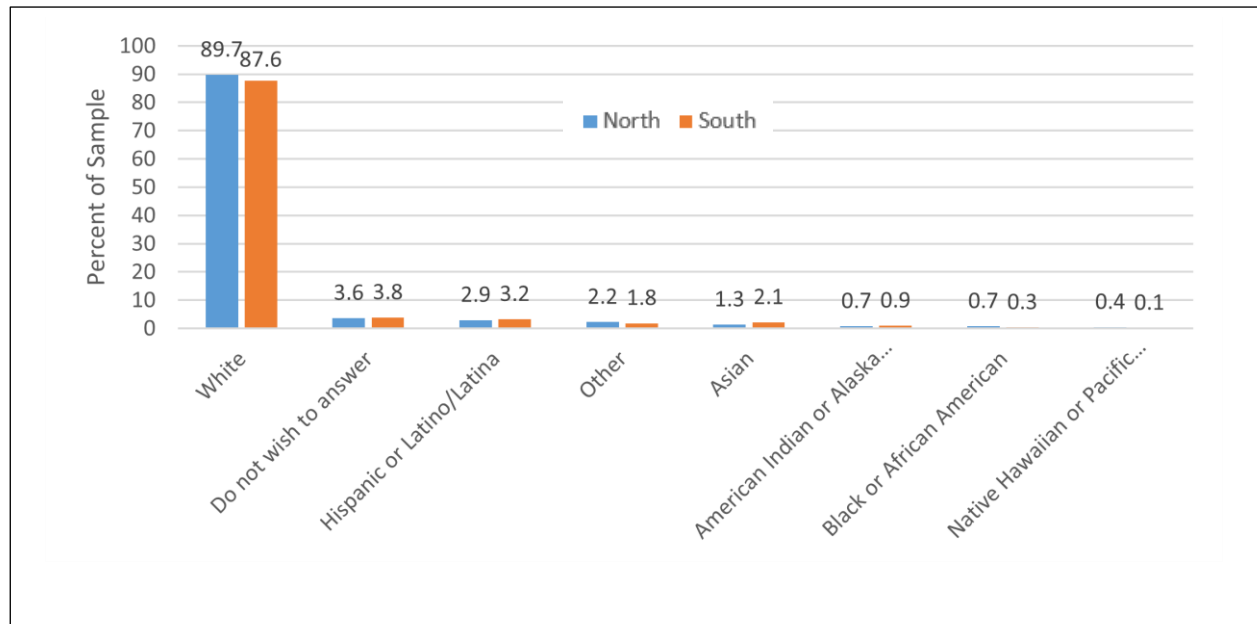


Figure 13. Visitor race distribution across all surveys, by survey location.

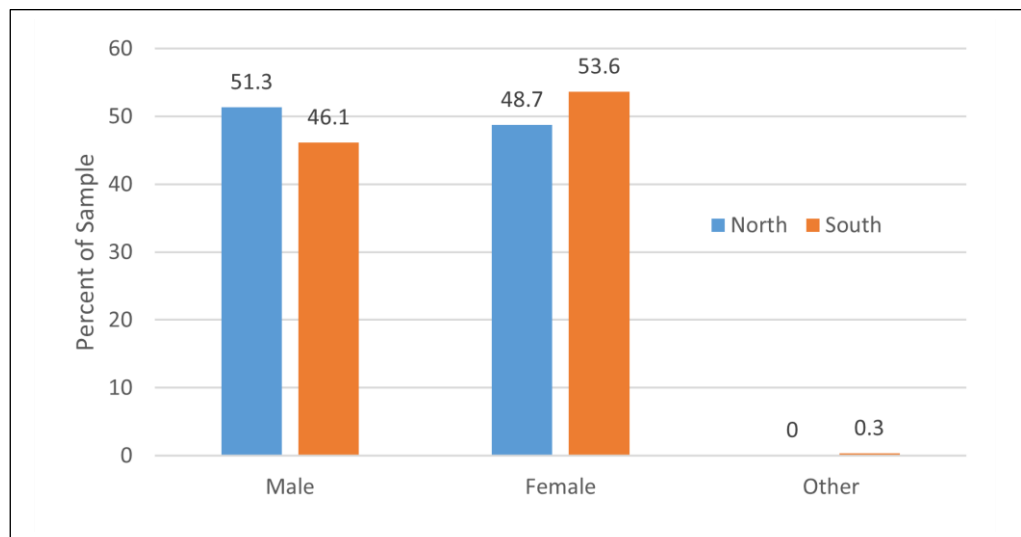


Figure 14. Distribution of visitors' gender across all surveys, by survey location.

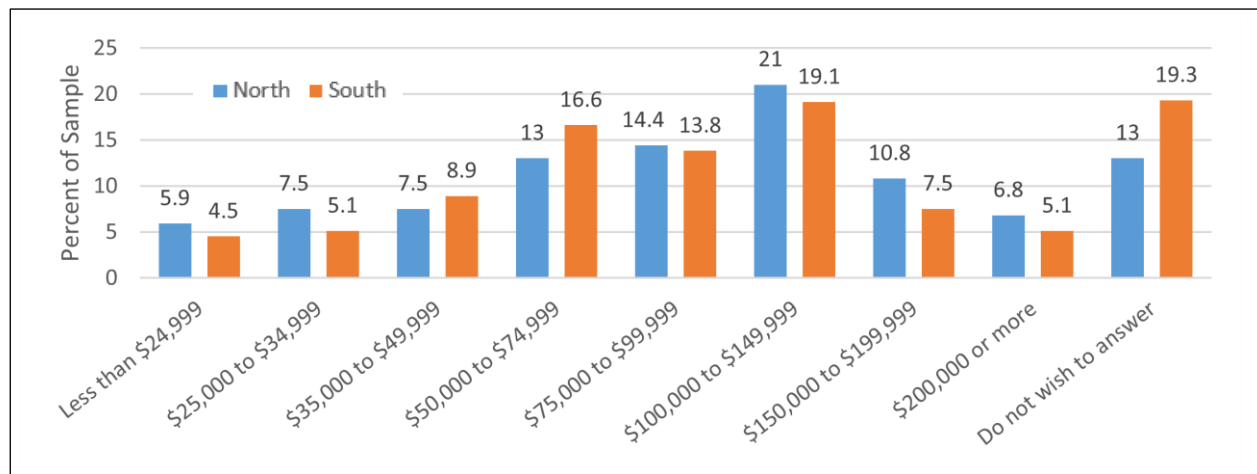


Figure 15. Distribution of visitors' annual household income across all surveys, by survey location.

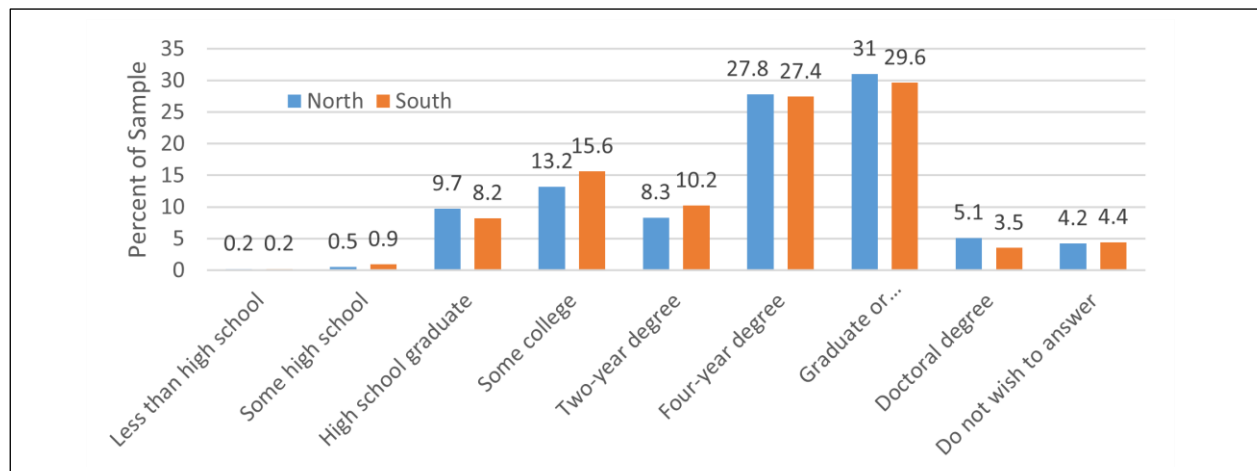


Figure 16. Distribution of visitors' visitor's education levels across all surveys, by survey location.

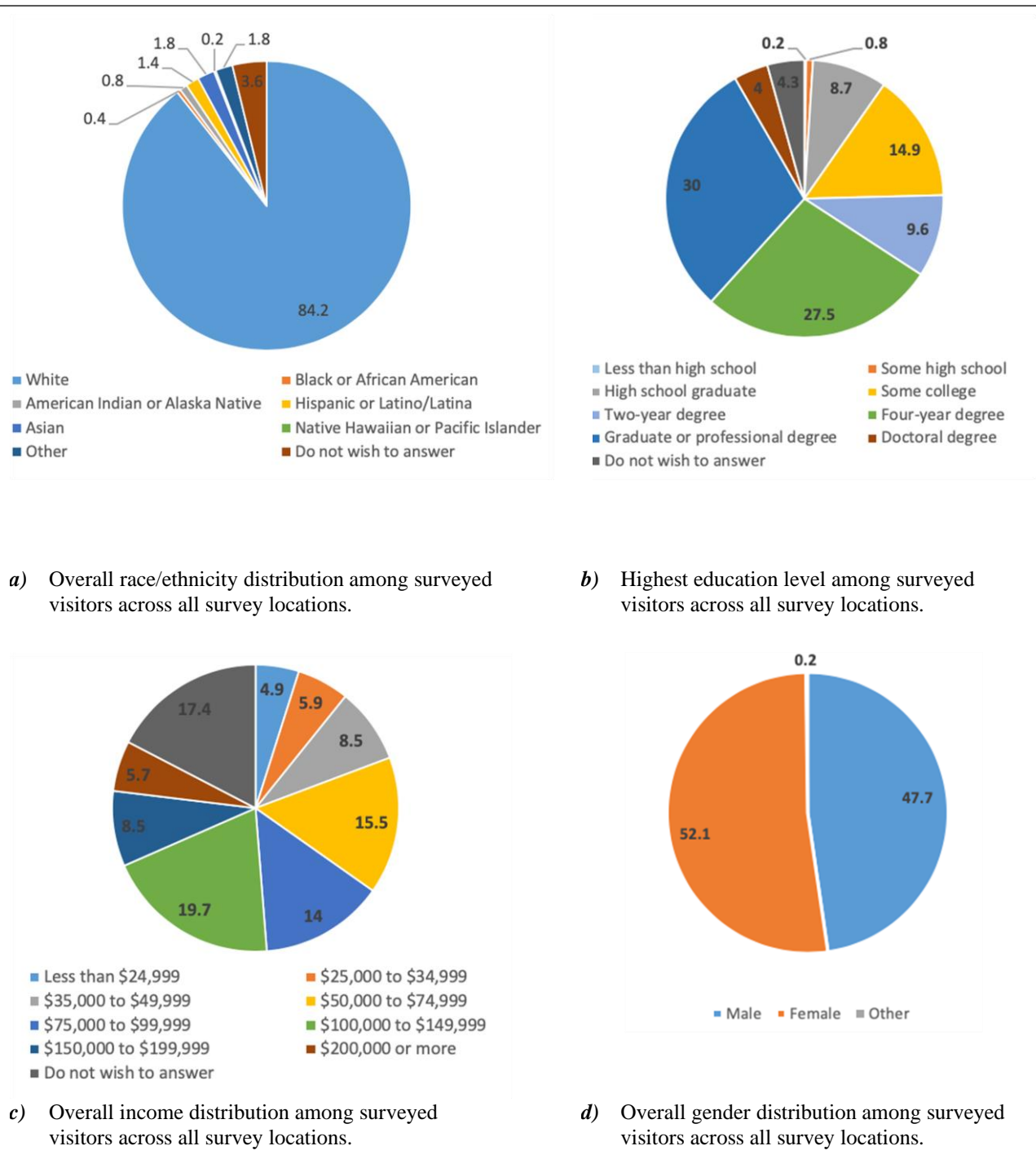


Figure 17. Summary of overall survey respondent demographics at THRO in 2017 and 2018.

Zip Code Data

While most visitors appear to reside in the Upper Midwest—especially from North Dakota, South Dakota, Minnesota, and Wisconsin—THRO draws people from all over the United States.

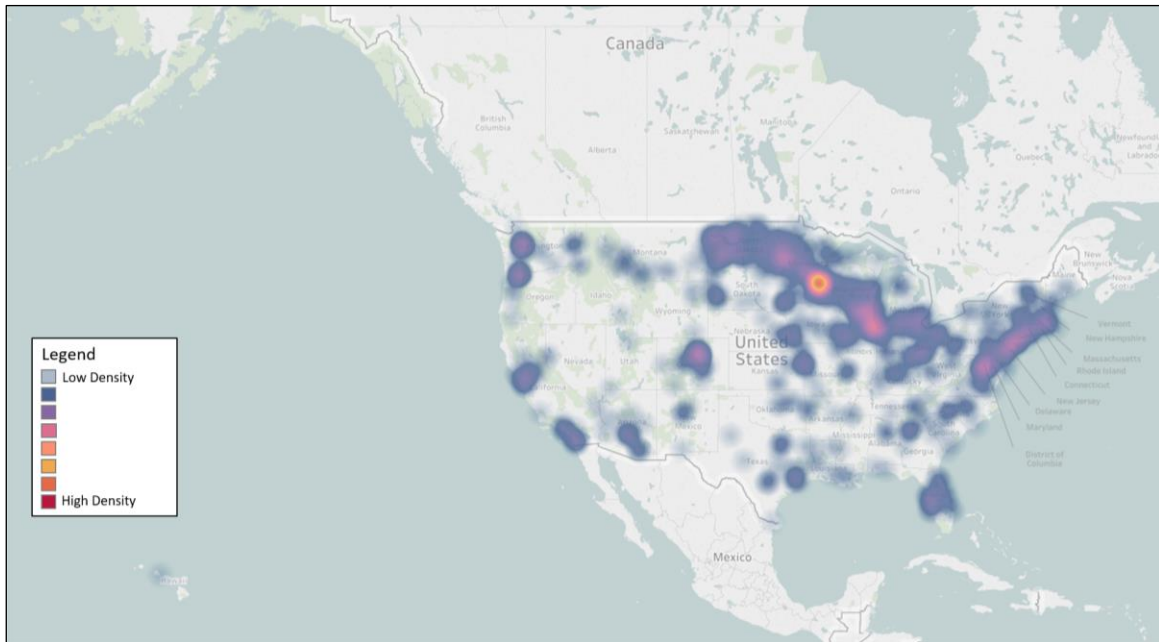


Figure 18. Map of United States zip codes reported by visitors who completed a questionnaire.

State	Count	Percent	State	Count	Percent
ND	396	26.9	GA	10	0.68
MN	200	13.59	LA	10	0.68
WI	77	5.23	KY	9	0.61
IL	50	3.4	NE	9	0.61
MI	49	3.33	VT	8	0.54
CA	37	2.51	MD	7	0.48
TX	34	2.31	SC	7	0.48
CO	33	2.24	TN	7	0.48
NY	32	2.17	ME	6	0.41
OH	31	2.11	NM	6	0.41
WA	30	2.04	AR	5	0.34
FL	29	1.97	OK	5	0.34
SD	28	1.9	AL	4	0.27
VA	28	1.9	AK	4	0.27
MT	26	1.77	DE	4	0.27
PA	26	1.77	ID	4	0.27
IN	20	1.36	NV	4	0.27
AZ	17	1.15	RI	4	0.27
IA	16	1.09	NH	3	0.2
KS	16	1.09	UT	3	0.2
CT	15	1.02	WV	3	0.2
MA	14	0.95	WY	3	0.2
MO	14	0.95	DC	2	0.14
OR	14	0.95	HI	1	0.07
NJ	13	0.88	MS	0	0
NC	12	0.82	Blank	87	5.91
			TOTAL	1472	100

Figure 19. Proportion of visitors from each state

Visitors' Access to Park Information

The top four avenues through which visitors obtain information about THRO are family and friends, the NPS website, and travel books/guides, as well as deriving experience-based knowledge from prior visits to the park.

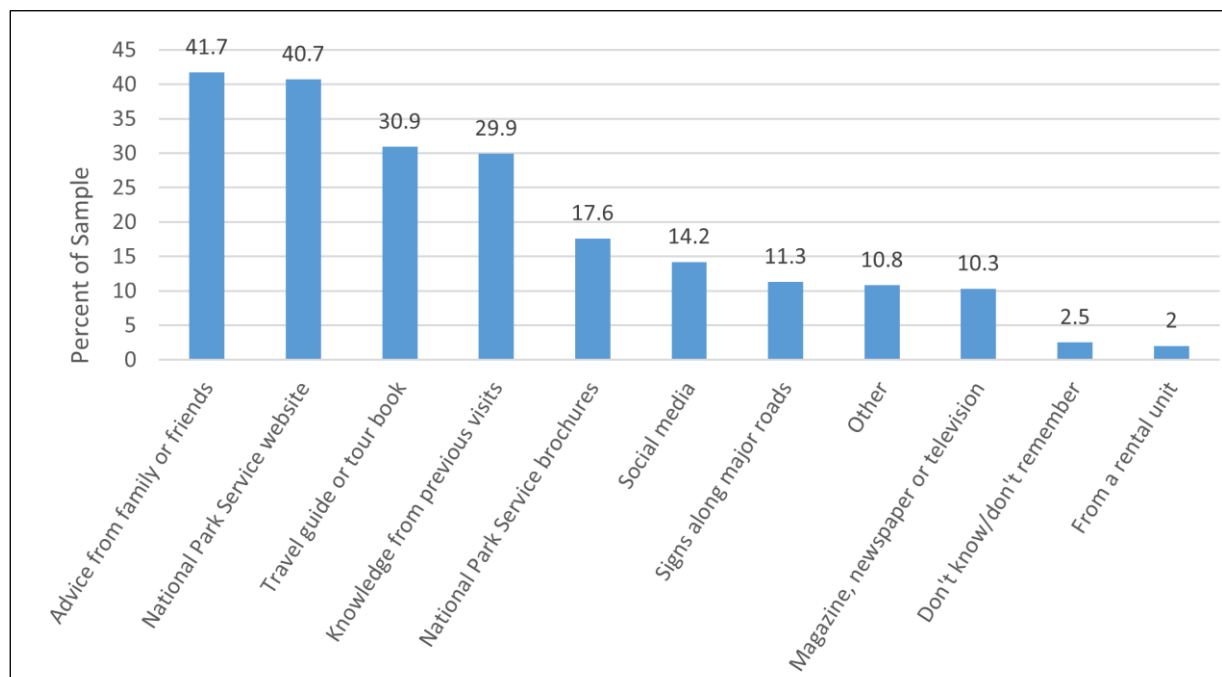


Figure 20. How visitors obtain park information prior to their visit, across all survey locations (Management Survey, Question 2). Note: 'Other' ways listed included internet searches, rest stop employees, PBS documentary, and from the area.

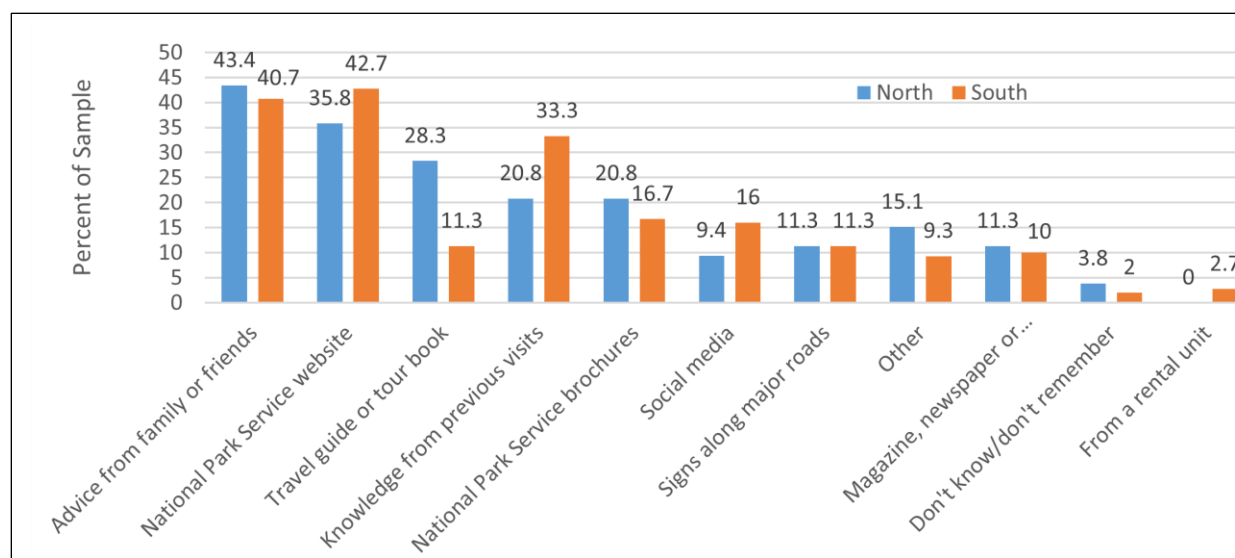


Figure 21. How visitors obtain park information prior to their visit, by survey location (Management Survey, Question 2). Note: 'Other' ways listed included internet searches, rest stop employees, PBS documentary, and from the area.

Changes in Access to Park Information 2001-2017 (Comparative Survey, Appendix B)⁵

The 2017 administration of the 2001 Comparative Survey revealed that the source of visitors' information about THRO has changed a bit over the years. The most substantial changes in the percentages of visitors sharing where they got their park information were regarding family/friend advice (and 8% increase), the NPS website (18% increase), and through knowledge of previous visits (a 21% decrease). Also, worth mentioning the fact that social media was not culturally ubiquitous in 2001, and yet only 14% of 2017 visitors reported getting their THRO information in that manner. The increase in the usage of the NPS website suggests that the improvement of its content may have changed substantially in quantity and quality and has become much more user-friendly. It is also possible that peoples' general propensity for seeing any sort of information online has increased.

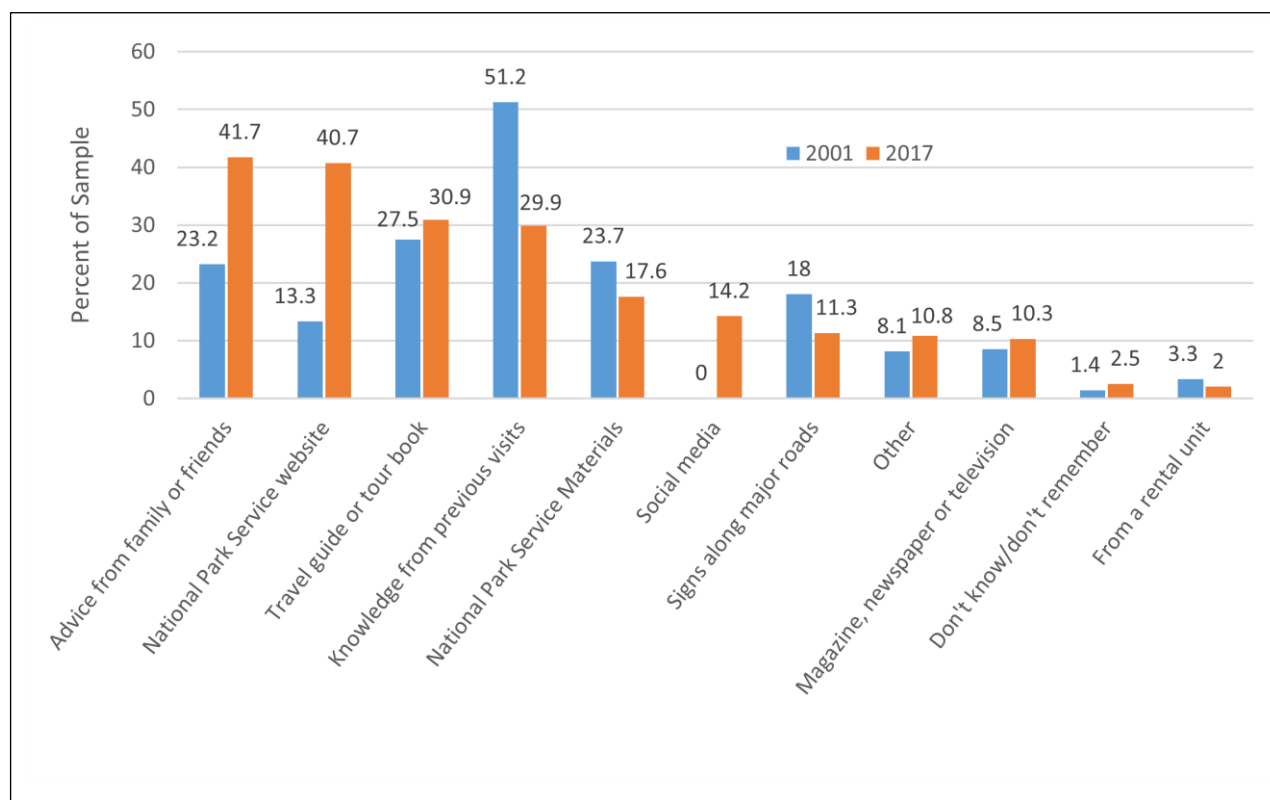


Figure 22. Changes in sources of park info before a visit from 2001 to 2017, across all survey locations.

Past Use History

North and South Unit visitors completed questionnaire sections regarding their history of visitation to THRO. Several elements go into understanding this past use history (PUH). Specifically, visitors indicated a) how many hours they have spent in the park in the last day, b) how many days in the last month they have used THRO for outdoor recreation activities; c) how many days in the last year they have used THRO for outdoor recreation activities; d) how many years (total) they have used THRO for outdoor recreation activities, and e) how many more hours they plan to spend in the park that day.

Most visitors reported spending 2-4 hours at THRO in the day prior to taking a survey. When asked about their visitation in the last month, 60% of visitors reported being at THRO for one day, and 24% for two days. In response to being asked about time spent at THRO in the last year, 52% of visitors reported spending only one day at the park, and 23% reported visiting for two days. The majority (57%) of survey respondents were first time visitors to THRO; these visitors reported that ‘including today’ they had only visited THRO for one year. When asked about their intention to spend more time at the park, 35% of visitors suggested that they would only be at THRO for one more hour, followed by 17% intending to spend two additional hours in the park. Fewer than 5% of respondents suggested that they would spend another full day at THRO.

Table 2. *Summary of frequency and duration of visits across all survey locations.*

	Min, Max	Mean (SD)
Including today, how many days in the last month (30 days) have you visited the park?	1, 23	1.81 (2.03) days
If you visited for only one day, how many hours did you spend in the park?	1, 24	5.08 (5.58) hours
If your trip is not complete, how many more hours do you plan to visit today?	1, 24	4.59 (6.43) hours
Including today, how many days in the last year (12 months) have you visited the park?	1, 38	2.56 (3.94) days
Including today, how many years (total) have you visited the park?	1, 55	5.9 (11.04) years

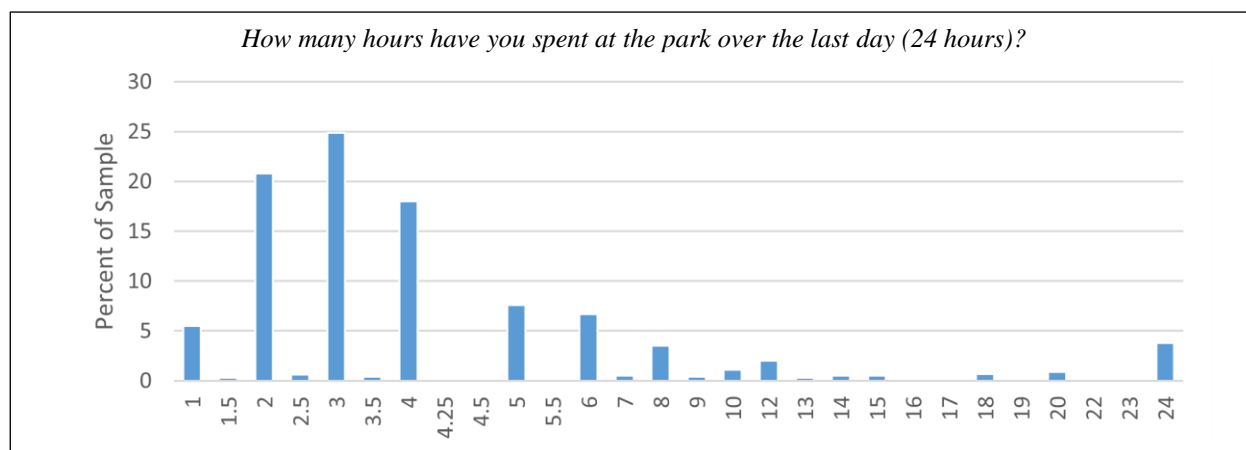


Figure 23. Past use history showing hours spent at THRO over the last day across all survey locations.

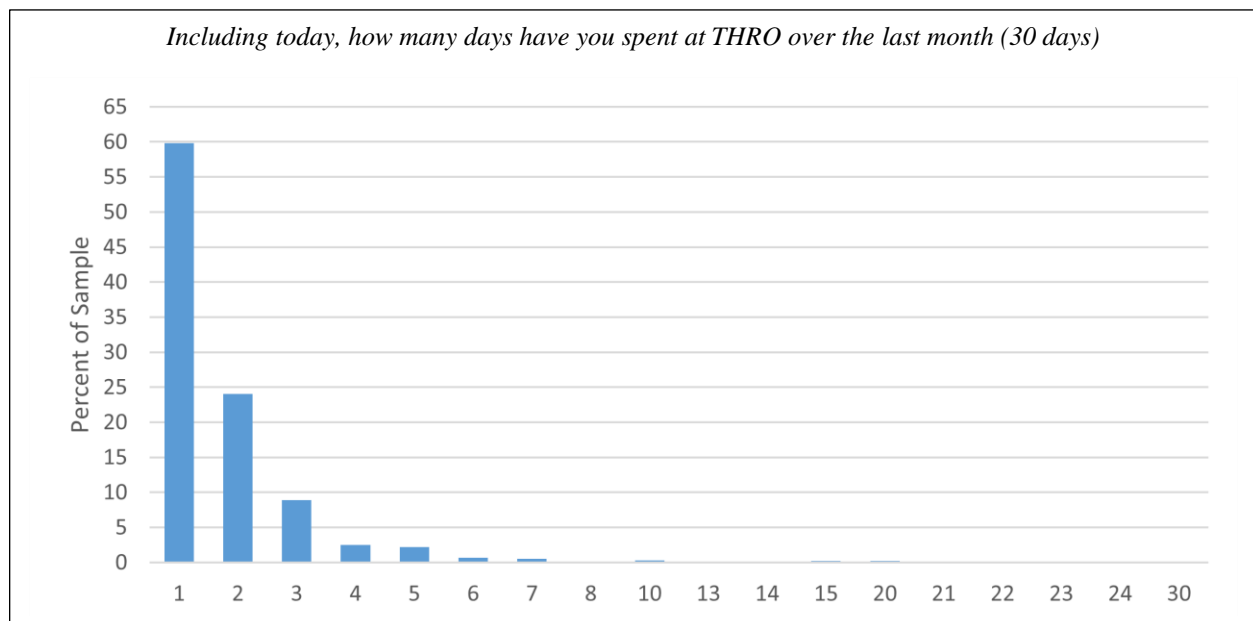


Figure 24. Past use history showing number of days at THRO in the last month across all survey locations.

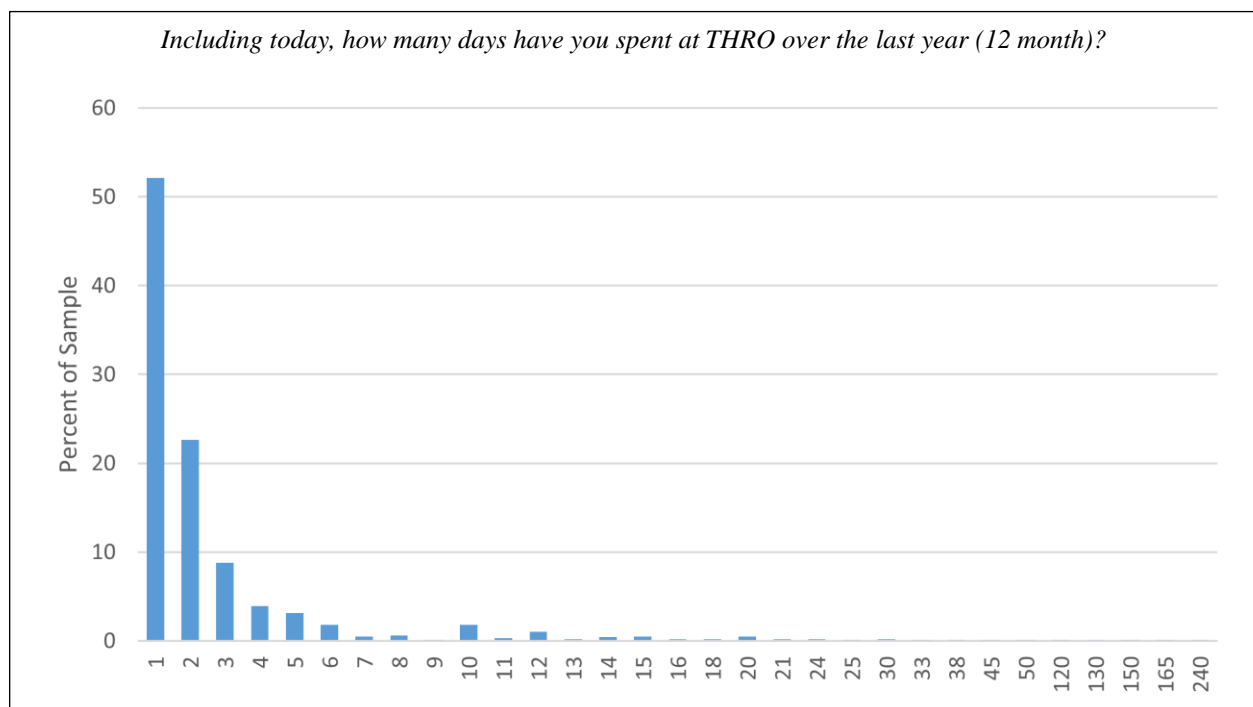


Figure 25. Past use history for the last year (12 months) across all survey locations.

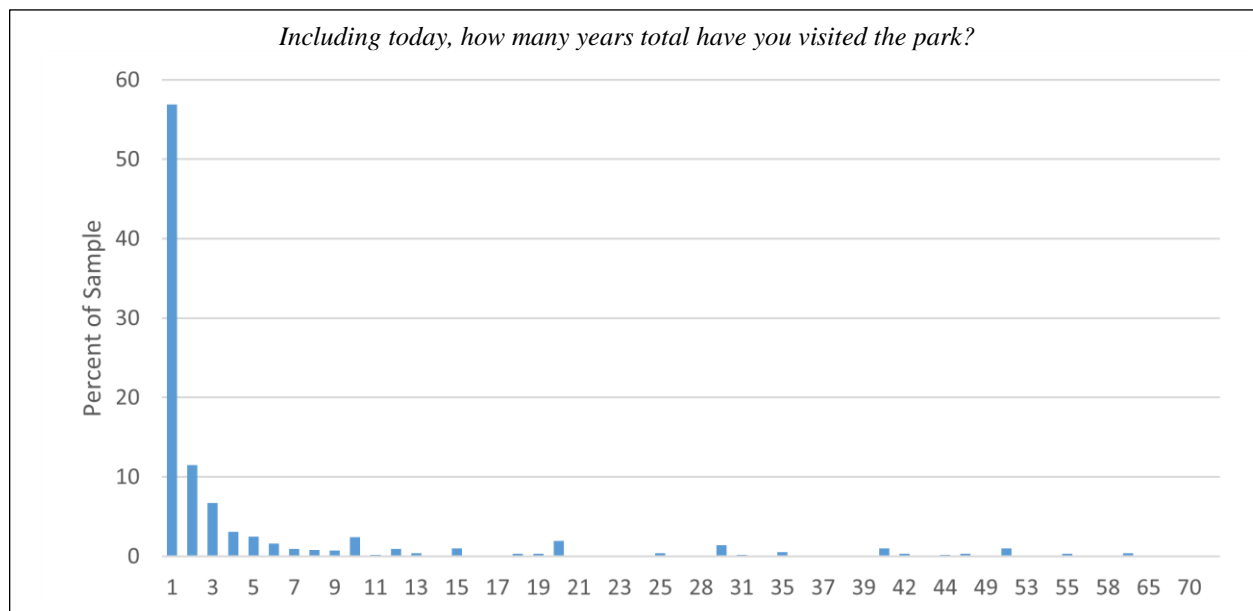


Figure 26. Past use history for the total number of years visiting THRO across all survey locations.

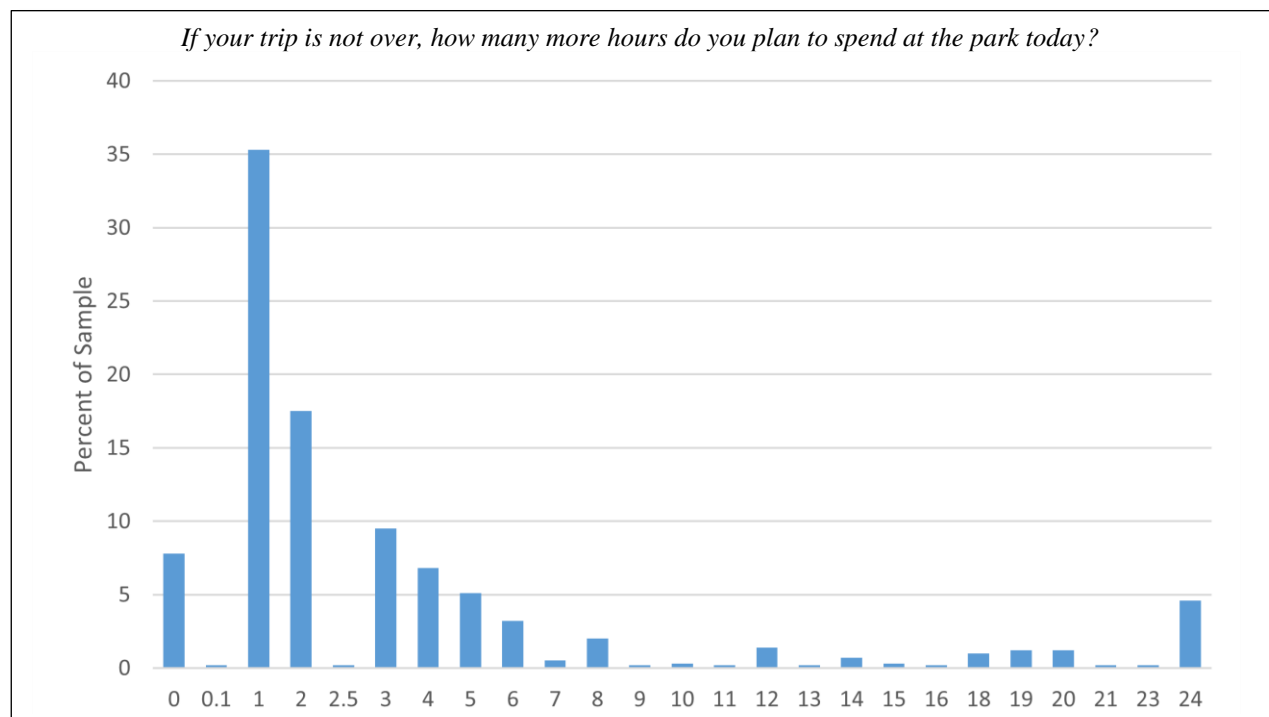


Figure 27. Total number of hours left in that day's visit to THRO across all survey locations.

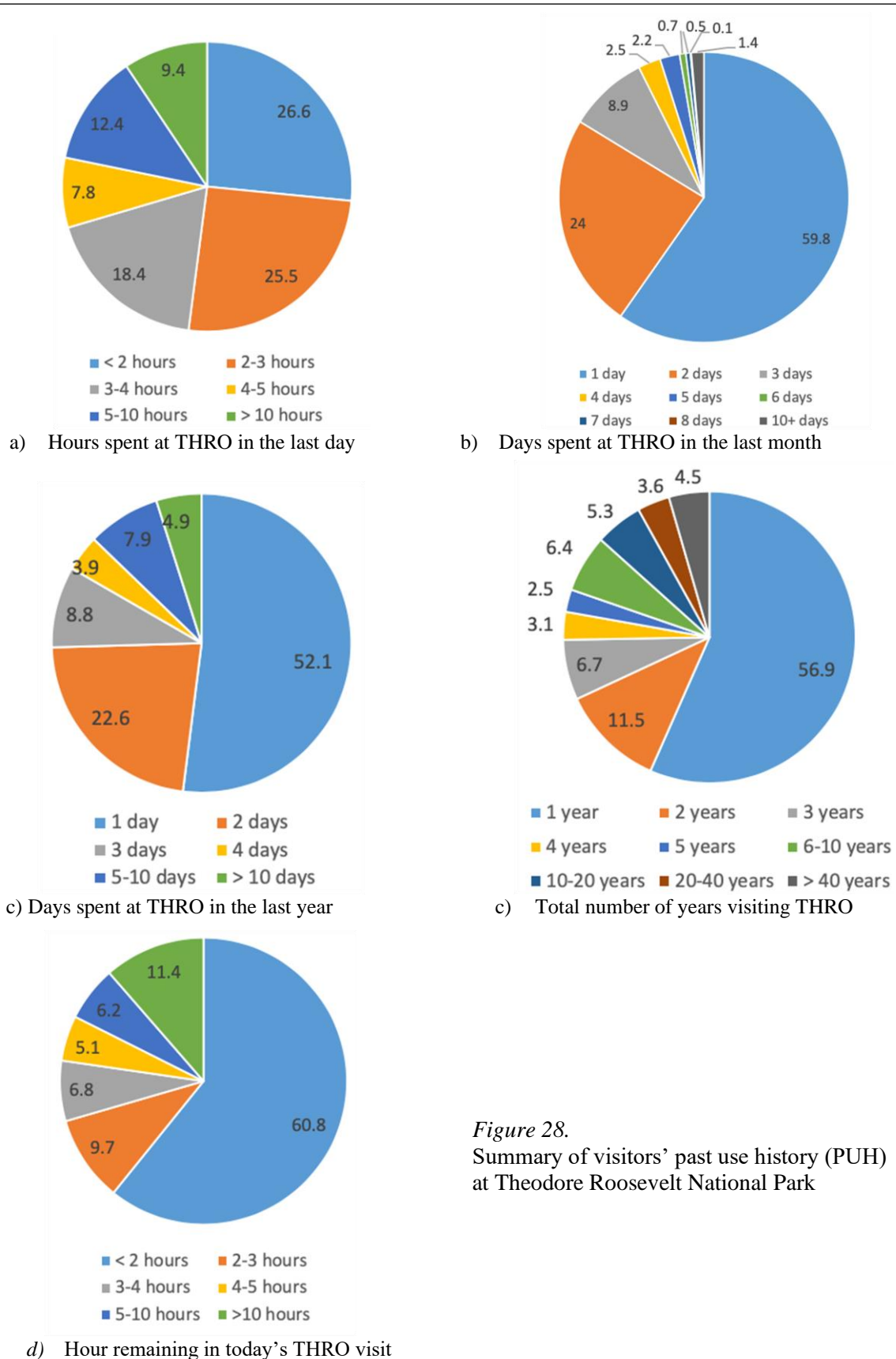


Figure 28.
Summary of visitors' past use history (PUH)
at Theodore Roosevelt National Park

Visitor Activities and Experience

Half of all visitors to THRO reported that their visit to the park was part of a larger trip, while 18% of visitors identified both THRO and Medora as their primary destination. For 17% of visitors, THRO was their primary destination, compared to only 6% intending to expressly visit Medora. These percentages varied somewhat in comparing responses from North and South Unit visitors

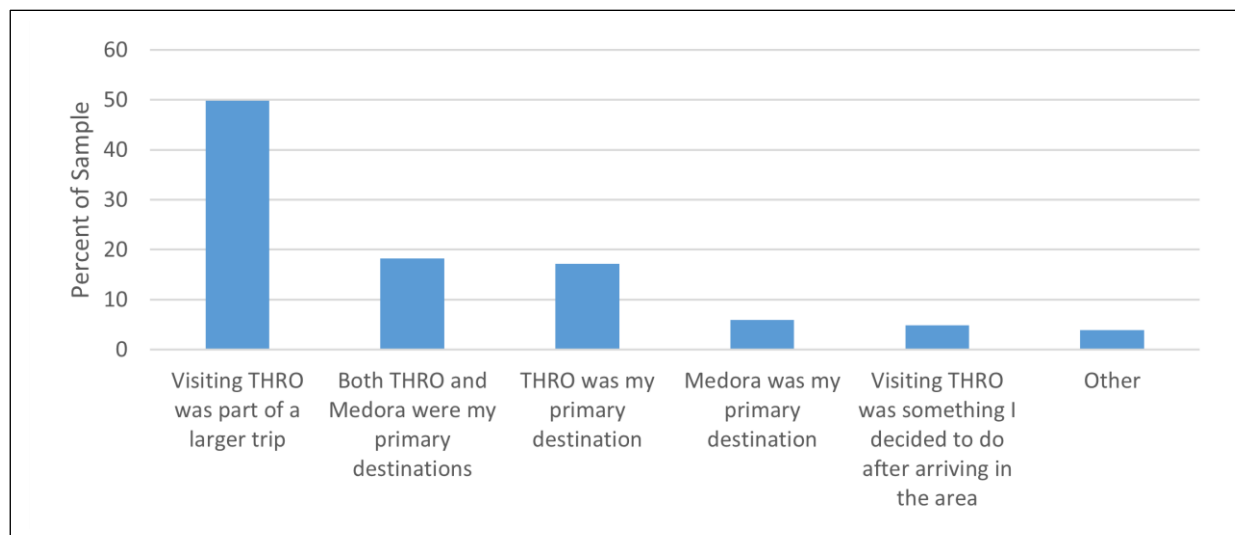


Figure 29. Nature of visitors' trips to Theodore Roosevelt National Park, across all survey locations (Management Survey, Question 3). Note: 'Other' trip natures listed included: live nearby, the badlands marathon, and family friends.

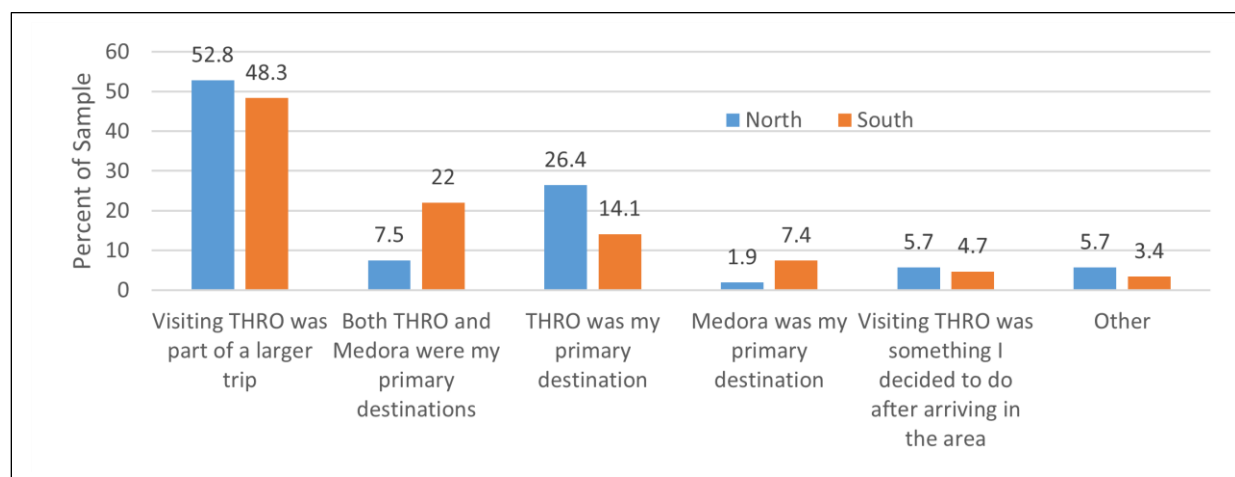


Figure 30. Nature of visitors' trips to Theodore Roosevelt National Park, by survey location. (Management Survey, Question 3). Note: 'Other' trip natures listed included: live nearby, the badlands marathon, and family friends.

Visitors nonetheless come to THRO to pursue various activities. In Question 3 of the Comparative Survey, visitors selected activities in which they participated both inside and outside the park. The primary activity inside the park was wildlife viewing (86% of visitors), followed by 71% reporting engaging in wildflower or general plant viewing, and thirdly—65% reported hiking on designated

trails. Outside the park, the majority of visitors identified attending the Medora Musical (33%), visiting local museums (18%), and visiting the Chateau de Mores State Historic Site (13%) as their primary activities in the area (see Tables 1 and 2 below). Fewer than one-quarter of respondents (22%) reported camping at THRO during their stay.

Table 3. *Percent of visitors participating in activities inside THRO*

Activity	% of sample
Wildlife Viewing	86.3
Wildflower and Plant Viewing	70.6
Hiking on Trails	65.2
Viewing Museum Exhibits in Visitor Center	51
Shopping in Visitor Center	47.1
Camping	20.1
Picnicking	19.1
Hiking Off-Trail	11.8
Participating in Ranger-Led Programs	10.8
Other (<i>see note</i>)	7.8
Bicycling	3.9
Horseback Riding	1.5

Note: ‘Other’ activities included: birding, geocaching, photography, geological history, auto touring, and enjoying the horses (Comparative Survey, Question 2).

Table 4. *Percent of visitors participating in activities outside THRO*

Activity	% of sample
Attended the Medora musical	32.8
Visited other museums in the area	18.1
Visited the Chateau de Mores SHS	12.7
Other (<i>see note</i>)	11.3
Toured the Little Missouri National Grasslands	8.8
Visited Fort Union Trading Post NHS	6.4
Visited Knife River Indian Villages NHS	6.4
Traveled on the Maah Daah Hey Trail by foot	5.9
Played golf	5.4
Visited the Dakota Dinosaur Museum	5.4
Visited Fort Buford NHS	3.4
Traveled on the Maah Daah Hey Trail by horseback	1.5
Traveled on the Maah Daah Hey Trail by bicycle	1
Mountain biked on other trails	0.5

Note: ‘Other’ activities included: visiting other units of the park, family, backcountry hiking, guided trail rides, pitchfork fondue, meat packing ruins, concerts, Bear Paw Battlefield, shopping and camping in Medora, and wildlife viewing (Comparative Survey Question 3).

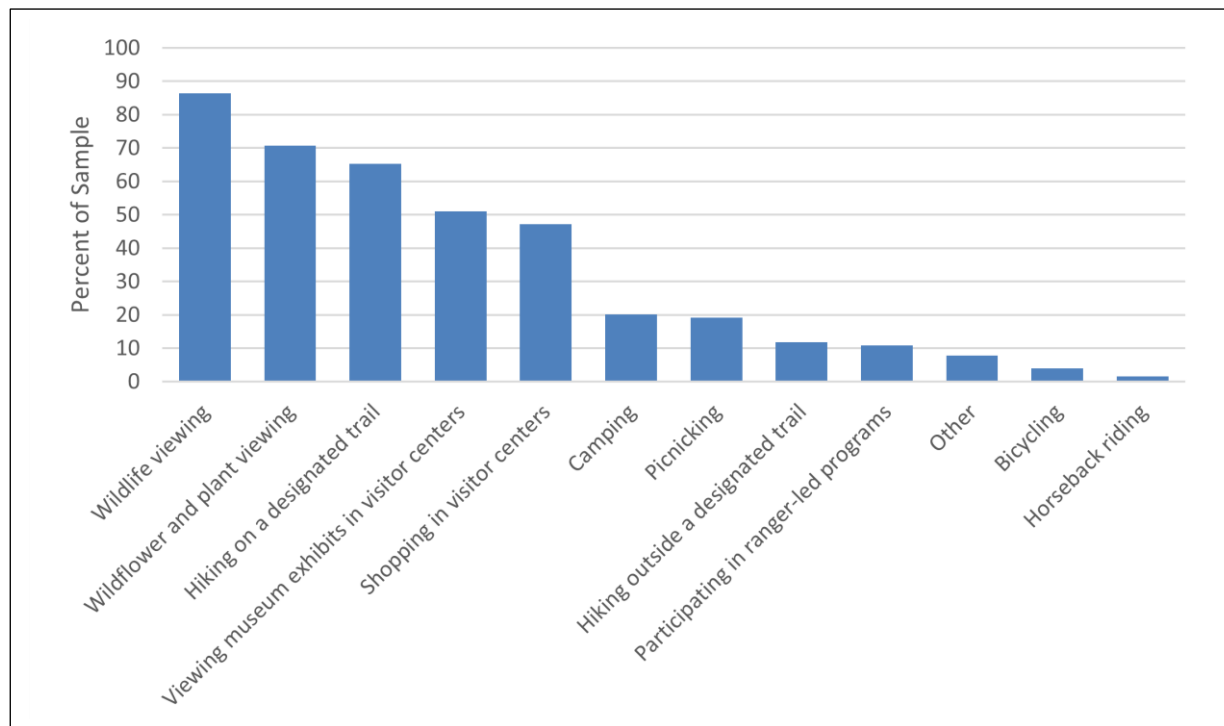


Figure 31. Percent of visitor participation in park activities across all locations (Comparative Survey, Question 2).

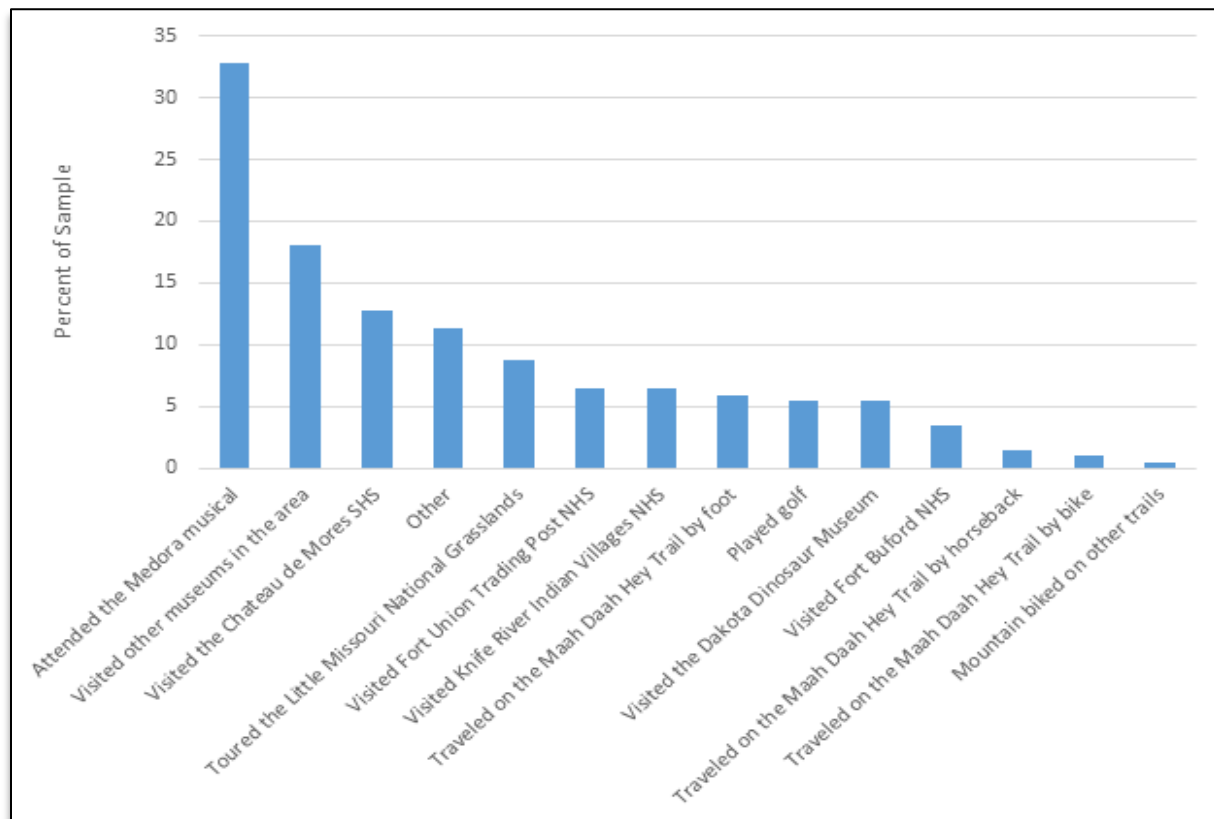


Figure 32. Percent of visitor participation in area activities across all locations (Comparative Survey, Question 2).

Table 5. Visitor participation in park activities by survey location (Comparative Survey, Question 3)

	North or South Unit	% of Sample
Wildlife viewing	N S	86.7 86.2
Wildflower and plant viewing	N S	73.3 69.8
Hiking on a designated trail	N S	75.6 62.3
Viewing museum exhibits in visitor centers	N S	42.2 53.5
Shopping in visitor centers	N S	42.2 48.4
Camping	N S	24.4 18.9
Picnicking	N S	20 18.9
Hiking outside a designated trail	N S	11.1 11.9
Participating in ranger-led programs	N S	11.1 10.7
Other	N S	2.2 9.4
Bicycling	N S	8.9 2.5
Horseback riding	N S	2.2 1.3

Note 1: ‘Other’ activities listed include: North unit of the park, family, backcountry hiking, Painted Canyon, guided trail rides, pitch fork fondue, meat packing ruins, concerts, Bear Paw Battlefield, shopping and camping in Medora, and wildlife viewing.

Table 6. *Visitor participation in area activities by survey location (Comparative Survey, Question 4)*

	North or South Unit	% of Sample
Attended the Medora Musical	N S	15.6 37.7
Visited other museums in the area	N S	15.6 18.9
Visited the Chateau de Mores SHS	N S	15.6 11.9
Visited Fort Buford NHS	N S	11.1 13
Other	N S	8.9 11.9
Toured the Little Missouri National Grasslands	N S	11.1 8.2
Visited Fort Union Trading Post NHS	N S	8.9 5.7
Visited Knife River Indian Villages NHS	N S	4.4 6.9
Played golf	N S	4.4 5.7
Visited the Dakota Dinosaur Museum	N S	4.4 5.7
Traveled on the Maah Daah Hey Trail by foot	N S	2.2 6.9
Traveled on the Maah Daah Hey Trail by horseback	N S	0 1.9
Traveled on the Maah Daah Hey Trail by bike	N S	0 1.3
Mountain biked on other trails	N S	0 0.6

Note 2: ‘Other’ activities listed include: North unit of the park, family, backcountry hiking, Painted Canyon, guided trail rides, pitch fork fondue, meat packing ruins, concerts, Bear Paw Battlefield, shopping and camping in Medora, and wildlife viewing.

Changes in Visitor Activities 2001-2017 (Comparative Survey, Appendix B)⁶

Visitors' activities inside and outside THRO have changed somewhat since 2001. For area activities, the most substantial of these changes were in regard to touring the Little Missouri Grasslands (an 8% decrease) and visiting Fort Union Trading Post National Historic Site (a 5% decrease) and Fort Buford State Historic Site (a 5% decrease). In regard to park activities, the most substantial changes relate to participation in plant/wildflower viewing (15% increase), trail hiking (22% increase), VC museum exhibits (25% decrease), VC shopping (14% decrease), and ranger-led activities (a 10% increase).

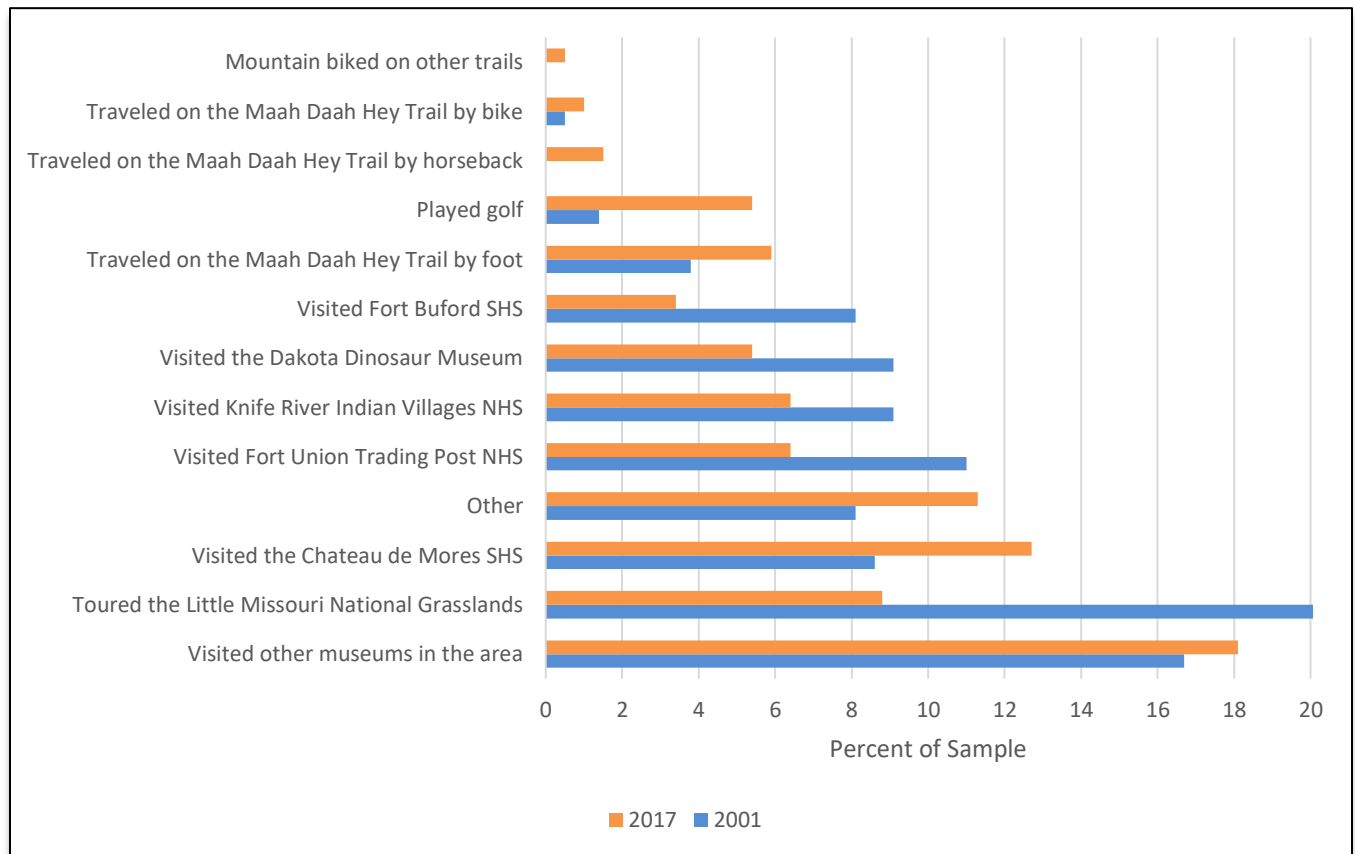


Figure 33. Changes in participation in area activities from 2001 to 2017, across all survey locations.

⁶ These comparisons should be interpreted with caution because 2001 and 2017 differed in sampling and completion methods, including sampling/intercept months, sampling locations, questionnaire completion medium, and question completion timeframe.

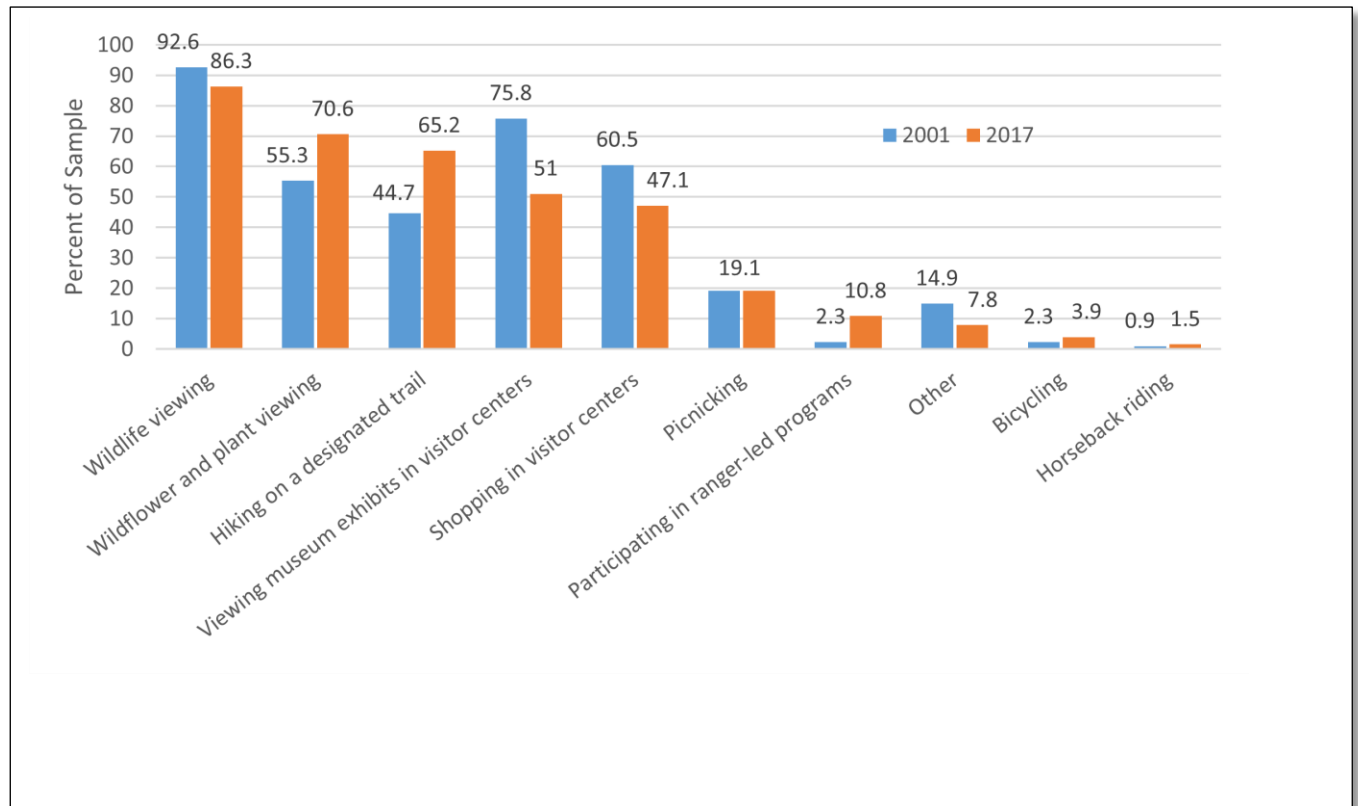


Figure 34. Changes in participation in park activities from 2001 to 2017 across all survey locations.

Visitor Experience and Perceptions of Importance

The activities that visitors reported enjoying the most at THRO were taking in the scenery (40% of respondents), the wildlife (38% of respondents), and hiking (9% of respondents). The things that visitors enjoyed the least included the lack of rest rooms/stops (28%), the parks roads and pullouts (10%), and the weather (9%).

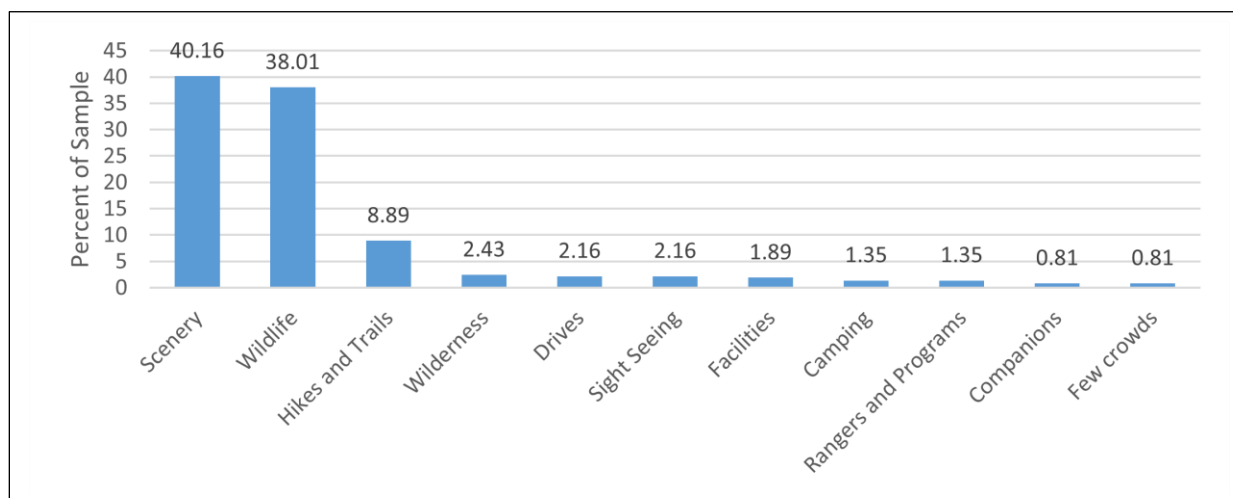


Figure 35. What visitors enjoyed most about their experience, across all survey locations. (Indicators Survey, Question 2).

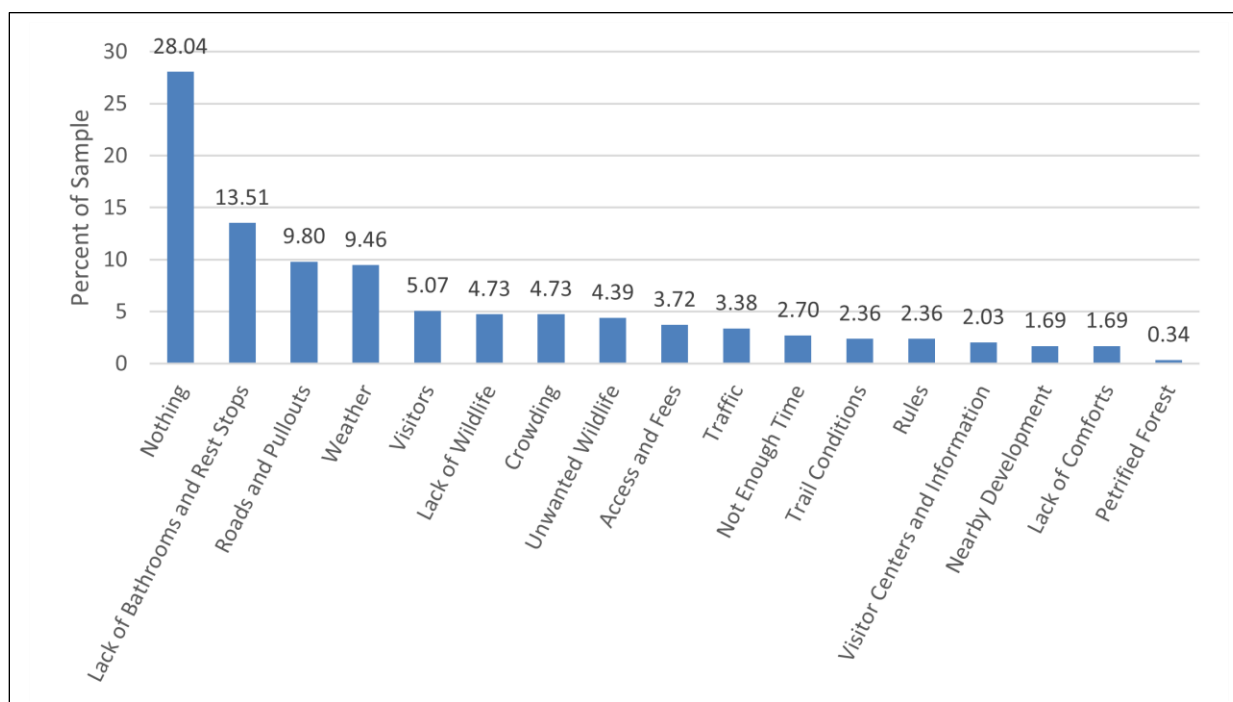


Figure 36. What visitors enjoyed least about their experience, across all survey locations. (Indicators Survey, Question 3).

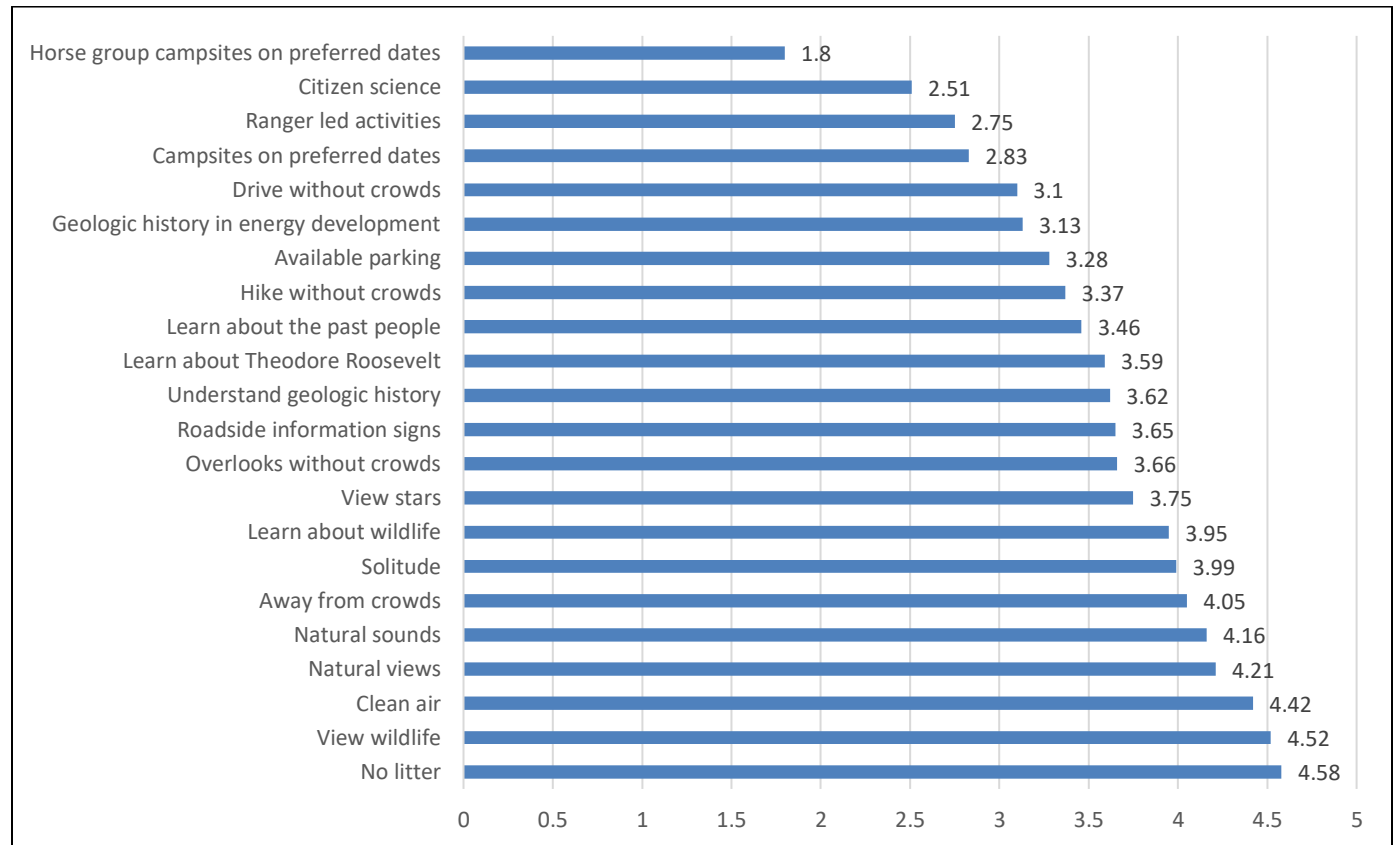


Figure 37. What visitors find most important during their visit, across all survey locations. (Indicators Survey, Question 6). Note: 1 = Not very important, 2 = Slightly Important, 3 = Moderately important, 4 = Very important, 5 = Extremely important

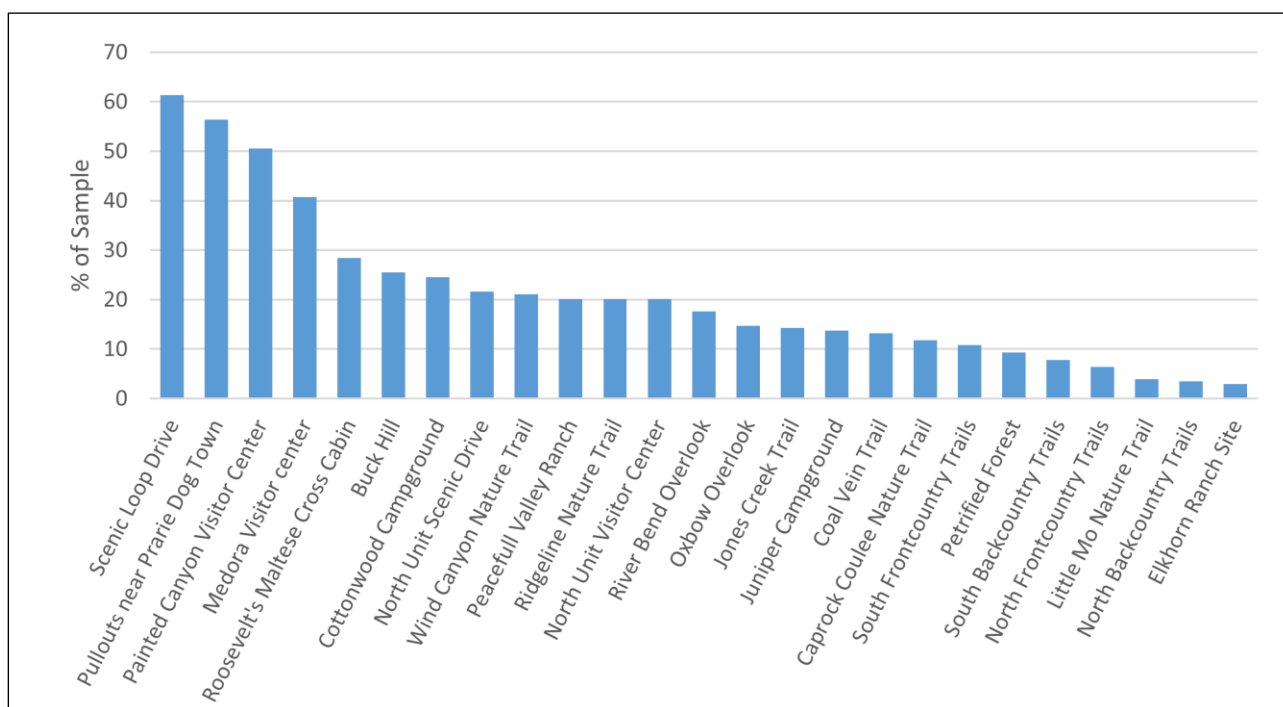


Figure 38. Visitor usage of park sites across all survey locations (Comparative Survey, Question 6a).

The four park sites used most by visitors were Scenic Loop Drive, prairie dog town pullouts, and the visitor centers at Painted Canyon and the South Unit. Overall, change in site usage since 2001 is mostly regarding relatively large decreases in visitation to the visitor centers, the North Unit scenic drive, Oxbow Overlook, and the Juniper campground.

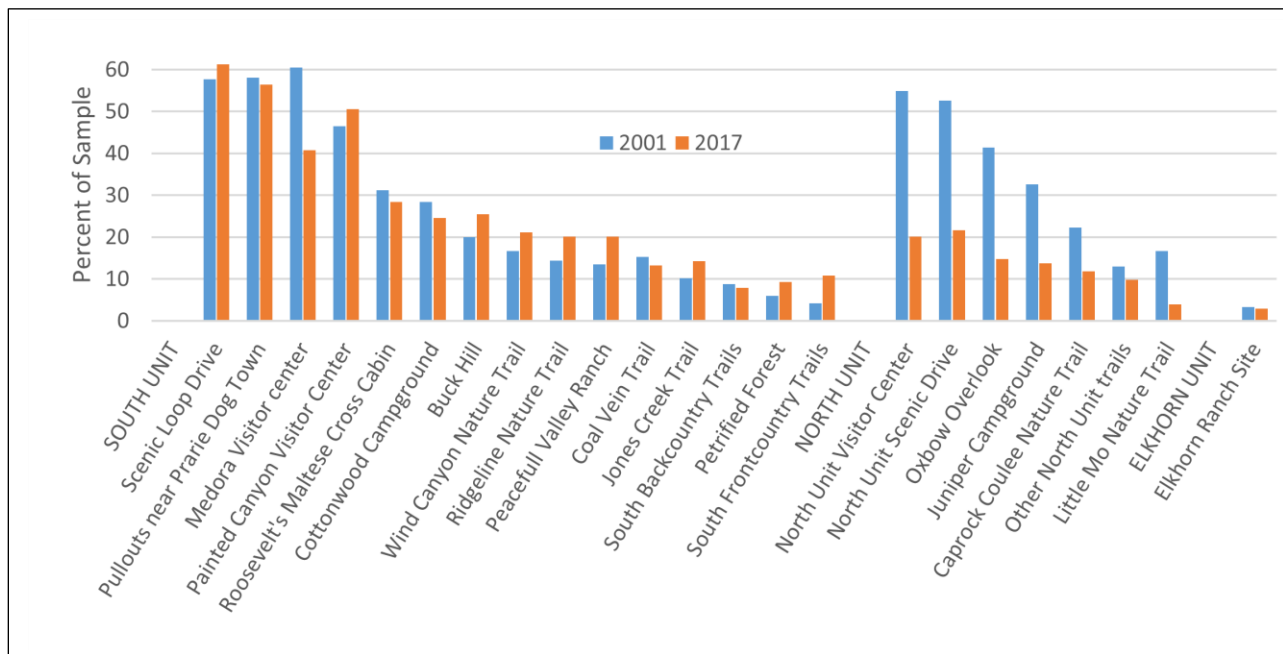


Figure 39. Changes in visitation to various park sites from 2001 to 2017, across all survey locations.

Consistent with what they report as enjoying most, visitors also identify THRO's clean environment (a low amount of litter, air and noise pollution, human structures), viewing and learning about wildlife, and being away from crowds as *very important* or *extremely important* for the quality of their visits. These attributes of the park also rank in visitors' top five most important experiential factors across park units. Scenic overlooks and interpretive signage with content about the park, geology, and Theodore Roosevelt also rank highly with visitors.

Table 7: What visitors find most important during their visit, across all survey locations. Listed as percent of sample (Indicators Survey, Question 6). Note: Highest percentages are highlighted.

	1) Not important at all	2) Slightly important	3) Moderately important	4) Very important	5) Extremely important	Mean (SD)
Experience a place free of litter	0.6	0.8	4.5	28	66	4.58 (.67)
Opportunity to view wildlife	0.3	0.6	6.7	31.3	61.2	4.52 (.67)
Experience clean air free of haze and pollutants	1.1	2.5	7.3	31.6	57.3	4.42 (.82)
Enjoy natural views without human structures within sight	2.5	3.9	10.2	36.6	46.8	4.21 (.95)
Experience natural sounds without human produced noise	1.4	3.4	13.4	41.7	40.1	4.16 (.88)
Be away from crowds of people	1.1	4	19.6	39.8	35.5	4.05 (.9)
Experience solitude	1.7	3.4	21.8	40.1	33.1	3.99 (.92)
Learn about wildlife	1.4	3.4	22.1	44.8	28.3	3.95 (.88)
View stars without seeing human lights	5.6	8.5	17.8	41	27.1	3.75 (1.11)
Enjoy overlooks without lots of other people	2.2	9.8	30.6	34	23.3	3.66 (1.01)
Read roadside signs containing information about the area	2	9.5	27.2	44	17.4	3.65 (.94)
Understand the geologic history of the area	2	7.6	35.1	36.8	18.5	3.62 (.94)
Learn about Theodore Roosevelt	2	7.3	35.6	40.1	15.1	3.59 (.9)
Learn about the past people that lived in and visited the area	3.9	11	35.1	35.1	14.9	3.46 (1)
Hike on trails without lots of other people	6.5	11.2	35.7	32.3	14.3	3.37 (1.07)
Find parking spaces without waiting	7.6	12.9	33.1	36.2	10.1	3.28 (1.06)
Learn about the importance of geologic history to current energy development in North Dakota	8.1	20	36.1	23.1	12.8	3.13 (1.12)
Drive without seeing lots of other cars	6.7	21.3	36.8	25.8	9.3	3.1 (1.05)
Reserve/find campsites without adjusting preferred dates	23.1	12.9	33.4	19.4	11.1	2.83 (1.29)
Participate in ranger led activities	15.4	24.9	34.2	20.2	5.3	2.75 (1.11)
Participate in citizen science projects	23.5	26.1	30.9	15.3	4.2	2.51 (1.13)
Reserve/find horse group campsites without adjusting preferred dates	61.9	12	14.7	6.7	4.7	1.8 (1.19)

Table 8. *Most important factors—Top 5 and # 1—for visitor experience, across all survey locations. Listed as percent of sample. (Indicators Survey, Question 7)*

	In Visitors' Top Five	Most Important
Opportunity to view wildlife	71.8	39.4
Enjoy natural views without human structures within sight	60.7	22
View stars without seeing human lights	28.2	5.6
Be away from crowds of people	33.1	5.1
Experience natural sounds without human produced noise	33.1	3.4
Experience clean air free of haze and pollutants	32.6	3.4
Hike on trails without lots of other people	16.8	3.1
Learn about Theodore Roosevelt	25.8	3.1
Experience solitude	19.1	3.1
Enjoy overlooks without lots of other people	24	2
Understand the geologic history of the area	13.7	2
Experience a place free of litter	24.3	2
Learn about wildlife	17.3	1.7
Participate in ranger led activities	5.2	1.1
Read roadside signs containing information about the area	14.2	0.8
Learn about the past people that lived in and visited the area	13.2	0.6
Learn about the importance of geologic history to energy development in ND	3.4	0.6
Reserve/find campsites without adjusting preferred dates	3.1	0.3
Drive without seeing lots of other cars	10.6	0.3
Participate in citizen science projects	0.8	0.3
Reserve/find horse group campsites without adjusting preferred dates	2.3	0.3
Find parking spaces without waiting	4.1	0

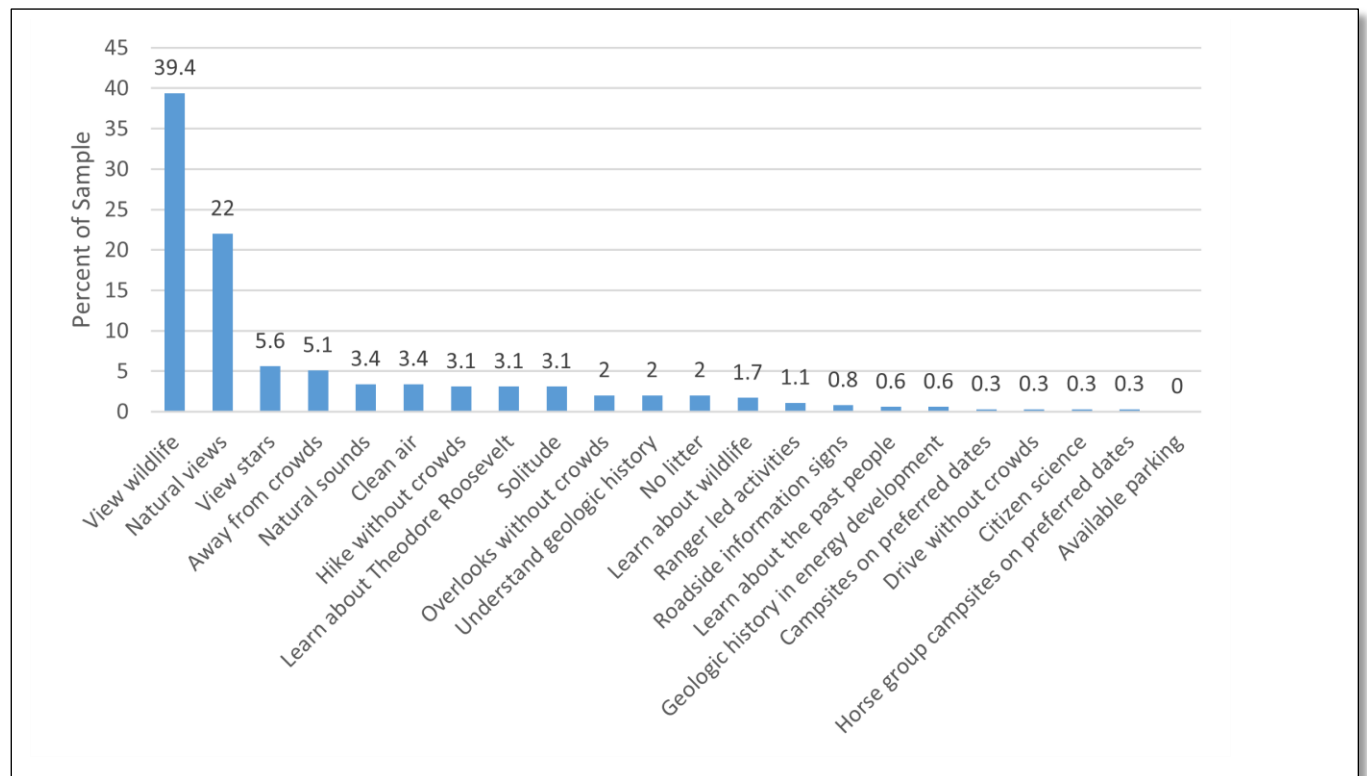


Figure 40: Visitors reported that views of wildlife, nature, and stars were the most important factors for visitor experience across all survey locations. (Indicators Survey, Question 7)

Table 9. *What visitors find most important during their visit, by survey location. Listed as percent of sample; Highest percentages are highlighted. Statistically significant differences marked with *($p < 0.05$). (Indicator Survey, Question 6).*

	North or South Unit	1) Not important at all	2) Slightly important	3) Moderately important	4) Very important	5) Extremely important	Mean (SD)	t-test
Experience a place free of litter	N	0	2	6	22	70	4.6 (0.7)	t(351) = 0.337
	S	0.8	0.4	4	30.4	64.4	4.57 (0.67)	$p = 0.736$
Opportunity to view wildlife	N	0	0	7.4	31.9	60.6	4.53 (0.63)	t(343) = 0.123
	S	0.4	0.8	6.4	31.1	61.4	4.52 (0.69)	$p = 0.902$
Experience clean air free of haze and pollutants	N	0	3	8	26	63	4.49 (0.77)	t(352) = 1.07
	S	1.6	2.4	7.1	33.9	55.1	4.39 (0.84)	$p = 0.285$
Enjoy natural views without human structures within sight	N	2	4	5	39.6	49.5	4.31 (0.89)	t(361) = 1.146
	S	2.7	3.8	12.2	35.5	45.8	4.18 (0.97)	$p = 0.253$
Experience natural sounds without human produced noise	N	2	0	16.3	37.8	43.9	4.21 (0.87)	t(355) = 0.759
	S	1.2	4.6	12.4	43.2	38.6	4.14 (0.89)	$p = 0.444$
Be away from crowds of people	N	2.1	4.2	18.9	34.7	40	4.06 (0.98)	t(350) = 0.244
	S	0.8	3.9	19.8	41.6	33.9	4.04 (0.87)	$p = 0.823$
Experience solitude	N	0	5	14.9	43.6	36.6	4.12 (0.84)	t(352) = 1.62
	S	2.4	2.8	24.5	38.7	31.6	3.94 (0.94)	$p = 0.106$
Learn about wildlife	N	1	4	19.1	45.5	30.3	4 (0.87)	t(351) = 0.644
	S	1.6	3.1	23.2	44.5	27.6	3.93 (0.88)	$p = 0.52$
View stars without seeing human lights	N	4	3	13	49	31	4 (0.96)	*t(215.48) = 2.84
	S	6.3	10.6	19.7	37.8	25.6	3.66 (1.15)	$p = 0.005$
Enjoy overlooks without lots of other people	N	0	6	32	32	30	3.86 (0.92)	*t(354) = 2.311
	S	3.1	11.3	30.1	34.8	20.7	3.59 (1.04)	$p = 0.021$
Read roadside signs containing information about the area	N	3	9.9	26.7	42.6	17.8	3.62 (0.99)	t(355) = -0.364
	S	1.6	9.4	27.3	44.5	17.2	3.66 (0.92)	$p = 0.716$
Understand the geologic history of the area	N	1	5	39	35	20	3.68 (0.89)	t(354) = 0.71
	S	2.3	8.6	33.6	37.5	18	3.6 (0.96)	$p = 0.478$
Learn about Theodore Roosevelt	N	5.9	6.9	31.7	35.6	19.8	3.56 (1.07)	t(148.98) = -0.31
	S	0.4	7.4	37.1	41.8	13.3	3.6 (0.83)	$p = 0.754$
Learn about the past people that lived in and visited the area	N	6.1	14.3	26.5	34.7	18.4	3.45 (1.13)	t(151.83) = -0.12
	S	3.1	9.7	38.4	35.3	13.6	3.47 (0.95)	$p = 0.9$
Hike on trails without lots of other people	N	2	6.1	31.3	41.4	19.2	3.7 (0.92)	*t(354) = 3.68
	S	8.2	13.2	37.4	28.8	12.5	3.24 (1.09)	$p = 2.69 \times 10^{-4}$
Find parking spaces without waiting	N	6.2	14.4	33	35.1	11.3	3.31 (1.05)	t(354) = 0.978
	S	8.1	12.4	33.2	36.7	9.7	3.27 (1.06)	$p = 0.781$
Learn about the importance of geologic history to current energy development in North Dakota	N	6.1	23.5	32.7	19.4	18.4	3.2 (1.18)	t(358) = 0.82
	S	8.8	18.7	37.4	24.4	10.7	3.1 (1.1)	$p = 0.413$
Drive without seeing lots of other cars	N	5	19	34	28	14	3.27 (1.08)	*t(354) = 1.964
	S	7.4	22.3	37.9	25	7.4	3.03 (1.03)	$p = 0.05$
Reserve/find campsites without adjusting preferred dates	N	20.8	18.8	39.6	14.6	6.3	2.67 (1.15)	t(348) = -1.418
	S	24	10.6	31.1	21.3	13	2.89 (1.34)	$p = 0.157$
Participate in ranger led activities	N	7.1	27.3	35.4	22.2	8.1	2.97 (1.05)	*t(355) = 2.334
	S	18.6	24	33.7	19.4	4.3	2.67 (1.12)	$p = 0.02$
Participate in citizen science projects	N	14.3	27.6	36.7	16.3	5.1	2.7 (1.07)	*t(351) = 2.033
	S	27.1	25.5	28.6	14.9	3.9	2.43 (1.15)	$p = 0.043$
Reserve/find horse group campsites without adjusting preferred dates	N	58.1	14	18.3	5.4	4.3	1.84 (1.16)	t(339) = 0.333
	S	63.3	11.3	13.3	7.3	4.8	1.79 (1.21)	$p = 0.739$

Visitor Perceptions of Crowding & Detractions (Comparative Survey, Appendix B)⁷

Overall, visitors to THRO reported very low levels of crowding at all queried THRO locations. In response to question 6b of the Comparative Questionnaire, the visitor reports for each area ranged on a nine-point scale from ‘not crowded at all’ (1) to ‘extremely crowded (9), with a low mean report of 1.11 on backcountry trails) to a high mean report of 2.11 at Cottonwood Campground.

These reported averages—and the other scores contained in Table 10—have relatively low and stable standard deviations indicating that the visiting population largely agrees in their assessment of ‘not crowded’ and ‘barely crowded’ during their THRO experience. Overall, these findings suggest that crowding is not a current issue at the park according to visitors, and when crowding does happen visitors perceive it occurring at a ‘low to moderately low’ level. Further details about perceptions of crowding at specific locations in THRO will be addressed in the sections on *people at one time* (PAOT) and *vehicles at one time* (VAOT) for specific areas of concern.

Slightly more crowding reported by 2017 visitors compared to 2001, specifically at the Medora Visitor Center, North Unit Visitor Center, pullouts by prairie dog towns, Cottonwood Campground, Juniper Campground, Caprock Coulee Nature Trail, the South Scenic Park Road, and Buck Hill.

Question 5 of the Comparative Questionnaire asked visitors about additional issues that may detract from their overall experience. While most queried issues were either not experienced by visitors or did not detract at all from their experiences at THRO, several issues were identified by a small percentage of visitors as serious or very serious detractions. These included a lack of restrooms, poor rules/regulations clarity, too little directional signage, seeing development outside THRO, and the potential for conflict with other visitors on park roads. These are identified in Tables 11 and 12.

The tables in this section provide data from the 2017 distribution of the Comparative Survey in alternating green-and-white rows. In the following section (*Change in Perceptions of Detractions to Experience*) are tables with alternating brown-and-white rows that compare visitors’ response patterns from the 2001 administration of the Comparative Survey with new data gathered in 2017.

⁷ These comparisons should be interpreted with caution because 2001 and 2017 differed in sampling and completion methods, including sampling/intercept months, sampling locations, questionnaire completion medium, and question completion timeframe.

Table 10. *Visitor opinions on crowding at various locations throughout the park, across all survey locations. Listed as percent of sample. (Comparative Survey, Question 6b)*

	1) Not Crowded	2) Barely Crowded	3) Slightly Crowded	4) Moderately Crowded	5) Crowded	6) Very Crowded	7) Extremely Crowded	Mean (SD)
SOUTH UNIT								
Painted Canyon Visitor Center	50	23.1	16.7	10.2	0	0	0	1.87 (1.033)
Medora Visitor Center	51.1	16.7	22.2	8.9	0	0	1.1	1.94 (1.248)
Roosevelt's Maltese Cross Cabin	70	16.7	10	3.3	0	0	0	1.38 (.761)
Pullouts near prairie dog town on Johnson's Plateau	54.3	22.8	11	7.9	3.1	0	0.8	1.77 (1.042)
Cottonwood Campground	48.2	12.5	19.6	3.6	14.3	1.8	0	2.11 (1.508)
Peaceful Valley Ranch	86.7	11.1	0	2.2	0	0	0	1.2 (.610)
Scenic Loop Drive	61.1	21.4	12.2	4.6	0	0.8	0	1.6 (.838)
Jones Creek Trail	83.9	16.1	0	0	0	0	0	1.24 (.436)
Ridgeline Nature Trail	81	14.3	2.4	2.4	0	0	0	1.31 (.676)
Coal Vein Trail	87.9	9.1	3	0	0	0	0	1.2 (.5)
Buck Hill	65.5	15.5	10.3	3.4	1.7	3.4	0	1.55 (.968)
Wind Canyon Nature Trail	68.8	20.8	6.3	4.2	0	0	0	1.46 (.756)
Petrified Forest	79.2	16.7	0	0	0	4.2	0	1.06 (.243)
Backcountry Trails (Wilderness Trails)	77.3	13.6	4.5	0	0	0	4.5	1.33 (.617)
Frontcountry Trails (Non-wilderness)	80	13.3	0	0	0	6.7	0	1.4 (1.142)
NORTH UNIT								
North Unit Visitor Center	68.1	8.5	8.5	0	14.9	0	0	1.73 (1.376)
Juniper Campground and Picnic Area	58.6	20.7	10.3	3.4	6.9	0	0	1.33 (.617)
Little Mo Nature Trail	90	10	0	0	0	0	0	1.1 (.316)
Caprock Coulee Nature Trail	72.7	6.1	9.1	3	6.1	3	0	1.73 (1.352)
Scenic Drive	68.8	25	4.2	2.1	0	0	0	1.42 (.765)
Oxbow Overlook	81.1	13.5	5.4	0	0	0	0	1.27 (.583)
River Bend Overlook	70.5	18.2	9.1	2.3	0	0	0	1.31 (.604)
Backcountry Trails (Wilderness Trails)	88.9	11.1	0	0	0	0	0	1.11 (.333)
Frontcountry Trails (Non-wilderness)	72.7	13.6	9.1	4.5	0	0	0	1.08 (.289)
ELKHORN UNIT								
Elkhorn Ranch Site	88.9	0	0	11.1	0	0	0	1.33 (1)

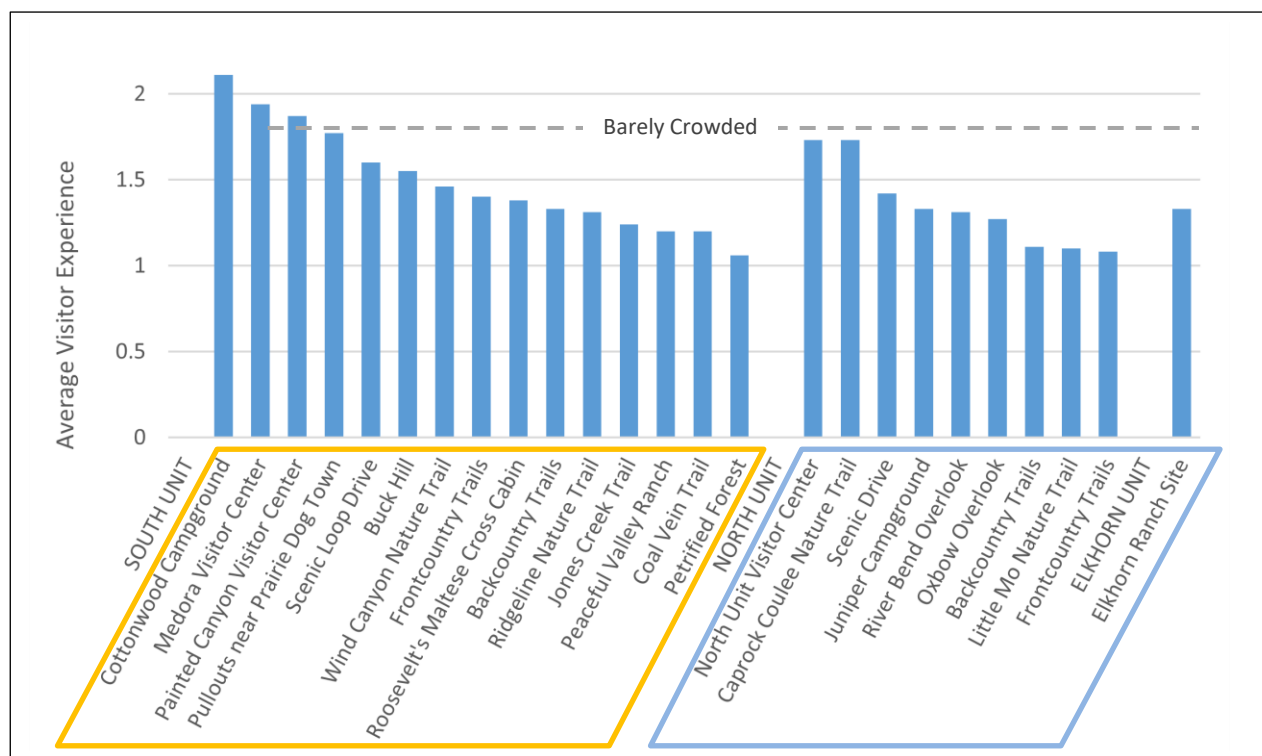


Figure 41: Average visitor opinion on crowding at various locations throughout the park, across all survey locations. (Comparative Survey, Question 6b) Note: 1 = Not Crowded, 2 = Barely Crowded, 3 = Slightly Crowded, 4 = Moderately Crowded, 5 = Crowded, 6 = Very Crowded, 7 = Extremely Crowded

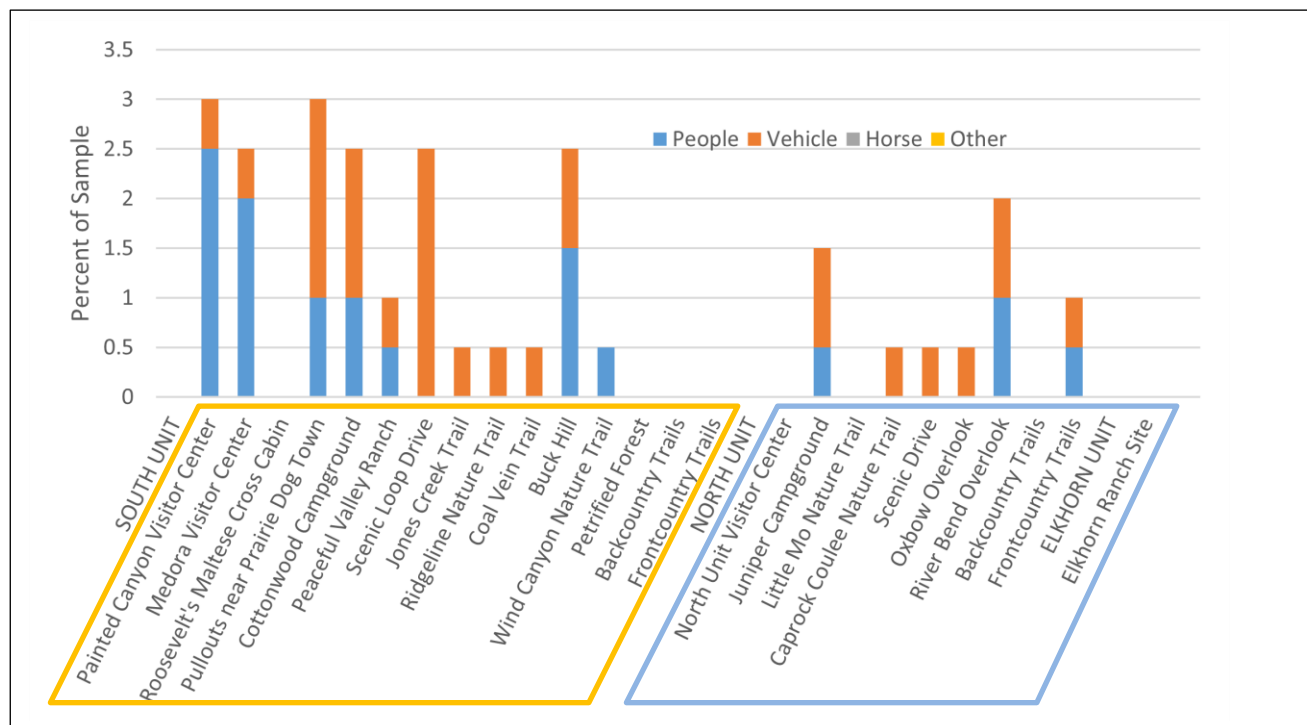


Figure 42: Percent of visitors who felt crowded and the reason for that crowding at various locations throughout the park, across all survey locations (Comparative Survey, Question 6c). South Unit percentages are on the left side of the chart; North Unit on right side.

Table 11. *Visitor opinions on detractors to their experience across all survey locations. Listed as percent of sample (Comparative Survey, Question 5). Breakdown by park unit in Table 12 (next page).*

	Did not at detract at all	Slightly detracted	Moderately detracted	Seriously detracted	Very seriously detracted	Did not experience
Too few parking spaces at pullouts and overlooks along scenic drives	60.1	9.6	8	0	0	22.3
Too few parking spaces at trailheads	57	10.5	5.8	0.6	0	26.2
Not enough restrooms	48.6	15.3	11.3	2.8	1.7	20.3
Congestion on park roads	62.2	13.4	3.5	0	0	20.9
Too little directional signage on park trails	54.2	16.2	5.6	1.1	1.1	21.8
Too few parking spaces at visitor centers	65.7	6.4	4.1	0	0.6	23.3
Confusion about rules and regulations	71.4	3.4	0	0.6	0.6	24
Restrooms not accessible	55	12.4	9.5	0.6	0	22.5
Congestion in the visitor centers	59	9.8	2.3	0.6	0	28.3
Too little directional signage on main park roads	61.2	11.8	5.3	0	0	21.8
Seeing development outside park boundaries	50	20.3	10.5	4.7	1.2	13.4
Congestion in the visitor center parking lot	60	7.3	2.4	0	0.6	29.7
Too little signage on wilderness or backcountry trails in the park	50.3	11.6	1.7	0	0.6	35.8
Too few interpretative signs	54.8	14.9	3	1.8	0.6	25
Noise from outside park boundaries	58.4	8.1	5.2	1.2	0	27.2
Not enough ranger-led activities	54.7	7	1.2	0	0	37.2
Conflicts with other visitors on park roads	50	9.9	4.7	0	1.2	34.3

Table 12a. *Potential detractions to quality of visitors' experience, by survey location. Listed as percent of sample (Comparative Survey, Question 5). Statistically significant differences marked with $*(p < 0.05)$.*

	Location	1) Did not detract	2) Slightly detracted	3) Moderately detracted	4) Seriously detracted	5) Very seriously detracted	Mean (SD)	t-test
Too few parking spaces at pullouts and overlooks along scenic drives	N	78.8	9.1	12.1	0	0	1.22 (0.6)	$t(101) = -0.848$ $p = 0.398$
	S	77	13.3	9.7	0	0	1.35 (0.68)	
Too few parking spaces at trailheads	N	72	16	12	0	0	1.4 (0.71)	$t(125) = -0.907$ $p = 0.512$
	S	78.4	13.7	6.9	1	0	1.3 (0.64)	
Not enough restrooms	N	43.8	21.9	28.1	3.1	3.1	2 (1.08)	$*t(139) = 2.195$ $p = 0.03$
	S	66.1	18.4	10.1	3.7	1.8	1.57 (0.95)	
Congestion on park roads	N	77.8	22.2	0	0	0	1.22 (0.42)	$t(134) = -0.383$ $p = 0.702$
	S	78.9	15.6	5.5	0	0	1.27 (0.56)	
Too little directional signage on park trails	N	58.1	25.8	12.9	3.2	0	1.61 (0.84)	$t(138) = 1.276$ $p = 0.204$
	S	72.5	19.3	5.5	0.9	1.8	1.4 (0.79)	
Too few parking spaces at visitor centers	N	75	17.9	3.6	0	3.6	1.39 (0.88)	$t(101) = -0.848$ $p = 0.398$
	S	88.5	5.8	5.8	0	0	1.17 (0.51)	
Confusion about rules and regulations	N	90.3	9.7	0	0	0	1.1 (0.30)	$t(32.1) = 1.272$ $p = 0.213$
	S	95.1	2.9	0	1	1	1.1 (0.52)	
Restrooms not accessible	N	50	17.9	28.6	3.6	0	1.86 (0.97)	$t(131) = -0.013$ $p = 0.99$
	S	76.7	15.5	7.8	0	0	1.31 (0.61)	
Congestion in the visitor centers	N	87.5	12.5	0	0	0	1.13 (0.34)	$*t(33.03) = 2.83$ $p = 0.008$
	S	81	14	4	1	0	1.25 (0.58)	

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Table 12b. Potential detractions to quality of visitors' experience, by survey location. Listed as percent of sample (Comparative Survey, Question 5). Statistically significant differences marked with $*(p < 0.05)$.

	Location	1) Did not detract	2) Slightly detracted	3) Moderately detracted	4) Seriously detracted	5) Very seriously detracted	Mean (SD)	t-test
Too little directional signage on main park roads	N	85.7	10.7	3.6	0	0	1.18 (0.48)	$t(59.45) = -1.392$ $p = 0.169$
	S	76.2	16.2	7.6	0	0	1.31 (0.61)	
Seeing development outside park boundaries	N	50	28.1	15.6	6.3	0	1.78 (0.94)	$t(53.18) = -1.259$ $p = 0.213$
	S	59.8	22.2	11.1	5.1	1.7	1.67 (0.98)	
Congestion in the visitor center parking lot	N	79.2	16.7	4.2	0	0	1.25 (0.53)	$t(147) = 0.59$ $p = 0.556$
	S	87	8.7	3.3	0	1.1	1.2 (0.6)	
Too little signage on wilderness or backcountry trails in the park	N	73.9	26.1	0	0	0	1.26 (0.45)	$t(109) = -0.084$ $p = 0.933$
	S	79.6	15.9	3.4	0	1.1	1.27 (0.64)	
Too few interpretative signs	N	67.9	25	3.6	0	3.6	1.46 (0.88)	$t(124) = 0.668$ $p = 0.505$
	S	74.5	18.4	4.1	3.1	0	1.36 (0.71)	
Noise from outside park boundaries	N	91.7	8.3	0	0	0	1.08 (0.28)	$*t(96.91) = -2.925$ $p = 0.004$
	S	77.5	11.8	8.8	2	0	1.35 (0.73)	
Not enough ranger-led activities	N	84.6	11.5	3.9	0	0	1.19 (0.49)	$t(106) = 0.635$ $p = 0.527$
	S	87.8	11	1.2	0	0	1.13 (0.38)	
Conflicts with other visitors on park roads	N	80	8	12	0	0	1.32 (0.69)	$t(111) = -0.315$ $p = 0.736$
	S	75	17.1	5.7	0	2.3	1.38 (0.79)	

Table 13: Changes in visitor perceptions of crowding in South Unit from 2001 to 2017. Across all survey locations, listed as percent of sample. Statistically significant differences marked with $*(p < 0.05)$.

		1) Not Crowded	2) Barely Crowded	3) Slightly Crowded	4) Moderately Crowded	5) Crowded	6) Very Crowded	7) Extremely Crowded	Mean (SD)	t-test
SOUTH UNIT										
Painted Canyon Visitor Center	2001	63.6	18.2	9.1	6.1	1	2	0	1.69 (1.14)	t(205) = -1.22
	2017	50	23.1	16.7	10.2	0	0	0	1.87 (1.03)	p = 0.226
Medora Visitor Center	2001	74.2	16.4	3.9	2.3	1.6	0.8	0.8	1.46 (1.03)	*t(174.93) = -3.15
	2017	51.1	16.7	22.2	8.9	0	0	1.1	1.94 (1.17)	p = 0.002
Roosevelt's Maltese Cross Cabin	2001	84.1	9.5	3.2	1.6	0	1.6	0	1.29 (0.83)	t(121) = -1.22
	2017	70	16.7	10	3.3	0	0	0	1.47 (0.81)	p = 0.225
Pullouts near prairie dog towns	2001	80.7	10.9	5	1.7	0.8	0	0.8	1.34 (0.89)	*t(231.69) = -3.83
	2017	54.3	22.8	11	7.9	3.1	0	0.8	1.86 (1.2)	p = 1.62x10 ⁻⁴
Cottonwood Campground	2001	76.7	10	3.3	3.3	1.7	5	0	1.58 (1.32)	*t(108.79) = -2.64
	2017	48.2	12.5	19.6	3.6	14.3	1.8	0	2.29 (1.53)	p = 0.01
Peaceful Valley Ranch	2001	78.6	10.7	3.6	7.1	0	0	0	1.39 (0.88)	t(39.68) = 1.17
	2017	86.7	11.1	0	2.2	0	0	0	1.18 (0.54)	p = 0.248
Scenic Loop Drive	2001	80.2	14	4.1	1.7	0	0	0	1.27 (0.62)	*t(224.88) = -3.59
	2017	61.1	21.4	12.2	4.6	0	0.8	0	1.63 (0.95)	p = 4.1x10 ⁻⁴
Jones Creek Trail	2001	81.8	13.6	4.5	0	0	0	0	1.23 (0.53)	t(51) = 0.533
	2017	83.9	16.1	0	0	0	0	0	1.16 (0.37)	p = 0.596
Ridgeline Nature Trail	2001	80	13.3	3.3	0	3.3	0	0	1.33 (0.84)	t(70) = 0.41
	2017	81	14.3	2.4	2.4	0	0	0	1.26 (0.63)	p = 0.681
Coal Vein Trail	2001	72.7	18.2	3	6.1	0	0	0	1.42 (0.83)	t(48.77) = 1.67
	2017	87.9	9.1	3	0	0	0	0	1.15 (0.44)	p = 0.102
Buck Hill	2001	81	11.9	4.8	2.4	0	0	0	1.29 (0.67)	*t(91.63) = -2.18
	2017	65.5	15.5	10.3	3.4	1.7	3.4	0	1.71 (1.24)	p = 0.032
Wind Canyon Nature Trail	2001	72.2	16.7	2.8	2.8	2.8	2.8	0	1.56 (1.18)	t(82) = 0.45
	2017	68.8	20.8	6.3	4.2	0	0	0	1.46 (0.8)	p = 0.654
Petrified Forest	2001	69.2	23.1	7.7	0	0	0	0	1.38 (0.65)	t(35) = 0.03
	2017	79.2	16.7	0	0	0	4.2	0	1.38 (1.06)	p = 0.976
Backcountry Trails (Wilderness Trails)	2001	77.8	16.7	5.6	0	0	0	0	1.28 (0.58)	t(38) = 0.21
	2017	77.3	13.6	4.5	0	0	0	4.5	1.5 (1.34)	p = 0.515
Frontcountry Trails (Non-wilderness)	2001	66.7	22.2	11.1	0	0	0	0	1.44 (0.73)	t(37) = -0.05
	2017	80	13.3	0	0	0	6.7	0	1.47 (1.28)	p = 0.961

Table 14: Changes in visitor perceptions of crowding in North and Elkhorn Ranch Units from 2001 to 2017. Across all survey locations, listed as percent of sample. *Statistically significant differences marked with $*(p < 0.05)$.*

		1) Not Crowded	2) Barely Crowded	3) Slightly Crowded	4) Moderately Crowded	5) Crowded	6) Very Crowded	7) Extremely Crowded	Mean (SD)	t-test
NORTH UNIT										
North Unit Visitor Center	2001	88	10.3	0	1.7	0	0	0	1.15 (0.49)	*t(50.13) = -3.21 p = 0.002
	2017	68.1	8.5	8.5	0	14.9	0	0	1.85 (1.46)	
Juniper Campground and Picnic Area	2001	86.6	7.5	3	1.5	0	1.5	0	1.25 (0.8)	*t(39.19) = -2.21 p = 0.033
	2017	58.6	20.7	10.3	3.4	6.9	0	0	1.79 (1.21)	
Little Mo Nature Trail	2001	88.6	8.6	0	2.9	0	0	0	1.17 (0.57)	t(43) = 0.38 p = 0.706
	2017	90	10	0	0	0	0	0	1.1 (0.32)	
Caprock Coulee Nature Trail	2001	91.5	6.4	0	0	2.1	0	0	1.15 (0.63)	*t(41.04) = -2.23 p = 0.032
	2017	72.7	6.1	9.1	3	6.1	3	0	1.73 (1.4)	
Scenic Drive	2001	83.8	11.7	3.6	0.9	0	0	0	1.22 (0.55)	t(74.73) = -1.63 p = 0.108
	2017	68.8	25	4.2	2.1	0	0	0	1.4 (0.68)	
Oxbow Overlook	2001	86.4	11.4	1.1	0	0	0	1.1	1.2 (0.73)	t(123) = -0.29 p = 0.772
	2017	81.1	13.5	5.4	0	0	0	0	1.24 (0.55)	
Other North Unit trails	2001	88.9	11.1	0	0	0	0	0	1.11 (0.32)	t(41.63) = -1.64 p = 0.109
	2017	80.8	12.4	4.6	2.3	0	0	0	1.35 (0.76)	
ELKHORN RANCH UNIT										
Elkhorn Ranch Site	2001	85.7	14.3	0	0	0	0	0	1.43 (1.13)	t(14) = 0.18 p = 0.861
	2017	88.9	0	0	11.1	0	0	0	1.33 (1)	

Table 15: Changes in visitor perceptions of crowding in North and Elkhorn Ranch Units from 2001 to 2017. Across all survey locations, listed as percent of sample. *Statistically significant differences marked with $*(p < 0.05)$.*

		1) Not Crowded	2) Barely Crowded	3) Slightly Crowded	4) Moderately Crowded	5) Crowded	6) Very Crowded	7) Extremely Crowded	Mean (SD)	t-test
NORTH UNIT										
North Unit Visitor Center	2001	88	10.3	0	1.7	0	0	0	1.15 (0.49)	*t(50.13) = -3.21 p = 0.002
	2017	68.1	8.5	8.5	0	14.9	0	0	1.85 (1.46)	
Juniper Campground and Picnic Area	2001	86.6	7.5	3	1.5	0	1.5	0	1.25 (0.8)	*t(39.19) = -2.21 p = 0.033
	2017	58.6	20.7	10.3	3.4	6.9	0	0	1.79 (1.21)	
Little Mo Nature Trail	2001	88.6	8.6	0	2.9	0	0	0	1.17 (0.57)	t(43) = 0.38 p = 0.706
	2017	90	10	0	0	0	0	0	1.1 (0.32)	
Caprock Coulee Nature Trail	2001	91.5	6.4	0	0	2.1	0	0	1.15 (0.63)	*t(41.04) = -2.23 p = 0.032
	2017	72.7	6.1	9.1	3	6.1	3	0	1.73 (1.4)	
Scenic Drive	2001	83.8	11.7	3.6	0.9	0	0	0	1.22 (0.55)	t(74.73) = -1.63 p = 0.108
	2017	68.8	25	4.2	2.1	0	0	0	1.4 (0.68)	
Oxbow Overlook	2001	86.4	11.4	1.1	0	0	0	1.1	1.2 (0.73)	t(123) = -0.29 p = 0.772
	2017	81.1	13.5	5.4	0	0	0	0	1.24 (0.55)	
Other North Unit trails	2001	88.9	11.1	0	0	0	0	0	1.11 (0.32)	t(41.63) = -1.64 p = 0.109
	2017	80.8	12.4	4.6	2.3	0	0	0	1.35 (0.76)	
ELKHORN RANCH UNIT										
Elkhorn Ranch Site	2001	85.7	14.3	0	0	0	0	0	1.43 (1.13)	t(14) = 0.18 p = 0.861
	2017	88.9	0	0	11.1	0	0	0	1.33 (1)	

Table 16: Change in significance of potential detractors to visitor experience from 2001 to 2017. Across all survey location, listed as percent of sample. *Statistically significant differences marked with * ($p < 0.05$).*

	Survey year	1) Did not detract	2) Slightly detracted	3) Moderately detracted	4) Seriously detracted	5) Very seriously detracted	Mean	t-test
Too few parking spaces at pullouts/overlooks on scenic drives	2001	95.9	1.2	1.7	1.2	0	1.08 (0.43)	*t(339.0) = -3.22
	2017	82.4	9.6	8	0	0	1.26 (0.59)	$p = 0.001$
Too few parking spaces at trailheads	2001	95.8	1.2	3	0	0	1.07 (0.36)	*t(285.29) = -3.21
	2017	83.2	10.5	5.8	0.6	0	1.24 (0.58)	$p = 0.001$
Not enough restrooms	2001	82.9	7.6	6.5	1.8	1.2	1.31 (0.77)	*t(338.33) = -2.47
	2017	63.9	15.3	11.3	2.8	1.7	1.53 (0.92)	$p = 0.014$
Congestion on park roads	2001	97.6	0.6	1.2	0.6	0	1.05 (0.32)	*t(299.51) = -3.51
	2017	83.1	13.4	3.5	0	0	1.2 (0.48)	$p = 0.001$
Too little directional signage on park trails	2001	89.1	6.1	4.2	0.6	0	1.16 (0.51)	*t(317.63) = -2.77
	2017	76	16.2	5.6	1.1	1.1	1.35 (0.74)	$p = 0.006$
Too few parking spaces at visitor centers	2001	98.2	1.8	0	0	0	1.02 (0.13)	*t(192.23) = -3.54
	2017	89	6.4	4.1	0	0.6	1.17 (0.54)	$p = 0.001$
Confusion about rules and regulations	2001	95.2	3	1.2	0	0.6	1.08 (0.41)	t(341) = 0.07
	2017	65.4	3.4	0	0.6	0.6	1.07 (0.42)	$p = 0.945$
Restrooms not accessible	2001	91.2	3.5	3.5	1.2	0.6	1.16 (0.59)	*t(331.83) = -2.45
	2017	77.5	12.4	9.5	0.6	0	1.33 (0.97)	$p = 0.015$
Congestion in the visitor centers	2001	94.1	4.7	0	0.6	0.6	1.09 (0.43)	t(339.88) = -1.52
	2017	87.3	9.8	2.3	0.6	0	1.16 (0.47)	$p = 0.131$
Too little directional signage on main park roads	2001	94	1.8	3.6	0.6	0	1.11 (0.45)	*t(328.7) = -2.16
	2017	83	11.8	5.3	0	0	1.22 (0.53)	$p = 0.032$
Seeing development outside park boundaries	2001	78.9	7	4.7	5.8	3.5	1.48 (1.06)	t(341) = -1.11
	2017	63.4	20.3	10.5	4.7	1.2	1.6 (0.93)	$p = 0.269$
Congestion in the visitor center parking lot	2001	97.6	2.4	0	0	0	1.02 (0.15)	*t(193.59) = -3.02
	2017	89.7	7.3	2.4	0	0.6	1.15 (0.5)	$p = 0.003$
Too little signage on wilderness / backcountry trails	2001	91.5	3.6	3.6	0.6	0.6	1.15 (0.56)	t(336) = -0.38
	2017	86.1	11.6	1.7	0	0.6	1.17 (0.5)	$p = 0.704$
Too few interpretative signs	2001	93.4	1.8	4.2	0.6	0	1.12 (0.48)	*t(317.21) = -2.38
	2017	79.8	14.9	3	1.8	0.6	1.26 (0.6)	$p = 0.018$
Noise from outside park boundaries	2001	94	3	1.2	1.8	0	1.11 (0.48)	t(328.59) = -1.94
	2017	85.6	8.1	5.2	1.2	0	1.22 (0.59)	$p = 0.053$
Not enough ranger-led activities	2001	93.9	3.1	2.5	0.6	0	1.1 (0.42)	t(333) = 0.13
	2017	91.9	7	1.2	0	0	1.09 (0.33)	$p = 0.9$
Conflicts with other visitors on park roads	2001	97.6	1.2	1.2	0	0	1.04 (0.24)	*t(218.13) = -3.86
	2017	84.3	9.9	4.7	0	1.2	1.24 (0.65)	$p = 1.47 \times 10^{-4}$

Visitor Satisfaction with Services and Facilities (Management Survey, Appendix A)

Visitors are by and large satisfied with the aspects of their THRO experience. Most survey respondents reported that they were either moderately satisfied or completely satisfied with 16 indicators of experience quality.

Most visitors reported being satisfied with park services. The average percentages of these visit visitors expressing that they were ‘completely satisfied’ with services were as follows:

- Park brochure, newspaper, and/or map – 53%
- Backcountry trail map and guide map – 27%
- National Geographic park map – 44%
- Information and directional signs – 46%
- Interpretative signs near trail heads – 39%
- Ranger-led programs map – 47%
- Assistance from park employees – 62%
- Overall quality of services at the park – 50%

Regarding park facilities, the average percentage of survey respondents reporting being ‘completely satisfied’ were as follows:

- Campgrounds – 55%
- Trail conditions – 48%
- Scenic road conditions – 63%
- Visitor Center exhibits – 50%
- Visitor Center bookstore – 37%
- Picnic areas – 41%
- Restrooms – 35%
- Overall quality of facilities at the park – 41%

Although overall, most visitors reported satisfaction with these park features, the visitors in the North Unit report slightly less satisfaction than South Unit visitors.

Changes in Visitor Satisfaction 2001-2017 (2001 Comparative Survey, Appendix B)

While numerous findings from the 2017 administration of the Management Survey are provided in tables with alternating green-and-white rows, this section’s tables with alternating brown-and-white rows compares response patterns from the 2001 administration of the Comparative Survey with new data gathered in 2017.

Several of the metrics captured by the re-administration of the Comparative Survey show statistically significant change between 2001 and 2017. Highlights from these changes in visitors’ satisfaction at THRO include slight decreases in satisfaction with the VC bookstore, restrooms, overall quality of services, and trail/directional signs. See Tables 17 and 18.

Table 17: Visitor satisfaction with park services by survey location, represented as percent of sample (Management Survey, Question 7). Statistically significant differences marked with $*(p < 0.05)$.

	<i>Location</i>	1) Completely dissatisfied	2) Moderately dissatisfied	3) Slightly dissatisfied	4) Neither satisfied or dissatisfied	5) Slightly satisfied	6) Moderately satisfied	7) Completely satisfied	Mean (SD)	t-test
Park Services										
Park brochure, newspaper, and/or map	N	7	2.3	0	9.3	11.6	27.9	41.9	5.67 (1.73)	$*t(57.193) = -2.47$ $p = 0.016$
	S	1.7	2.5	0	1.7	5.8	23.1	65.3	6.38 (1.21)	
Backcountry trail map and guide	N	0	6.7	13.3	23.3	6.7	23.3	26.7	5.07 (1.66)	$*t(40.894) = -2.82$ $p = 0.007$
	S	0	0	5.7	12.6	4.6	29.9	47.1	6.00 (1.25)	
National geographic park map	N	0	4	0	16	12	32	36	5.76 (1.33)	$t(116) = -1.543$ $p = 0.126$
	S	0	0	1.1	9.7	14	23.7	51.6	6.15 (1.06)	
Information and directional signs	N	4.4	8.9	0	13.3	15.6	22.2	35.6	5.36 (1.80)	$*t(59.651) = -2.78$ $p = 0.007$
	S	0	0.8	6.5	3.2	12.1	20.2	57.3	6.16 (1.23)	
Interpretative signs near trail heads	N	0	6.8	6.8	13.6	20.5	35	27.3	5.32 (1.52)	$*t(65.583) = -3.00$ $p = 0.004$
	S	0	0.9	5.3	6.1	11.4	24.6	51.8	6.09 (1.22)	
Ranger-led programs	N	3.7	0	11.1	44.4	0	14.8	25.9	4.85 (1.66)	$*t(42.646) = -2.81$ $p = 0.008$
	S	2.1	0	1.1	5.3	4.3	19.1	68.1	5.88 (1.25)	
Assistance from park employees	N	5.3	2.6	5.3	2.6	13.2	21.1	50	5.79 (1.73)	$t(51.898) = -1.98$ $p = 0.054$
	S	2.1	0	1.1	5.3	4.3	19.1	68.1	6.39 (1.19)	
Overall quality of services at the park	N	4.4	2.2	2.2	4.4	11.1	44.4	31.1	5.73 (1.50)	$*t(169) = -3.31$ $p = 0.001$
	S	0.8	0.8	1.6	4	5.6	19	68.8	6.43 (1.09)	

Table 18: Visitor satisfaction with park facilities by survey location, represented as percent of sample (Management Survey, Question 7). Statistically significant differences marked with $*(p < 0.05)$.

	Location	1) Completely dissatisfied	2) Moderately dissatisfied	3) Slightly dissatisfied	4) Neither satisfied or dissatisfied	5) Slightly satisfied	6) Moderately satisfied	7) Completely satisfied	Mean (SD)	t-test
Park Facilities										
Campgrounds	N	4.5	0	4.5	18.2	22.7	22.7	27.3	5.32 (1.55)	$*t(79) = -2.99$ $p = 0.004$
	S	0	0	0	15.3	6.8	15.3	62.7	6.25 (1.12)	
Trail conditions	N	0	2.9	2.9	5.7	17.1	31.4	40	5.91 (1.25)	$t(133) = -1.81$ $p = 0.073$
	S	0	0	1	8	8	27	56	6.29 (0.99)	
Scenic road conditions	N	2.3	2.3	6.8	4.5	2.3	20.5	61.4	6.09 (1.55)	$t(53.317) = -1.64$ $p = 0.107$
	S	0	0.8	1.6	1.6	5.5	24.4	66.1	6.50 (0.90)	
Visitor Center exhibits	N	0	8.3	0	12.5	16.7	29.2	33.3	5.58 (1.50)	$*t(26.673) = -2.90$ $p = 0.007$
	S	0	0	1	4	5.1	23.2	66.7	6.51 (0.85)	
Visitor Center bookstore	N	4.8	9.5	0	28.6	4.8	28.6	23.8	5.00 (1.82)	$*t(25.857) = -2.27$ $p = 0.031$
	S	0	2.5	2.5	12.5	11.3	21.3	50	5.96 (1.33)	
Picnic areas	N	0	0	0	25	12.5	31.3	31.3	5.69 (1.20)	$t(64) = -0.74$ $p = 0.462$
	S	0	0	4	18	8	18	52	5.96 (1.31)	
Restrooms	N	2.7	5.4	10.8	10.8	2.7	40.5	27	5.35 (1.70)	$t(137) = -1.36$ $p = 0.177$
	S	1	2.9	7.8	7.8	10.8	27.5	42.2	5.75 (1.49)	
Overall quality of facilities at the park	N	2.3	2.3	0	18.6	16.3	37.2	23.3	5.49 (1.37)	$*t(54.863) = -4.25$ $p = 8.3 \times 10^{-5}$
	S	0	0.8	0.8	4.1	1.6	33.3	59.3	6.44 (0.89)	

Table 19: *Changes in visitor satisfaction regarding park facilities from 2001 to 2017 across all survey locations, listed as percent of sample. Statistically significant differences marked with *($p < 0.05$).*

Park Facilities	<i>Survey Year</i>	1) Completely dissatisfied	2) Moderately dissatisfied	3) Slightly dissatisfied	4) Neither satisfied / dissatisfied	5) Slightly satisfied	6) Moderate satisfied	7) Completely satisfied	Mean (SD)	t-test
Campgrounds	2001	2.9	2.9	1.5	11.8	5.9	19.1	55.9	5.96 (1.57)	t(147) = -0.19 p = 0.852
	2017	1.2	0	1.2	16	11.1	17.3	53.1	6 (1.31)	
Trail conditions	2001	0.8	2.4	4.9	5.7	9.8	24.4	52	6.02 (1.38)	t(257) = -1.14 p = 0.254
	2017	0	0.7	1.5	7.4	10.3	27.9	52.2	6.2 (1.07)	
Scenic road conditions	2001	1	0.5	4.7	2.6	4.1	22.3	64.8	6.34 (1.2)	t(363) = -0.44 p = 0.661
	2017	0.6	1.2	2.9	2.3	4.7	23.3	65.1	6.4 (1.11)	
Visitor Center exhibits	2001	1	0.5	1	2.5	3	25.3	66.7	6.48 (1)	t(320) = 1.32 p = 0.189
	2017	0	1.6	0.8	5.6	7.3	24.2	60.5	6.33 (1.07)	
Visitor Center bookstore	2001	1.7	1.2	0.6	7	8.7	19.2	61.6	6.24 (1.27)	*t(184.37) = 2.7 p = 0.008
	2017	1	4	2	15.8	9.9	22.8	44.6	5.76 (1.48)	
Picnic areas	2001	2.5	1.3	5.1	12.7	6.3	19	53.2	5.89 (1.55)	t(143) = -0.03 p = 0.973
	2017	0	0	3	19.7	9.1	21.2	47	5.89 (1.28)	
Restrooms	2001	1	0.5	4.5	2.5	7.6	18.7	65.2	6.32 (1.22)	*t(252.00) = 4.21 p = 3.6×10^{-5}
	2017	1.4	3.6	8.6	8.6	8.6	30.7	68.6	5.66 (1.55)	
Overall quality of facilities at the park	2001	1	0	1.4	1.4	3.8	26.9	65.4	6.5 (0.94)	*t(325.14) = 2.76 p = 0.006
	2017	0.6	1.2	0.6	7.8	5.4	34.1	50.3	6.2 (1.11)	

Table 20: *Changes in visitor satisfaction regarding park services from 2001-2017 across survey locations, listed as percent of sample. Statistically significant differences marked with $*(p < 0.05)$.*

										t-test
	Survey Year	1) Completely dissatisfied	2) Moderately dissatisfied	3) Slightly dissatisfied	4) Neither satisfied / dissatisfied	5) Slightly satisfied	6) Moderate satisfied	7) Completely satisfied	Mean (SD)	
Park Services										
Park brochure, newspaper, and/or map	2001	1.6	0.5	0.5	4.7	3.1	19.3	70.3	6.46 (1.11)	t(312.74) = 1.96 p = 0.051
	2017	3	2.4	0	3.5	7.3	24.2	59.4	6.2 (1.39)	
Backcountry trail map and guide	2001	4.7	0	3.5	10.6	8.2	25.9	47.1	5.84 (1.57)	t(201) = 0.3 p = 0.762
	2017	0	1.7	7.6	15.3	5.1	28	42.4	5.77 (1.42)	
Information and directional signs	2001	1.1	0	1.6	6.8	5.8	26.3	58.4	6.29 (1.12)	*t(317.04) = 2.46 p = 0.015
	2017	1.2	2.9	4.7	5.9	12.9	20.6	51.8	5.95 (1.44)	
Interpretative signs near trail heads	2001	1.5	0.7	5.8	10.9	8	21.2	51.8	5.94 (1.43)	t(294) = 0.38 p = 0.706
	2017	0	2.5	5.7	8.2	13.8	24.5	45.3	5.88 (1.35)	
Ranger-led programs	2001	5	0	0	32.5	7.5	10	45	5.48 (1.69)	t(114) = -0.13 p = 0.9
	2017	1.3	0	5.3	30.3	2.6	23.7	36.8	5.51 (1.48)	
Assistance from park employees	2001	2.9	0	0.6	5.2	2.9	13.3	75.1	6.46 (1.25)	t(304) = 1.53 p = 0.127
	2017	3	0.8	2.3	4.5	6.8	19.5	63.2	6.23 (1.39)	
Overall quality of services at the park	2001	1.5	0.5	1.5	2	2.5	22	70	6.5 (1.07)	*t(263.81) = 2.31 p = 0.022
	2017	1.7	1.2	1.7	4.1	7	25.6	58.7	6.25 (1.24)	

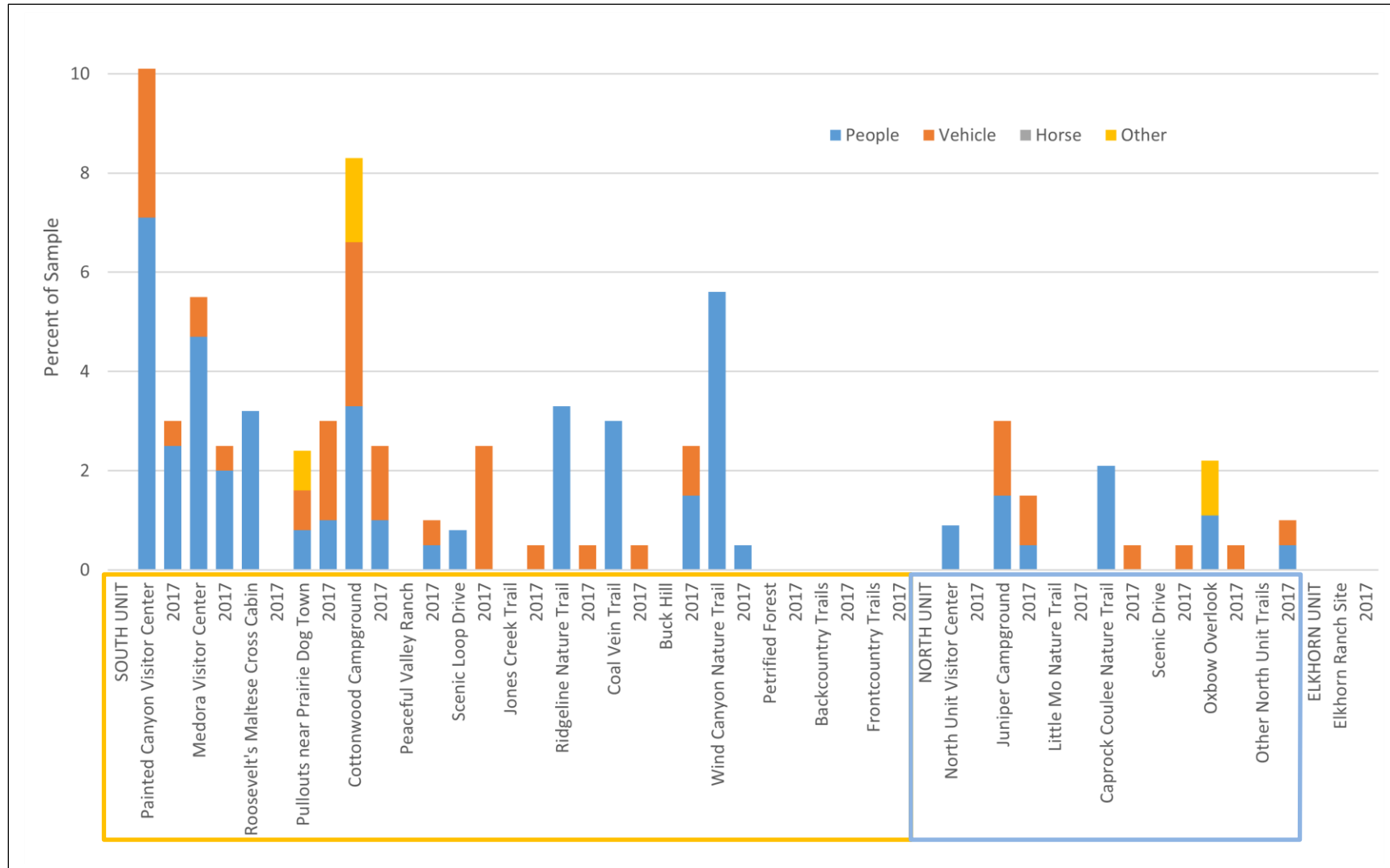


Figure 41. Changes in the percentage of visitors who felt crowded—due to people, vehicles, horses, or ‘other’—from 2001 to 2017, across all survey locations. Note: Labels of "2017" represent the 2017 responses for the previous label, which displays the 2001 responses.

Aspects of the park that visitors think NPS should change or not change

Clarifying their desires through Questions 4 and 5 of the Indicators Survey, 11% of visitors stated that addition of bathrooms and 8% reported the addition of signage at the top of their list of improvements. The top things that visitors did *not* want to change were the ruggedness of THRO's landscape (36%) and the accessibility of the park (9%); 36%-46% of visitors request *no change*.

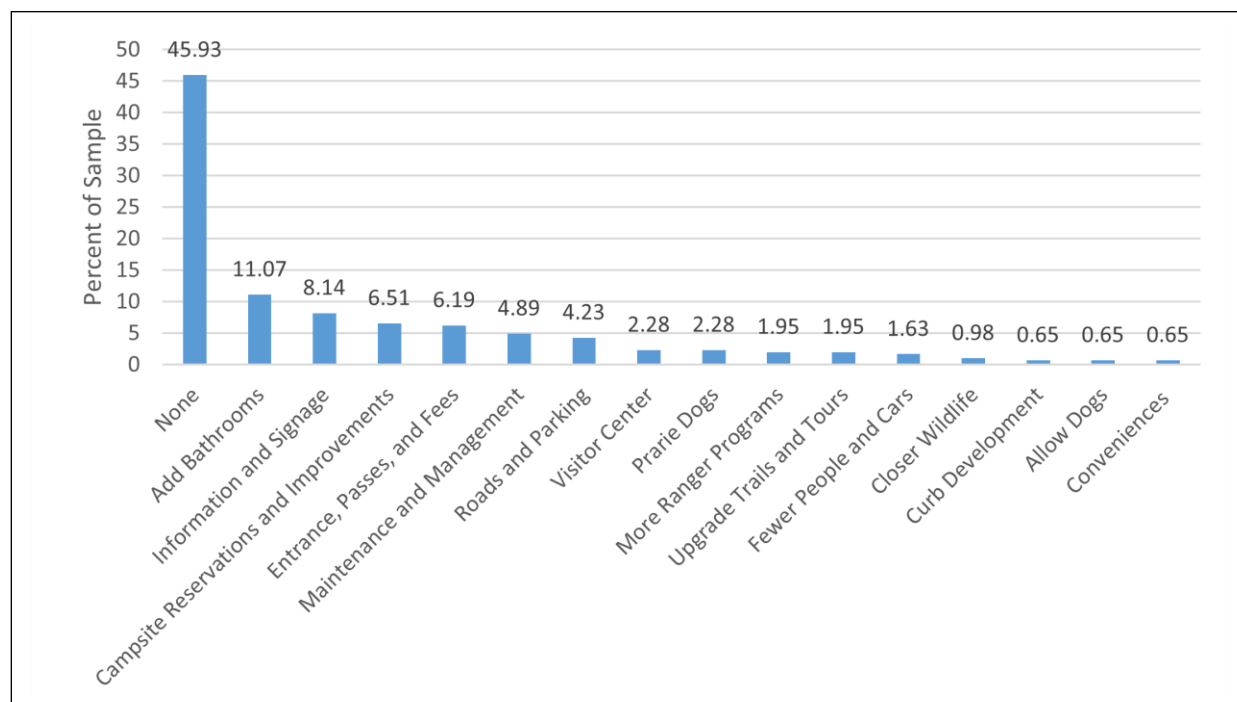


Figure 42. What visitors would like the NPS to change, across all survey locations. (Indicators Survey, Question 4)

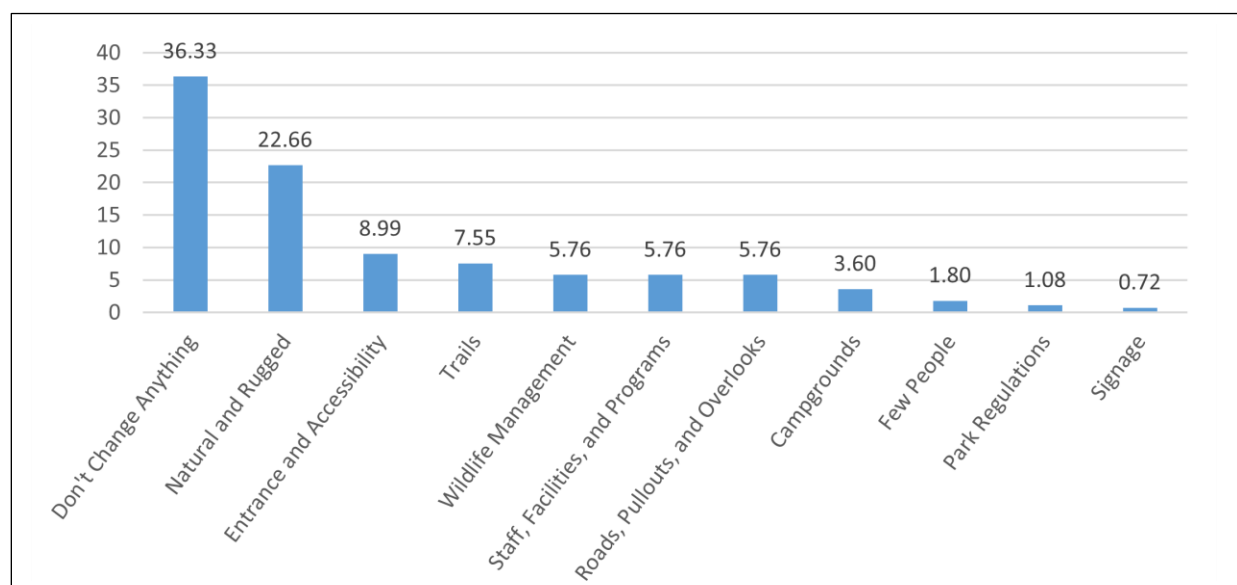


Figure 43. What visitors would like NPS not to change, across all survey locations (Indicators Survey, Question 5).

Visitor Opinions about Potential Management Actions (Questionnaire in Appendix A)

As a result of a meeting in 2017, park managers and researchers generated a list of potential management actions to enhance visitor services and experience quality. These potential actions were listed in the Management Questionnaire and visitors were asked to rank their level of opposition or support for each potential action. In addition, visitors were asked to identify their top five actions well as single most preferred action.

In Question 4 of the Management Survey, visitors quantified their support for various management actions at THRO. In terms of maintaining and improving the aesthetic experience in THRO, 49% of visitors attested to *strong* support for maintaining the size of horse herds and 43% *support* for maintaining the size of longhorn herds. Collaborating with developers adjacent to the park to reduce visual impacts in the park garnered the support of 42% of visitors, including through the use of visual buffers to screen development, which an average of 33% of respondents strongly supported.

More short-length hiking trails at THRO had the support of 42% of visitors support followed closely by support for increasing the number of backcountry or wilderness trails (35%). The availability of more ranger-led programs received support from 41% of visitors, and slightly more visitors (45%) support the provision more information for things to see and do in the area.

In terms of infrastructure, 38% of respondents supported improving accessibility of park facilities and 31% of visitors support creating new or increased size of roadside pullouts as well as additional spaces at pullouts and parking areas. Support for constructing a permanent visitor center in the North Unit was suggested by 35% of respondents, as well as the improvement of campground restrooms (41%) and overall construction of more restroom facilities in the park (36%). Only one potential management action—creating new roadside pullouts and parking areas—showed a statistically significant difference between North Unit and South Unit respondents.

Visitor preferences will be discussed in the next section, *Visitor Preferences for Improvements at THRO*, wherein the assignment of preference points to specific management actions is broken down according to responses from North and South Unit visitors. All the aforementioned responses are visible in Table 21, and additionally broken down by park unit in Table 22a and 22b.

Regarding changes in visitors' support for various management actions, the 2017 administration of the 2001 Comparative Survey revealed large increases in support across the actions (see Table 23). The most substantial of these changes were in regard to the provision of more information for visitors about things to see and do in the area, more short hiking trails, more ranger-led programs, more restroom facilities, and more parking spaces at pullouts and parking areas along scenic drives.

While responses from the 2017 Management Survey are provided in tables with alternating green-and-white rows, comparisons of visitor responses from the 2017 administration of the Comparative Survey of are provide in table with alternating brown-and-white rows. All these response patterns are consistent with those in the Management Survey.

Table 21: *Visitor opinions on possible management actions across all units, listed as percent of sample (Management Survey, Question 4). Note: The highest value in each row has been highlighted*

	1) Strongly oppose	2) Oppose	3) Somewhat oppose	4) Neither oppose or support	5) Somewhat support	6) Support	7) Strongly support
Maintain the herd of longhorn steers in the North Unit of the park	1.25	3.25	4.49	9.61	3.25	43.32	35.08
Maintain the herd of horses in the S. Unit of park	0.52	2.19	1.67	6.58	6.05	33.92	49.16
Increase size of roadside pullouts and parking areas	1.02	6.91	5.79	26.42	14.33	30.69	14.84
Create new roadside pullouts and parking areas	2.61	6.33	6.93	27.64	13.87	30.35	12.26
Construct a permanent visitor center in N. Unit	0.00	3.61	1.86	27.47	14.67	35.39	17.11
Improve existing restroom facilities at park campgrounds	0.56	3.02	1.23	26.17	11.86	41.05	16.11
Use buffers to screen outside development such as oil & gas site sand cell phone towers	2.13	4.27	4.27	22.36	7.42	29.27	30.28
Reduce maximum trailer length at campgrounds	1.35	9.23	7.26	47.97	8.61	20.42	5.29
Increase the maximum trailer length at campgrounds	7.15	11.71	11.71	53.88	5.18	7.15	3.21
Work with developers adjacent to the park to reduce visual impacts in the park	2.17	4.34	3.82	19.52	7.64	41.84	20.66
Provide more information for visitors about things to see and do in the area	0.00	1.63	1.63	18.28	17.77	44.64	16.14
Increase the number of backcountry trails (Wilderness trails)	0.55	2.32	2.32	24.28	15.01	34.66	20.75
Provide more short hiking trails	0.00	0.00	3.24	19.62	14.20	42.07	20.77
Provide more ranger-led programs	1.05	0.53	1.05	26.48	16.56	41.46	12.66
Provide more restroom facilities	0.52	1.66	4.88	22.85	17.45	36.45	16.30
Provide more parking spaces at pullouts and parking areas along scenic drives	2.12	4.75	4.24	29.60	18.48	31.21	9.49
Expand campgrounds loop by creating additional camping spots	1.91	4.43	6.34	36.12	12.68	26.56	12.08
Install water, sewer, and electrical hookups in campgrounds	5.78	12.15	12.76	23.59	12.76	22.86	10.23
Provide running water and showers at restroom facilities at campgrounds	3.02	7.31	4.87	20.30	19.03	29.47	16.01
Create new reserved group campgrounds	3.89	7.90	7.90	39.90	12.42	19.57	8.53
Improve accessibility at existing park facilities	1.19	1.19	4.02	32.03	16.61	34.31	10.86
Expand existing campgrounds by providing larger loops, larger pull-offs, and additional RV sites	2.60	8.29	12.13	28.22	17.95	19.93	10.89

Table 21a. *Visitor opinions on possible management actions by survey location, listed as percent of sample (Management Survey, Question 4).*
 Note: *The highest value in each row has been highlighted . Statistically significant differences marked with *(p < 0.05).*

	Location	1) Strongly oppose	2) Oppose	3) Somewhat oppose	4) Neither oppose or support	5) Somewhat support	6) Support	7) Strongly support	Mean (SD)	t-test
Maintain the herd of longhorn steers in N. Unit of the park	N	2.4	2.4	7.3	14.6	2.4	26.8	43.9	5.68 (1.63)	t(59.55) = -0.536 p = 0.594
	S	0.9	3.5	3.5	7.8	3.5	49.6	31.3	5.83 (1.32)	
Maintain the herd of horses in the South Unit of the park	N	2.1	2.1	0	4.3	14.9	29.8	46.8	6.04 (1.30)	t(180) = -0.591 p = 0.555
	S	0	2.2	2.2	7.4	3	35.6	49.6	6.16 (1.67)	
Increase size of roadside pullouts and parking areas	N	2	8.2	2	34.7	10.2	22.4	20.4	4.92 (1.61)	t(186) = -0.361 p = 0.719
	S	0.7	6.5	6.5	23.7	15.8	33.8	12.9	5.01 (1.44)	
Create new roadside pullouts and parking areas	N	8	8	6	30	14	24	10	4.46 (1.72)	*t(185) = -2.146 p = 0.033
	S	0.7	5.7	7.3	27	13.9	32.8	13.1	4.99 (1.42)	
Construct a permanent visitor center at the North Unit	N	0	4	4	24	16	26	26	5.34 (1.41)	t(161) = 0.381 p = 0.704
	S	0	3.5	0.9	28.3	14.2	39.8	13.3	5.26 (1.23)	
Improve existing restroom facilities at park campgrounds	N	2.2	4.3	2.2	13	15.2	50	13	5.37 (1.37)	t(166) = 0.226 p = 0.822
	S	0	2.5	0.8	31.1	10.7	37.7	17.2	5.32 (1.24)	
Use buffers to screen outside development such as oil & gas sites & cell phone towers	N	0	4.1	2	22.4	16.3	18.4	36.7	5.53 (1.44)	t(185) = 0.834 p = 0.406
	S	2.9	4.3	5.1	22.5	4.3	3.3	27.5	5.31 (1.63)	
Reduce maximum trailer length at campgrounds	N	2.4	9.5	9.5	54.8	9.5	9.5	4.8	4.07 (1.28)	t(150) = -1.611 p = 0.109
	S	0.9	9.1	6.4	45.5	8.2	24.5	5.5	4.46 (1.37)	
Increase the maximum trailer length at campgrounds	N	9.3	4.7	14	55.8	7	7	2.3	3.77 (1.31)	t(152) = 0.231 p = 0.818
	S	6.3	14.4	10.8	53.2	4.5	7.2	3.6	3.71 (1.36)	
Work with developers adjacent to the park to reduce visual impacts in the park	N	6.3	4.2	4.2	18.8	2.1	35.4	29.2	5.29 (1.80)	t(67.50) = -0.198 p = 0.844
	S	0.7	4.4	3.7	20	9.6	44.4	17	5.35 (1.37)	
Provide more information for visitors about things to see and do in the area	N	0	0	0	18	16	50	16	5.64 (0.96)	t(183) = 0.944 p = 0.346
	S	0	2.2	2.2	17.8	18.5	43	16.3	5.47 (1.16)	

(Continued on next page)

Table 22b. *Visitor opinions on possible management actions, listed as percent of sample (Management Survey, Question 4). Note: The highest value in each row has been highlighted. Statistically significant differences marked with *($p < 0.05$). Continued from previous page.*

	Location	1) Strongly oppose	2) Oppose	3) Somewhat oppose	4) Neither oppose or support	5) Somewhat support	6) Support	7) Strongly support	Mean (SD)	t-test
Increase the number of backcountry trails (Wilderness trails)	N	2.1	2.1	4.2	25	16.7	33.3	16.7	5.19 (1.39)	$t(170) = -1.198$ $p = 0.233$
	S	0	2.4	1.6	24.2	14.5	34.7	22.6	5.45 (1.26)	
Provide more short hiking trails	N	0	0	2	22	20	44	12	5.42 (1.03)	$t(181) = -1.139$ $p = 0.256$
	S	0	0	3.8	18.8	12	41.4	24.1	5.63 (1.15)	
More ranger-led programs	N	2.1	2.1	0	31.3	18.8	35.4	10.4	5.10 (1.28)	$t(178) = -1.557$ $p = 0.121$
	S	0.8	0	1.5	24.2	15.9	43.9	13.6	5.41 (1.12)	
Provide more restroom facilities	N	2.2	2.2	2.2	10.9	17.4	56.5	8.7	5.43 (1.22)	$t(182) = 0.875$ $p = 0.383$
	S	0	1.4	5.8	26.8	17.4	29.7	18.8	5.25 (1.28)	
Provide more parking spaces at pullouts and parking areas along scenic drives	N	4.2	4.2	2.1	33.3	16.7	37.5	2.1	4.75 (1.38)	$t(186) = -0.972$ $p = 0.332$
	S	0.7	5	5	28.6	19.3	29.3	12.1	4.97 (1.36)	
Expand campgrounds loop by creating additional camping spots	N	4.4	4.4	6.7	26.7	24.4	26.7	6.7	4.69 (1.46)	$t(155) = -0.78$ $p = 0.437$
	S	0.9	3.6	6.3	40.2	8	26.8	14.3	4.88 (1.40)	
Install water, sewer, and electrical hookups in campgrounds	N	9.3	9.3	14	23.3	20.9	18.6	4.7	4.12 (1.67)	$t(154) = -1.151$ $p = 0.252$
	S	3.5	13.3	12.4	23.9	9.7	24.8	12.4	4.47 (1.73)	
Provide running water and showers at restroom facilities at campgrounds	N	6.5	4.3	4.3	8.7	30.4	30.4	15.2	5.04 (1.63)	$t(160) = 0.255$ $p = 0.799$
	S	0.9	8.6	5.2	25	14.7	29.3	16.4	4.97 (1.53)	
Create new reserved group campgrounds	N	9.8	9.8	7.3	39	9.8	22	2.4	4.05 (1.61)	$t(151) = -1.855$ $p = 0.066$
	S	1.8	7.1	8	40.2	13.4	18.8	10.7	4.55 (1.44)	
Improve accessibility at existing park facilities	N	4.4	0	2.2	33.3	22.2	24.4	13.3	4.96 (1.40)	$t(173) = -0.778$ $p = 0.437$
	S	0	1.5	4.6	31.5	14.6	37.7	10	5.12 (1.19)	
Expand existing campgrounds by providing larger loops, larger pull-offs, and additional RV sites	N	7.3	4.9	14.6	24.4	19.5	22	7.3	4.39 (1.63)	$t(153) = -0.841$ $p = 0.401$
	S	0	9.6	11.4	29.8	17.5	19.3	12.3	4.62 (1.48)	

Table 23: *Changes in support for potential management actions from 2001 to 2017 across all survey locations, listed as percent of sample. Statistically significant differences marked with $*(p < 0.05)$.*

	Survey Year	1) Strongly oppose	2) Oppose	3) Somewhat oppose	4) Neither oppose nor support	5) Somewhat support	6) Support	7) Strongly support	Mean (SD)	t-test
Maintain the herd of longhorn steers in the North Unit of the park	2001	0.5	0	3.8	18.6	30.6	14.2	32.2	5.5 (1.27)	$*t(338) = -2.07$ $p = 0.039$
	2017	1.3	3.3	4.5	9.6	3.3	43.3	35.1	5.8 (1.4)	
Maintain the herd of horses in the South Unit of the park	2001	0.5	0	0	9.5	28.6	17.5	43.9	5.94 (1.11)	$t(370) = -1.67$ $p = 0.096$
	2017	0.5	2.2	1.7	6.6	6.1	33.9	49.2	6.14 (1.2)	
Use buffers to screen outside development such as oil & gas site sand cell phone towers	2001	3.2	2.7	5.9	20.9	18.7	8.6	40.1	5.35 (1.67)	$t(373) = -0.15$ $p = 0.883$
	2017	2.1	4.3	4.3	22.4	7.4	29.3	30.3	5.38 (1.58)	
Reduce maximum trailer length at campgrounds	2001	6	0.6	4.8	47	15.1	7.8	18.7	4.63 (1.54)	$t(316) = 1.66$ $p = 0.097$
	2017	1.4	9.2	7.3	48	8.6	20.4	5.3	4.36 (1.35)	
Work with developers adjacent to the park to reduce visual impacts in the park	2001	2.2	0.5	1.6	16.7	29.6	13.4	36	5.55 (1.38)	$t(368) = 1.42$ $p = 0.158$
	2017	2.2	4.3	3.8	19.5	7.6	41.8	20.7	5.34 (1.49)	
Provide more information for visitors about things to see and do in the area	2001	0.5	0.5	0.5	28.1	46.9	7.3	16.1	5.07 (1.07)	$*t(374.35) = -3.89$ $p = 1.17 \times 10^{-4}$
	2017	0	1.6	1.6	18.3	17.8	44.6	16.1	5.51 (1.11)	
Provide more short hiking trails	2001	0.6	1.1	6.1	18.2	31.8	14.9	21	5.22 (1.29)	$*t(351) = -2.73$ $p = 0.007$
	2017	0	0	3.4	19.6	14.2	42.1	20.8	5.57 (1.12)	
Provide more ranger-led programs	2001	0	0.6	3.5	46.5	32.6	7.6	9.3	4.71 (1.03)	$*t(348.15) = -5.26$ $p = 2.52 \times 10^{-7}$
	2017	1.1	0.5	1.1	26.5	16.6	41.5	12.7	5.32 (1.17)	
Provide more restroom facilities	2001	1.3	0	5.7	34.8	43	8.2	7	4.71 (1.03)	$*t(339.12) = -4.71$ $p = 4 \times 10^{-6}$
	2017	0.5	1.7	4.9	22.9	17.5	36.5	16.3	5.29 (1.26)	
Provide more parking spaces at pullouts and parking areas along scenic drives	2001	3.3	1.7	9.4	37.9	31.1	5.6	11.1	4.53 (1.31)	$*t(367) = -2.6$ $p = 0.01$
	2017	2.1	4.8	4.2	29.6	18.5	31.2	9.5	4.89 (1.39)	

Visitor Preferences for Improvements

Question 5 of the Management Survey asked visitors to allocate 100 “preference points” for the potential expansion or creation of various elements within Theodore Roosevelt National Park. Visitors could assign 100 points to one item and zero to all the others, or assign 50 points to one, 25 to another, and 25 to yet another, so long as the total did not exceed 100 points. In the Figure 43 below, each pair of bars represents one specific action to which visitors assigned preference points. Each bar shows the average number of points given from North or South Unit responses.

For the most part, North and South Unit visitors assigned the same average number of points to each action item. Visitors assigned an average of 50 preferences points for the construction of a visitor center in the North Unit. On average, one quarter of preference points went toward each of improving accessibility of park facilities, improving campgrounds, and opposition to all expansion. To a slightly lesser degree, visitors preferred expanding campgrounds through both the creation of new reserved group sites as well as providing larger loops, pull-offs, and RV sites.

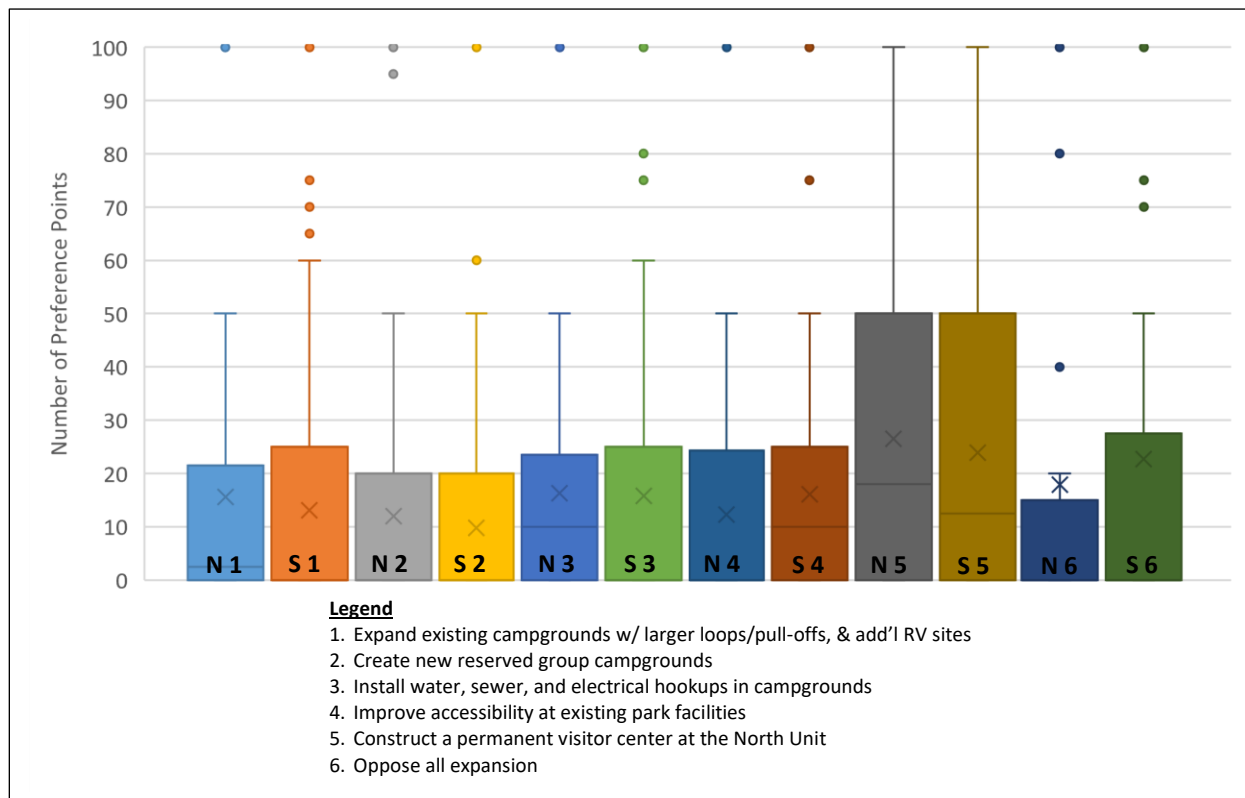


Figure 43. Visitor allocation of 100 preference points to possible park expansions, by survey location. (Management Survey, Question 5) Note: N = North Unit, S = South Unit, number corresponds to action item in legend.

Question 6 of the Management Survey asked visitors to choose specifically from the six potential management actions in Figure 44, with the assumption that only one would be implemented. The chart below summarizes visitor preferences if given one hypothetical choice for improvements to THRO. Of all Management Survey respondents:

- 14% preferred expanding campgrounds
- 10% preferred creating new group sites
- 16% chose installing new hookups in campgrounds
- 15% preferred improving facility accessibility
- 24% preferred a new visitor center for the North Unit
- 21% opposed all expansion in THRO

These percentages are displayed as North and South Unit visitor responses on the following page.

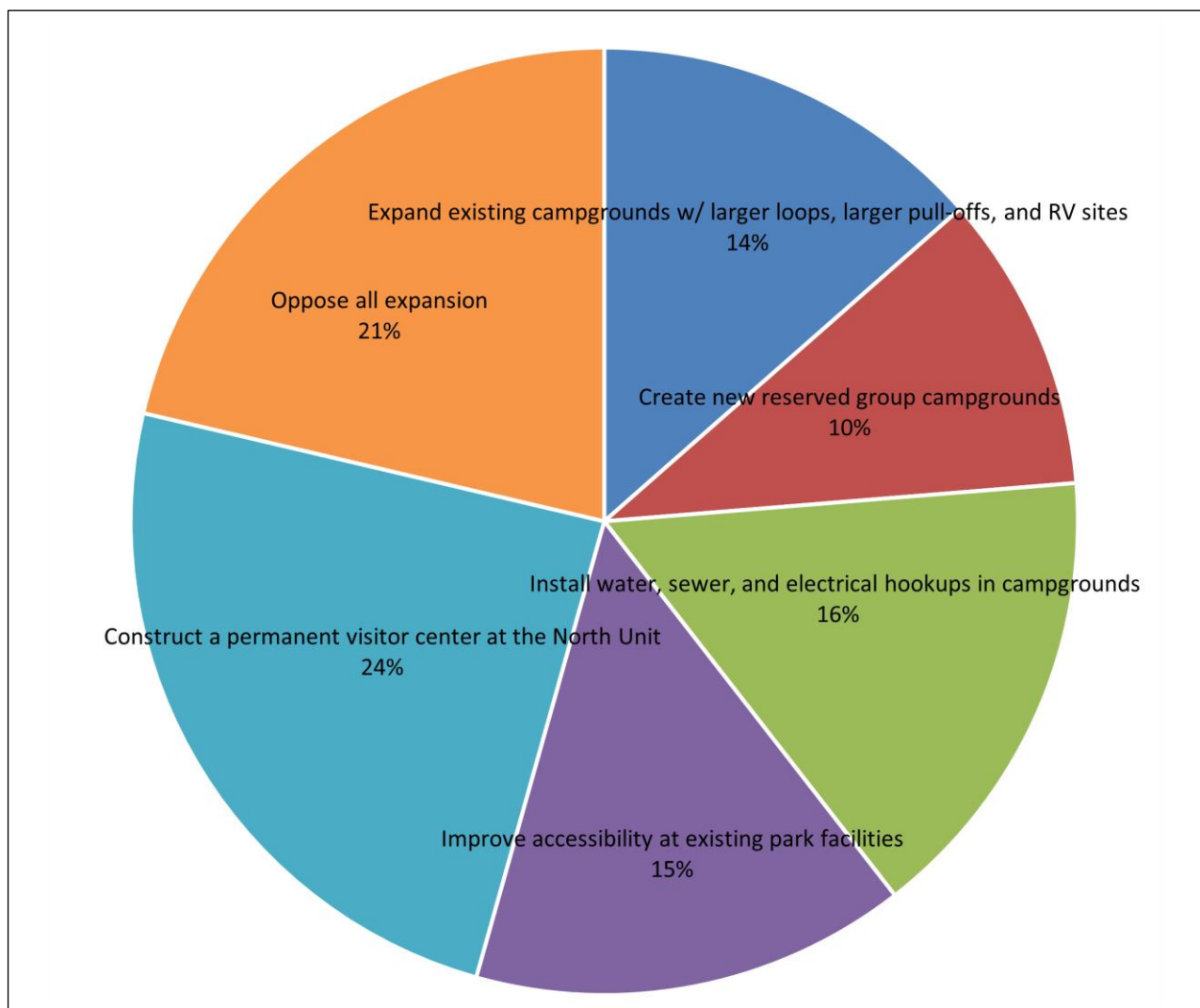


Figure 44. Visitor preference if only one expansion project were to be chosen, across all survey locations (Management Survey, Question 6).

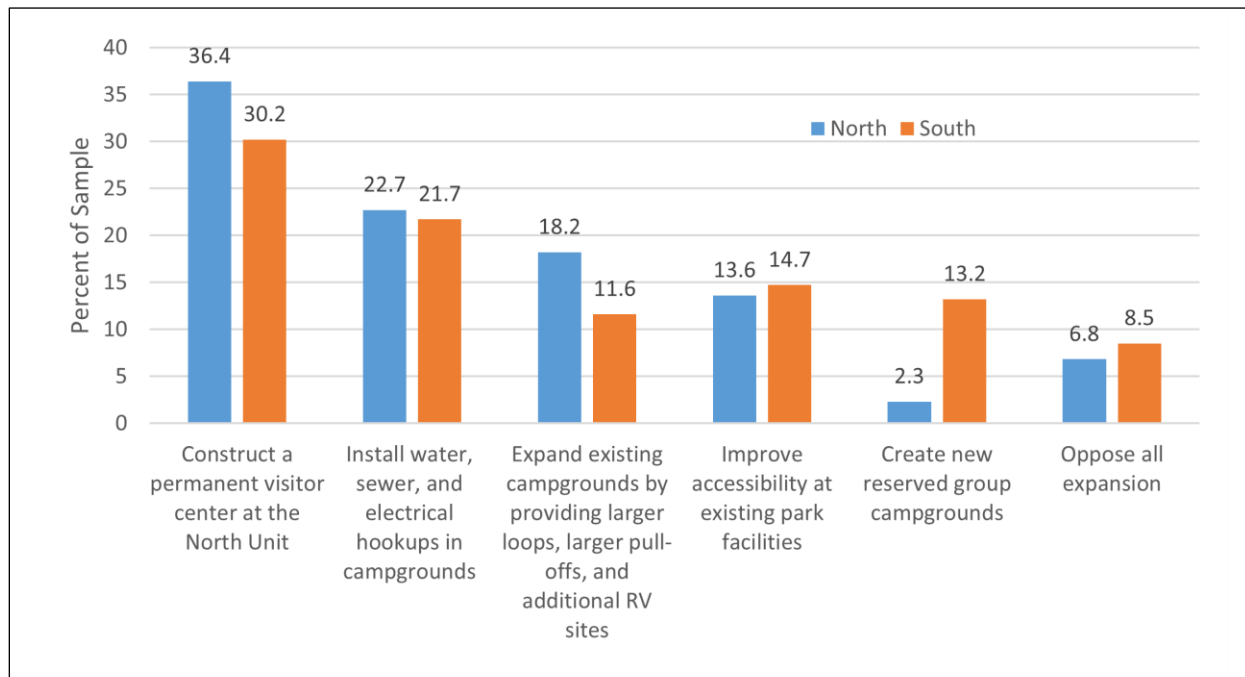


Figure 45. Visitor preference if only one expansion project were to be chosen, by survey location (Management Survey, Question 6)

Visitor Opinions of Technology (Questionnaire in Appendix D)

The Technology Survey asked visitors numerous questions about their use of devices and apps both at THRO and in their general lives. Visitors' responses to these questions were evenly distributed across a 7-point Likert scale ranging from -3 ("strong disagreement") to +3 ("strong agreement").

Regarding Question 2 of the Technology Survey, the majority of visitors reported that their 'attitudes toward mobile devices,' ranged from neutral position to strong agreement with each of the question parameters. Notably among these were *agreement* that:

- Mobile devices enhance my personal life – 85% agreement
- Mobile devices help me connect with friends and family – 93% agreement
- Mobile devices enhance my work life – 87% agreement
- Mobile devices enable me to stay connected to work wherever I am – 63% agreement
- Staying connected to work allows me more time away from the office – 40% agreement
- Mobile devices enhance my outdoor experiences – 47% agreement
- I use mobile devices to search for info about my outdoor experiences – 84% agreement
- I like being constantly connected – 33% agreement
- Constant connection decreases my enjoyment of outdoor experiences – 47% agreement
- Devices distract me from immersing myself in an outdoor experience – 55% agreement

Regarding Question 3 of the Technology Survey, most visitors reported that the 'influence of mobile devices' ranged a neutral position to strong *disagreement* with each of the questions, with a couple of exceptions. Notably among these were:

- Mobile devices improved my experiences at Theodore Roosevelt NP – 46% agreement
- Using mobile devices will help me share my experiences at Theodore Roosevelt NP with family and friends – 83% agreement
- I was able to spend more time at Theodore Roosevelt NP today because I was able to be connected to work during my visit – 56% disagreement
- Mobile devices detract from my experiences at Theodore Roosevelt NP – 44% disagreement
- I was distracted because I felt connected to work – 58% disagreement
- Mobile devices distracted me from immersing myself in my experiences at Theodore Roosevelt NP – 50% disagreement (28% neutral)
- Mobile devices prevent me from feeling disconnected – 39% disagreement (27% neutral)
- It is annoying seeing people using their mobile devices at Theodore Roosevelt NP – 33% disagreement (36% neutral)

Question 5 of the Technology Survey asked visitors to rank the reasons they used mobile devices, from most important to least important. Visitors reported that the most important reasons were to use their device as a camera (42% of respondents), and to feel safe (43% of respondents). The least important reasons were sharing important moments during their visit (24%) and to find local restaurants and businesses (46%). Concerning connectivity via cellular network or Wi-Fi (Question 4), visitors reported that both were important, but cell service was regarded as more important park-wide than Wi-Fi, being more important when in buildings. See Tables 24-27.

Table 24. *Visitor attitudes towards mobile devices by survey location, represented as percent of sample. (Technology Survey, Question 2) Note: N = North Unit, S = South Unit. Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.*

	Location	1) Strongly disagree	2) Disagree	3) Neutral	4) Agree	5) Strongly agree	Mean (SD)	t-test
Mobile devices enhance my personal life	N	0	3.5	3.5	54.4	38.6	4.28 (0.70)	$*t(246) = 2.264$ $p = 0.024$
	S	2.1	7.3	13.6	45.5	31.4	3.97 (0.97)	
Mobile devices help me connect with friends and family	N	0	1.8	8.8	35.1	54.4	4.42 (0.73)	$t(246) = -0.455$ $p = 0.650$
	S	1.6	1	1.6	40.3	55.5	4.47 (0.73)	
Mobile devices enhance my work life	N	0	1.8	30.9	32.7	34.5	4.00 (0.86)	$t(115.836) = 1.471$ $p = 0.144$
	S	6.8	4.7	23.7	32.1	32.6	3.79 (1.15)	
Mobile devices enable me to stay connected to work wherever I am	N	5.5	1.8	32.7	34.5	25.5	3.72 (1.04)	$t(242) = -0.579$ $p = 0.563$
	S	6.3	3.2	25.4	31.7	33.3	3.83 (1.12)	
Staying connected to work allows me more time away from the office	N	7.1	8.9	42.9	21.4	19.6	3.38 (1.12)	$t(243) = 1.082$ $p = 0.281$
	S	13.8	13.8	34.4	18	20.1	3.17 (1.29)	
Mobile devices enhance my outdoor experiences	N	12.3	15.8	22.8	28.1	21.1	3.30 (1.31)	$t(246) = 0.703$ $p = 0.483$
	S	15.7	16.2	23.6	25.7	18.8	3.16 (1.34)	
I use mobile devices to search for information about my outdoor experiences	N	1.8	0	7	43.9	47.4	4.35 (0.77)	$*t(245) = 2.201$ $p = 0.029$
	S	5.3	5.3	11.1	40	38.4	4.01 (1.09)	
I like being constantly connected	N	14	17.5	31.6	22.8	14	3.05 (1.26)	$t(245) = 1.524$ $p = 0.129$
	S	20.5	26.8	23.2	15.8	13.7	2.75 (1.32)	
Being constantly connected decreases my enjoyment of outdoor experiences	N	10.5	15.8	33.3	19.3	21.1	3.25 (1.26)	$t(246) = -0.723$ $p = 0.471$
	S	13.1	11.5	22	30.4	23	3.39 (1.31)	
Mobile devices distract me from immersing myself in an outdoor experience	N	12.3	17.5	19.3	19.3	31.6	3.40 (1.41)	$t(244) = -0.071$ $p = 0.945$
	S	13.2	11.6	20.1	30.2	24.9	3.42 (1.33)	

Table 25: *Influence of mobile devices on visitors by survey location, represented as percent of sample (Technology Survey, Question 3). Note: N = North Unit, S = South Unit. Highest frequencies are highlighted. Statistically significant differences marked with $*(p < 0.05)$.*

	Location	1) Strongly disagree	2) Disagree	3) Neutral	4) Agree	5) Strongly agree	Mean (SD)	t-test
Mobile devices improved my experiences at Theodore Roosevelt NP	N	5.3	8.8	31.6	33.3	21.1	3.56 (1.086)	*t(245) = 2.319 $p = 0.021$
	S	13.2	9.5	38.4	26.3	12.6	3.16 (1.171)	
Using mobile devices will help me share my experiences at Theodore Roosevelt NP with family and friends	N	1.8	1.8	8.8	50.9	36.8	4.19 (0.811)	t(246) = 0.672 $p = 0.502$
	S	3.7	3.7	14.1	36.6	41.9	4.09 (1.016)	
I was able to spend more time at Theodore Roosevelt NP today because I was able to be connected to work during my visit	N	33.9	17.9	33.9	3.6	10.7	2.39 (1.289)	t(244) = 0.710 $p = 0.478$
	S	39.5	10	39.5	6.8	4.2	2.26 (1.175)	
Mobile devices detract from my experiences at Theodore Roosevelt NP	N	22.8	24.6	36.8	5.3	10.5	2.56 (1.21)	t(246) = -0.440 $p = 0.661$
	S	22	17.8	41.4	12	6.8	2.64 (1.152)	
I was distracted because I felt connected to work	N	43.6	16.4	23.6	9.1	7.3	2.2 (1.297)	t(76.14) = 0.244 $p = 0.808$
	S	37.6	18.5	37.6	3.7	2.6	2.15 (1.058)	
Mobile devices distracted me from immersing myself in my experiences at Theodore Roosevelt NP	N	28.1	22.8	24.6	19.3	5.3	2.51 (1.241)	t(245) = 0.193 $p = 0.847$
	S	28.4	20.5	31.1	15.3	4.7	2.47 (1.189)	
Mobile devices prevented me from feeling disconnected	N	23.2	17.9	32.1	19.6	7.1	2.7 (1.235)	t(244) = -0.42 $p = 0.675$
	S	20.5	14.7	41.1	14.2	9.5	2.77 (1.202)	
It is annoying seeing people using their mobile devices at Theodore Roosevelt NP	N	25.5	9.1	36.4	23.6	5.5	2.75 (1.236)	t(244) = -1.108 $p = 0.269$
	S	17.3	15.2	36.1	17.3	14.1	2.96 (1.26)	

Table 23: *Visitor ranking of reasons for using mobile devices in the park by survey location, listed as percent of sample (Technology Survey, Question 5). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.*

	Location	1) Most important	(2)	(3)	(4)	(5)	6) Least important	Mean (SD)	t-test
To stay connected to friends/family	N	19.2	26.9	7.7	15.4	23.1	7.7	3.19 (1.68)	$t(233) = -1.18$ $p = 0.239$
	S	11.5	16.9	23.5	19.1	18	10.9	3.48 (1.52)	
To use as a camera	N	36.5	30.8	25	5.8	1.9	0	2.06 (1.02)	$t(233) = 0.334$ $p = 0.737$
	S	46.4	27.9	13.1	7.7	2.2	2.7	1.99 (1.24)	
Sharing important moments during my visit	N	1.9	5.8	23.1	21.2	21.2	26.9	4.35 (1.36)	$t(233) = 1.423$ $p = 0.156$
	S	5.5	12.6	20.8	18	22.4	20.8	4.02 (1.51)	
To feel safe	N	28.8	13.5	9.6	15.4	17.3	15.4	3.25 (1.88)	$t(233) = -0.14$ $p = 0.892$
	S	25.1	17.5	8.2	19.7	11.5	18	3.29 (1.84)	
To get information about places I am visiting	N	13.5	17.3	25	19.2	21.2	3.8	3.29 (1.43)	$t(233) = -0.96$ $p = 0.337$
	S	9.3	20.2	21.3	13.7	30.6	4.9	3.51 (1.46)	
To find local businesses/restaurants I might want to visit	N	0	5.8	9.6	23.1	15.4	46.2	4.87 (1.27)	$t(233) = 0.73$ $p = 0.466$
	S	2.2	4.9	13.1	21.9	15.3	42.6	4.71 (1.37)	

Table 27. Visitor preferences for Wi-Fi access by survey location, represented as percent of sample (Technology Survey, Question 4). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	Location	1) Extremely unimportant	2) Unimportant	3) Neither important nor unimportant	4) Important	5) Extremely important	Mean (SD)	t-test
Wi-Fi in all buildings	N	21.8	18.2	34.5	25.5	0	2.64 (1.1)	$*t(243) = -2.542$ $p = 0.012$
	S	12.6	19.5	23.7	34.2	10	3.09 (1.2)	
Wi-Fi in all campgrounds	N	17.3	34.6	23.1	21.2	3.8	2.6 (1.13)	$*t(235) = -2.674$ $p = 0.008$
	S	14.6	14.6	26.5	35.7	8.6	3.09 (1.97)	
Wi-Fi park-wide	N	30.8	26.9	21.2	21.2	0	2.33 (1.13)	$t(237) = -1.187$ $p = 0.236$
	S	25.7	26.7	20.9	19.8	7	2.56 (1.26)	
Cell service park-wide	N	13.5	19.2	19.2	36.5	11.5	3.13 (1.25)	$*t(236) = -3.062$ $p = 0.002$
	S	5.9	11.3	15.1	43	24.7	3.69 (1.14)	
Cell service park-wide in all national parks	N	9.4	18.9	22.6	34	15.1	3.26 (1.21)	$t(238) = -1.586$ $p = 0.114$
	S	9.6	10.2	18.2	38	24.1	3.57 (1.23)	

Visitors' Relationship with Nature

Question 6 of the Technology Survey also asked visitors about nature and outdoor experiences to possibly help understand the relationship between their technology use and how they identify with the natural world. The majority of respondents report enjoying the outdoors, having an affinity for remote areas, and being very aware of environmental issues. While the scale for each item making up this question ranged from 'strongly agree' to 'strongly disagree,' visitors to THRO consistently reported evidence of a strong relationship with the natural world. Of particular relevance in this regard are the following average percentages of visitors' responses to the items queried by Question 6:

- I enjoy being outdoors, even in unpleasant weather – 74% agreement
- My ideal vacation spot would be a remote, wilderness area – 71% agreement
- I always think about how my actions affect the environment – 93% agreement
- I am very aware of environmental issues – 91% agreement
- I take notice of wildlife wherever I am – 97% agreement
- I don't often go out in nature – 81% disagreement
- I am not separate from nature, but a part of nature – 75% agreement
- The thought of being deep in the woods, away from civilization, is frightening – 73% disagreement

- My feelings about nature do not affect how I live my life – 66% disagreement
- My relationship to nature is an important part of who I am – 77% agreement

Mobile Device App Use at THRO

Question 7 of the Technology Survey asked visitors about their app use—including NPS apps—as well as their use of social media. An average of 52% of visitors reported being aware that several National Park sites have mobile apps, and 34% reported having downloaded them. Of these visitors, 49% reported using the mobile app before coming to THRO, and 39% during their park visit. Following their visit, 75% of visitors reported that they planned to use an NPS app, and 69% predicted accessing THRO websites after their park visit.

Regarding the frequency of NPS app use, 27% of respondents said that they used the app once a day, 17% once a week, 24% once a month, and 64% only one time ever. During their visit, however, 9% reported using the app more than once an hour, 29% once per hour, 9% every two hours, and 52% only once.

Most respondents reported using Facebook (68%), followed by Instagram (12%) and Twitter (6%). Visitors used Facebook—70% of whom used Facebook for accessing park information—as well as Snapchat and Instagram while visiting THRO. Of these social media apps/sites, 91% of visitors reported using them at least once daily, and 9% only once weekly. Of their preferred social media, 80% reported using it only once during their visit and 10% reported twice per hour, with another 10% once per two hours. One-quarter of respondents reported not using social media at all.

Table 28: Visitor agreement about nature and outdoor experiences by survey location, represented as percent of sample (Technology Survey, Question 6). Note: N = North Unit, S = South Unit. Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	Location	1) Strongly disagree	2) Disagree	3) Neutral	4) Agree	5) Strongly agree	Mean (SD)	t-test
I enjoy being outdoors, even in unpleasant weather	N	5.4	10.7	12.5	48.2	23.3	3.73 (1.1)	$t(242) = -0.917$ $p = 0.36$
	S	1.1	12.2	11.2	49.5	26.1	3.87 (0.97)	
My ideal vacation spot would be a remote, wilderness area	N	3.6	7.1	21.4	46.4	21.4	3.75 (1)	$t(239) = -0.182$ $p = 0.856$
	S	2.7	10.3	19.5	41.6	25.9	3.78 (1.03)	
I always think about how my actions affect the environment	N	1.8	0	3.6	48.2	46.4	4.38 (0.73)	$t(242) = 0.163$ $p = 0.871$
	S	0.5	2.1	7.4	41	48.9	4.36 (0.76)	
I am very aware of environmental issues	N	0	1.8	5.5	63.6	29.1	4.2 (0.62)	$t(102.688) = -1.305$ $p = 0.195$
	S	0.5	1.1	9.6	42.6	46.3	4.33 (0.74)	
I take notice of wildlife wherever I am	N	1.9	0	0	24.1	74.1	4.69 (0.67)	$t(238) = 0.144$ $p = 0.885$
	S	0	0.5	3.2	24.7	71.5	4.67 (0.57)	
I don't often go out in nature	N	60.7	21.4	7.1	7.1	3.6	1.71 (1.11)	$t(240) = -0.216$ $p = 0.83$
	S	53.2	27.4	11.8	6.5	1.1	1.75 (0.97)	
I am not separate from nature, but a part of nature	N	5.5	5.5	10.9	36.4	41.8	4.04 (1.12)	$t(241) = 0.414$ $p = 0.679$
	S	2.1	2.7	25.5	35.1	34.6	3.97 (0.95)	
The thought of being deep in the woods, away from civilization, is frightening	N	41.1	32.1	12.5	8.9	5.4	2.05 (1.18)	$t(241) = 0.726$ $p = 0.469$
	S	48.7	22.5	17.6	9.6	1.6	1.93 (1.09)	
My feelings about nature do not affect how I live my life	N	33.9	32.1	17.9	12.5	3.6	2.2 (1.15)	$t(242) = 0.175$ $p = 0.862$
	S	38.3	28.2	17	11.7	4.8	2.16 (1.2)	
My relationship to nature is an important part of who I am	N	5.4	5.4	7.1	32.1	50	4.16 (1.13)	$t(242) = 0.186$ $p = 0.853$
	S	1.6	2.7	20.2	31.9	43.6	4.13 (0.94)	

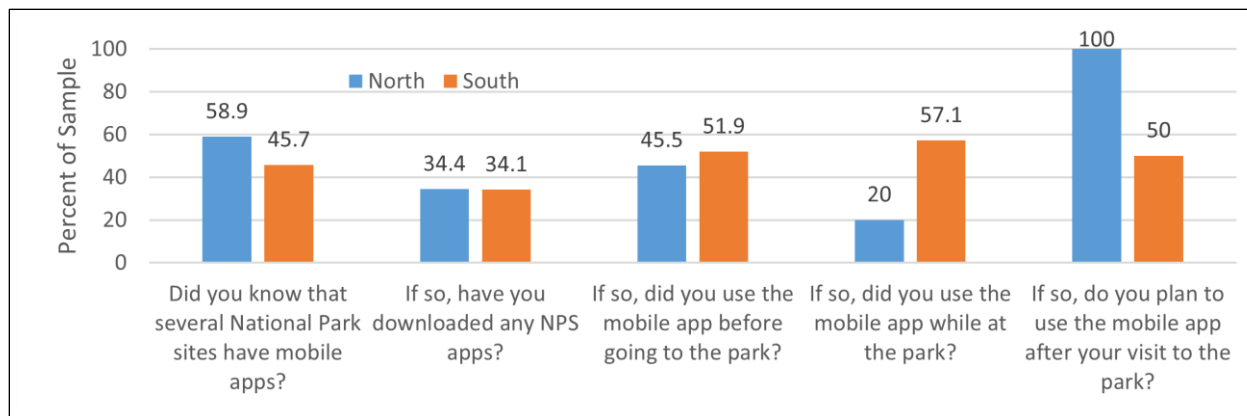


Figure 46. Visitor use of NPS apps by survey location. (Technology Survey, Question 7)

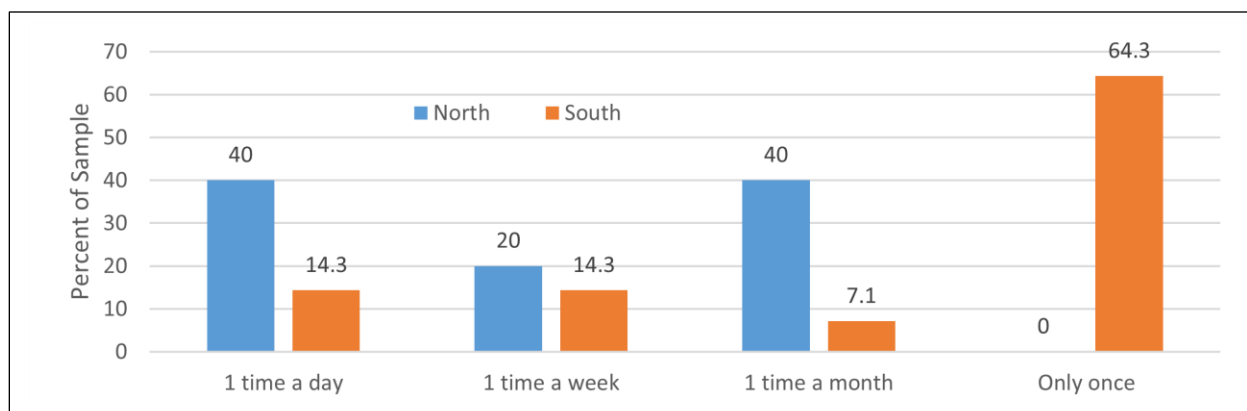


Figure 47. Frequency of visitor use of NPS apps before their visit, by survey location. Technology Survey, Question 7)

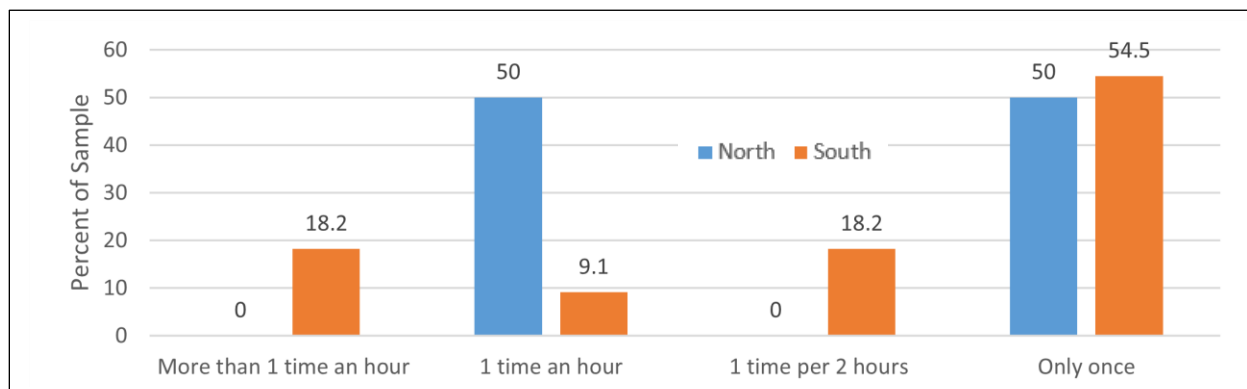


Figure 48. Frequency of visitor use of NPS apps during their visit, by survey location. Technology Survey, Question 7)

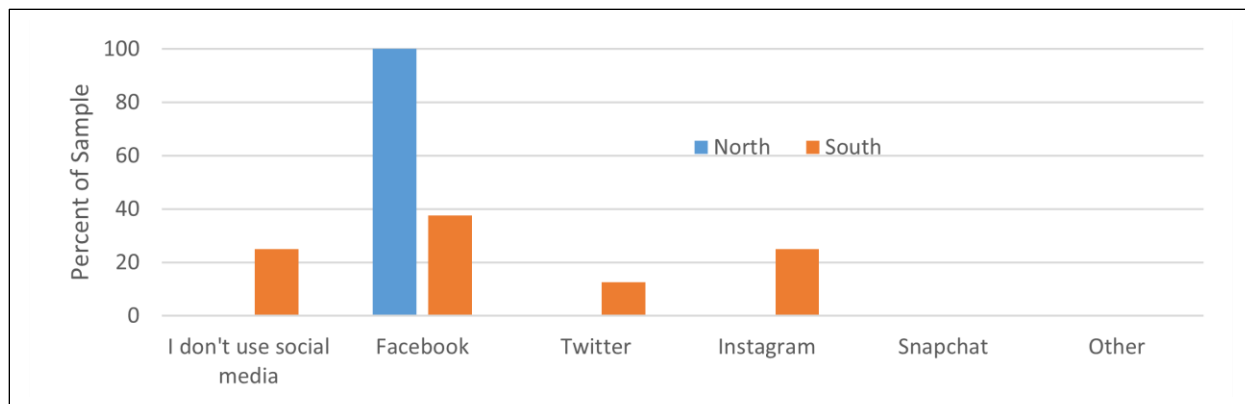


Figure 49: Visitor use of social media sites, by survey location. (Technology Survey, Question 8)

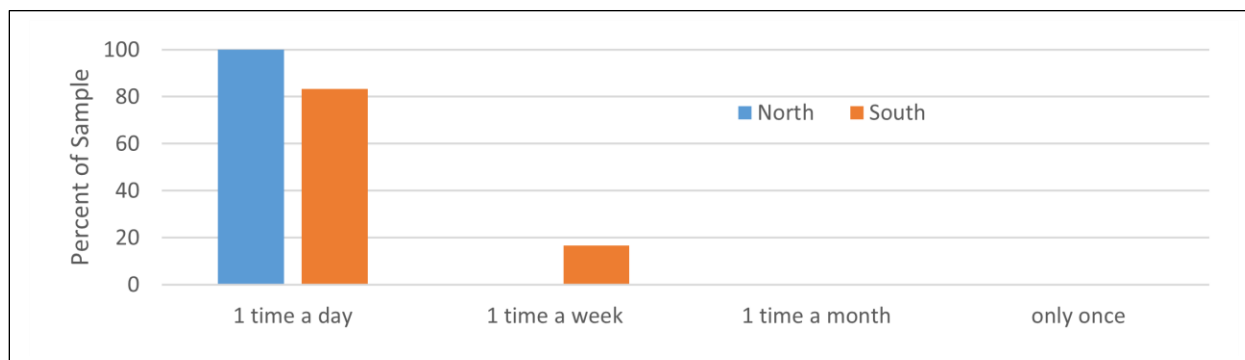


Figure 50. Minimum frequency at which visitors use their preferred social media, by survey location. (Technology Survey, Question 8)

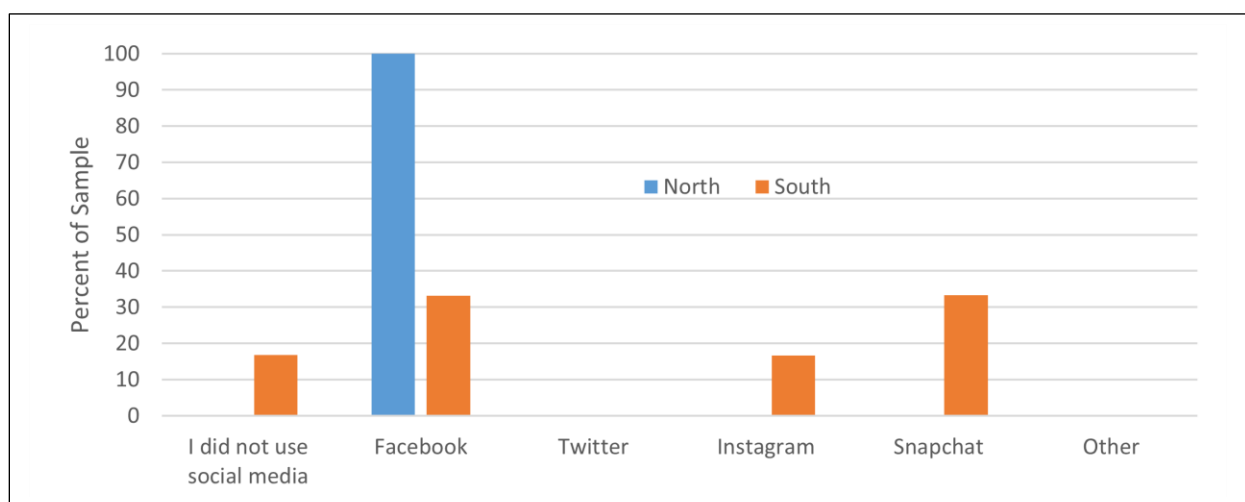


Figure 51. Visitor-preferred social media during their visit, by survey location. (Technology Survey, Question 9)

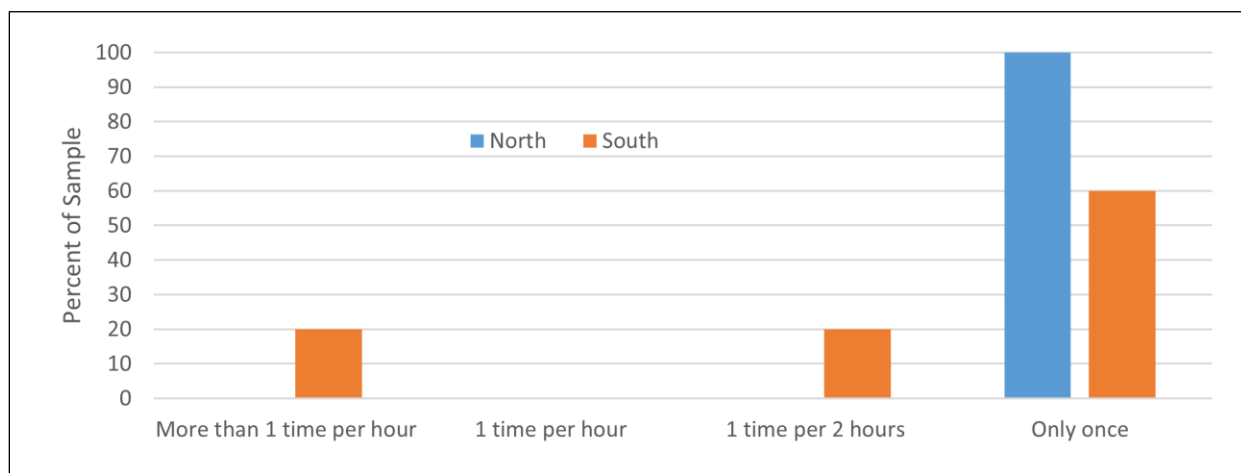


Figure 52. Frequency at which visitors used their preferred social media during their visit, by survey location (Technology Survey, Question 9).

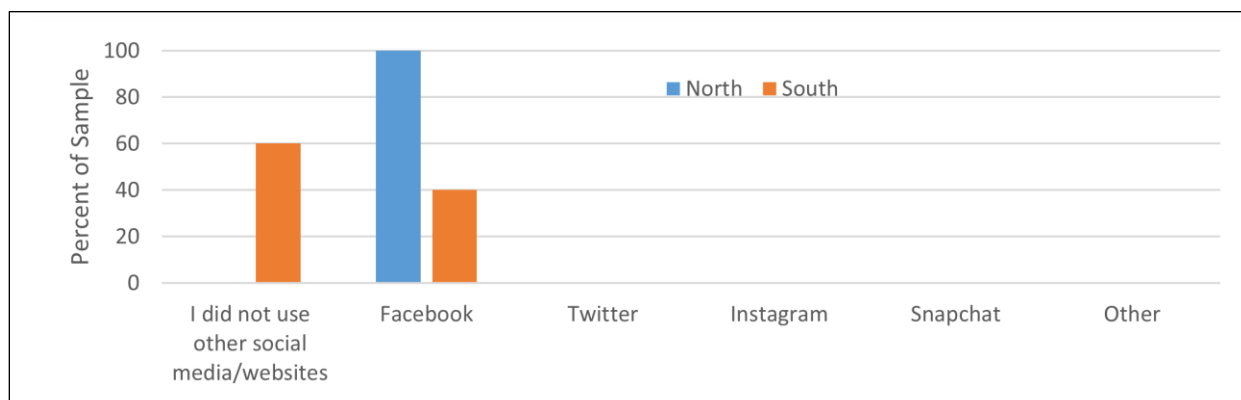


Figure 53. Visitor-preferred social media for park information, by survey location. (Technology Survey, Question 10).

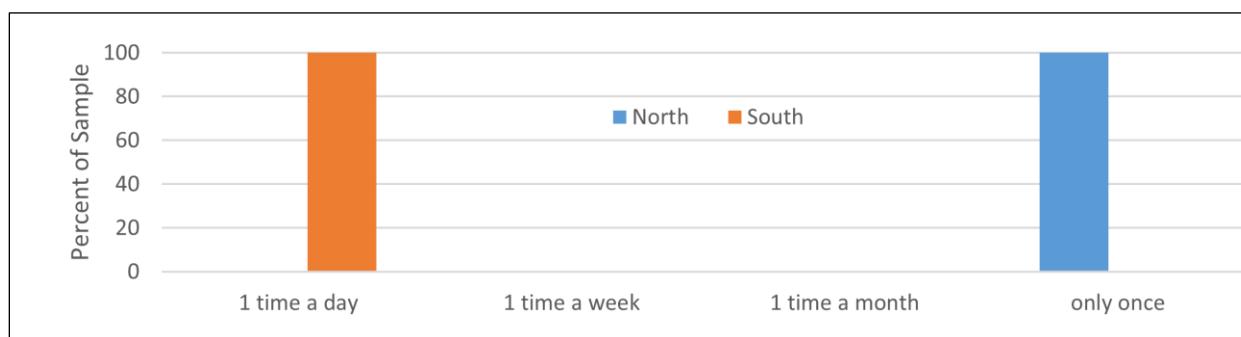


Figure 54. Frequency at which visitors used their preferred social media for park information, by survey location (Technology Survey, Question 10).

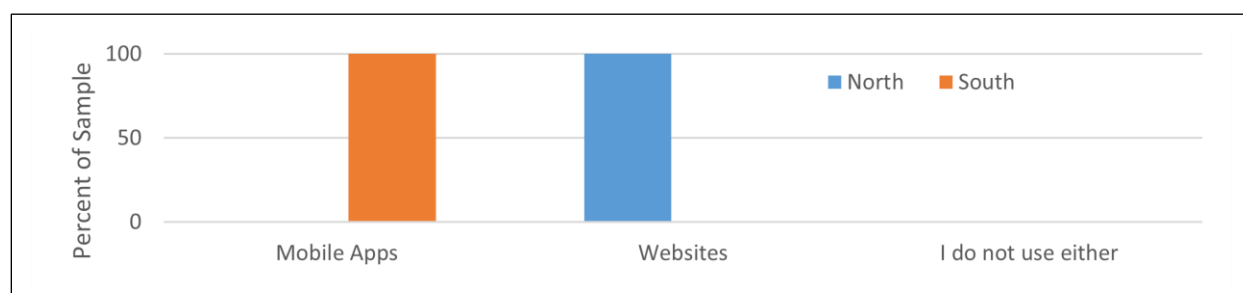


Figure 55. Visitor technology preference, by survey location. (Technology Survey, Question 11).

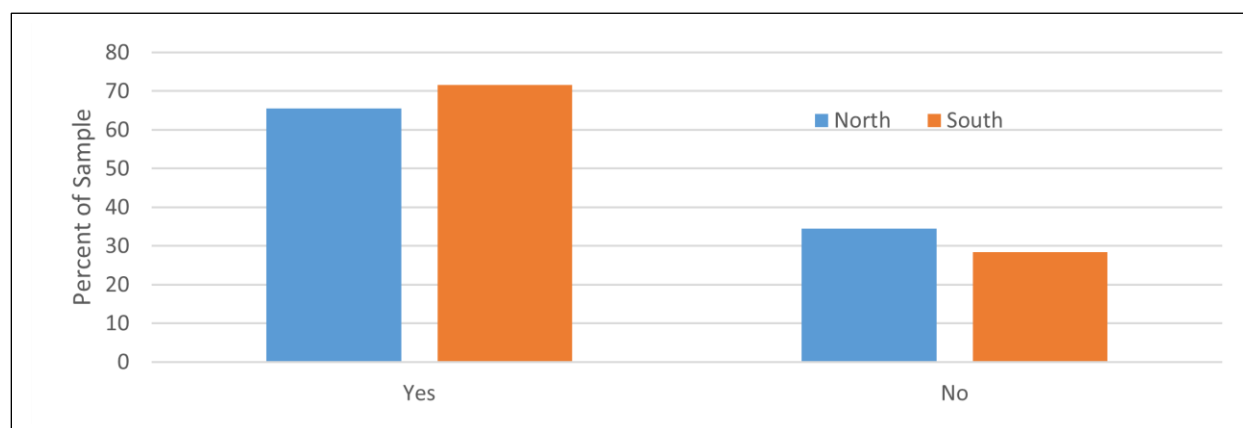


Figure 56. Visitor predicted use of THRO websites after returning home, by survey location (Technology Survey, Question 12).



OVERALL THRESHOLD QUESTIONNAIRE RESULTS

**Human
Structures on
the Landscape**



• **Large Animal
Sightings per
Hour**



• **Wait Times
for Parking**



• **Vehicles at One
Time**



Threshold for Human Structures on the Landscape

Informed by management, park documents, and conversations with visitors, the amount of Human Structures on the Landscape (HSOL) was selected as a primary element pertaining to the quality of a visit (i.e., indicator of quality) to THRO. Consequently, the research team evaluated visitors' desired conditions for HSOL at THRO to understand the conditions that visitors deem a) the minimally acceptable condition (i.e., threshold), b) when management action should take place (i.e., management action), and c) when they might not return to the site because of conditions (i.e., displacement).

These desired conditions, or visitor norms, were revealed through survey responses to a photo panel of digitally manipulated images that show from zero (Photo 1) to twelve (Photo 5) human structures on the landscape at THRO. The HSOL survey helps to understand whether actual conditions aligned with or exceeded visitors' desired conditions for the number of structures that might be visible in a single view of THRO's landscape. Overall, the results for HSOL at THRO indicate decreasing levels of acceptability as HSOL increases. Visitor's consensus in either park unit regarding the acceptability rating for each level in the HSOL panel was moderate, indicated by the size of the bubbles for each photograph. This level of consensus indicates that on average visitors to either unit tend to agree on the acceptability rating regarding the conditions displayed in the photographs.

The social norm curve for HSOL shows similar trends in the experiences and opinion of North and South Unit visitors, but different levels of acceptance of potentially undesirable conditions at THRO. North and South Unit respondents reported experiencing one or fewer visible human structures on the landscape while visiting THRO with 90% and 64% of visitors, respectively, identifying Photo 1 (0 structures) as representing conditions most similar their experience that day. However, whereas South Unit respondents reported their threshold for acceptability at approximately 6 HSOL, North Unit respondents reported a much smaller tolerance of approximately 2 HSOL, identifying Photos 2, 3, 4, and 5 as 'very unacceptable.' Perhaps related to the more remote nature of the North Unit, and therefore different expectations about evidence of human presence on the landscape, North Unit visitors suggested that management action should be required at the 6 HSOL level, with 85% reporting they would be displaced at 9 HSOL. The South Unit, which is located nearer to both the interstate and larger cities, seems to garner lower expectations in regard to HSOL, with 72% of visitors suggesting management action at 11 HSOL and 66% indicating displacement at 12 HSOL, on average.

The differences in North versus South Unit responses were statistically significant in all cases except reported conditions, suggesting that the current low level of HSOL is acceptable, but even small increases in the number of visible human structures will result in decreased visitor satisfaction in regard to THRO's landscape aesthetics. This idea is supported by responses to the Questions 4c and 5c of the Thresholds Survey, wherein an average of 62% of visitor responses indicate that reported conditions of 1 or fewer visible HSOL either 'increased' or 'extremely increased' the quality of their experience at THRO. This finding also suggests that the range of acceptable conditions occurs between 0 to 2 structures at THRO, with 0 structures being the most acceptable condition. It is also worth mentioning that an average of 20% of visitors reported that use should never be limited, suggesting that there are at least some visitors to THRO are fundamentally opposed to use limits related to human structures.



Photo 1: 0 Structures



Photo 2: 3 Structures



Photo 3: 6 Structures



Photo 4: 9 Structures



Photo 5: 12 Structures

Figure 57. Photo series showing human-built structures on the landscape at THRO, numbering from zero structures in Photo 1 to twelve structures in Photo 5. Photos were enlarged for increased clarity during respondent survey completion.

Table 29: *Evaluative dimensions of visitor opinions in regard to human structures on the landscape by survey location, represented as percent of sample (Thresholds Survey, Questions 4 and 5 b, d, e, and f). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.*

	Location	P1: 0 Structures	P2: 3 Structures	P3: 6 Structures	P4: 9 Structures	P5: 12 Structures	6) None show high enough use	7) Use should never be limited	Mean Photo # (SD)	t-test
Experienced	N	89.9	7.9	1.1	1.1	0			1.135 (0.45)	$*t(210.896) = -3.85$ $p = 1.57 \times 10^{-4}$
	S	63.7	31.5	4	0	0.8			1.427 (0.65)	
Management Action	N	8.9	41.1	15.6	4.4	22.2	7.8		3.133 (1.55)	$*t(164.87) = -7.29$ $p = 1.206 \times 10^{-11}$
	S	1.7	3.3	15.7	21.5	30.6	27.3		4.579 (1.23)	
Displacement	N	0	23.6	21.3	12.4	28.1	14.6		3.888 (1.43)	$*t(154.533) = -5.75$ $p = 4.625 \times 10^{-8}$
	S	0	2.5	9.2	16.7	37.5	34.2		4.917 (1.05)	
Use limit	N	44.6	16.3	7.6	3.3	1.1	10.9	16.3	2.978 (2.38)	$*t(162.541) = -5.73$ $p = 4.77 \times 10^{-8}$
	S	3.3	4.1	27.6	17.1	6.5	17.9	23.6	4.675 (1.79)	

Table 30. *Visitors' acceptance of varying numbers of structures on the landscape in the North and South Units. Listed as percent of sample. (Thresholds Survey, Questions 4a and 5a). Highest percentages are highlighted. Statistically significant differences marked with *($p < 0.05$).*

	-4 (Very unacceptable)	-3 (Unacceptable)	-2 (Moderately Unacceptable)	-1 (Slightly unacceptable)	0 (Neither)	+1 (Slightly acceptable)	+2 (Moderately Acceptable)	+3 (Acceptable)	+4 (Very acceptable)	Mean (SD)
North Unit Survey Responses										
0 Structures	5.6	1.1	0	1.1	0	0	3.3	14.4	74.4	3.21 (2.02)
3 Structures	31.5	14.1	8.7	4.3	5.4	7.6	8.7	9.8	9.8	-0.97 (2.96)
6 Structures	44.6	14.1	13	6.5	1.1	5.4	2.2	8.7	4.3	-2 (2.59)
9 Structures	50	26.1	8	2.3	1.1	1.1	3.4	3.4	4.5	-2.6 (2.27)
12 Structures	67.1	15.3	4.7	3.5	0	2.4	1.2	2.4	3.5	-3.0 (2.04)
South Unit Survey Responses										
0 Structures	2.4	0.8	0	0	3.3	4.1	5.7	26.8	56.9	3.11 (1.61)
3 Structures	8.1	1.6	3.2	4	3.2	4.8	12.9	37.1	25	1.94 (2.4)
6 Structures	6.5	11.3	9.7	15.3	5.6	13.7	18.5	14.5	4.8	.194 (2.36)
9 Structures	15.3	16.1	15.3	16.1	8.1	8.9	8.1	7.3	4.8	-.90 (2.4)
12 Structures	37.5	12.5	15	12.5	5	5	4.2	4.2	4.2	-1.86 (2.38)

Table 31: Visitor-reported acceptability in human structures on the landscape by survey location, represented as percent of sample (Thresholds Survey, Question 4a and 5a). Note: N = North Unit, S = South Unit. Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

		- 4 (Very unacceptable)	-3 (Unacceptable)	-2 (Moderately Unacceptable)	-1 (Slightly unacceptable)	0 (Neither)	+1 (Slightly acceptable)	+2 (Moderately Acceptable)	+3 (Acceptable)	+ 4 (Very acceptable)	Mean (SD)	t-test
Photo 1 0 Structures	N	5.6	1.1	0	1.1	0	0	3.3	14.4	74.4	3.21 (2.02)	$t(211) = 0.39$ $p = 0.696$
	S	2.4	0.8	0	0	3.3	4.1	5.7	26.8	56.9	3.11 (1.61)	
Photo 2 3 Structures	N	31.5	14.1	8.7	4.3	5.4	7.6	8.7	9.8	9.8	-0.97 (2.96)	$*t(172) = -7.74$ $p = 8.29 \times 10^{-13}$
	S	8.1	1.6	3.2	4	3.2	4.8	12.9	37.1	25	-1.94 (2.4)	
Photo 3 6 Structures	N	44.6	14.1	13	6.5	1.1	5.4	2.2	8.7	4.3	-2.0 (2.59)	$*t(214) = -7.98$ $p = 5.90 \times 10^{-10}$
	S	6.5	11.3	9.7	15.3	5.6	13.7	18.5	14.5	4.8	.19 (2.36)	
Photo 4 9 Structures	N	50	26.1	8	2.3	1.1	1.1	3.4	3.4	4.5	-2.60 (2.27)	$*t(210) = -5.20$ $p = 4.82 \times 10^{-7}$
	S	15.3	16.1	15.3	16.1	8.1	8.9	8.1	7.3	4.8	-.90 (2.4)	
Photo 5 12 Structures	N	67.1	15.3	4.7	3.5	0	2.4	1.2	2.4	3.5	-3.0 (2.04)	$*t(193) = -3.67$ $p = 3.11 \times 10^{-4}$
	S	37.5	12.5	15	12.5	5	5	4.2	4.2	4.2	-1.86 (2.38)	

Table 32: Comparison of visitor opinions in regard to human structures on the landscape when asked the question: "Considering the conditions that you experienced today, to what degree have they impacted the quality of your park experience?" Listed as percent of sample (Thresholds Survey, Question 4c and 5c). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

Location	-2 (Extremely decreased)	-1 (Decreased)	0 (Did not improve/detract)	+1 (Increased)	+2 (Extremely increased)	Mean (SD)	t-test
North	5.6	4.4	26.7	20	43.3	0.91 (1.18)	$t(152.849) = -0.555$ $p = 0.580$
South	0	1.6	30.9	34.1	33.3	0.99 (0.84)	

Human Structures on the Landscape Norm Curve

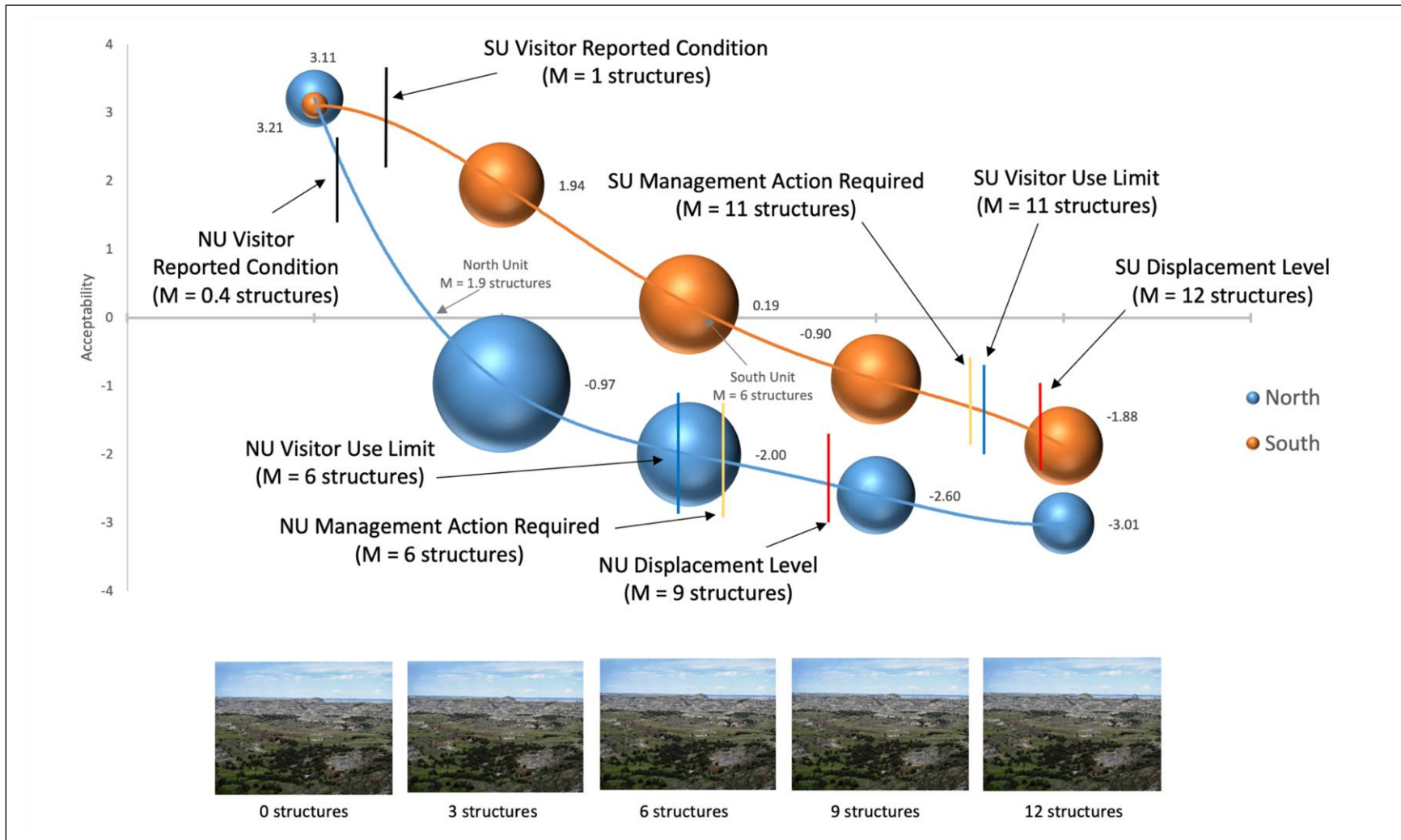


Figure 58. Social norm curve for HSOL showing visitors' evaluative dimensions of acceptability, desired action, and displacement.



Figure 59. Digitally manipulated image (#2 in HSOL panel) showing potential threshold violation for North Unit visitors of 3 HSOL.

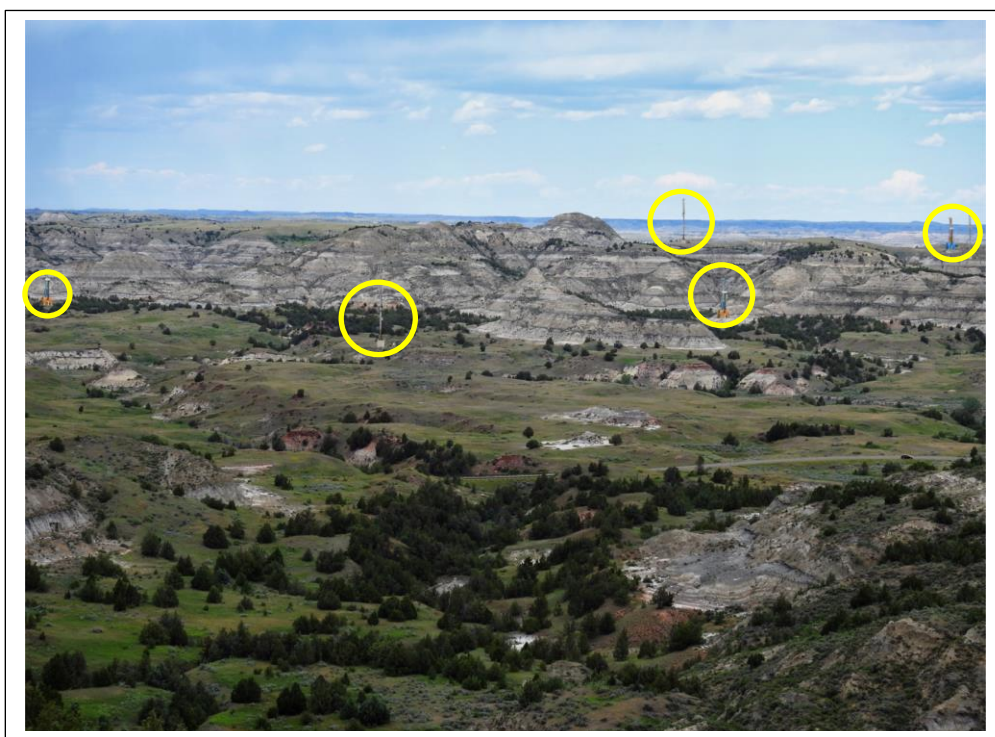


Figure 60. Digitally manipulated image (# 3 in HSOL panel) showing potential threshold for South Unit visitors of 6 HSOL (2 structures in circle on right).

Threshold for Large Animal Sightings per Hour

Informed by management, park documents, and conversations with visitors, the amount of Large Animal Sightings per Hour (LASH) was selected as a primary element pertaining to the quality of a visit (i.e., indicator of quality) to THRO. Consequently, the research team evaluated visitors' desired conditions for LASH at THRO to understand the conditions that visitors deem a) the minimally acceptable condition (i.e., threshold), b) when management action should take place (i.e., management action), and c) when they might not return to the site because of conditions (i.e., displacement).

These desired conditions, or visitor norms, were revealed through survey responses to Question 6 of the Thresholds Questionnaire, which asked about actual experiences as well as the hypothetical acceptability of zero to ten (or more) large animal sightings per hour at THRO. The LASH survey helps to understand whether actual conditions aligned with or exceeded visitors' desired conditions for the number of animals that might be encountered while visiting THRO.

Overall, the results for LASH at THRO indicate increasing levels of acceptability as sightings increase. In the North Unit, visitor consensus was moderate regarding the acceptability rating for each level in the LASH panel. Consensus is indicated by the relatively consistent size of the bubbles for each photograph. This level of consensus indicates that North Unit visitors on average tend to agree on the acceptability rating regarding hypothetical LASH conditions. Both North and South Unit visitors reported a similar level of acceptability for less frequent large animal sightings. South Unit visitors, however, reported higher consensus regarding the acceptability of steadily increasing animal sightings, indicated by a trend of bubbles becoming smaller on the norm curve.

The social norm curve for LASH shows similar trends in the experiences and opinion of North and South Unit visitors, as well as similar levels of acceptance of potentially undesirable frequencies of seeing large animals at THRO. Survey respondents reported experiencing 7 LASH in the North Unit and 8 LASH in the South Unit. An average of 39% of visitors agreed that seeing zero animals per hour was 'neither acceptable nor unacceptable,' while seeing 2-10+ animals per hour was 'very acceptable,' with the percentage of visitors expressing that opinion growing steadily from 25% (2 LASH) to 70% (10 LASH).

The differences in North versus South Unit responses were statistically non-significant in all cases except reported conditions, suggesting that the current low level of LASH is acceptable to visitors in both units, but even small increases in the number of large animal encounters will result in increased visitor satisfaction in regard to visiting THRO. This idea is supported by responses to the Questions 4c and 5c of the Thresholds Survey, wherein an average of 33% of visitors indicate that their experienced LASH 'extremely increased' the quality of their experience at THRO. This finding also suggests that the range of acceptable LASH is wide, but that conditions at or near zero LASH warrant management action according to an average of 14% of visitors; 63% report that no level of LASH warrants management action. Zero large animal sightings per hour are unlikely to result in displacement in both units, with only 17% of visitors claiming that they would go elsewhere under such conditions and 76% reporting that none of the suggested LASH conditions would displace them. Excluding responses of "none of these (LASH) conditions," however, results in 37% of visitors suggesting that zero large animal sightings per hour (0 LASH) warrant management action and would also displace 68% of visitors.

Table 32. Visitor opinions on the number of large animals viewed within one hour, listed as percent of sample. (Thresholds Survey, Question 6a) *Note 4: A "large animal" is considered a bison, elk, deer, sheep, etc. Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

		-4 (Very unacceptable)	-3 (Unacceptable)	-2 (Moderately Unacceptable)	-1 (Slightly unacceptable)	0 (Neither)	+1 (Slightly acceptable)	+2 (Moderately Acceptable)	+3 (Acceptable)	+4 (Very acceptable)	Mean (SD)	t-test
0 animals	N	9.1	1.5	4.5	6.1	31.8	6.1	4.5	7.6	28.8	0.97 (2.55)	t(382) = 1.30
	S	12.5	2.8	6.9	3.2	33.3	3.7	7.9	3.2	26.4	0.59 (2.67)	$p = 0.193$
2 animals	N	1.5	4.6	3.1	7.7	13.8	10.8	20	13.8	24.6	1.57 (2.14)	t(361) = 1.13
	S	3	5	5.5	4	16.1	15.6	15.1	9.5	26.1	1.37 (2.27)	$p = 0.261$
4 animals	N	3.2	1.6	4.8	4.8	11.3	6.5	12.9	14.5	40.3	2.05 (2.27)	t(342) = -0.13
	S	2	1.5	2.5	2.5	18.1	8.5	14.1	14.6	36.2	2.05 (2.04)	$p = 0.897$
6 animals	N	6.5	0	1.6	0	8.1	9.7	11.3	17.7	45.2	2.37 (2.21)	t(339) = -0.03
	S	2.6	0	2.6	2.1	14.9	6.7	10.8	13.8	46.7	2.39 (2.01)	$p = 0.978$
8 animals	N	5.1	0	3.4	1.7	13.6	1.7	10.2	8.5	55.9	2.42 (2.31)	t(271.3) = -1.30
	S	2.6	1	0.5	1	13.3	4.6	5.1	15.3	56.6	2.72 (1.96)	$p = 0.194$
10 animals	N	4.7	1.6	1.6	0	12.5	1.6	3.1	9.4	65.6	2.72 (2.26)	t(292.3) = -1.66
	S	2.7	0.9	0.9	0.5	11.3	3.2	5	6.8	68.8	2.93 (1.96)	$p = 0.099$

Table 33: Visitor opinions on the number of large animals viewed within one hour, based on survey location. Listed as percent of sample. (Thresholds Survey, Question 6b, 6c, 6e, 6f). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	Location	1) 0 Large Animals	2) 2 Large Animals	3) 4 Large Animals	4) 6 Large Animals	5) 8 Large Animals	6) 10 Large Animals	7) 10+ Lg. Animals	None of these conditions	Mean Condition (SD)	t-test
Experienced	N	8.4	24.3	1.4	22.9	8.6	17.1	20		4.36 (2)	*t(357.1) = -6.08
	S	3.9	12.9	7.7	18.9	8.6	28.8	19.3		4.79 (1.82)	$p = 3.08 \times 10^{-9}$
Management Action	N	16.7	2.8	4.2	5.6	2.8	4.2		63.9	5.43 (2.37)	t(412) = -0.63
	S	10.3	9.4	5.6	3.4	3	5.2		63.1	5.47 (2.27)	$p = 0.535$
Displacement	N	16.9	0	0	0	0	2.8		80.3	5.96 (2.26)	t(412) = 1.122
	S	17.2	5.6	1.7	1.7	0.9	1.7		71.1	5.53 (2.44)	$p = 0.261$

Table 34. Comparison of visitor opinions in regard to large animal sightings when asked the question: "Considering the number of large animals you've seen, to what degree has this impacted your park experience? (Thresholds Survey, Question 6c). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

Location	-2 (Extremely decreased)	-1 (Decreased)	0 (Did not improve/detract)	+1 (Increased)	+2 (Extremely increased)	Mean (SD)	t-test
North	1.4	7	23.9	26.8	40.8	0.88 (1.04)	* $t(345.348) = -4.782$ $p = 3 \times 10^{-6}$
South	0.9	2.2	13.8	28.9	54.3	1.34 (0.86)	

Table 35: Visitor opinions on the number of large animals viewed within one hour, excluding responses of "None of these conditions," which have been changed to zeros to calculate the mean. Based on survey location. Listed as percent of sample (Thresholds survey, Question 6e and 6f). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	Location	1) 0 large animals	2) 2 large animals	3) 4 large animals	4) 6 large animals	5) 8 large animals	6) 10 large animals	Mean Condition (SD)	t-test
Management Action	N	47.7	18.5	9.2	10.8	4.6	9.2	0.84 (1.5)	$t(407.274) = -1.327$ $p = 0.177$
	S	27.9	25.6	15.1	9.3	8.1	14	1.056 (1.74)	
Displacement	N	75.6	12.2	2.4	0	0	9.8	0.374 (0.99)	$t(409.316) = -1.675$ $p = 0.095$
	S	59.7	19.4	6	6	3	6	0.552 (1.17)	

Large Animal Sightings Norm Curve

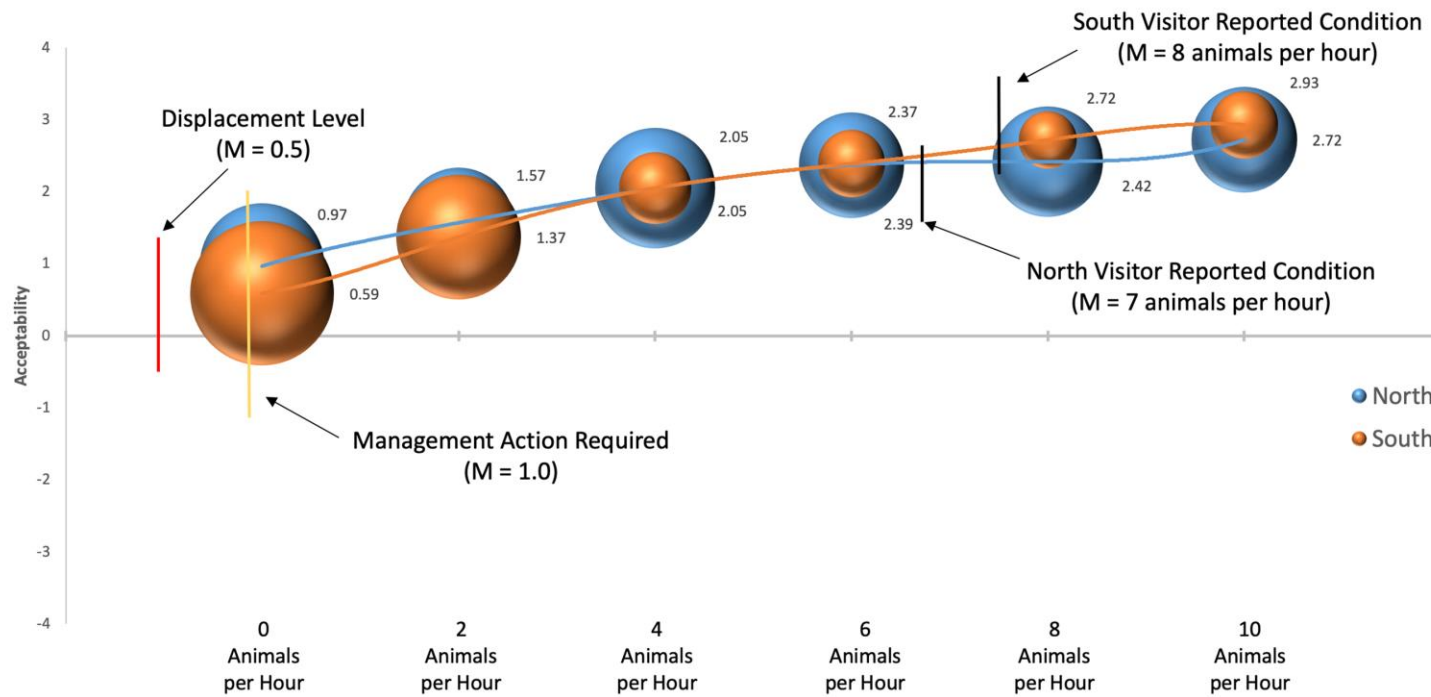


Figure 61. Social norm curve for LASH at THRO's North and South Units, showing visitors' reports and preferences.

Thresholds regarding Wait Times for Parking

Informed by management, park documents, and conversations with visitors, the length of visitors' of wait time for parking (WTP) was selected as a primary element pertaining to the quality of a visit (i.e., indicator of quality) to THRO. Consequently, the research team evaluated visitors' desired WTP at THRO to understand the conditions that visitors deem a) the minimally acceptable condition (i.e., threshold), b) when management action should take place (i.e., management action), and c) when they might not return to the site because of conditions (i.e., displacement).

These desired conditions, or visitor norms, were revealed through survey responses to Question 7 of the Thresholds Questionnaire, which asked about actual experiences as well as the hypothetical acceptability of zero to two hours of waiting to find parking at THRO. The WTP survey helps to understand whether actual conditions aligned with or exceeded visitors' desired conditions for finding parking.

Overall, the results for WTP at THRO indicate decreasing levels of acceptability for visitors to both North and South Units as wait times for parking increase, with both groups identifying the threshold for acceptability at approximately 12 minutes of waiting. Both North and South visitors similarly rate each WTP level, though with some inconsistency within each group; North unit visitors exhibit a greater level of agreement for each WTP level. South Unit visitors, however, reported higher consensus (smaller bubbles) toward the extremes of WTP, with less consensus near the threshold (larger bubbles). Nonetheless, the pattern of acceptability in the norm curve indicates that both units tend to agree on the acceptability of hypothetical levels of WTP.

The social norm curve for WTP shows similar trends in the experiences and opinion of North and South Unit visitors, as well as similar levels of acceptance of potentially undesirable wait times for parking at THRO. Survey respondents reported waiting less than one minute for parking in both units. The majority of responses from both units reported that waiting zero to five minutes was 'very acceptable,' with the higher percentage of visitors (90% of North respondents and 83% of South) expressing this opinion in regard to 'no waiting,' as seen in Table 35. Visitors to both units suggest that waiting for parking longer than ten minutes would be 'very unacceptable.'

The differences in North and South Unit responses were statistically non-significant at all WTP levels (see Table 35), suggesting that the current low level of WTP is acceptable to visitors in both units, but even small increases in wait times will result in decreased visitor satisfaction. This idea is supported by responses to Question 7d of the Thresholds Survey (see Table 37), wherein an average of 48% of visitors indicate that their short experienced WTP 'extremely increased' the quality of their experience at THRO. Findings also suggests that WTP at or near 20 minutes warrant management action; WTP of 24 minutes was likely to result in displacement in both units. An average of 15% of visitors reported that no amount of waiting (up to 2 hours) for parking would displace them.

Table 35: Visitor reported acceptability of various lengths of waiting times for parking, by survey location. Listed as percent of sample. (Thresholds Survey, Question 7a) Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	Location	-4 (Very unacceptable)	-3 (Unacceptable)	-2 (Moderately Unacceptable)	-1 (Slightly unacceptable)	0 (Neither)	+1 (Slightly acceptable)	+2 (Moderately Acceptable)	+3 (Acceptable)	+4 (Very acceptable)	Mean (SD)	t-test
No waiting	N	0	0	0	0	9.8	0	0	0	90.2	3.61 (1.20)	$t(384) = 0.17$ $p = 0.863$
	S	2.7	0	0	1.4	5.9	1.4	2.7	2.7	83.3	3.36 (1.7)	
5 minutes	N	0	1.5	4.6	7.7	15.4	4.6	6.2	18.5	41.5	2.17 (2.09)	$t(369) = -0.94$ $p = 0.349$
	S	4.7	1.9	0.9	3.8	17.1	5.2	11.4	21.3	33.6	1.96 (2.23)	
10 minutes	N	7.7	6.2	10.8	12.3	10.8	12.3	15.4	7.7	16.9	0.51 (2.51)	$t(374) = 0.128$ $p = 0.898$
	S	13.7	1.9	8	10.8	19.3	7.5	16	12.7	9.9	0.3 (2.49)	
20 minutes	N	30.8	10.8	10.8	15.4	15.4	6.2	1.5	0	9.2	-1.46 (2.46)	$t(375) = -0.53$ $p = 0.597$
	S	30.5	7.5	12.7	14.6	14.6	6.1	5.2	3.8	5.2	-1.36 (2.41)	
30 minutes	N	44.3	11.5	11.5	18	6.6	0	0	0	8.2	-2.20 (2.31)	$t(358) = 0.268$ $p = 0.789$
	S	48.8	9.8	11.2	10.2	7.8	3.9	3.4	1.5	3.4	-2.28 (2.21)	
1 hour	N	68.8	6.3	7.8	3.1	7.8	1.6	0	0	4.7	-2.92 (2.31)	$t(291) = 1.50$ $p = 0.135$
	S	73.4	4.9	6.9	5.9	5.9	1	0	0.5	1.5	-3.2 (1.61)	
2 hours	N	79.7	6.8	0	0	6.8	0	0	1.7	5.1	-3.14 (2.14)	$t(271) = 1.49$ $p = 0.138$
	S	82.2	6.6	1.5	1.5	5.6	1	0	0	1.5	-3.46 (1.45)	

Table 36: Visitor opinions on the length of wait time for parking, based on survey location. Listed as percent of sample (Thresholds Survey, Question 7b, 7c, 7e). Note: N = North Unit, S = South Unit. Bolded numbers in column headings refer to bolded categories in row headings. Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	Location	1) 0 minutes	2) 5 minutes	3) 10 minutes	4) 20 minutes	5) 30 minutes	6) 1 hours	7) 2 hours	None of these conditions	Mean Condition (SD)	t-test
Experienced	N	98.6	0	0	1.4	0	0	0		1.04 (0.36)	$t(403) = -0.49$ $p = 0.626$
	S	93.4	5.7	0.9	0	0	0	0		1.07 (0.26)	
Management Action	N		4.2	15.5	21.1	18.3	19.7	7	14.1	4.11 (1.73)	$t(408) = 1.07$ $p = 0.287$
	S		7.3	16.4	21.6	25.9	14.2	7.3	7.3	3.75 (1.6)	
Displacement	N		2.9	8.6	17.1	20	18.6	15.7	17.1	4.59 (1.68)	$t(408) = 1.34$ $p = 0.182$
	S		7.3	9.1	15.5	20.7	27.2	8.2	12.1	4.24 (1.68)	

Table 37: Comparison of visitor responses in regard to survey location when asked the question: "Considering the average time you've waited to find parking, to what degree has this impacted your park experience?" Listed as percent of sample (Thresholds Survey, Question 7d). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

Location	-2 (Extremely decreased)	-1 (Decreased)	0 (Did not improve/detract)	+1 (Increased)	+2 (Extremely increased)	Mean (SD)	t-test
North	1.4	7	23.9	26.8	40.8	0.99 (1.04)	t(401) = -0.722 p = 0.44
South	0.9	2.2	13.8	28.9	54.3	1.34 (0.86)	

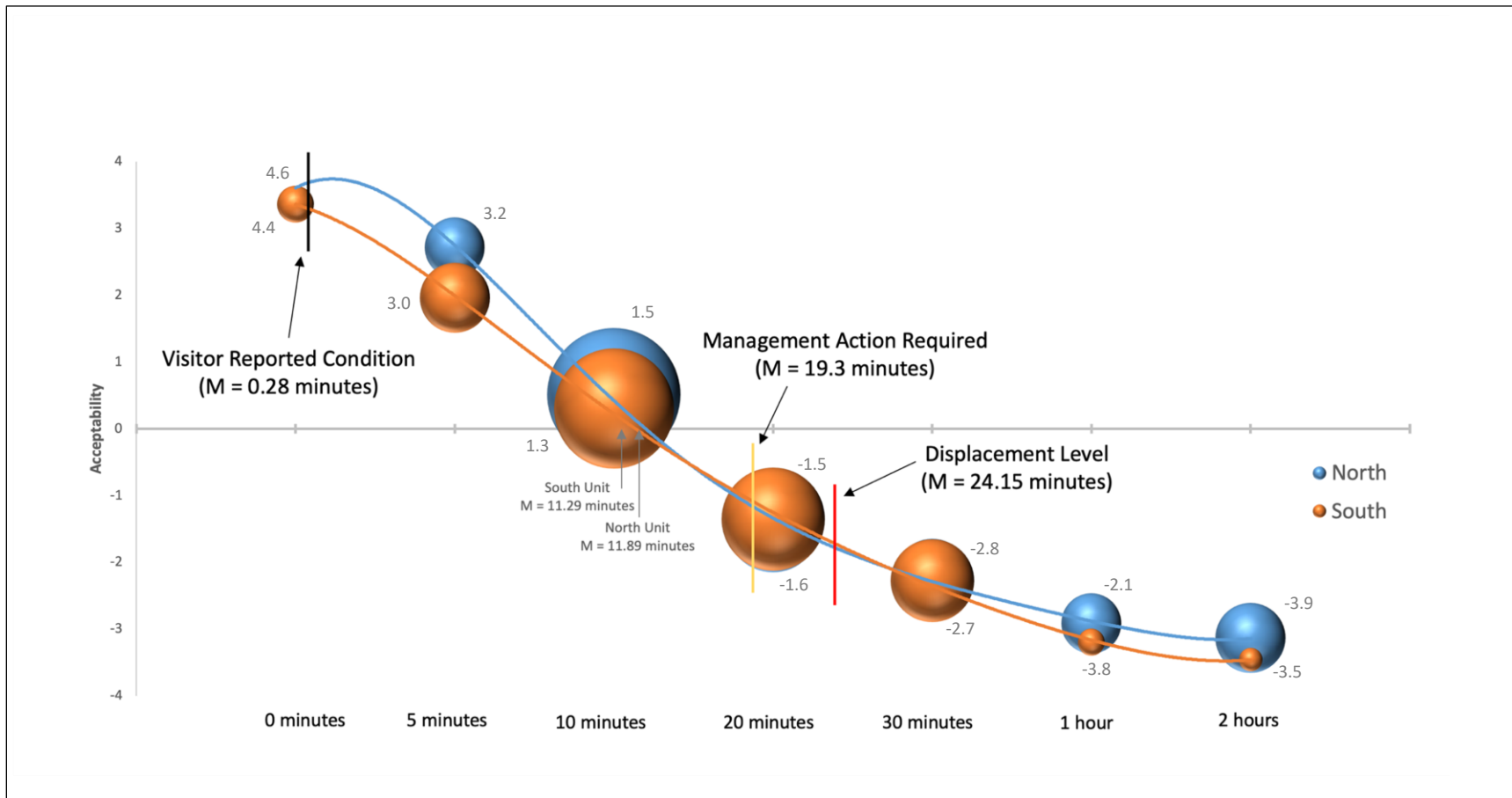
Wait Times for Parking Social Norm Curve

Figure 62. Social norm curve regarding wait times for parking, comparing responses from the North and South Units.

Threshold: Vehicles at One Time at Prairie Dog Town

Informed by management, park documents, and conversations with visitors, the number of Vehicles at One Time (VAOT) at a South Unit prairie dog town was selected as an important element of the THRO experience that may contribute to the quality of a visit (i.e., indicator of quality). Consequently, the research team evaluated the visitor desired conditions of VAOT to understand the conditions that visitors deem a) the minimally acceptable condition (i.e., threshold), b) when management action should take place (i.e., management action), and c) when they might not return to the site because of conditions (i.e., displacement). These desired conditions, or visitor norms, were judged against actual conditions recorded by field cameras (FCs) to understand if actual conditions aligned with or exceeded visitors' desired conditions for the number of vehicles (some with trailers) at one time.

The Thresholds Questionnaire used a photo panel to determine both North Unit and South Unit visitors' thresholds for VAOT. These data were coupled together to construct a social norm curve for VAOT.

Overall, the norm curve displays decreasing levels of acceptability as VAOT increases. Results indicate that acceptability of conditions decreases for every increase of 5 vehicles. On average, visitors report a threshold of 11 and 19 vehicles in the North and South Units, respectively. In other words, when there are more than 19 vehicles within view, then conditions become unacceptable to visitors. This finding also suggests that the range of acceptable conditions occurs between 0 to 19 vehicles, with 0 vehicles being the most acceptable condition.

On average, visitors reported seeing two or fewer vehicles with 67% claiming that this number of vehicles 'increased' or 'extremely increased' the quality of their experience. Visitors also reported that management action should occur when 18 vehicles are within view at one time (18 VAOT). It is important to note that 25% of visitors do not believe that any of the photographs display conditions that require management action and 52% report that none of the VAOT photographs display conditions so severe that they would be displaced from the site. Furthermore, 28% of visitors reported that use should never be limited regardless of VAOT, suggesting that a portion of the visiting population is ideologically opposed to use limits. Consensus regarding the acceptability rating for each photograph was moderate, displayed as the size of the bubbles for each photograph. This level of consensus indicates that on average visitors tend to agree more in regard to the acceptability rating of low VAOT than higher levels of VAOT.

Location of Tripod for VAOT Photo Panel

Figure 63. The tripod for the prairie dog town VAOT photo panel was located ten paces to the north from the center point between two sagebrush shrubs (circled). Equipment coordinates in Appendix F.



Figure 64. Looking southwest toward sagebrush shrubs (in yellow circle above).



Figure 65. Looking northeast toward the parking area or roadside pull-off



Photo 1: 0 Vehicles



Photo 2: 5 Vehicles



Photo 3: 10 Vehicles



Photo 4: 15 Vehicles



Photo 5: 20 Vehicles

Figure 66. Photo panel showing digitally manipulated vehicles at one time (VAOT) ranging from zero vehicles in Photo 1 to twenty vehicles in Photo 5, corresponding with the social norm curve.

Table 38. Visitor-reported acceptability regarding the VAOT at prairie dog town by survey location, represented as percent of sample (Thresholds Survey, Question 5a). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	Location	-4 (Very unacceptable)	-3 (Unacceptable)	-2 (Moderately Unacceptable)	-1 (Slightly unacceptable)	0 (Neither)	+1 (Slightly acceptable)	+2 (Moderately Acceptable)	+3 (Acceptable)	+4 (Very acceptable)	Mean (SD)	t-test
0 Vehicles	N	4.3	0	0	0	1.1	2.2	1.1	23.7	67.7	3.29 (1.71)	$t(196) = 1.10$ $p = 0.272$
	S	1.9	0	1	1.9	5.7	1	6.7	27.6	54.3	3.03 (1.63)	
5 Vehicles	N	2.2	1.1	3.3	3.3	2.2	5.4	13	34.8	34.8	2.53 (6.06)	$t(193) = 1.03$ $p = 0.302$
	S	1	3.9	2.9	2.9	3.9	8.7	13.6	38.8	24.3	2.25 (1.9)	
10 Vehicles	N	5.3	6.4	6.4	8.5	10.6	12.8	13.8	17	19.1	1.06 (2.44)	$*t(198) = 2.20$ $p = 0.029$
	S	4.7	13.2	6.6	17	7.5	14.2	13.2	15.1	8.5	0.31 (2.39)	
15 Vehicles	N	6.6	11	13.2	12.1	5.5	15.4	13.2	6.6	16.5	0.30 (2.57)	$*t(196) = 3.20$ $p = 0.002$
	S	16.8	20.6	13.1	11.2	4.7	8.4	10.3	10.3	4.7	-0.88 (2.58)	
20 Vehicles	N	17.4	17.4	9.8	7.6	5.4	9.8	9.8	8.7	14.1	-0.37 (2.88)	$*t(179.4) = 3.6$ $p = 4.2 \times 10^{-4}$
	S	34.9	15.1	14.2	9.4	4.7	8.5	3.8	5.7	3.8	-1.75 (2.44)	

Table 4 Comparison of visitor opinions regarding VAOT at prairie dog town by survey location, represented as percent of sample. (Thresholds Survey, Question 5 b, d, e, and f). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	Location	1) 0 Vehicles	2) 5 Vehicles	3) 10 Vehicles	4) 15 Vehicles	5) 20 Vehicles	6) None show high enough use	7) Use should be limited	Mean Condition (SD)	t-test
Experienced	N	60.9	35.6	3.4	0	0			1.425 (0.56)	$t(188) = -0.347$ $p = 0.729$
	S	60.2	35.9	2.9	0	1			1.456 (0.65)	
Management Action	N	5.7	2.3	10.2	15.9	33	33		4.671 (1.39)	$t(191) = 1.282$ $p = 0.201$
	S	6.7	2.9	12.4	26.7	23.8	27.6		4.41 (1.43)	
Displacement	N	1.1	1.1	3.3	14.4	20	60		5.311 (1.03)	$*t(194) = 2.174$ $p = 0.031$
	S	1.9	0	11.3	18.9	22.3	45.3		4.962 (1.19)	
Use limit	N	2.1	4.3	14.9	7.4	5.3	36.2	29.8	5.372 (1.68)	$*t(199) = 2.22$ $p = 0.028$
	S	0	4.7	28	13.1	14	13.1	27.1	4.841 (1.7)	

Table 40. Comparison of visitor opinions regarding VAOT at prairie dog town when asked the question “Considering the conditions that you experienced today, to what degree have they impacted the quality of your park experience?” Listed as percent of sample (Thresholds Survey, Question 5c). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

Location	-2 (Extremely decreased)	-1 (Decreased)	0 (Did not improve/detract)	+1 (Increased)	+2 (Extremely increased)	Mean (SD)	t-test
North	3.2	2.1	26.3	33.7	34.7	0.95 (0.99)	$t(196) = 0.042$ $p = 0.966$
South	1	1	32	35	31.1	0.94 (0.87)	

Norm Curve for VAOT at Prairie Dog Town

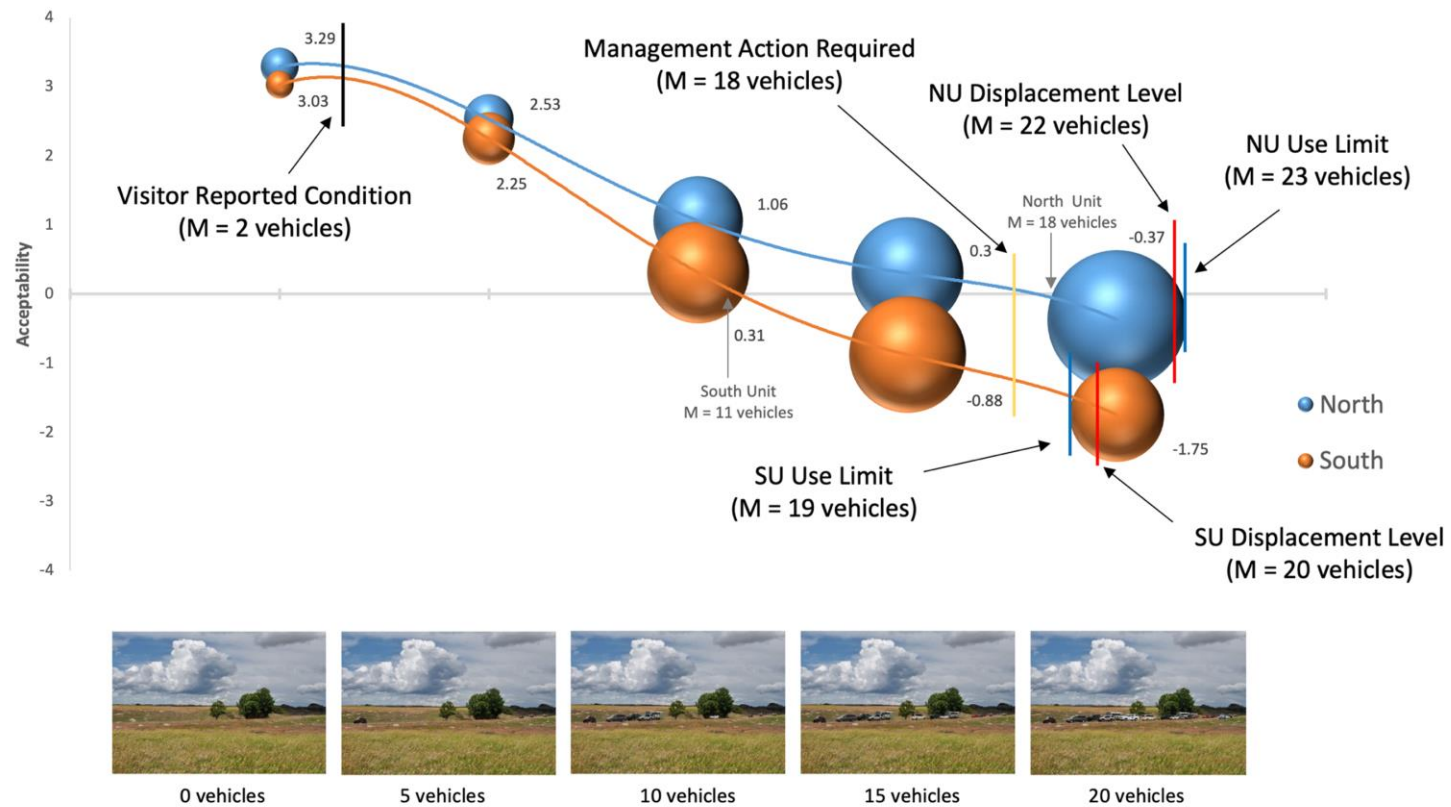
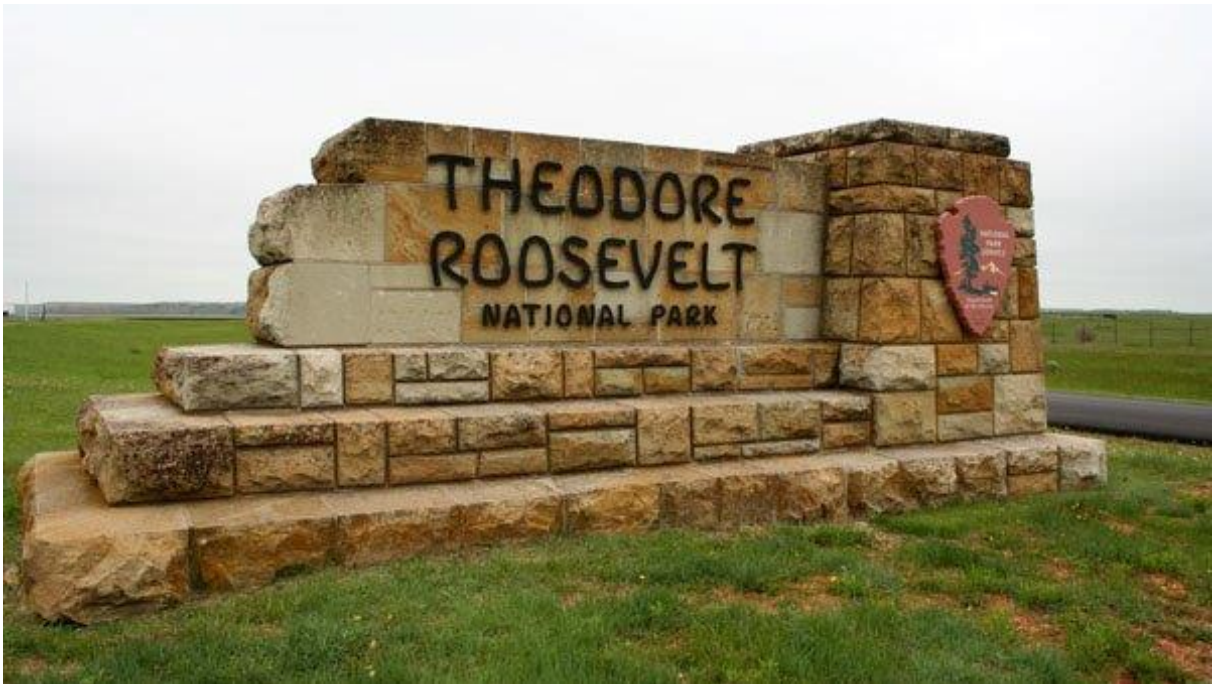


Figure 67. Norm Curve for VAOT, comparing responses of North and South Unit visitors.



NORTH UNIT RESULTS

People at One Time (PAOT) • **Field and Parking Lot Cameras** • **Trail Counters** • **Spatial and Temporal Distribution of Visitors** • **Wilderness Permit Data**



North Unit Research Locations

This section of the report focuses specifically on findings for River Bend Overlook, Oxbow Overlook, and Caprock Coulee in THRO's North Unit. Included here are analyses for field equipment locations (PLCs, FCs, and TCs), data gathered, analyses, and implications. Findings for THRO's South Unit and Elkhorn Ranch Units are in subsequent sections of this report.

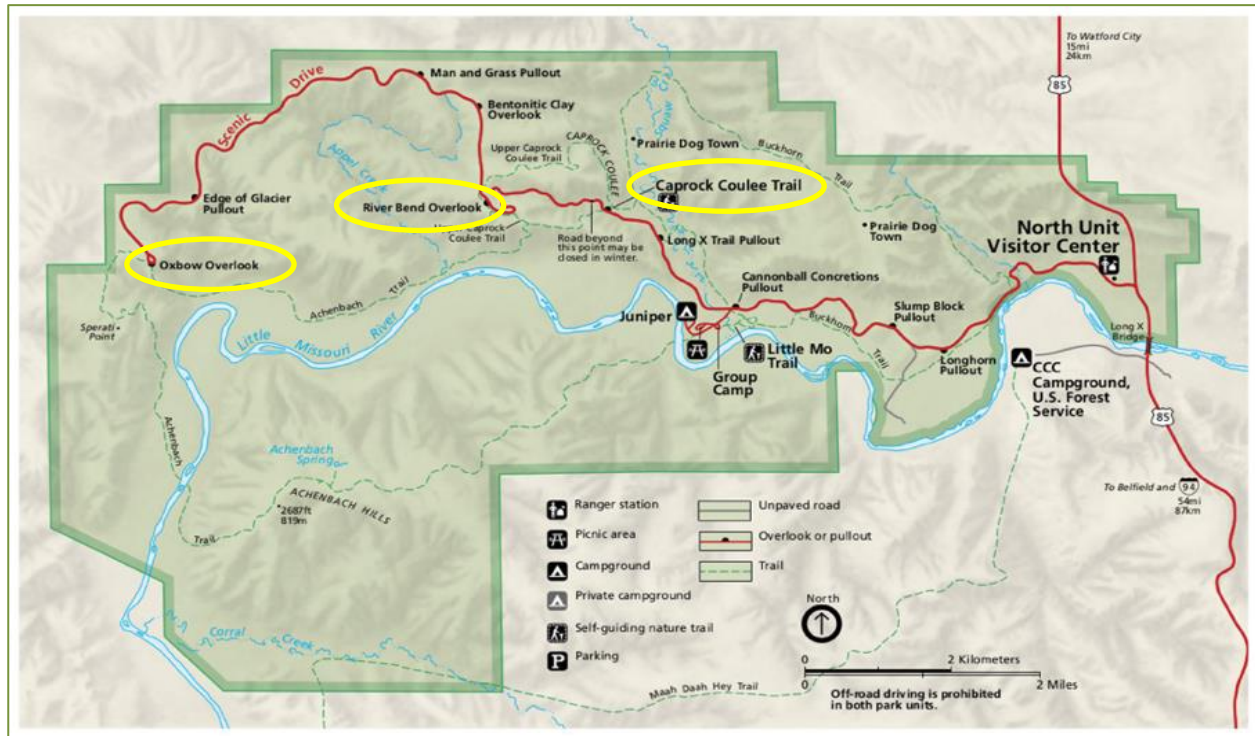


Figure 68. Detailed map of Theodore Roosevelt National Park's North Unit

Included in the North Unit section are details about:

- People at One Time (PAOT) at River Bend Overlook
- Vehicles at One Time (VAOT) – prairie dog town
- Parking Lot Cameras (PLC) at Oxbow Overlook and Caprock Coulee
- Field Cameras at the River Bend
- Trail Counters (TC) at Caprock Coulee
- Spatial and temporal distributions for day use visitors
- Spatial and temporal distributions for wilderness users
- Wilderness permit data

Data and analysis for River Bend Overlook

At the North Unit's River Bend Overlook, researchers assessed visitors' thresholds for perceptions of people at one time (PAOT) and also set up field cameras (FCs) to gather in-field PAOT.

Threshold: People at One Time at River Bend Overlook

Informed by management, park documents, and conversations with visitors, the number of People at One Time (PAOT) at the North Unit's River Bend Overlook was selected as a primary element of the THRO experience that may contribute to the quality of a visit (i.e., indicator of quality). Consequently, the research team evaluated the visitor desired conditions of PAOT at River Bend Overlook to understand the conditions that visitors deem a) the minimally acceptable condition (i.e., threshold), b) when management action should take place (i.e., management action), and c) when they might not return to the site because of conditions (i.e., displacement). These desired conditions, or visitor norms, were judged against actual conditions at River Bend Overlook recorded by field cameras (FCs) to understand if actual conditions aligned with or exceeded visitors' desired conditions for the amount of people that can be at the River Bend Overlook at one time.

The Thresholds Questionnaire used photo panels to determine visitors' tolerance for number of people at one time (PAOT) at the River Bend Overlook. The two photo panels for this location additionally compare the potential effect of PAOT in two different situational views—one of PAOT in the distance and one of PAOT close to the viewer—to determine if the proximity of PAOT to the viewer has an influence on preferences. These two pieces of data were coupled together to construct a social norm curve for PAOT at River Bend Overlook. To determine whether subjective opinions based on the PAOT conditions took place, two FCs were deployed at River Bend Overlook to gather objective counts of PAOT at each photo panel.

Overall, the results for PAOT at River Bend Overlook display decreasing levels of acceptability as PAOT increases. On average, visitors report a threshold of approximately 55 people at one time (55 PAOT). In other words, when there are more than 55 people at River Bend Overlook, then conditions become unacceptable to visitors. This finding also suggests that the range of acceptable conditions occurs between 0 to 55 people at River Bend Overlook, with 0 people being the most acceptable condition. Consensus regarding the acceptability rating for each photograph was moderate, displayed as the size of the bubbles for each photograph. This level of consensus indicates that on average visitors tend to agree more regarding the acceptability rating of low PAOT than higher levels of PAOT.

Survey respondents reported an average of 7 PAOT at River Bend THRO, leading 65% of these visitors to state that their experienced level of PAOT 'increased' or 'extremely increased' the quality of their visit. On average, visitors report that management action is required when PAOT reaches 54, and they would not return to the site when there are 63 people present (63 PAOT). It is important to note that 34% of visitors do not believe that any of the photographs display conditions that require management action. Additionally, 55% of visitors report that none of the photographs display conditions so severe that they would be displaced from the site and 25% reported that PAOT at River Bend Overlook should never be limited, suggesting that a portion of the River Bend Overlook visiting population is ideologically opposed to use limits.

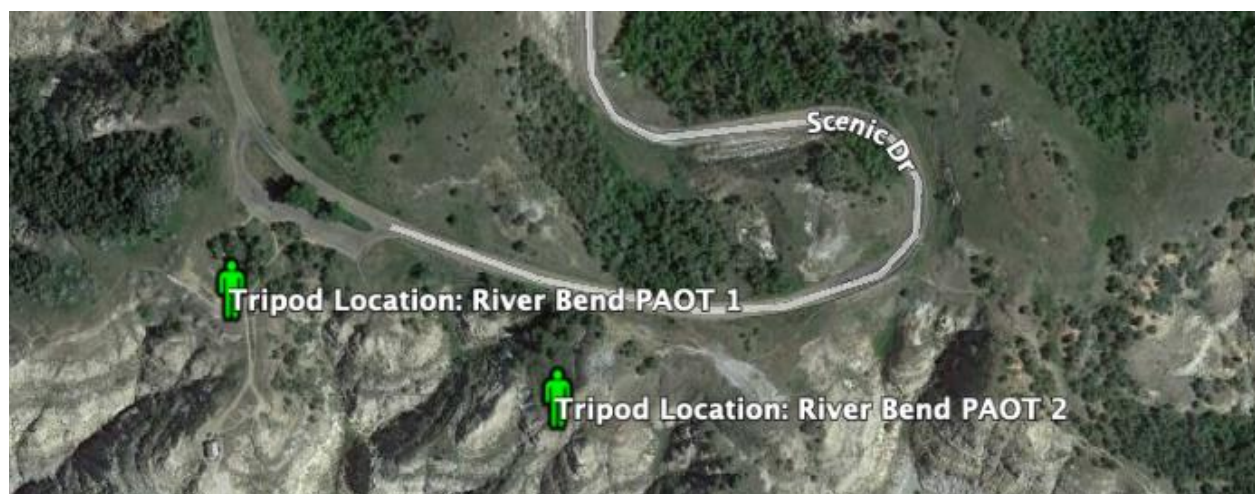


Figure 69. Tripod locations for taking the pictures for River Bend PAOT photo panels



Figure 70. Tripod view for River Bend 'Proximal' PAOT Photo Panel. Equipment coordinates in Appendix F



Figure 71. Tripod view for River Bend 'Distant' PAOT Photo Panel. Equipment coordinates in Appendix F



Photo 1: 0 people



Photo 2: 15 people



Photo 3: 30 people



Photo 4: 45 people



Photo 5: 60 people

Figure 72. Photo panel showing people at one time (PAOT) in the distance (distant view) of the North Unit's River Bend Overlook, numbering from 0 people in Photo 1 to 60 people in Photo 5, corresponding with the social norm curve.



Photo 1: 0 people



Photo 2: 15 people



Photo 3: 30 people



Photo 4: 45 people



Photo 5: 60 people

Figure 73. Photo panel showing people at one time (PAOT) in the foreground (proximal view) of the North Unit's River Bend Overlook, numbering from 0 people in Photo 1 to 60 people in Photo 5, corresponding with the social norm curve.

Norm Curve for PAOT at River Bend Overlook – Proximal vs. Distant Views

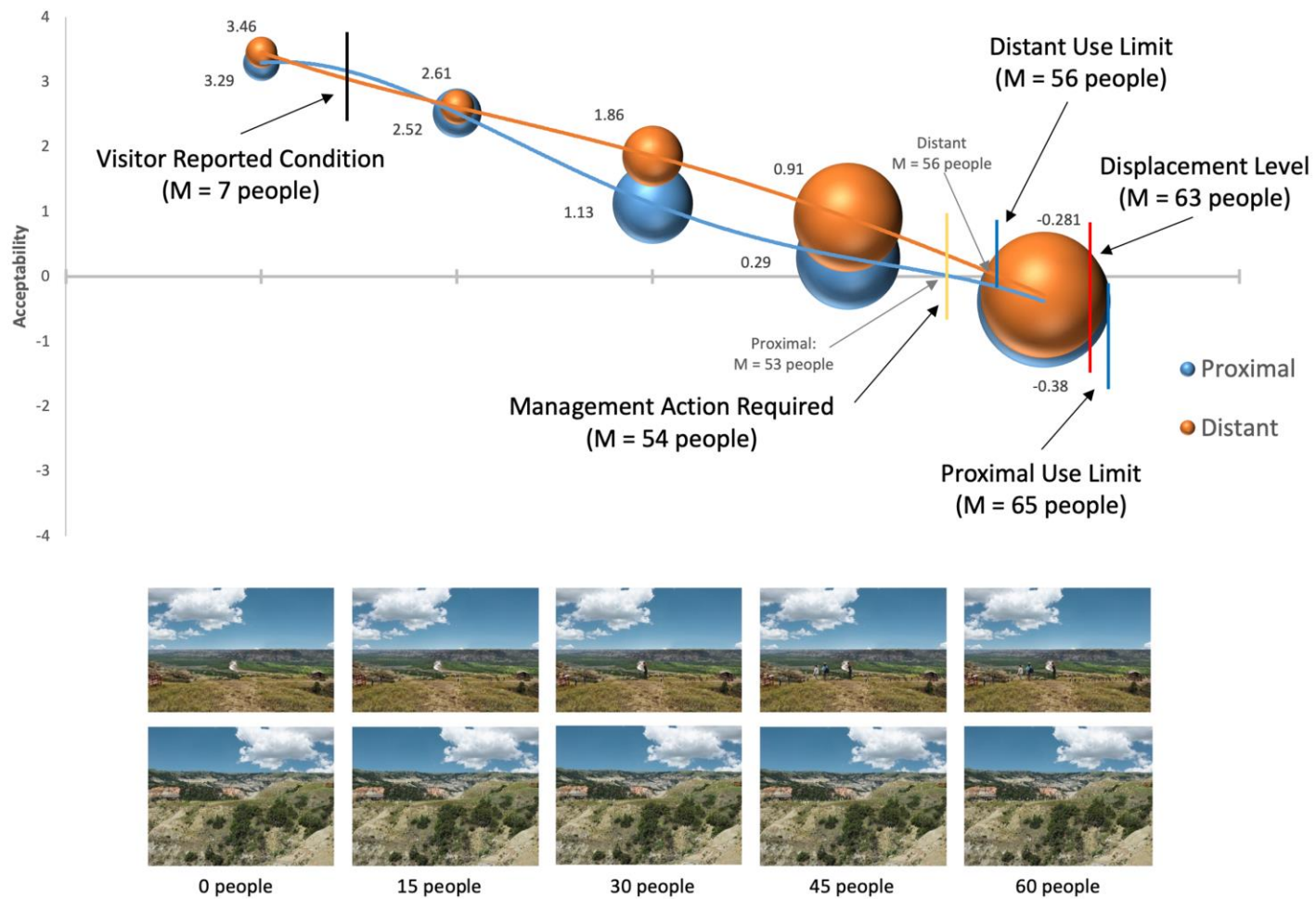


Figure 74. Norm Curve for PAOT at River Bend Overlook comparing similar norms regarding views of people nearby versus in the distance.

Table 41. Visitor acceptability of varying PAOT at River Bend Overlook in two different views. Listed as percent of sample. (Thresholds Survey, Questions 4a and 5a). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	-4 (Very unacceptable)	-3 (Unacceptable)	-2 (Moderately Unacceptable)	-1 (Slightly unacceptable)	0 (Neither)	+1 (Slightly acceptable)	+2 (Moderately Acceptable)	+3 (Acceptable)	+4 (Very acceptable)	Mean (SD)
River Bend Proximal View Photo Panel										
0 People	4.2	0	0	0	1.1	2.1	1.1	24.2	67.4	3.3 (1.69)
15 People	2.1	1.1	3.2	3.2	2.1	5.3	13.8	36.2	33	2.52 (1.85)
30 People	5.2	4.2	6.3	9.4	10.4	15.6	13.5	16.7	18.8	1.13 (2.35)
45 People	6.5	9.7	14	12.9	6.5	15.1	12.9	6.5	16.1	.29 (2.53)
60 People	16	19.1	9.6	8.5	5.3	9.6	8.5	9.6	13.8	-0.38 (2.86)
River Bend Distant View Photo Panel										
0 People	1.1	2.3	0	1.1	0	1.1	3.4	12.6	78.2	3.46 (1.5)
15 People	1.1	1.1	1.1	4.5	2.3	6.8	18.2	26.1	38.6	2.614 (1.71)
30 People	1.1	2.3	5.7	8	6.9	8	14.9	32.2	20.7	1.862 (2.04)
45 People	2.2	14.6	7.9	7.9	4.5	13.5	13.5	16.9	19.1	.91 (2.56)
60 People	19.1	10.1	11.2	9	6.7	12.4	7.9	12.4	11.1	-0.28 (2.8)

Table 42: Comparison of visitor opinions regarding two different River Bend Overlook PAOT photo panels, listed as percent of sample. (Thresholds Survey, Questions 4 and 5 b,d,e, and f). Highest percentages are highlighted. Statistically significant differences marked with $^*(p < 0.05)$.

	View	P1: 0 People	P2: 15 People	P3: 30 People	P4: 5 People	P5: 60 People	None show high enough use	Use should never be limited	Mean Photo # (SD)	t-test
Experienced	P	60.7	36	3.4	0	0			1.427 (0.56)	$t(173) = -0.166$ $p = 0.868$
	D	61.6	33.7	3.5	1.2	0			1.442 (0.63)	
Management Action	P	5.6	3.3	8.9	16.7	31.1	34.4		4.678 (1.41)	$t(177) = 0.653$ $p = 0.514$
	D	4.5	5.6	11.2	22.5	22.5	33.7		4.539 (1.43)	
Displacement	P	1.1	0	2.2	15.2	20.7	60.9		5.37 (0.95)	$t(179) = 1.87$ $p = 0.063$
	D	2.2	0	6.7	18	24.7	48.3		5.079 (1.14)	
Use limit	P	2.1	3.1	16.7	7.3	7.3	34.4	29.2	5.344 (1.67)	$^*t(183) = 2.239$ $p = 0.021$
	D	1.1	11.2	14.6	18	13.5	21.3	20.2	4.764 (1.72)	

Table 43: Comparison of visitor responses regarding two different River Bend Overlook photo panels when asked the question: "Considering the conditions that you experienced today, to what degree have they impacted the quality of your park experience?" Represented as percent of sample (Thresholds Survey, Question 4c and 5c). Note: P = Proximal View, D = Distant View. Highest percentages are highlighted. Statistically significant differences marked with $^*(p < 0.05)$.

View	-2 (Extremely decreased)	-1 (Decreased)	0 (Did not improve/detract)	+1 (Increased)	+2 (Extremely increased)	Mean (SD)	t-test
Proximal	3.1	2.1	25.8	33	36.1	.97 (0.99)	$t(184) = 0.019$ $p = 0.985$
Distant	0	5.6	33.7	19.1	41.6	.97 (0.99)	

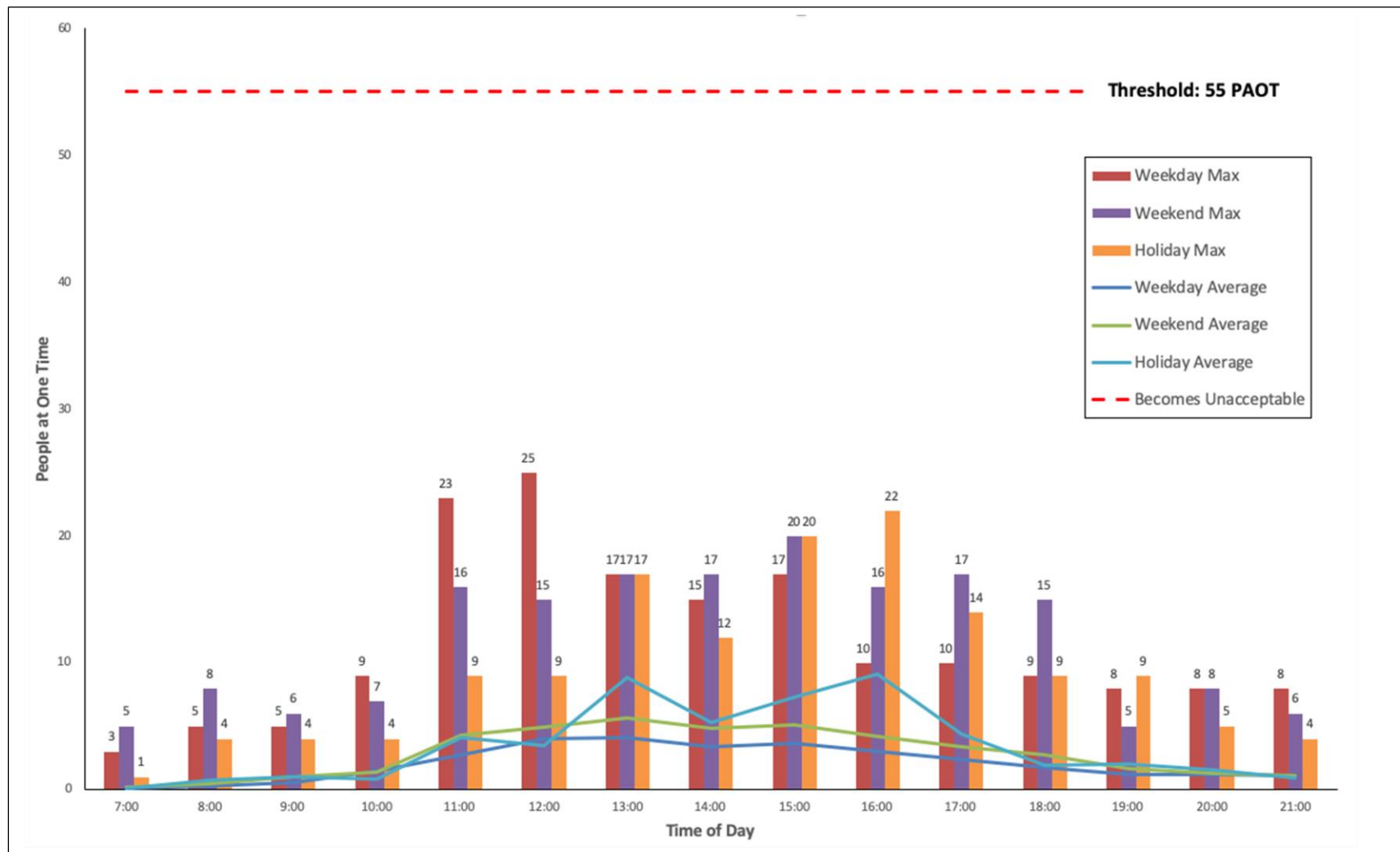
Actual PAOT at River Bend Overlook as Documented by Field Cameras

Figure 74b. Average and maximum daily of number of people at one time (PAOT) at River Bend Overlook determined by field cameras.

Field Camera (FC) River Bend Overlook

The field camera (FC) at River Bend Overlook indicated that average weekday (2 PAOT), weekend (3 PAOT), and holiday (4 PAOT) from 7:00 am to 7:00 pm are within the acceptable range (0 to 55 PAOT). In other words, the average conditions at River Bend Overlook do not exceed or violate visitors' threshold for people at one time at River Bend (55 PAOT). Between 7:00 am and 7:00 pm, visitor numbers peak from late morning to early afternoon, but are present most of the time at River Bend Overlook on weekdays, weekends, and holidays. Even the maximum number of River Bend Overlook visitors recorded by the FC on weekdays (25 PAOT), weekends (17 PAOT), and holidays (22 PAOT) did not come close to exceeding visitors' desired conditions.



Figure 75. *River Bend Overlook PAOT photo from field camera*



Figure 76. The River Bend Overlook PLC and FC were placed very near one another. Equipment coordinates in Appendix F.



Figure 77. The PLC at the River Bend Overlook (a Spypoint cell camera) was placed in cedar tree approximately three feet from the ground, facing west towards the parking lot. This camera provided wide-angle capability that could capture both the parking lot and the overlook. Equipment coordinates in Appendix F.

Data and Analysis for Oxbow Overlook

At the North Unit's Oxbow Overlook, researchers up set up a parking lot camera (PLC) to assess parking lot usage. A field camera (FC) mounted at the same location did not yield usable data due to a lightning strike.



Figure 78. At the Oxbow Overlook parking lot, researchers placed two wide-angle Spypoint cameras to capture both field activity (not presented due to damage) and parking lot activity. The PLC faced northeast toward the parking lot. Both cameras were mounted to the base of a dead tree. Equipment coordinates in Appendix F.

Parking Lot Camera (PLC) for Oxbow Overlook

The parking lot camera (PLC) at Oxbow Overlook indicated that average weekday, weekend, and holiday vehicle counts never reached the lot capacity of 15 spaces from 7:00 am to 7:00 pm.



Figure 79. Oxbow Overlook parking lot photo from PLC camera showing 8 vehicles in lot



Figure 80. Oxbow Overlook PAOT photo from FC camera showing 6 hikers

2017 Parking Lot Usage for Oxbow Overlook as Documented by PLC

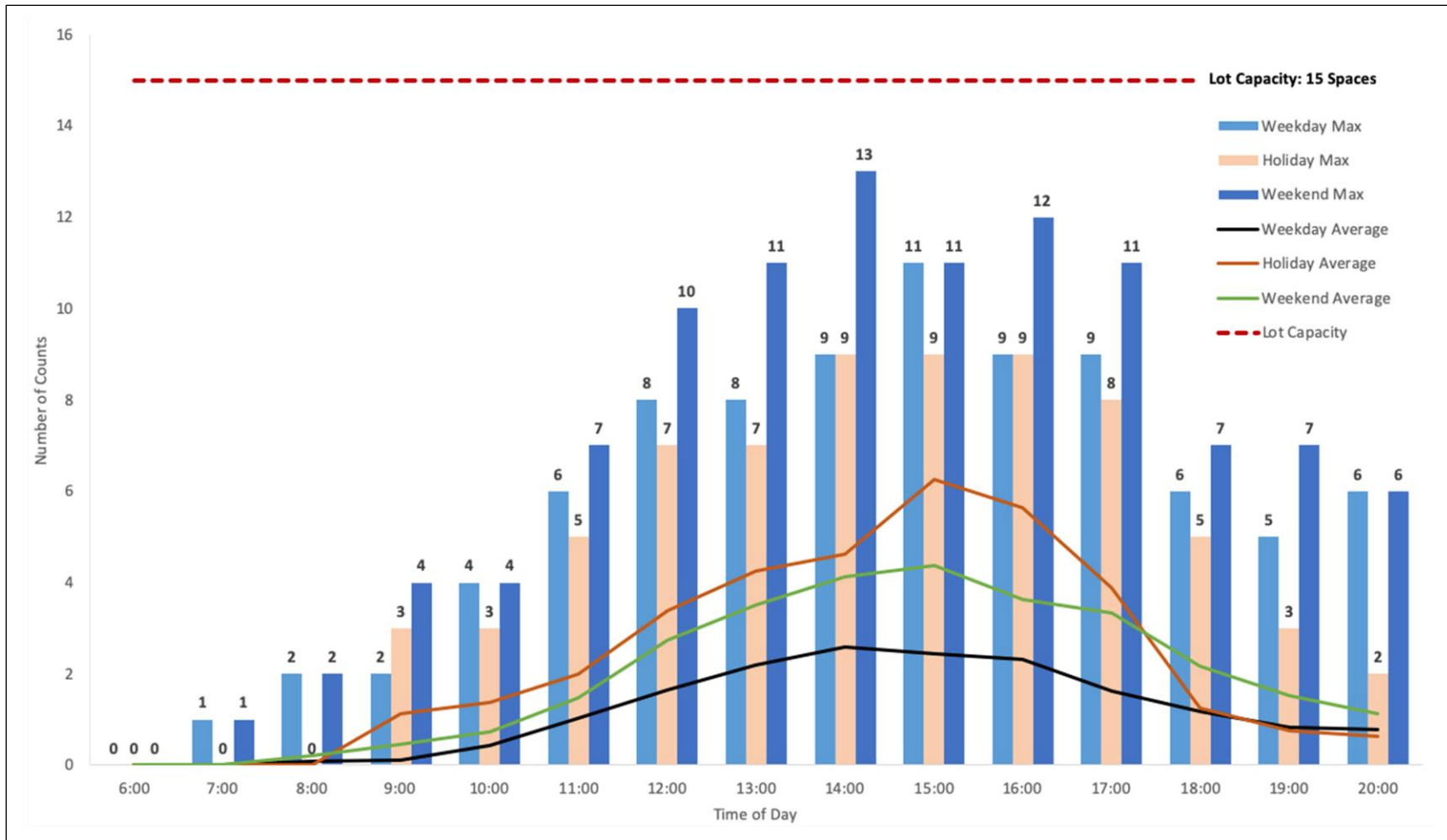


Figure 81. 2017 parking lot camera data for Oxbow Overlook, showing low average vehicle numbers that remain below the lot's capacity of 15 spaces.

2018 Parking Lot Usage for Oxbow Overlook as Documented by PLC

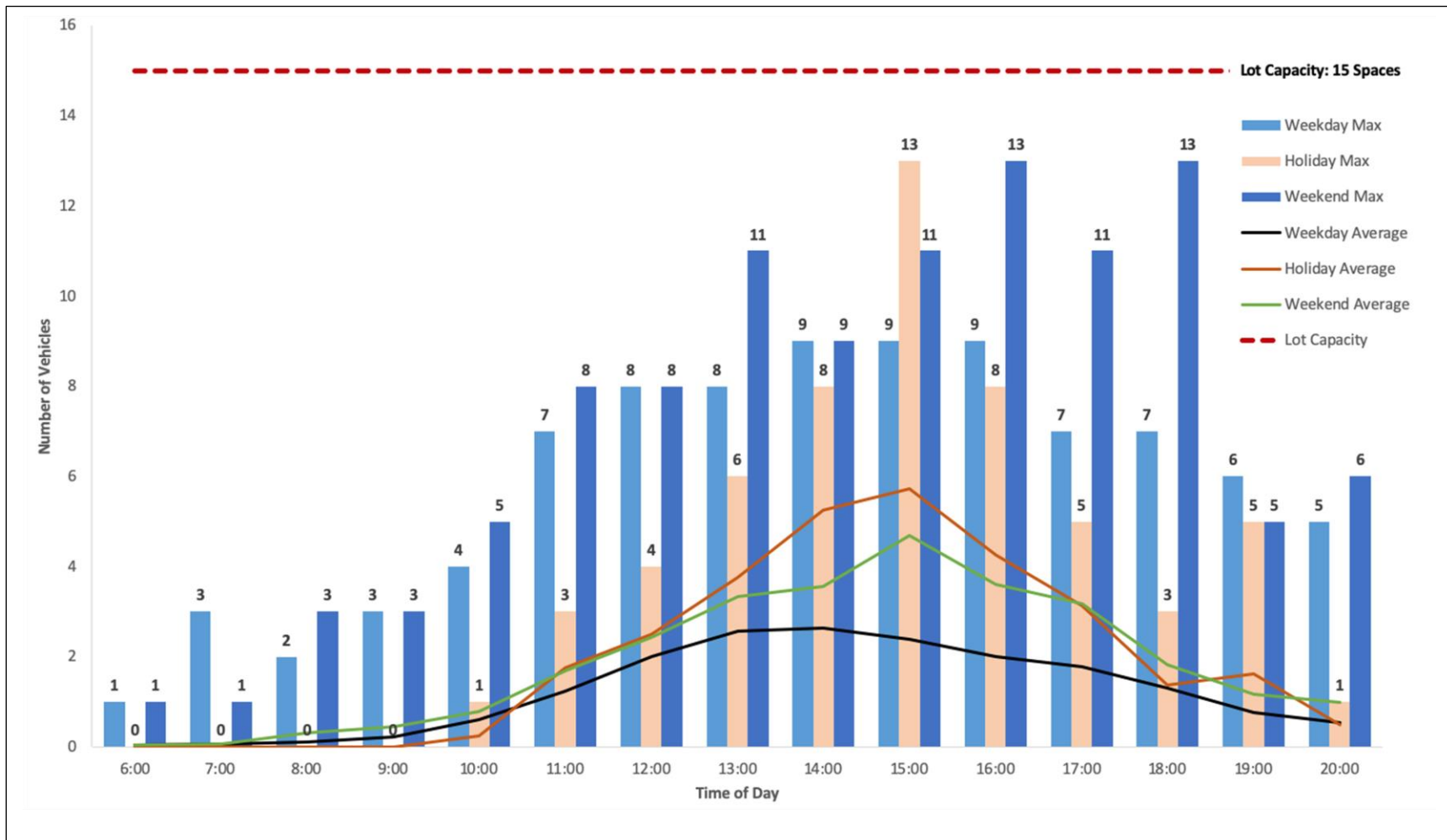


Figure 82. 2018 parking lot camera data for Oxbow Overlook, showing higher average vehicle numbers than 2017, but still below the lot's capacity of 15 spaces.

Caprock Coulee Data and Analysis

At the North Unit's Caprock Coulee trailhead, researchers set up a parking lot camera (PLC) to assess parking lot usage and two trail counters (TCs) to gather objective data for trail usage.

The PLC at Caprock indicated that maximum weekday and weekend vehicle counts frequently exceeded lot capacity during midday, matching TC data at Caprock Coulee.

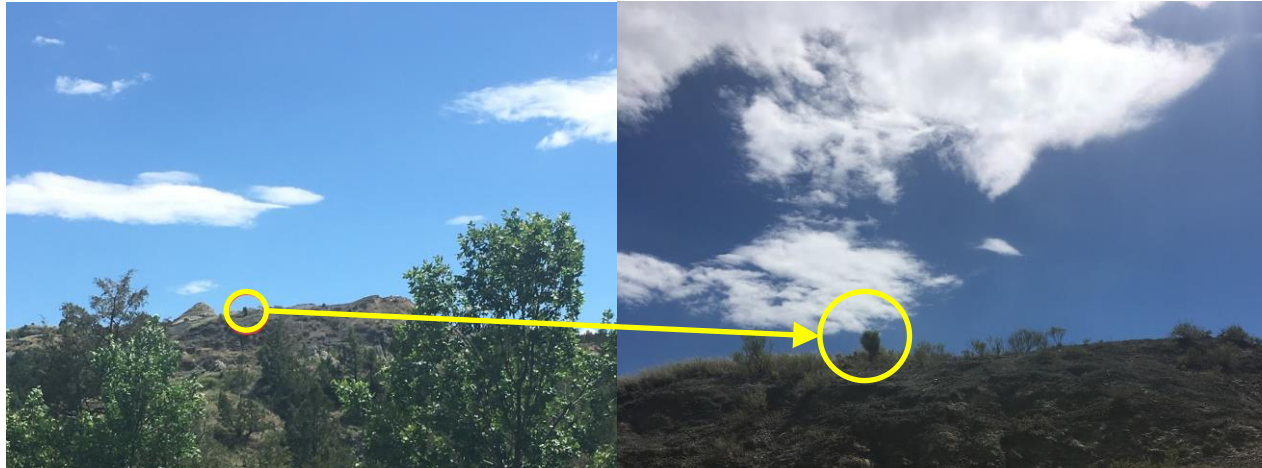


Figure 83. The Caprock Coulee PLC (Spypoint D12) was mounted in a small shrub at top of the hill facing north-northwest towards the parking lot. Equipment coordinates in Appendix F.



Figure 84. Photo of Caprock Coulee parking lot showing 8 vehicles onsite

2017 Parking Lot Camera Data for Caprock Coulee as Documented by PLC

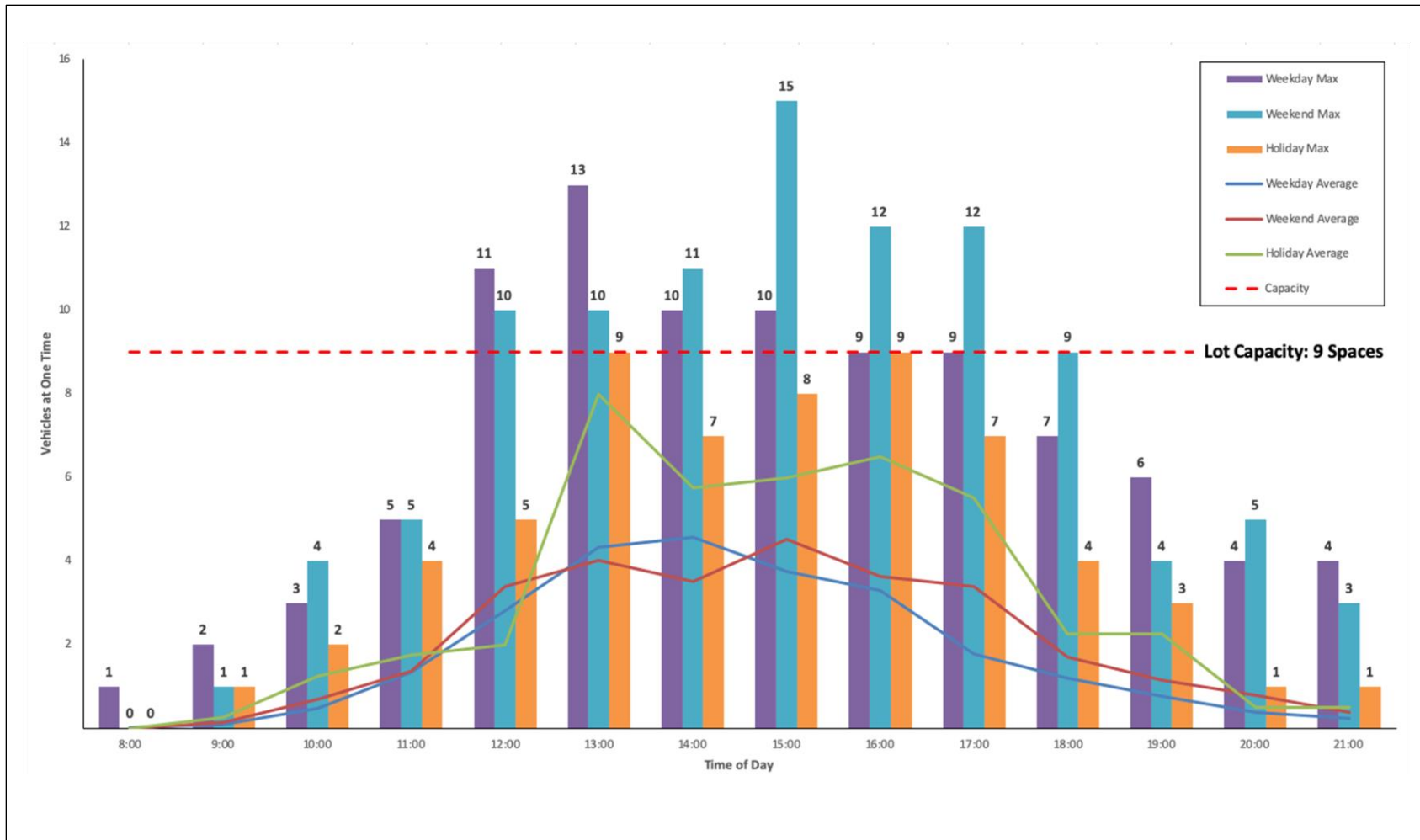


Figure 85. 2017 parking lot camera data for Caprock Coulee, showing frequent exceedance of the lot's capacity of 9 spaces during midday.

Trail Counter Data for Caprock Coulee

In the North Unit, two trail counters (TCs) were placed at Caprock Coulee. Average trail use collected by TC #1 from June 6, 2016 through September 9, 2017 shows an average of 17 daily users, with a monthly average of 535 trail users from June through September. Average trail use recorded by TC #2 (on the Nature Trail) during the same period shows an average of 45 daily users, with a monthly average of 1,540 trail users from June through September.

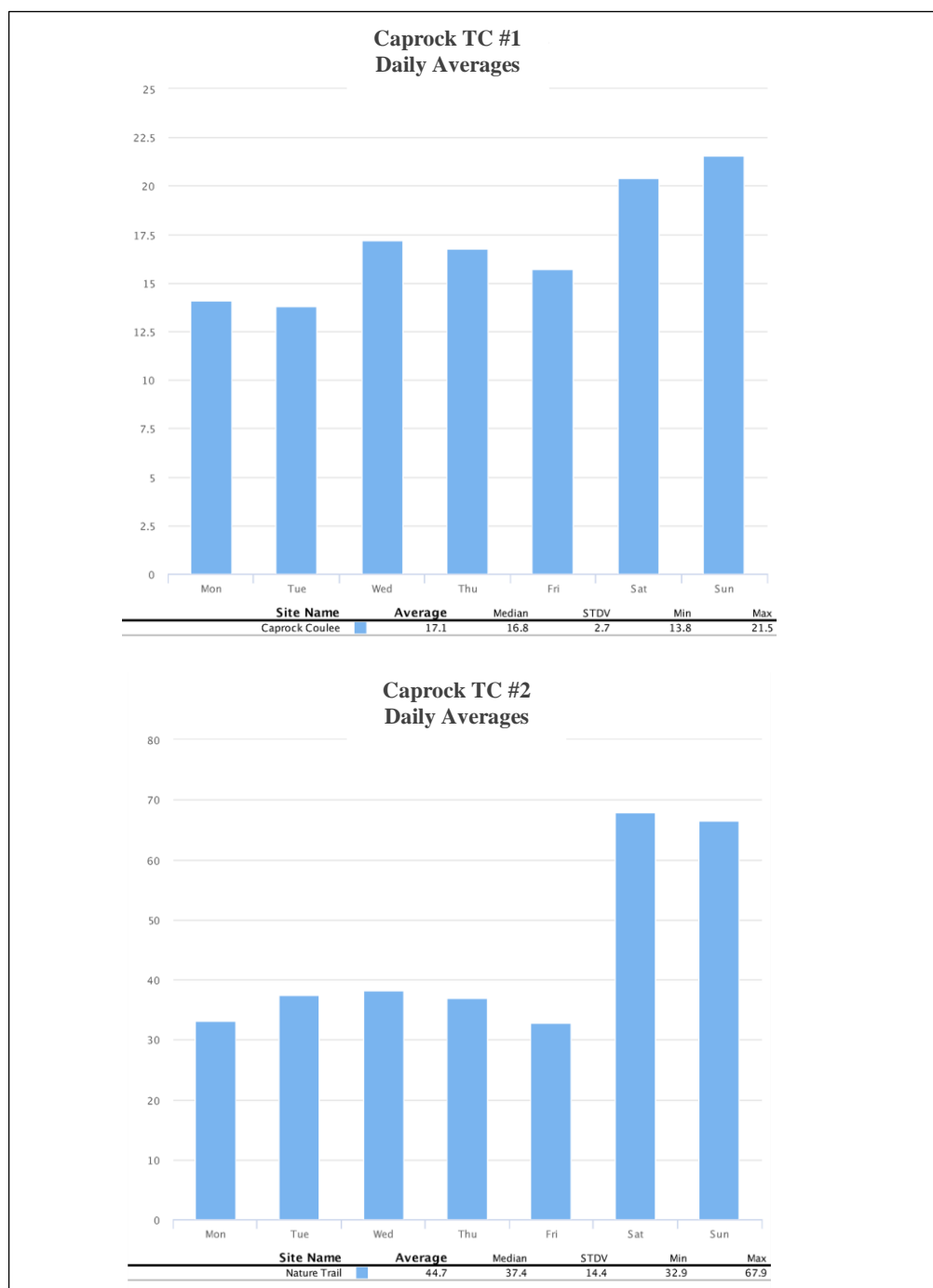


Figure 86. Daily averages for Caprock Coulee TCs #1 and #2

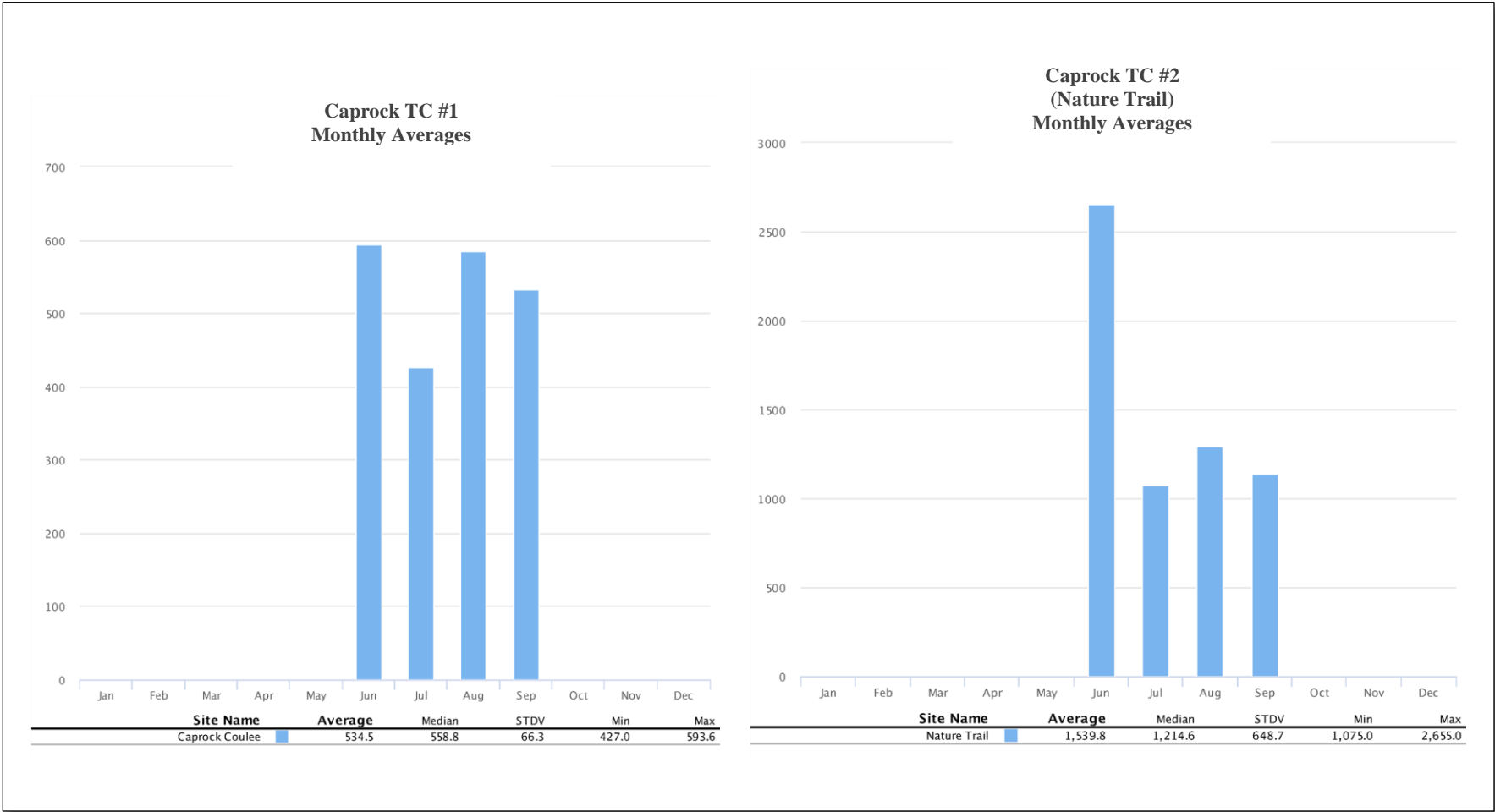


Figure 87. Monthly averages for Caprock Coulee TCs #1 and #2

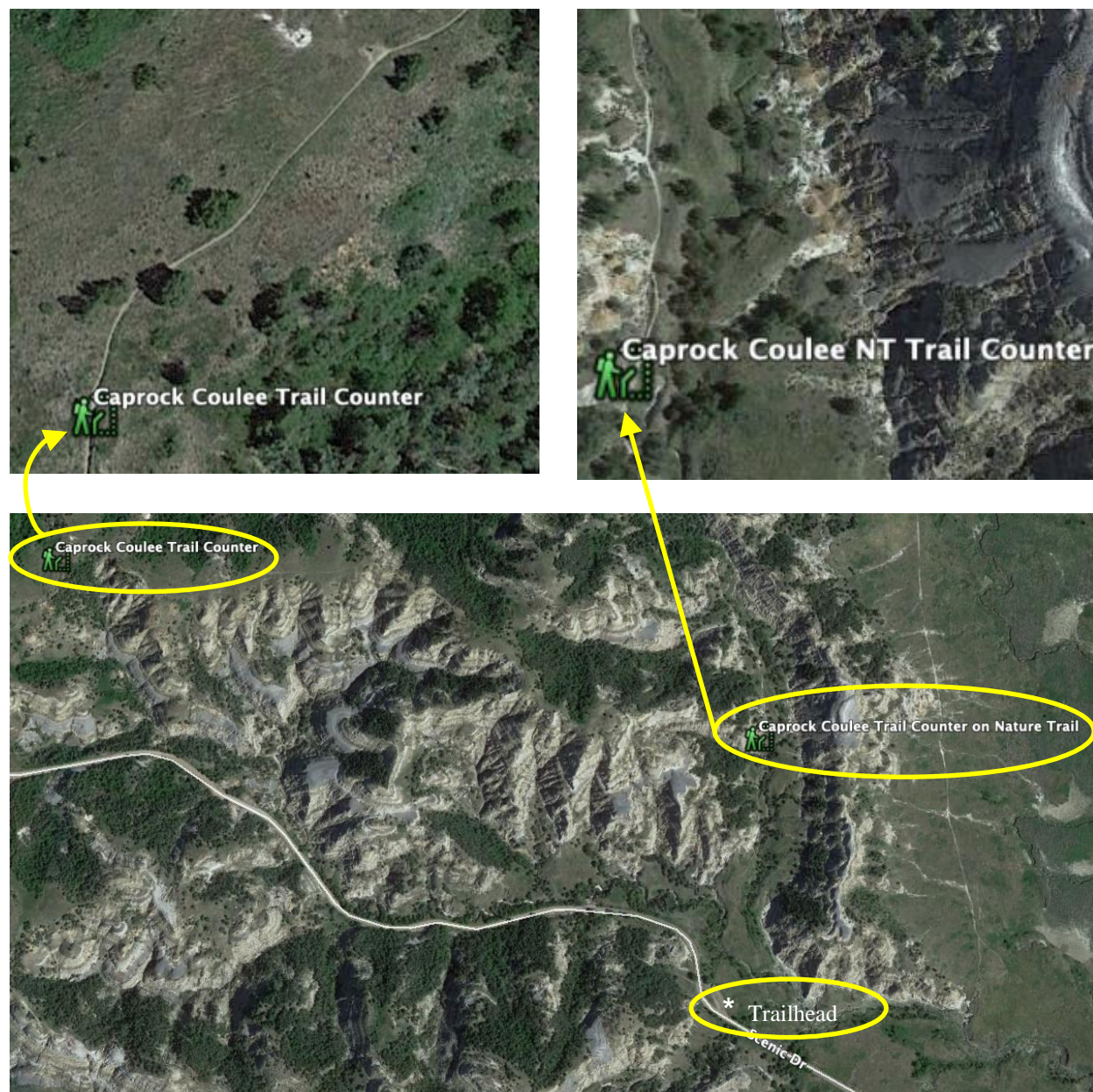


Figure 88. Trail Counters (TCs) #1 and #2 (on nature trail) locations at Caprock Coulee. Equipment coordinates are located in Appendix F.



Figure 89. Caprock Coulee TC #1 was located on the right side of the trail if traveling from the trailhead, mounted three feet up the trunk of a juniper. Equipment coordinates are located in Appendix F.



Figure 90. Caprock Coulee TC #2 was mounted approximately three feet up the trunk of a Rocky Mountain Juniper on the south side of the nature trail between posts 7 (Sagebrush) and 8 (Lignite). Equipment coordinates are located in Appendix F.

Spatial and Temporal Distributions for Day Use Visitors in the North Unit

Time and distance in the North Unit

On average, visitors stay at the park for approximately 2 hours and 39 minutes and drive 28 miles during their stay. Approximately 29% of visitors stop at the North Unit Visitor Center and stay approximately 10 minutes, on average.

Approximately 69% of visitors venture away from the road and hike approximately 1 mile during their visit. This occurs both at overlooks (e.g., Riverbend) and official trails, although the majority of the time spent venturing away from the road is at popular overlooks, such as Riverbend and Oxbow Overlooks. This distance away from the road constitutes approximately 17% of their total visit time. Results reveal that 12% of visitors use the Buckhorn Trail, 11% use the Caprock Coulee Trail, and 7% use the South Achenbach Trail, which represents the three most used trails in the North Unit by day visitors. However, the amount of time spent at each of these locations ranges from 20 minutes at the Buckhorn Trail to 1 hour and 37 minutes at the Caprock Coulee Trail, on average.

Approximately 91% of visitors visit at least one official park overlook or pull out during their visit. On average, visitors spend approximately 18% of their total visit time at official park overlooks or pull outs. Results reveal that 79% of visitors stop at Riverbend Overlook, 73% stop at Oxbow Overlook, and 44% use the Picnic Area, which represents the three most used areas in the North Unit by day visitors. The amount of time spent at each of these locations ranges from 15 minutes to 18 minutes, on average.

Spatial distribution in the North Unit

Similar to the South Unit, the results indicate that visitors spend the majority of their time driving on the park road and stopping at official park overlooks or pullouts. Some day-visitors frequent the trails in the Theodore Roosevelt Designated Wilderness in the North Unit. When trails are used, they are directly related to overlook use or are generally near the park road. Furthermore, this spatial characterization of visitor use remains relatively consistent across the hours of the day.

Table 44. *North Unit overlook and trail use in 2017 by day visitors displayed by percent time of total visit and distance hiked.*

Travel attribute	Minutes, miles, or percent	
	<i>M (SD)</i>	Min-max
Total minutes of visit	2:39 (1:22)	43-407
Total miles driving during visit	27.77 (6.16)	12-49
Total miles hiked during visit	1.01 (1.26)	0.01-5.22
Percent time of total visit at overlooks	18% (11.9%)	0-65%
Percent time of total visit not on road	17% (19%)	0-84%
Percent of visitors venturing away from the road	69%	-

Note. *M* = mean; *SD* = standard deviation; 2017 data was used to approximate typical travel patterns without road construction influence from the South Unit.

Table 45. *North Unit overlook and attraction area use in 2017 by day visitors displayed by average minutes spent in each location and percent of visitors who visited each location.*

Overlooks and attractions	Minutes	
	<i>M (SD)</i>	Min-max
North Unit Visitor Center	0:10 (0:15)	1-74
Percent of visitors	28.9%	
Longhorn Pull Out	0:04 (0:04)	1-9
Percent of visitors	20.0%	
Slump Block Pull Out	0:03 (0:03)	1-19
Percent of visitors	25.2%	
Cannon Pull Out	0:11 (0:11)	1-41
Percent of visitors	43.7%	
Picnic Area	0:17 (0:18)	1-124
Percent of visitors	44.4%	
Long X Trail Pull Out	0:03 (0:02)	1-7
Percent of visitors	31.9%	
Riverbend Overlook	0:18 (0:14)	1-97
Percent of visitors	79.3%	
Bentonitic Clay Overlook	0:03 (0:02)	1-12
Percent of visitors	37.8%	

Man Grass Pull Out Percent of visitors	0:02 (0:01) 8.9%	1-4
Edge of Glacier Pull Out Percent of visitors	0:04 (0:05) 27.4%	1-25
Oxbow Overlook Percent of visitors	0:15 (0:19) 73.3%	1-101

Note. *M* = mean; *SD* = standard deviation; 2017 data was used to approximate typical travel patterns without road construction influence from the South Unit.

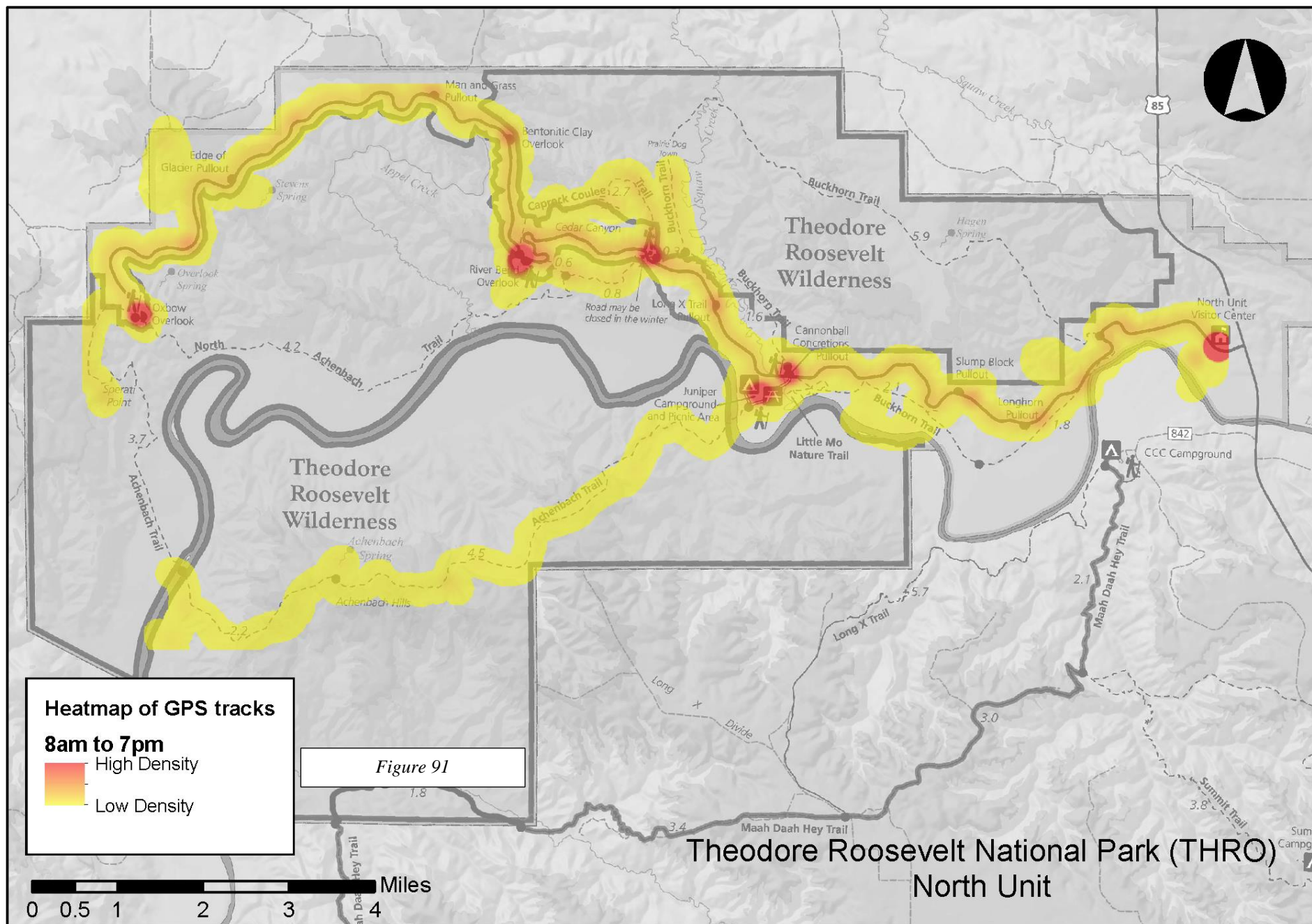
Table 46. *North Unit trail use in 2017 by day visitors displayed by average minutes spent in each location and percent of visitors who visited each location.*

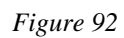
Trails	Minutes	
	<i>M</i> (<i>SD</i>)	Min-max
Buckhorn Trail Percent of visitors	0:20 (0:18) 11.9%	1-60
Caprock Coulee Trail Percent of visitors	1:37 (0:83) 11.1%	21-258
South Achenbach Trail Percent of visitors	0:50 (0:28) 6.7%	4-80
North Achenbach Trail Percent of visitors	1:31 (1:19) 2.2%	26-185

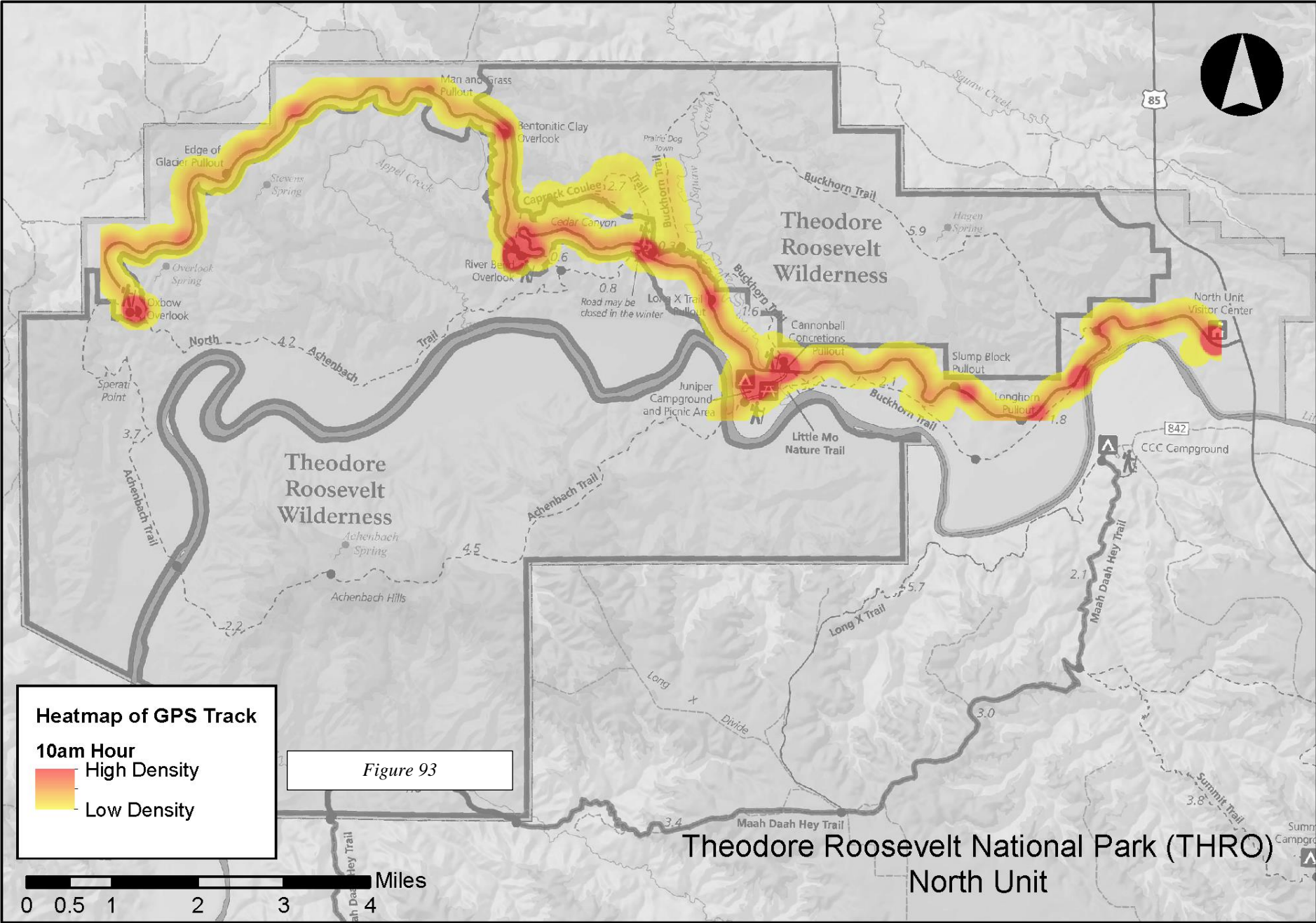
Note. *M* = mean; *SD* = standard deviation; 2017 data was used to approximate typical travel patterns without road construction influence from the South Unit

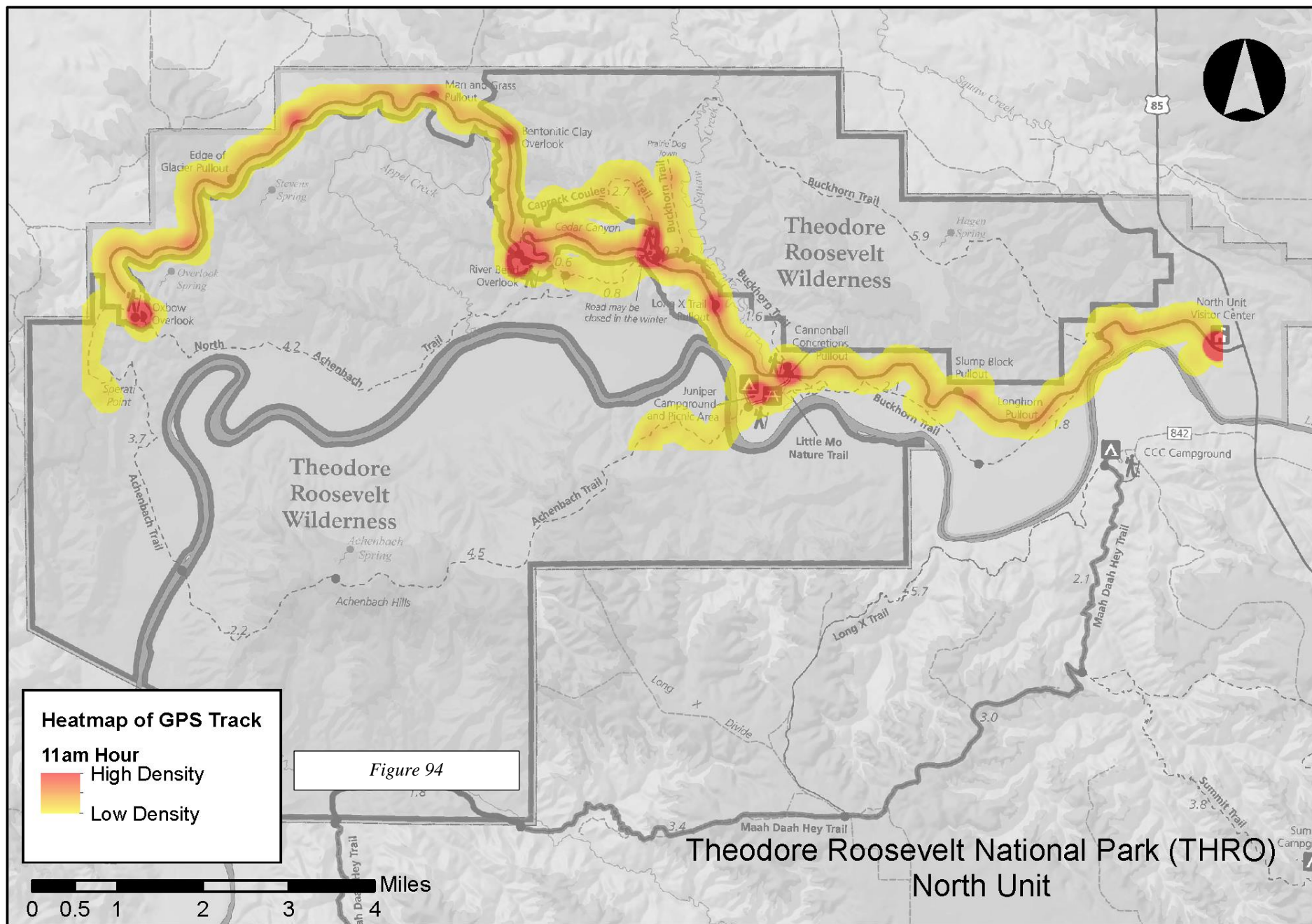
North Unit density maps

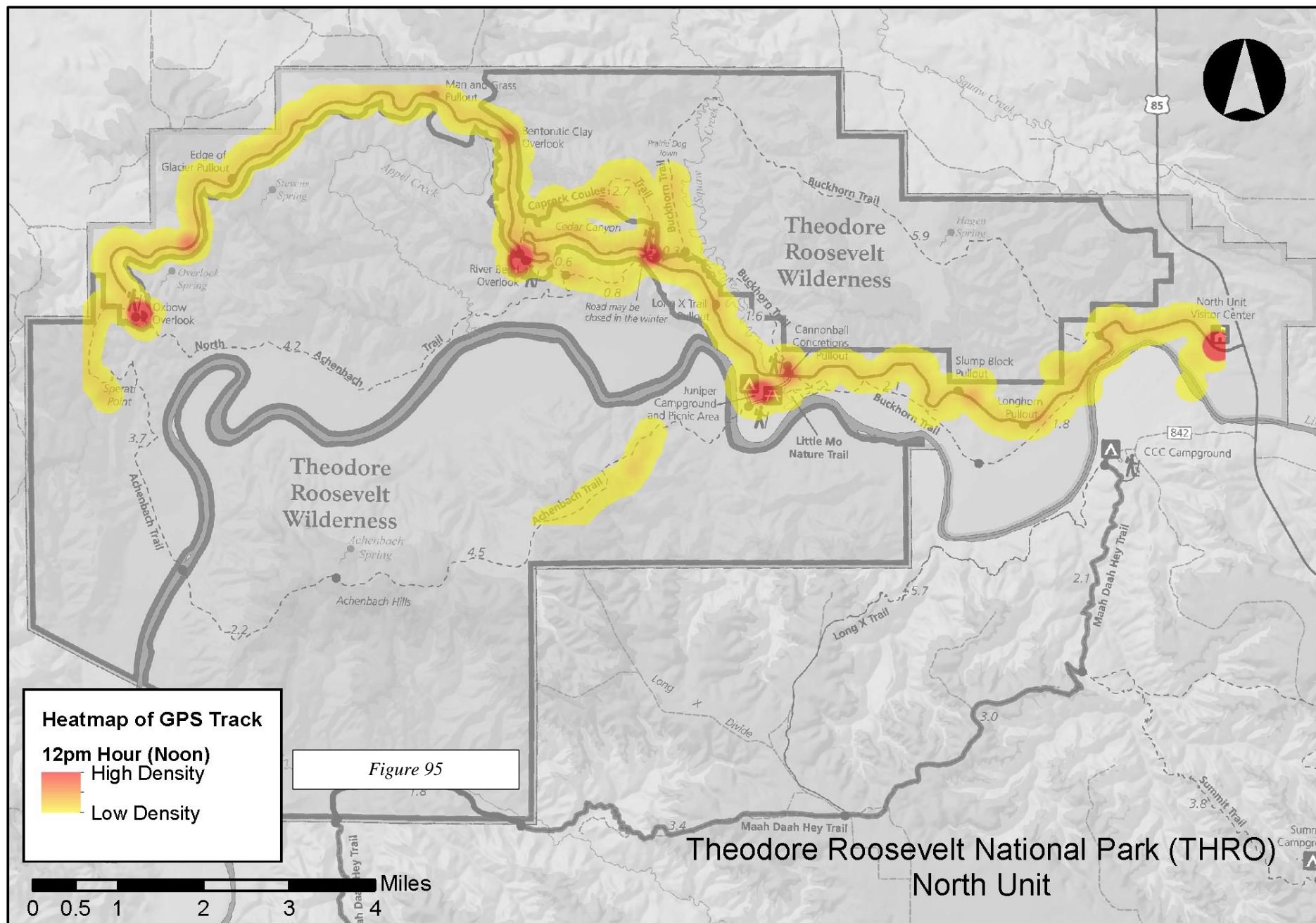
The following section contains a series of density maps representing areas of higher visitor use (high density) and lower visitor use (low density). The first map displays the overall density of visitor use, across the day from 8:00 am to 7:00 pm. The subsequent maps display locations of higher and lower density at each hour of the day (e.g., 9:00 am).

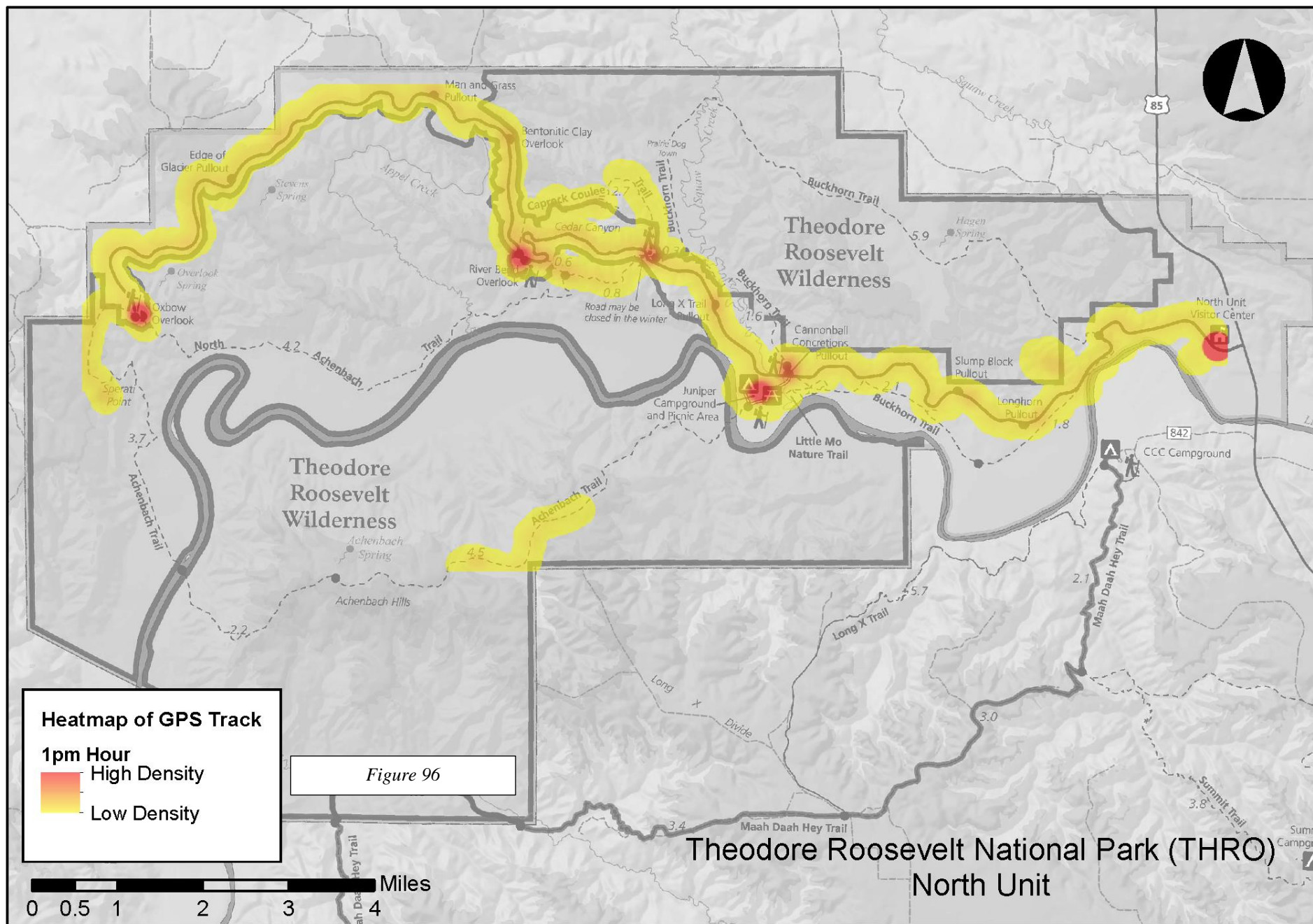


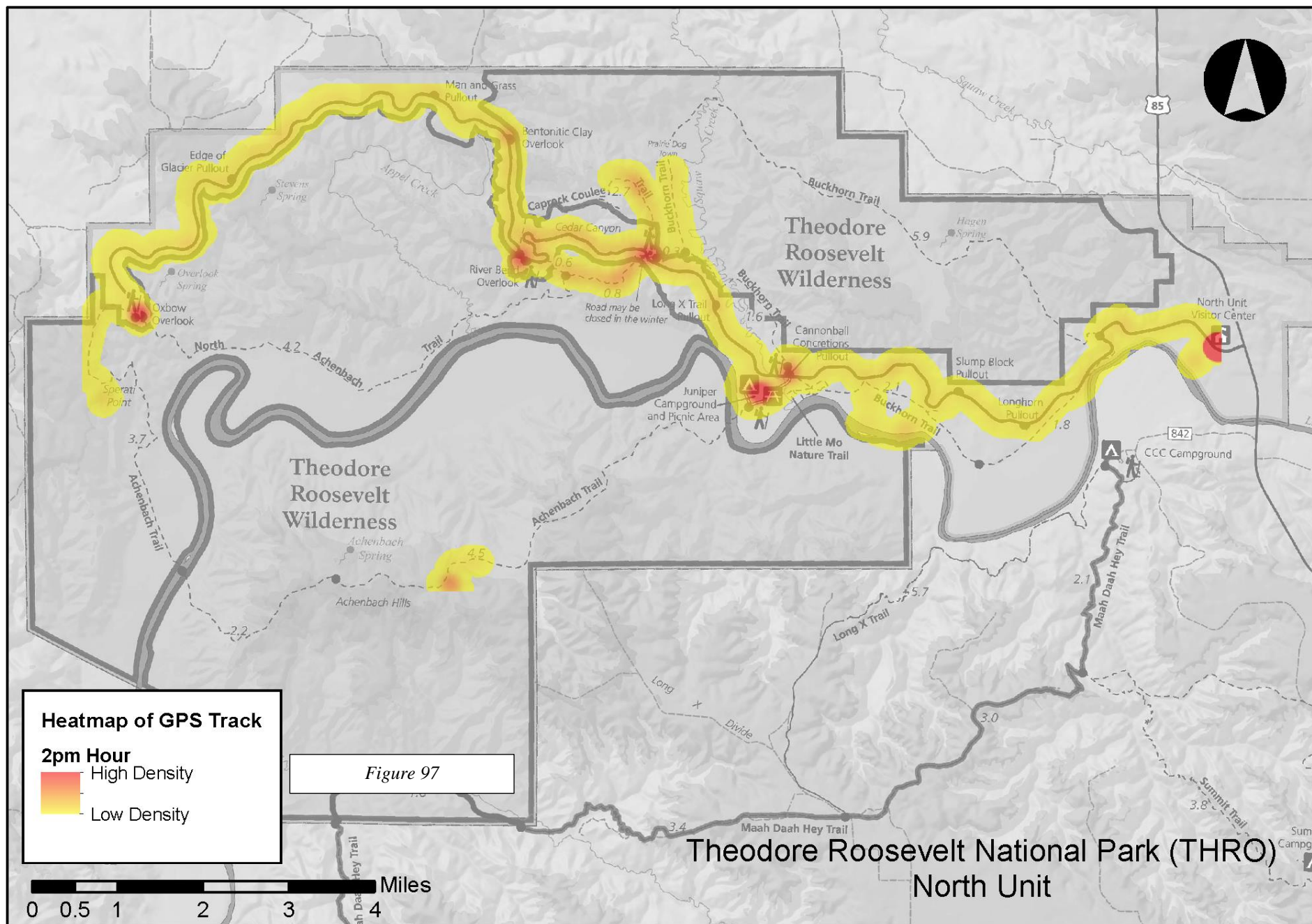


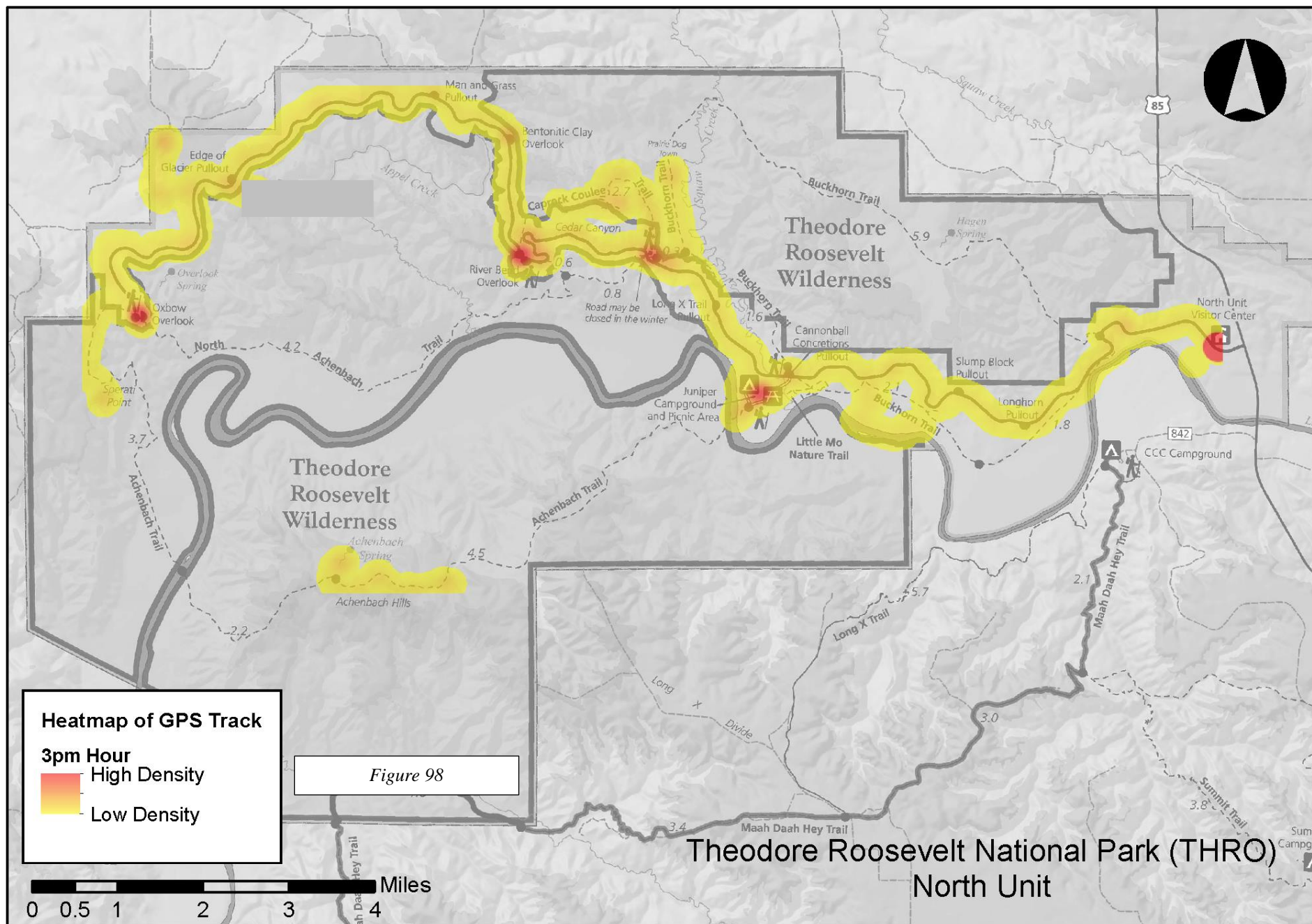


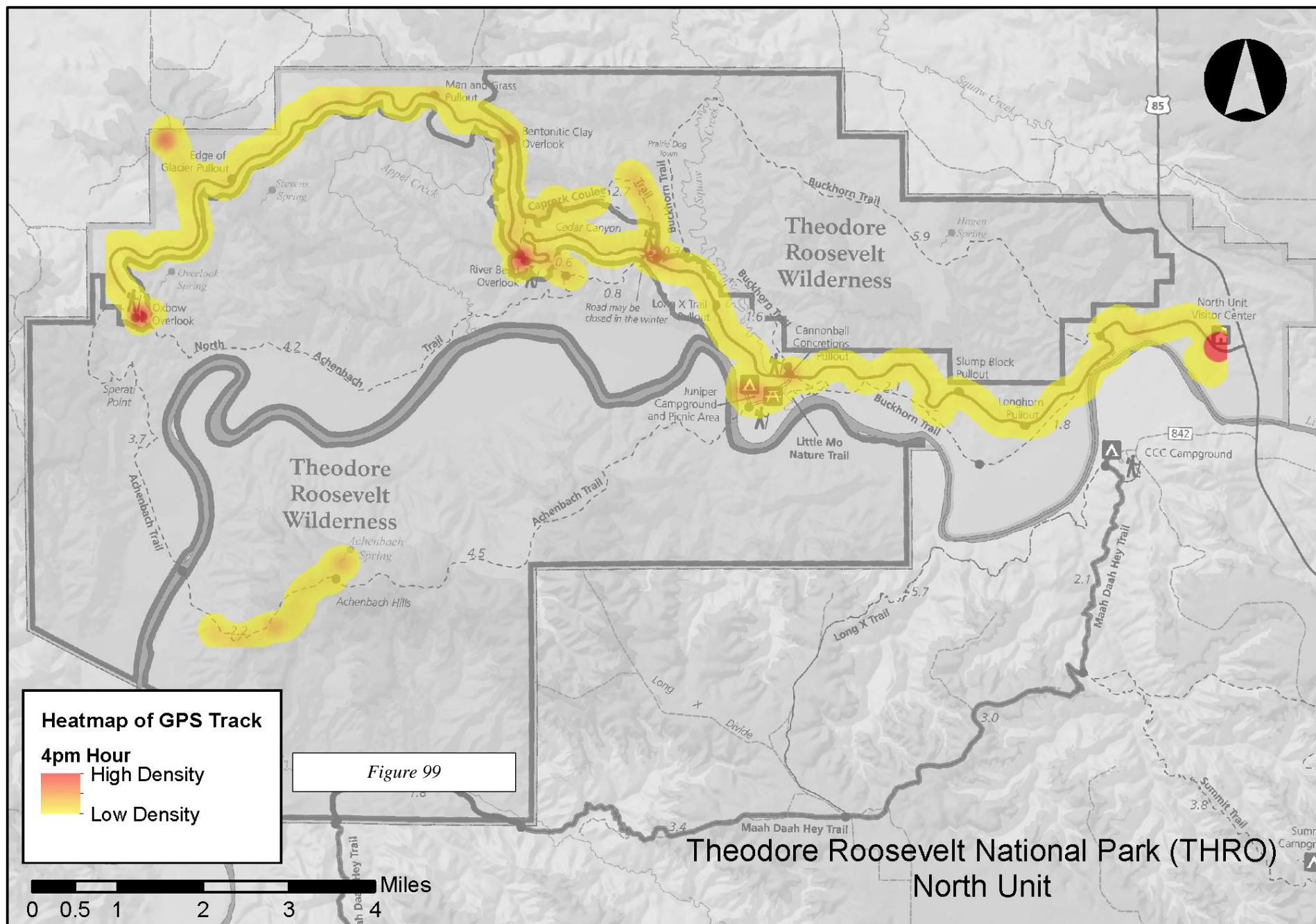


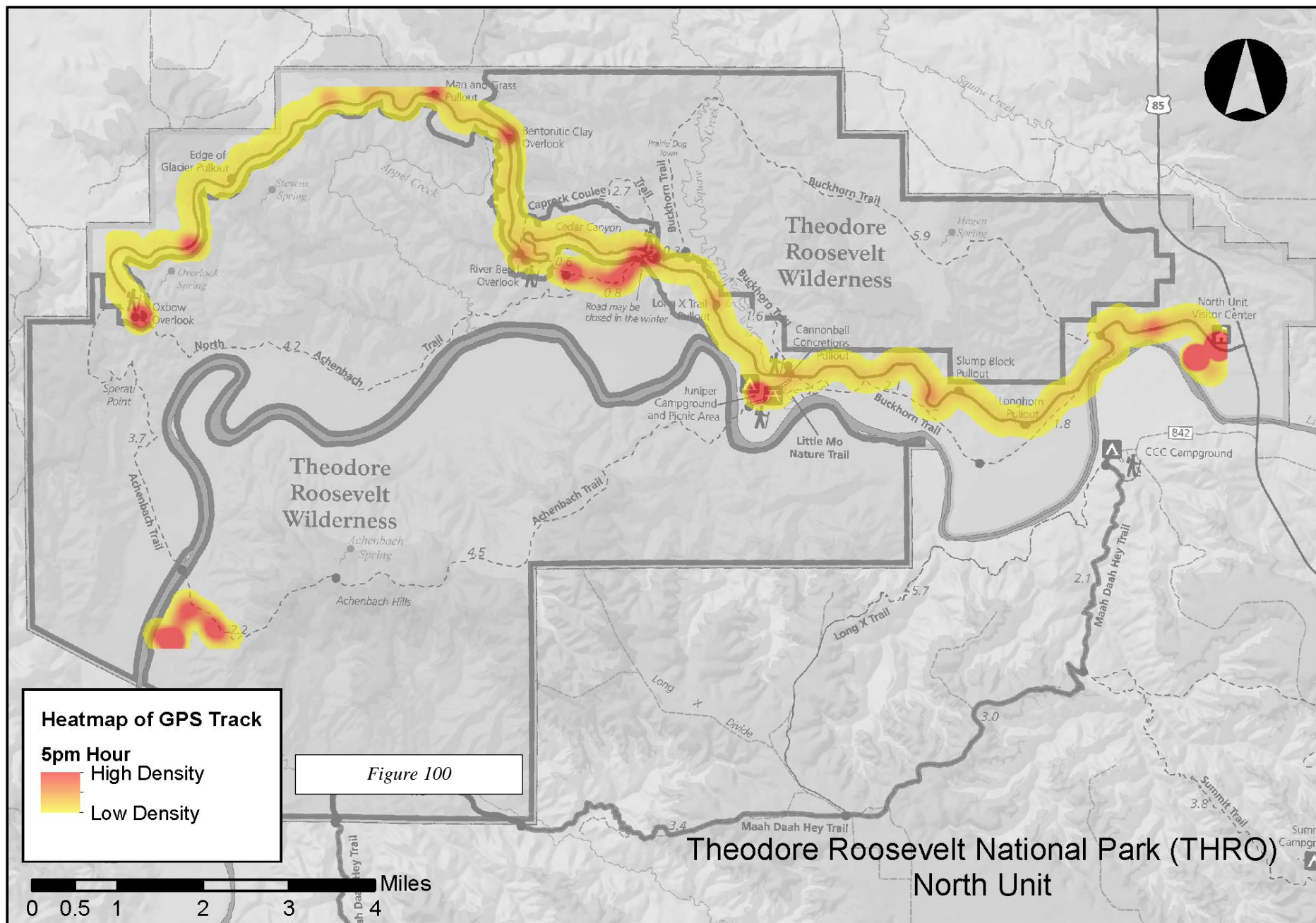


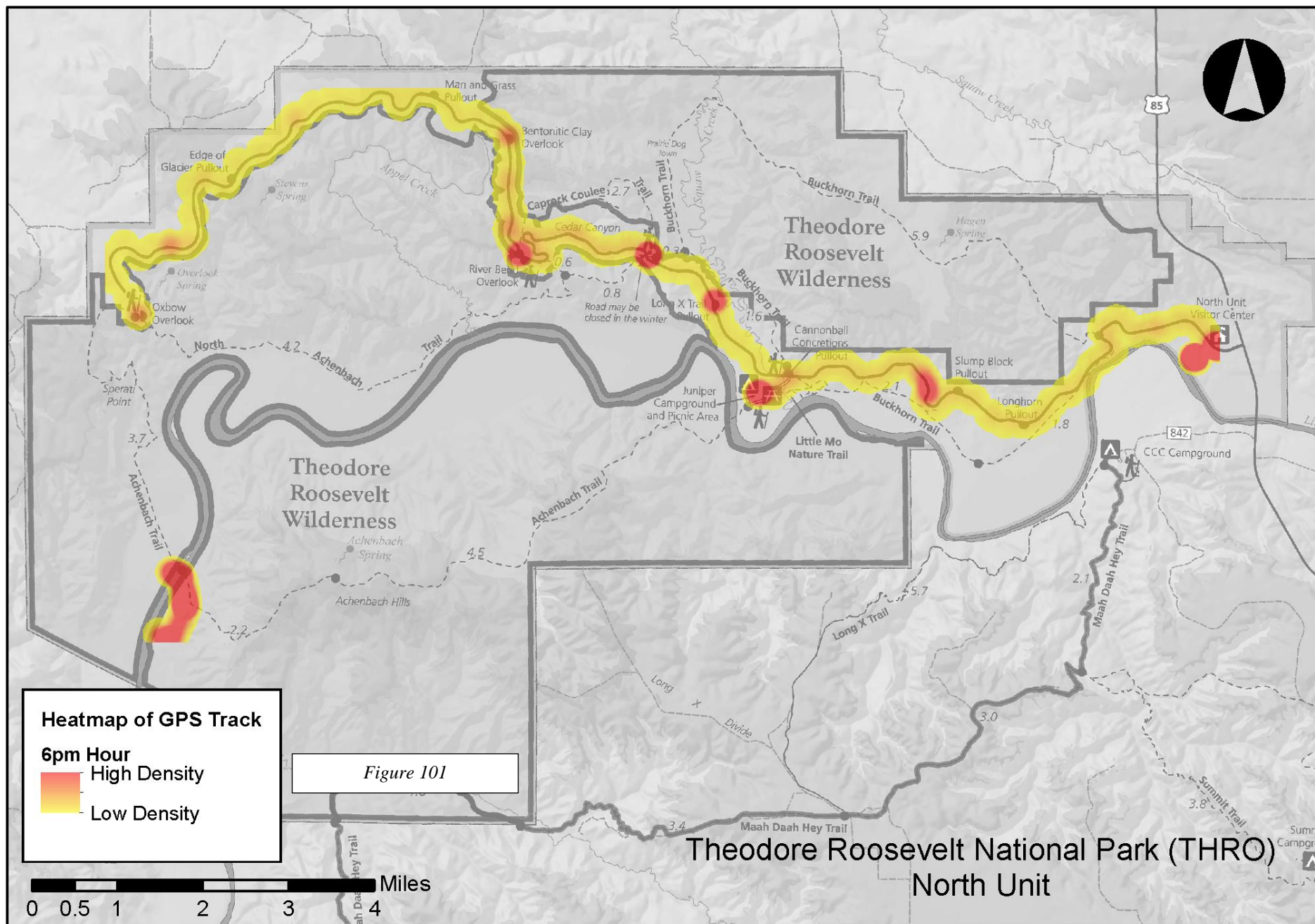


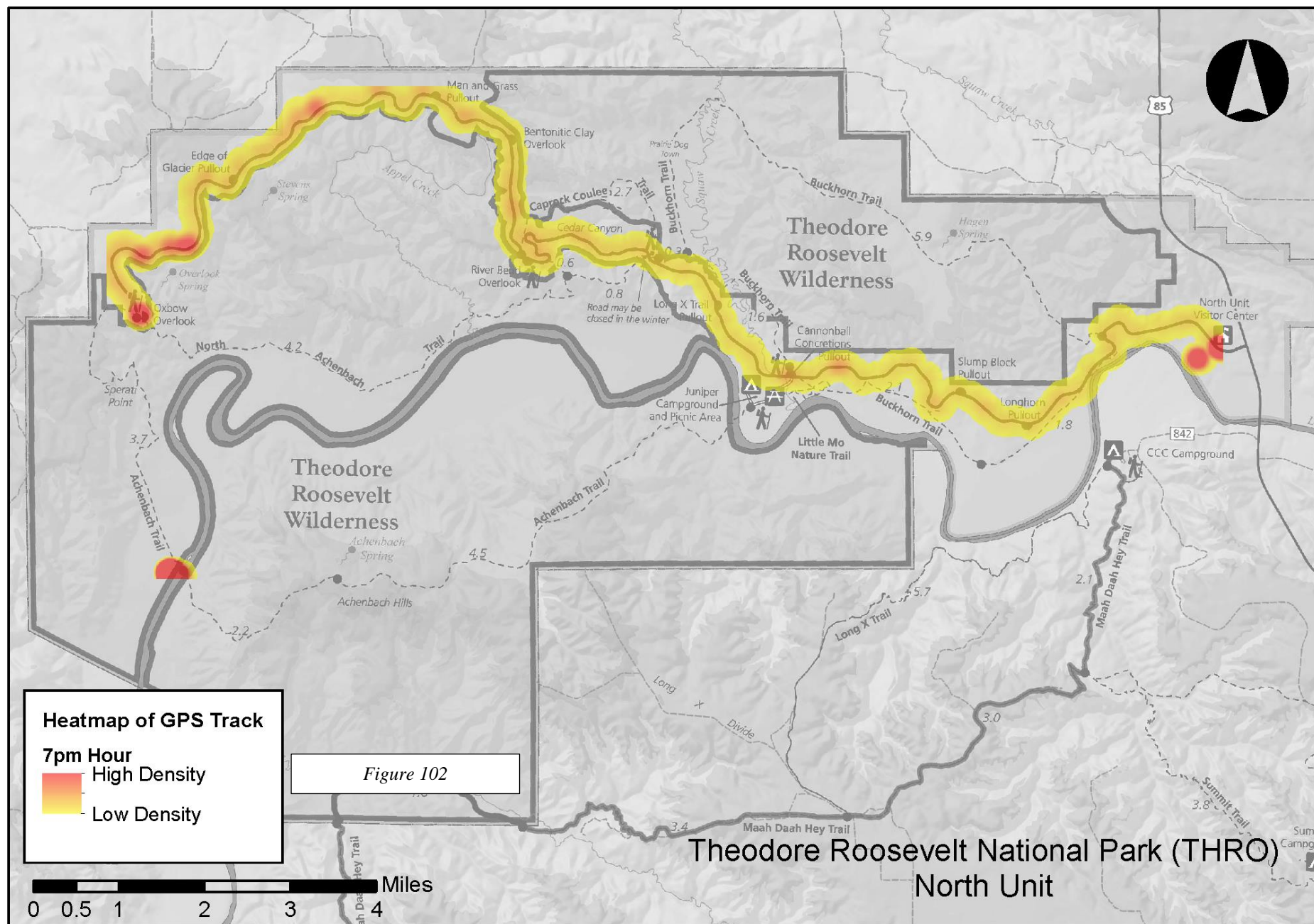










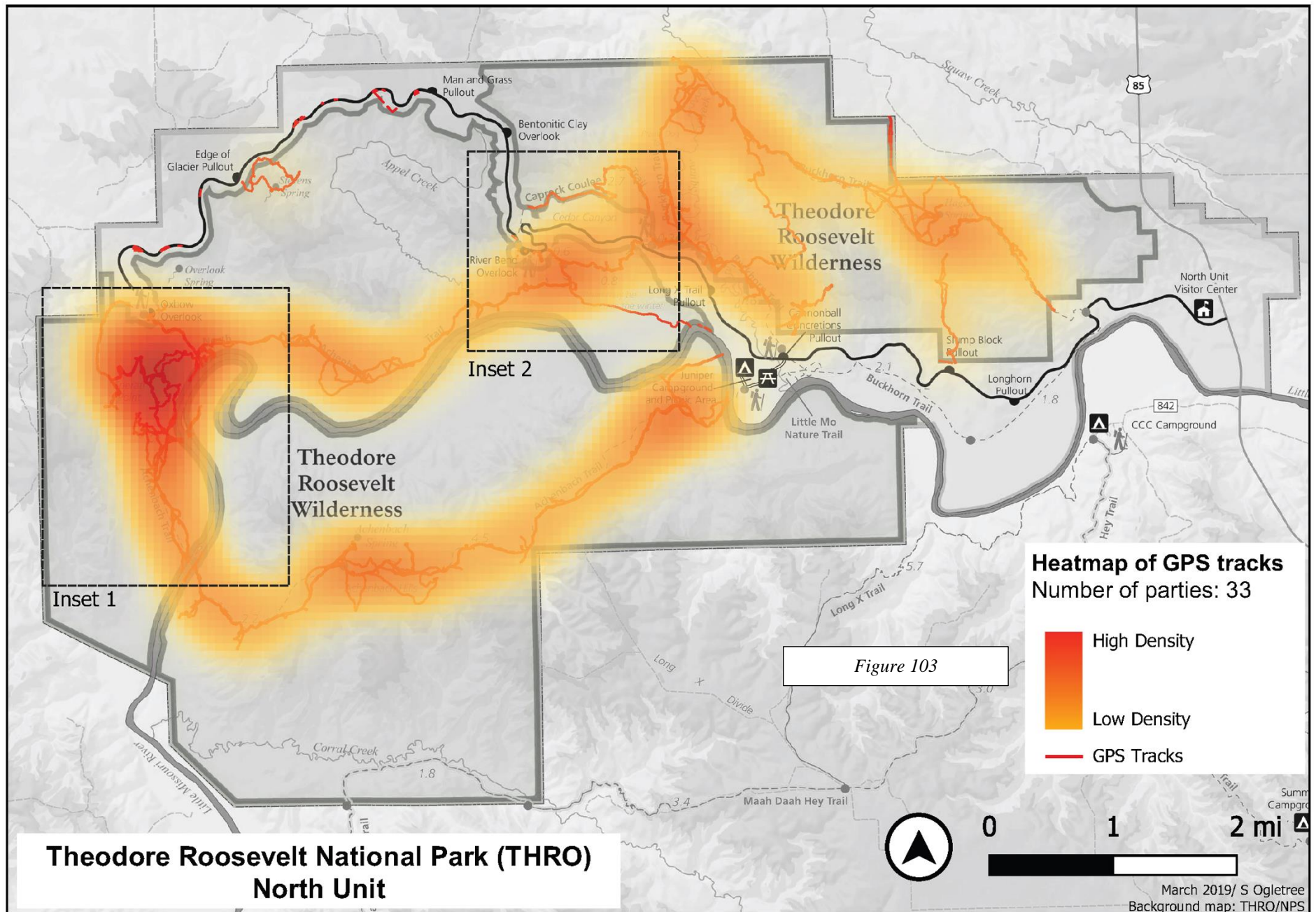


Spatial distribution of use in the Theodore Roosevelt's North Unit Designated Wilderness

Researchers limited the wilderness GPS waypoint analysis to areas within the Theodore Roosevelt Designated Wilderness. Point density analysis in the North Unit reveals that the overwhelming majority of visitors hike on designated park trails and do not venture far from these corridors.

In the North Unit, visitors frequent the Achenbach Trails, Caprock Coulee Trail, and the Buckhorn Trail. This also reveals that most of the wilderness trails in the North Unit are used by wilderness visitors. The two areas of highest use density in the North Unit are 1) Sperati Point near Oxbow Overlook and the Achenbach Trail near the Little Missouri River, and 2) the Achenbach Trail just below the River Bend Overlook. The proximity of the trail to the river, and a water source, just below Oxbow Overlook is likely an attraction for wilderness users accessing this area.

Figure 103 on the next page provides a map of use-density for THRO's North Unit, with two zoomed-in inset maps provided on the following page that offer greater detail of the trail use at Oxbow Overlook, Sperati Point, and Achenbach Trail (Inset 1) and River Bend Overlook and Caprock Coulee (Inset 2).



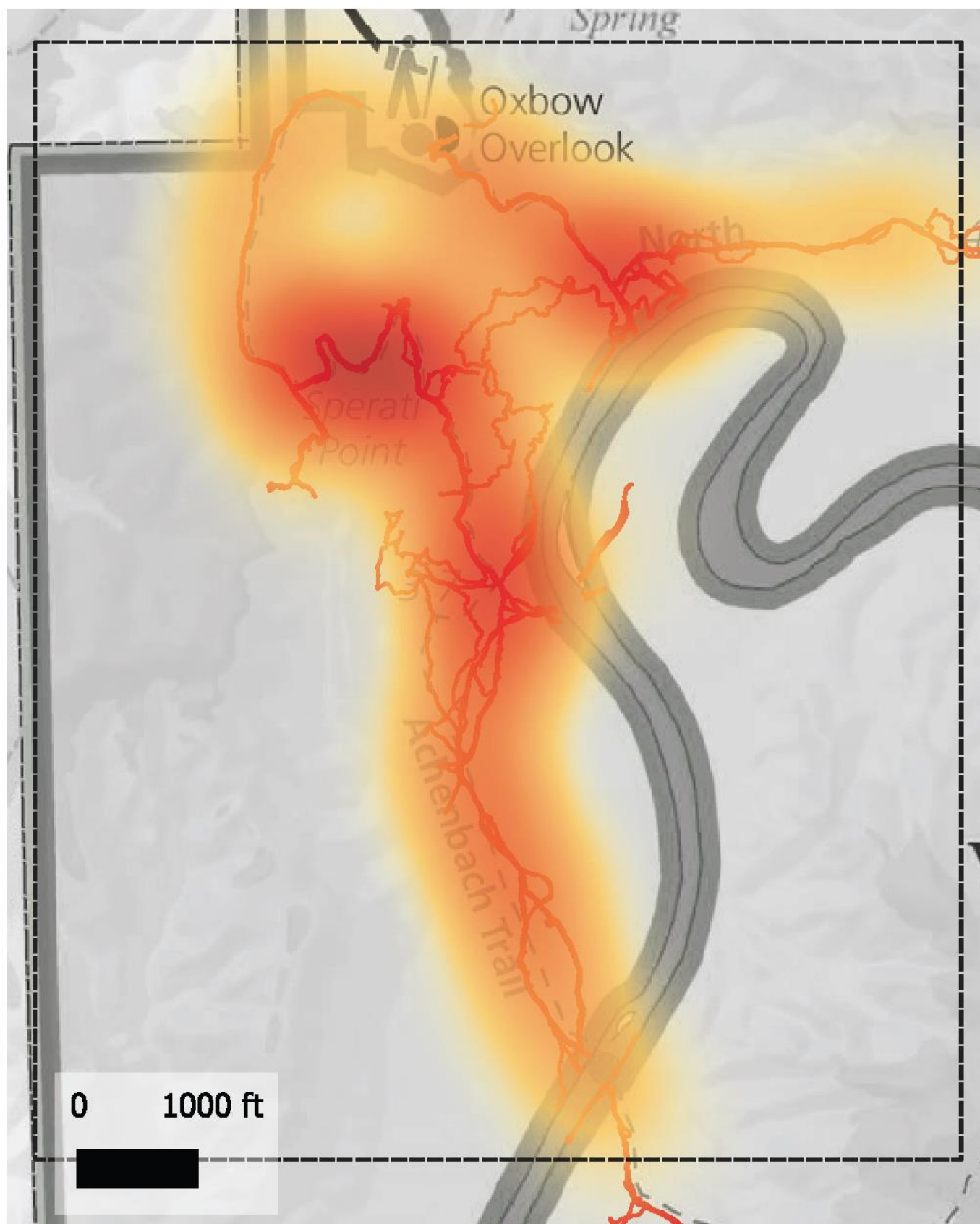


Figure 104 Inset 1: Heatmap for Oxbow Overlook, Sperati Point, and Achenbach Trail showing trail use density.

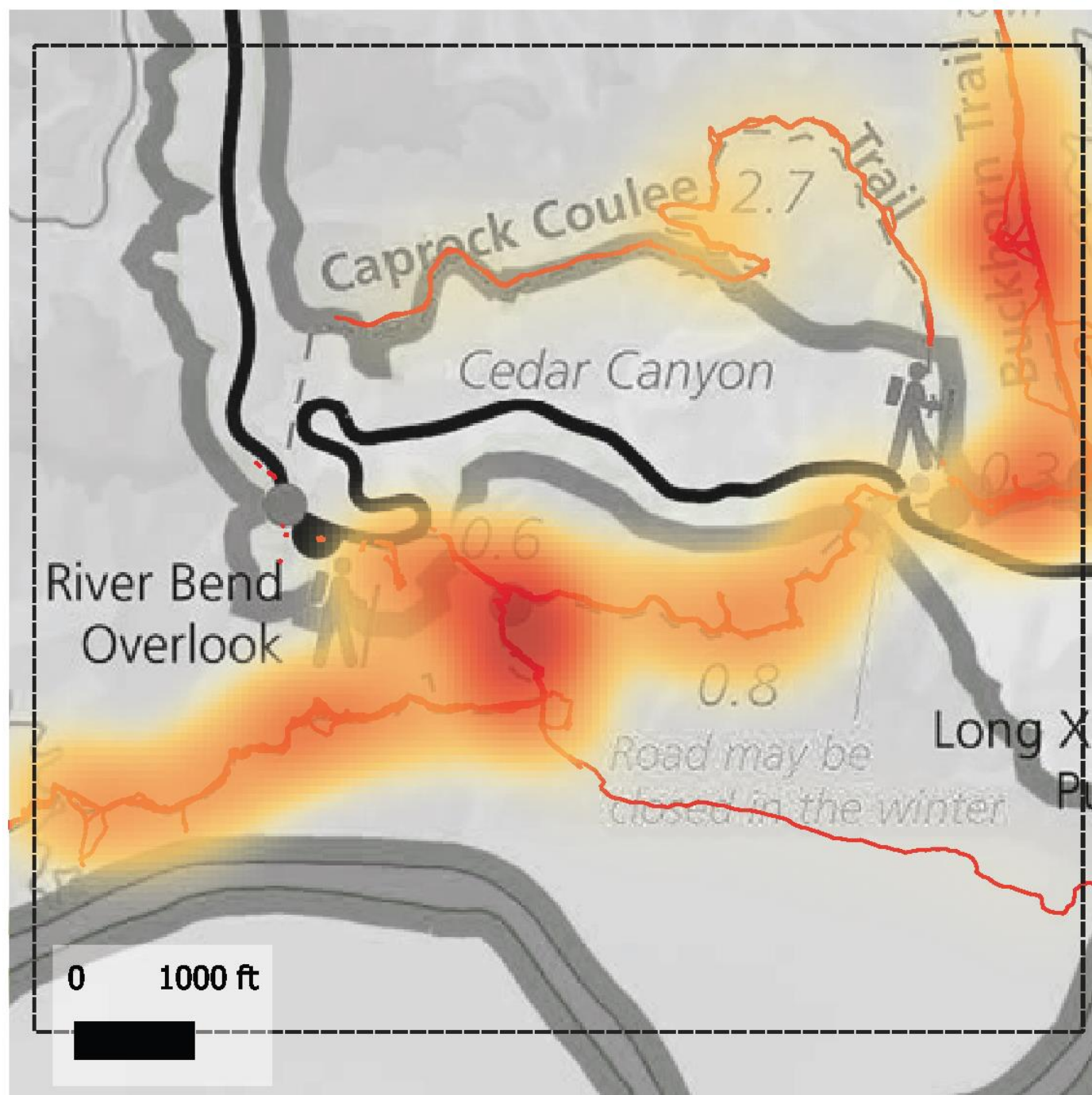


Figure 105 Inset 2: Heatmap for River Bend Overlook and Caprock Coulee showing trail use density.

Wilderness Permit Data for North Unit

Figure 106 shows the percentage of visitors that accessed THRO's wilderness areas through various North Unit locations. Researchers used 2017 NPS Wilderness Permit data to generate the percentages that are displayed in Figure 106. The Top 5 of these entry locations—in order of decreasing percentage of visitor ingress—were the Juniper Picnic Area (23.2%), Oxbow Overlook (18.5%), Buckhorn Trailhead, (15.7%), the Cannonball pullout (10.2%), and the Caprock Coulee trailhead (7.4%).

These same five locations were also the Top 5 wilderness exits for visitors, but in slightly different percentages (in descending order of visitor egress): Juniper Picnic Area (23.2%), Oxbow Overlook (18.5%), Buckhorn Trailhead, (12.0%), the Cannonball pullout (11.1%), and the Caprock Coulee trailhead (8.33%).

Further breakdown of these percentages is provided in Tables 47-50.

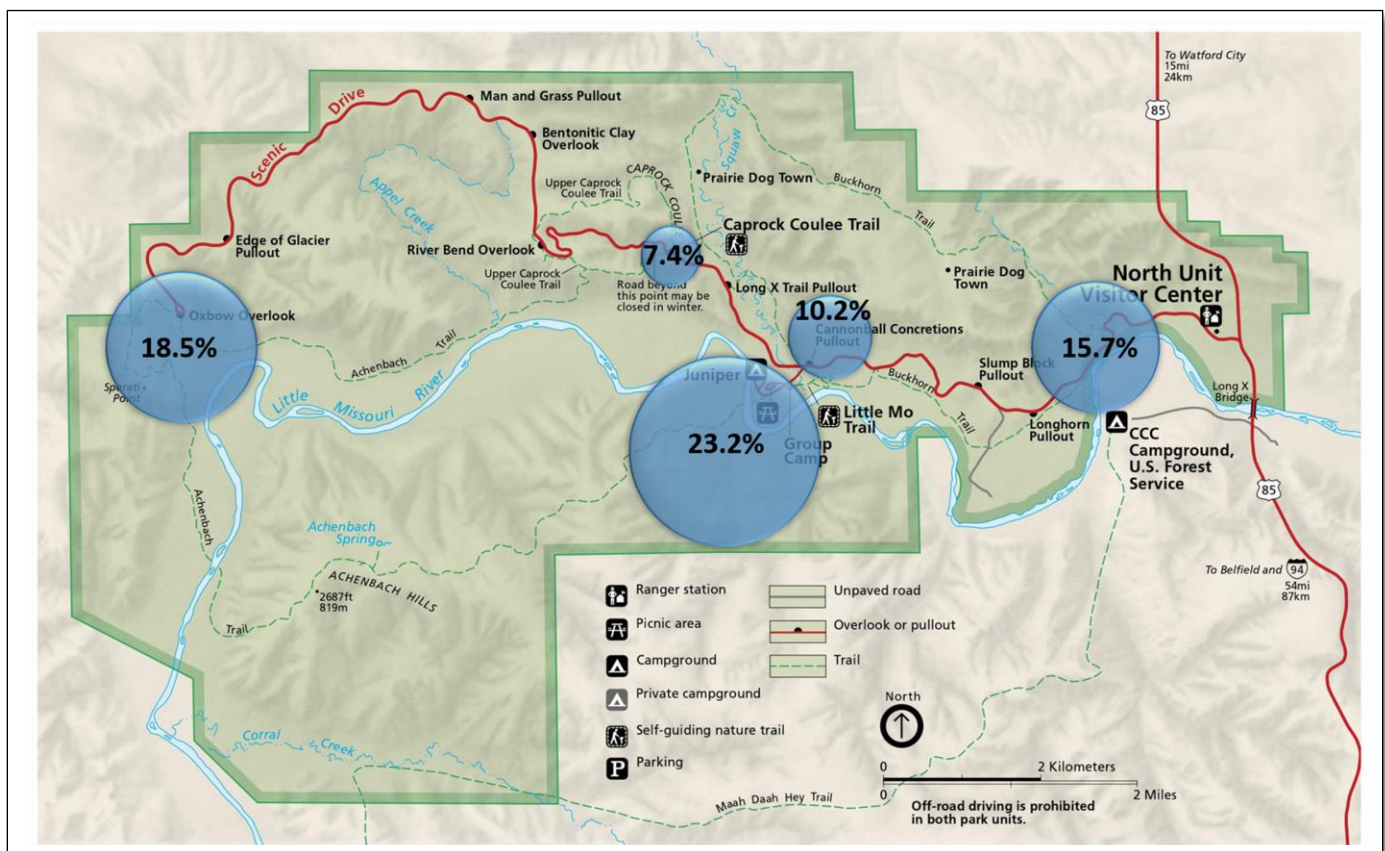


Figure 106. Map of North Unit showing visitors' wilderness entry locations

Table 47: *North Unit Entry Locations from 2017 Wilderness Permits*

Location of Entry	Number of Recordings	Percent
Picnic Area	25	23.15
Oxbow	20	18.52
Buckhorn	17	15.74
Cannonball	11	10.19
Caprock	8	7.41
Juniper	5	4.63
River Bend	5	4.63
Juniper Campground	2	1.85
Mile 1	2	1.85
Sperati Point	2	1.85
Campground	1	0.93
Campground/Picnic Area	1	0.93
Cannonball Pullout	1	0.93
Cannonball/Picnic Area	1	0.93
Caprock/Buckhorn	1	0.93
East Buckhorn	1	0.93
Juniper Picnic Area	1	0.93
Mile 10	1	0.93
Oxbow Overlook	1	0.93
South Achenbach	1	0.93
Unreadable	1	0.93
TOTAL	108	100.00

Table 48: *North Unit Exit Locations from 2017 Wilderness Permits*

Location of Entry	Number of Recordings	Percent
Picnic Area	25	23.15
Oxbow	20	18.52
Buckhorn	13	12.04
Cannonball	12	11.11
Caprock	9	8.33
Juniper	5	4.63
River Bend	5	4.63
Campground	3	2.78
Juniper Campground	2	1.85
Mile 1	2	1.85
Sperati Point	2	1.85
Campground/Picnic Area	1	0.93
Cannonball Pullout	1	0.93
Cannonball/Picnic Area	1	0.93
Caprock/Buckhorn	1	0.93
East Buckhorn	1	0.93
Juniper Picnic Area	1	0.93
Mile 10	1	0.93
Oxbow Overlook	1	0.93
South Achenbach	1	0.93
Unreadable	1	0.93
TOTAL	108	100.00

Table 49: *North Unit First Campsites Used from 2017 Wilderness Permits*

First Campsite	Number of Recordings	Percent
Not Given	17	15.74
Achenbach Springs	9	8.33
Buckhorn	8	7.41
Zone 1	8	7.41
Zone 4	8	7.41
Unreadable	5	4.63
Zone 2	5	4.63
Prairie Dog Towns	4	3.70
South Achenbach	4	3.70
West Achenbach	4	3.70
West Sperati Point	4	3.70
Hagen Spring	3	2.78
North Achenbach	3	2.78
Sperati Point	3	2.78
Achenbach	2	1.85
Achenbach Hills	2	1.85
Buckhorn Spring	2	1.85
Caprock	2	1.85
Steven's Point	2	1.85
West Prairie Dog Towns	2	1.85
Achenbach Loop	1	0.93
Buckhorn Flats	1	0.93
Buckhorn Loop	1	0.93
Buckhorn Plateau	1	0.93
North Caprock	1	0.93
Norwest Buckhorn	1	0.93
Picnic Area	1	0.93
Plateau	1	0.93
River Crossing	1	0.93
Top Plateau	1	0.93
West Oxbow	1	0.93
TOTAL	108	100.00

Table 50: *North Unit Additional Campsites Used from 2017 Wilderness Permits*

Additional Campsites	Number of Recordings	Percent
Zone 1	5	16.13
Buckhorn	3	9.68
Unreadable	3	9.68
Zone 2	3	9.68
Zone 4	3	9.68
Hagen Spring	2	6.45
Petrified Forest	2	6.45
Sperati Point	2	6.45
Zone 3	2	6.45
Achenbach	1	3.23
East Oxbow	1	3.23
North Achenbach	1	3.23
River	1	3.23
River Bottom	1	3.23
South Achenbach	1	3.23
TOTAL	31	100.00



SOUTH UNIT RESULTS

**People at One
Time (PAOT)**



• **Field and
Parking Lot
Cameras**



• **Trail Counters**



• **Wilderness
Permit Data**



South Unit Results

This section of the report focuses specifically on findings for THRO's South Unit, including information about the locations of field equipment (PLCs, FCs, and TCs), data gathered, analyses, and implications.

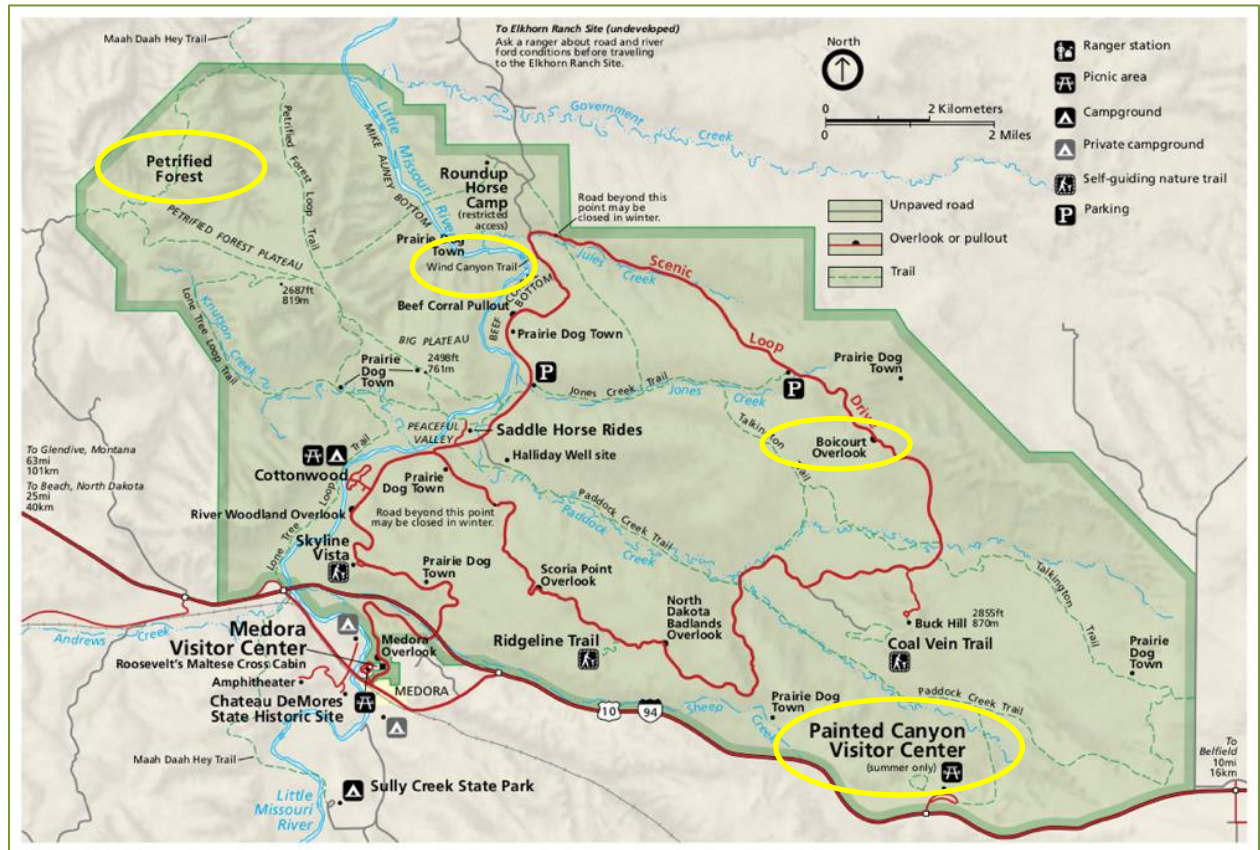


Figure 107. Detailed map of Theodore Roosevelt National Park's South Unit

Included in this section are details about:

- People at one time, field cameras, and parking lot cameras at Boicourt Overlook
- Parking lot cameras at Petrified Forest and Wind Canyon Overlook
- Trail counters at Petrified Forest and Painted Canyon
- Spatial and temporal distributions for day use visitors
- Spatial and temporal distributions for wilderness users
- Wilderness permit data

Threshold: People at One Time at Boicourt Overlook

Informed by management, park documents, and conversations with visitors, the number of people at one time (PAOT) at the South Unit's Boicourt Overlook was selected as a primary element of the THRO experience that may contribute to the quality of a visit (i.e., indicator of quality). Consequently, the research team evaluated the visitor desired conditions of PAOT at Boicourt to understand the conditions that visitors deem a) the minimally acceptable condition (i.e., threshold), b) when management action should take place (i.e., management action), and c) when they might not return to the site because of conditions (i.e., displacement). These desired conditions, or visitor norms, were judged against actual conditions at Boicourt Overlook by using field cameras (FCs) to understand if actual conditions aligned with or exceeded visitors' desired conditions.

The Thresholds Questionnaire used photo panels to determine visitors' tolerance for number of people at one time (PAOT) at Boicourt Overlook. Additionally, researchers digitally manipulated the two photo panels for this location to explore the potential effect of two different situational weather conditions, with one panel showing PAOT under a bright, sunny sky, and the second photo panel showing PAOT under a dark, foreboding sky. These data were coupled together to construct a social norm curve for PAOT at Boicourt. To determine whether subjective opinions based on the PAOT conditions actually took place, two FCs were deployed at Boicourt to gather objective counts of PAOT at each photo panel location.

Overall, the results for people at one time (PAOT) at Boicourt Overlook display decreasing levels of acceptability as PAOT increases. On average, visitors report a threshold of 34 people at one time (34 PAOT). In other words, when there are more than 34 people at Boicourt Overlook, then conditions become unacceptable to visitors. This finding also suggests that the general range of acceptable conditions occurs between 0 to 34 people at Boicourt, with 0 people being the most acceptable condition.

Survey respondents reported experiencing an average of 7 PAOT at Boicourt Overlook. 33% of visitors stated that their experienced level of PAOT 'increased' or 'extremely increased' the quality of their visit. On average, 28% of visitors report that management action is required when 60 people are at Boicourt Overlook (53 PAOT). When there are hypothetically 53 people present (53 PAOT), 31% of visitors report they would not return to the site. It is important to note that 28% of visitors do not believe that any of the photographs display conditions that require management action. Additionally, 39% of respondents report that none of the PAOT photographs display conditions so severe that they would be displaced from the site. Furthermore, 26% of visitors reported that use at Boicourt Overlook should never be limited regardless of PAOT, suggesting that a portion of the Boicourt Overlook visiting population is ideologically opposed to use limits. Consensus regarding the acceptability rating for each photograph was moderate, displayed as the size of the bubbles for each photograph. This level of consensus indicates that on average visitors tend to agree more in regard to the acceptability rating of low PAOT than higher levels of PAOT.

Boicourt Overlook PAOT Photo Panel Location

Figure 108. The tripod for the Boicourt PAOT photo panel faced northeast towards the parking lot. Equipment coordinates are located in Appendix F.



Figure 109. Example images (0 people) from Boicourt PAOT *bright* and *dark* sky photo panels.



Photo 1: 0 people



Photo 2: 15 people



Photo 3: 30 people



Photo 4: 45 people



Photo 5: 60 people

Figure 110. Digitally manipulated photo panel showing people at one time (PAOT) at the South Unit's Boicourt Overlook under a bright sky, numbering from 0 people in Photo 1 to 60 people in Photo 5, corresponding with the PAOT photos on the social norm curve.



Photo 1: 0 people



Photo 2: 15 people



Photo 3: 30 people



Photo 4: 45 people



Photo 5: 60 people

Figure 111. Digitally manipulated photo panel showing people at one time (PAOT) at the South Unit's Boicourt Overlook under a dark sky, numbering from 0 people in Photo 1 to 60 people in Photo 5, that corresponding with the PAOT photos on the social norm curve.

View		-4 (Very unacceptable)	-3 (Unacceptable)	-2 (Moderately Unacceptable)	-1 (Slightly unacceptable)	0 (Neither)	+1 (Slightly acceptable)	+2 (Moderately Acceptable)	+3 (Acceptable)	+4 (Very acceptable)	Mean (SD)	t-test
Photo 1 0 People	B	3.4	0.8	0.8	0.8	5	1.7	7.6	25.2	54.6	7.92 (1.86)	t(211) = -1.37 p = 0.173
	D	0.9	0	0	0.9	3.7	3.7	5.6	29.6	55.6	8.21 (1.29)	
Photo 2 15 People	B	5.9	2.5	2.5	4.2	5.1	5.9	11	34.7	28	7.03 (2.31)	t(224) = -0.67 p = 0.494
	D	2.8	2.8	3.7	2.8	1.9	6.5	14.8	42.6	22.2	7.23 (1.99)	
Photo 4 30 People	B	5.8	10.8	6.7	15	2.5	10.8	20	20.8	7.5	5.59 (2.45)	t(227) = 1.93 p = 0.054
	D	4.6	12.8	10.1	17.4	11	15.6	12.8	10.1	5.5	4.99 (2.23)	
Photo 5 45	B	12.4	15.7	11.6	11.6	8.3	9.9	12.4	12.4	5.8	4.64 (2.56)	*t(228) = 3.05 p = 0.003

	View	-4 (Very unacceptable)	-3 (Unacceptable)	-2 (Moderately Unacceptable)	-1 (Slightly unacceptable)	0 (Neither)	+1 (Slightly acceptable)	+2 (Moderately Acceptable)	+3 (Acceptable)	+4 (Very acceptable)	Mean (SD)	t-test
Photo 1 0 People	B	3.4	0.8	0.8	0.8	5	1.7	7.6	25.2	54.6	7.92 (1.86)	t(211) = -1.37 p = 0.173
	D	0.9	0	0	0.9	3.7	3.7	5.6	29.6	55.6	8.21 (1.29)	
Photo 2 15 People	B	5.9	2.5	2.5	4.2	5.1	5.9	11	34.7	28	7.03 (2.31)	t(224) = -0.67 p = 0.494
	D	2.8	2.8	3.7	2.8	1.9	6.5	14.8	42.6	22.2	7.23 (1.99)	
Photo 4 30 People	B	5.8	10.8	6.7	15	2.5	10.8	20	20.8	7.5	5.59 (2.45)	t(227) = 1.93 p = 0.054
	D	4.6	12.8	10.1	17.4	11	15.6	12.8	10.1	5.5	4.99 (2.23)	
Photo 5 45	B	12.4	15.7	11.6	11.6	8.3	9.9	12.4	12.4	5.8	4.64 (2.56)	*t(228) = 3.05 p = 0.003

Table 52: Comparison of visitor responses when given 2 different sets of Boicourt Overlook photos and asked the question: “Considering the conditions you’ve experienced, how have they impacted your park experience?” (Thresholds Survey, Question 4c). Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

View	-2 (Extremely decreased)	-1 (Decreased)	0 (Did not improve/detract)	+1 (Increased)	+2 (Extremely increased)	Mean (SD)	t-test
Bright	0.8	0	30.3	36.1	32.8	4 (0.84)	$t(223) = 0.298$
Dark	0	2.8	33	32.1	32.1	3.934 (0.88)	$p = 0.565$

Table 53: Comparison of visitor opinions in regard to two different Boicourt Overlook photo panels, represent as percent of sample. (Thresholds Survey, Question 4b, 4d, 4e, 4f). B = Bright Sky, D = Dark Sky. Highest percentages are highlighted. Statistically significant differences marked with $*(p < 0.05)$.

	View	P1: 0 People	P2: 15 People	P3: 30 People	P4: 45 People	P5: 60 People	6) None show high enough use	7) Use should never	Mean (SD)	t-test
Experienced	B	59.5	35.3	4.3	0	0.9			1.47 (0.67)	$t(224) = 0.748$
	D	64.5	31.8	2.7	0	0.9			1.41 (0.64)	$p = 0.455$
Management Action	B	7.6	1.7	11.8	21.8	27.7	29.4		4.49 (1.45)	$t(223) = -0.5$
	D	0	3.8	16	25.5	28.3	26.4		4.58 (1.15)	$p = 0.617$
Displacement	B	1.7	0.9	7.7	15.4	28.2	46.2		5.06 (1.13)	$t(223) = 1.538$
	D	0	1.9	12	19.4	34.3	32.4		4.83 (1.07)	$p = 0.125$
Use limit	B	0.8	3.4	22.7	15.1	11.8	21	25.2	4.97 (1.65)	$t(227) = 1.362$
	D	1.8	4.5	31.8	15.5	7.3	11.8	27.3	4.66 (1.8)	$p = 0.175$

Norm Curve for PAOT at Boicourt Overlook – Bright Sky & Dark Sky

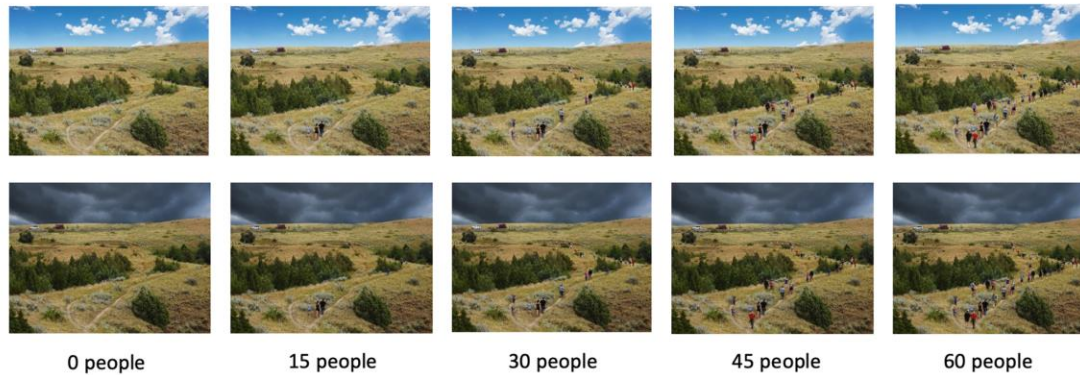
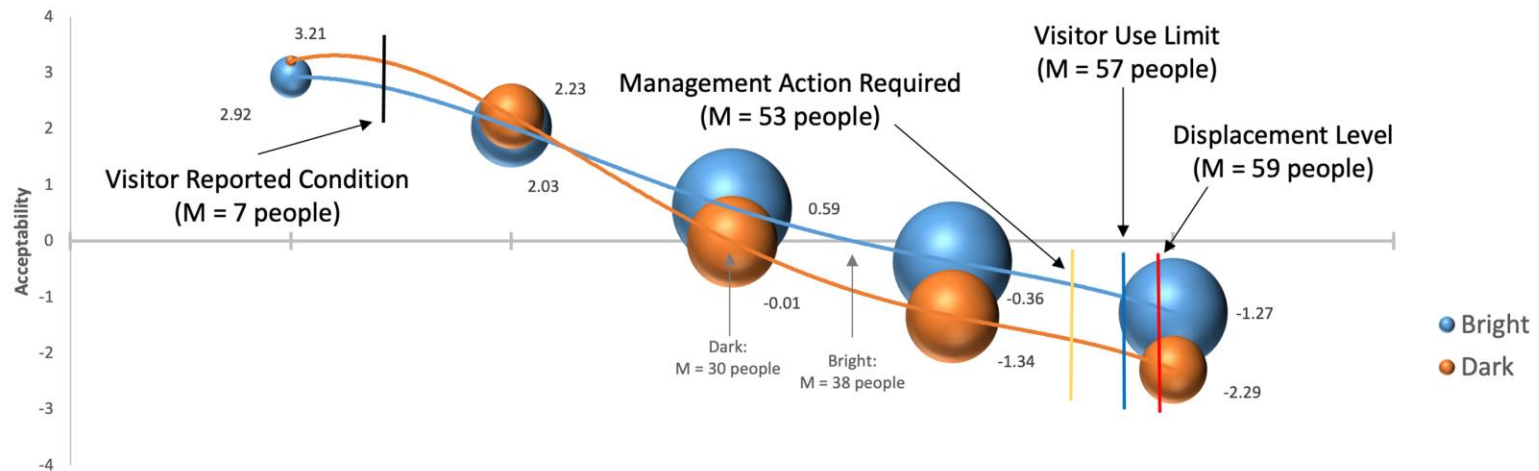


Figure 112. Norm Curve for PAOT at Boicourt Overlook comparing the effect of a bright sky versus a dark sky in digitally altered photos.

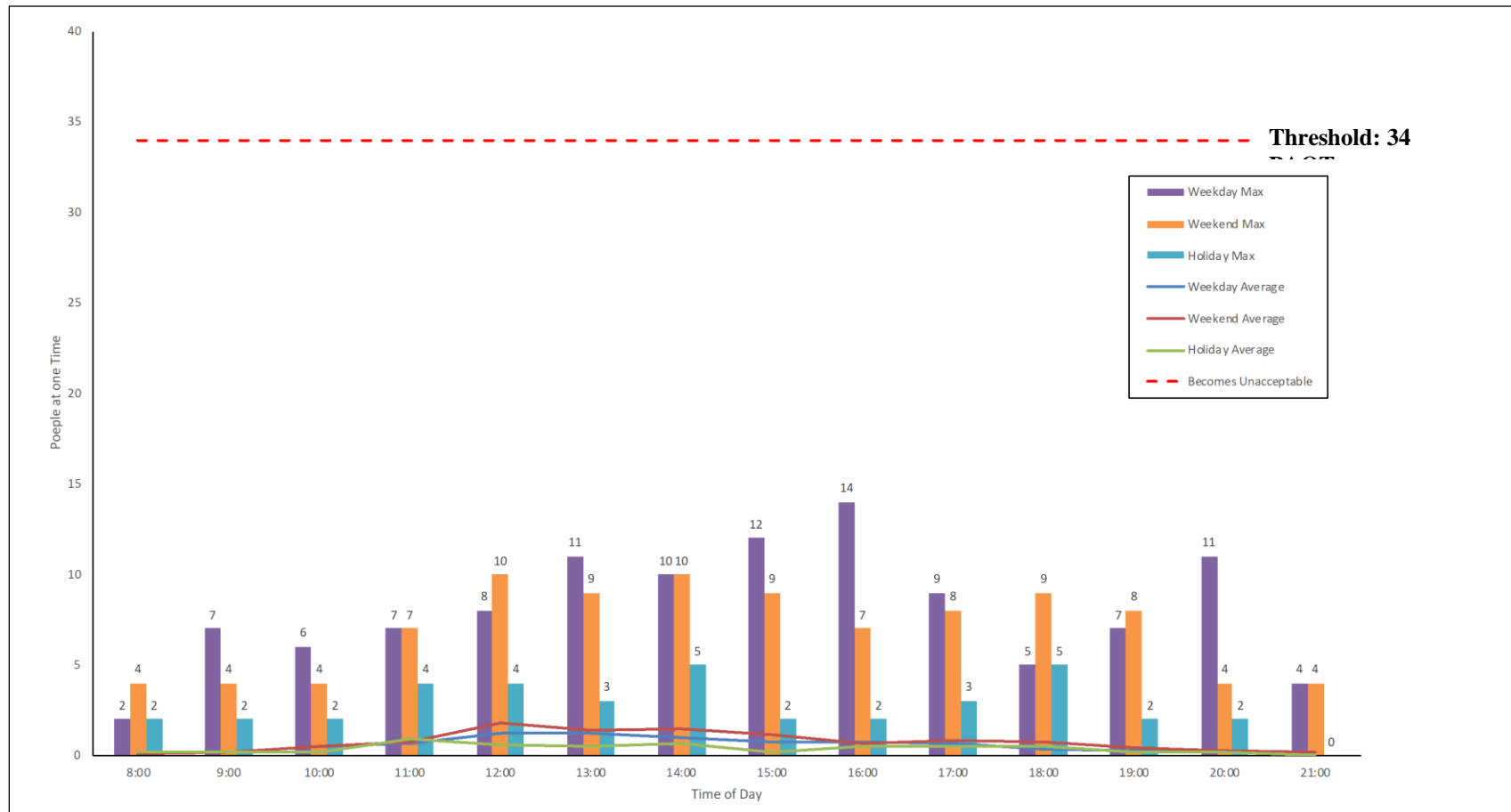
Field Camera at Boicourt Overlook

Figure 113. People at one time at Boicourt determined by field cameras, showing numbers well below the threshold of 34 PAOT

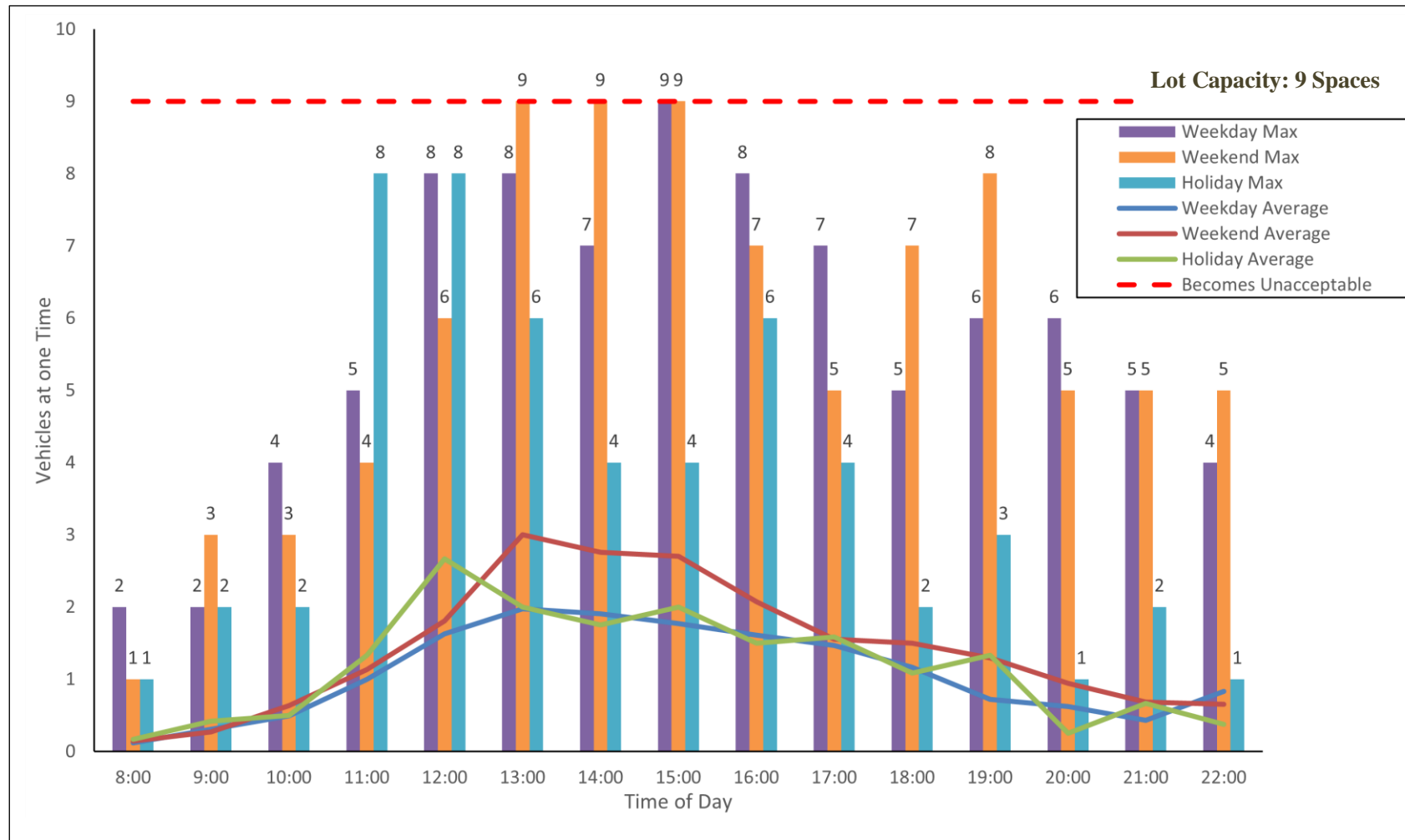
Parking Lot Camera at Boicourt Overlook

Figure 114. PLC data for Boicourt Overlook parking lot showing midday lot at capacity, primarily on the weekends.

Field Camera (FC) Boicourt Overlook

The field camera (FC) at Boicourt Overlook indicated that average weekday (1-2 PAOT), weekend (2-3 PAOT), and holiday (1 PAOT) from 7:00 am to 7:00 pm are within the acceptable range (0 to 34 PAOT). In other words, the average conditions at Boicourt Overlook do not exceed or violate visitors' threshold for the amount of people at one time at Boicourt Overlook (34 PAOT). Between 7:00 am and 7:00 pm, visitors' numbers peak in early afternoon, but are present most of the time at Boicourt Overlook on weekdays, weekends, and holidays. Even the maximum number of Boicourt Overlook visitors recorded by the FC on weekdays (14 PAOT), weekends (10 PAOT), and holidays (5 PAOT) did not come close to exceeding visitors' desired conditions.

Parking Lot Camera (PLC) for Boicourt Overlook

The parking lot camera (PLC) at Boicourt Overlook indicated that average weekday, weekend, and holiday vehicle counts never reached lot capacity from 7:00 am to 7:00 pm. However, weekday and weekend vehicle maximums approach and occasionally threaten to exceed the parking lot's capacity of nine spaces.

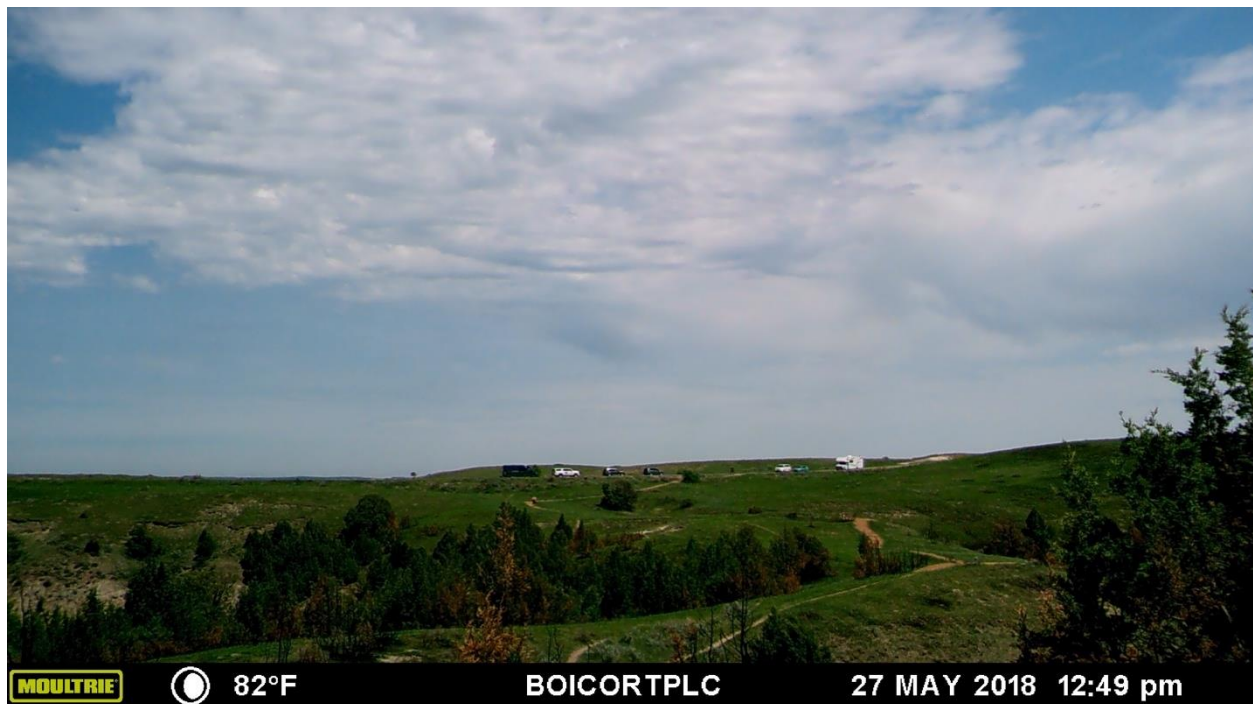


Figure 115. Parking lot camera image from Boicourt Overlook showing 7 vehicles.



Figure 116. Locations of Boicourt Overlook Field Cameras



Figures 117 a & b. Boicourt Overlook FC #1 (Spypoint D12) was mounted in a cedar tree three feet above ground. Equipment coordinates are located in Appendix F.



Figures 118 a & b. Boicourt Overlook FC #2 (Spypoint D12) was mounted in cedar tree five feet above ground facing northeast (towards the parking lot). Equipment coordinates are located in Appendix F.

Wind Canyon Parking Lot Camera

The PLC data for Wind Canyon indicated that average weekday, weekend, and holiday vehicle counts remained at or below half of lot capacity from 7:00 am to 7:00 pm. However, weekday and weekend vehicle maximums occasionally approach and threaten to exceed the parking lot's capacity of 15 spaces.



Figure 119 The Wind Canyon PLC (Spypoint D12) was concealed in the rocks across East River Road.

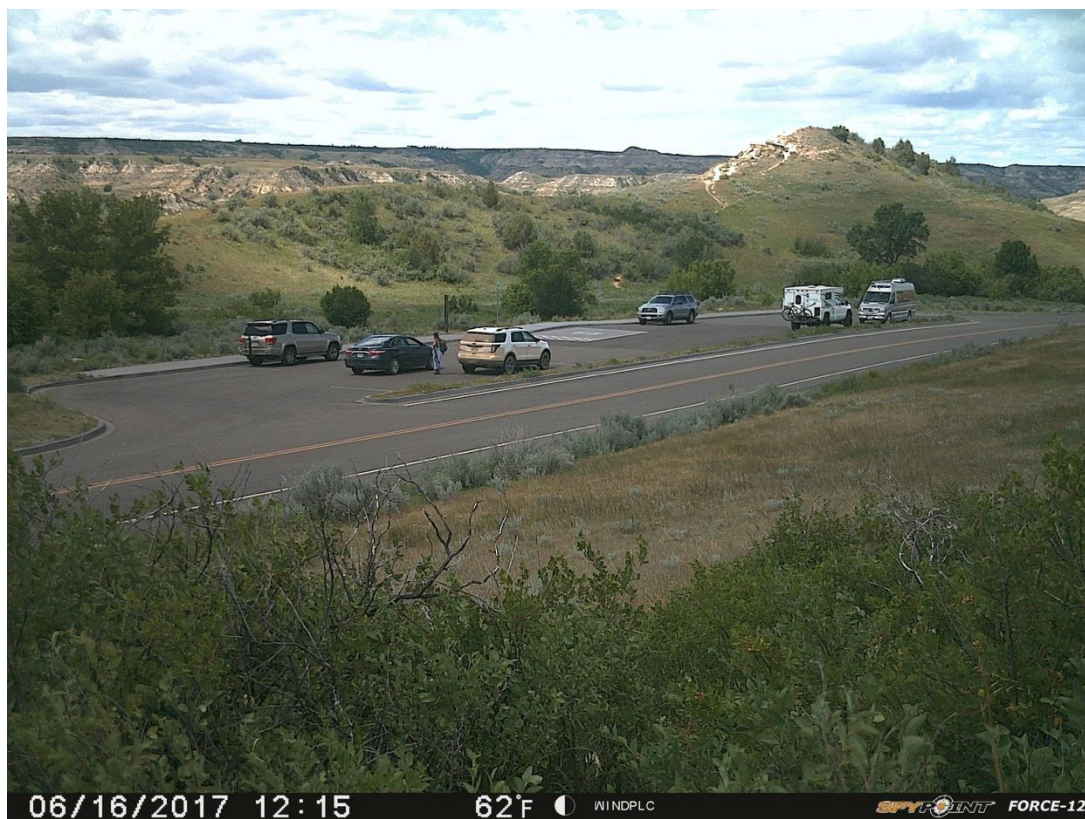


Figure 120. Parking lot camera image from Wind Canyon showing 6 vehicles.

2017 PLC at Wind Canyon Parking Lot

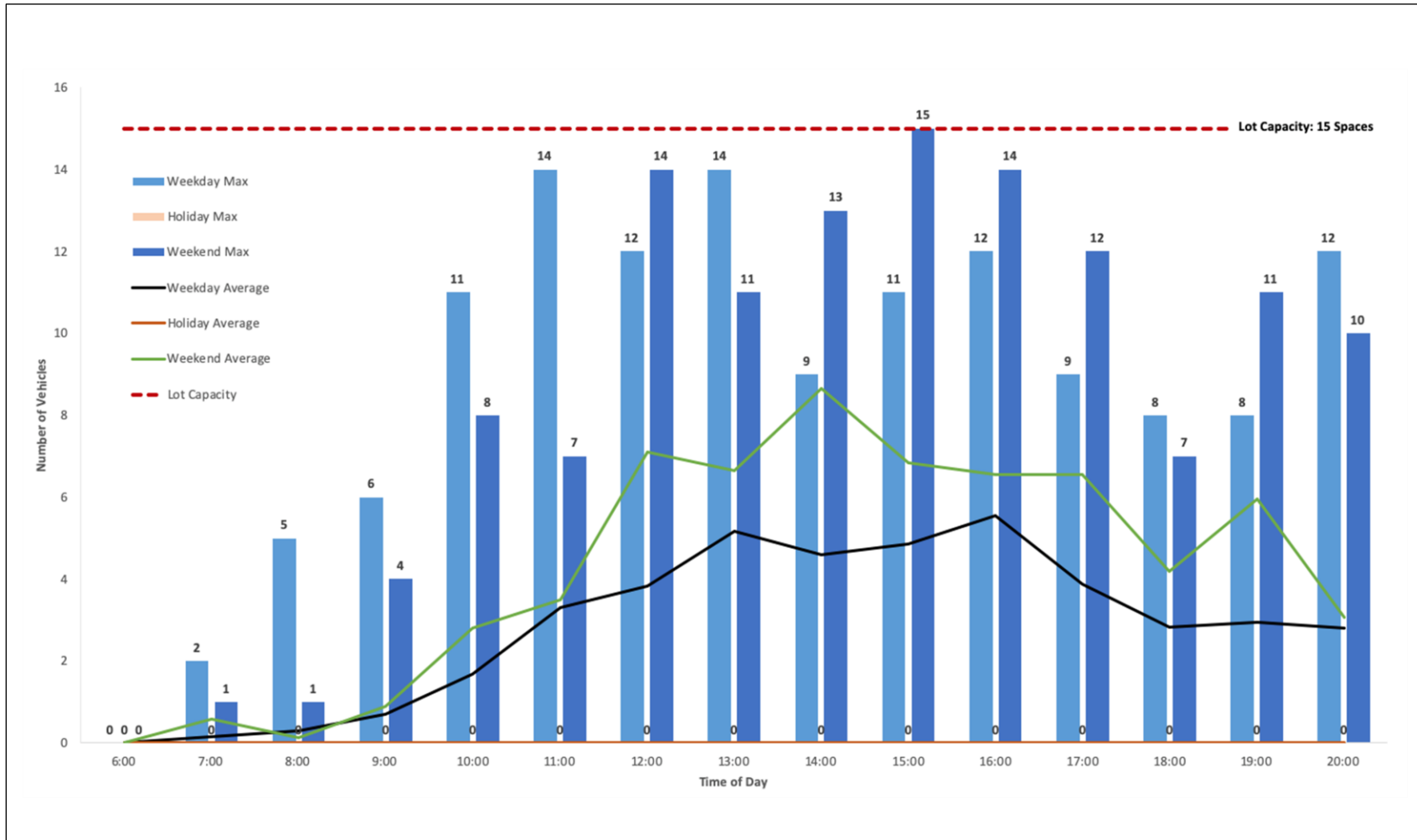


Figure 121. PLC data for Wind Canyon parking lot showing midday lot nearing capacity, primarily during weekend afternoons. Due to technology malfunction and wildlife disturbance no vehicles were recorded on holidays.

Buck Hill Field and Parking Lot Camera

The Buck Hill FC was positioned so that it could also serve as a PLC. The PLC data for Buck Hill indicated that average weekday, weekend, and holiday vehicle counts remained at or below half of lot capacity from 7:00 am to 7:00 pm. However, weekday and weekend vehicle maximums occasionally approach and threaten to exceed the parking lot's capacity of 15 spaces.

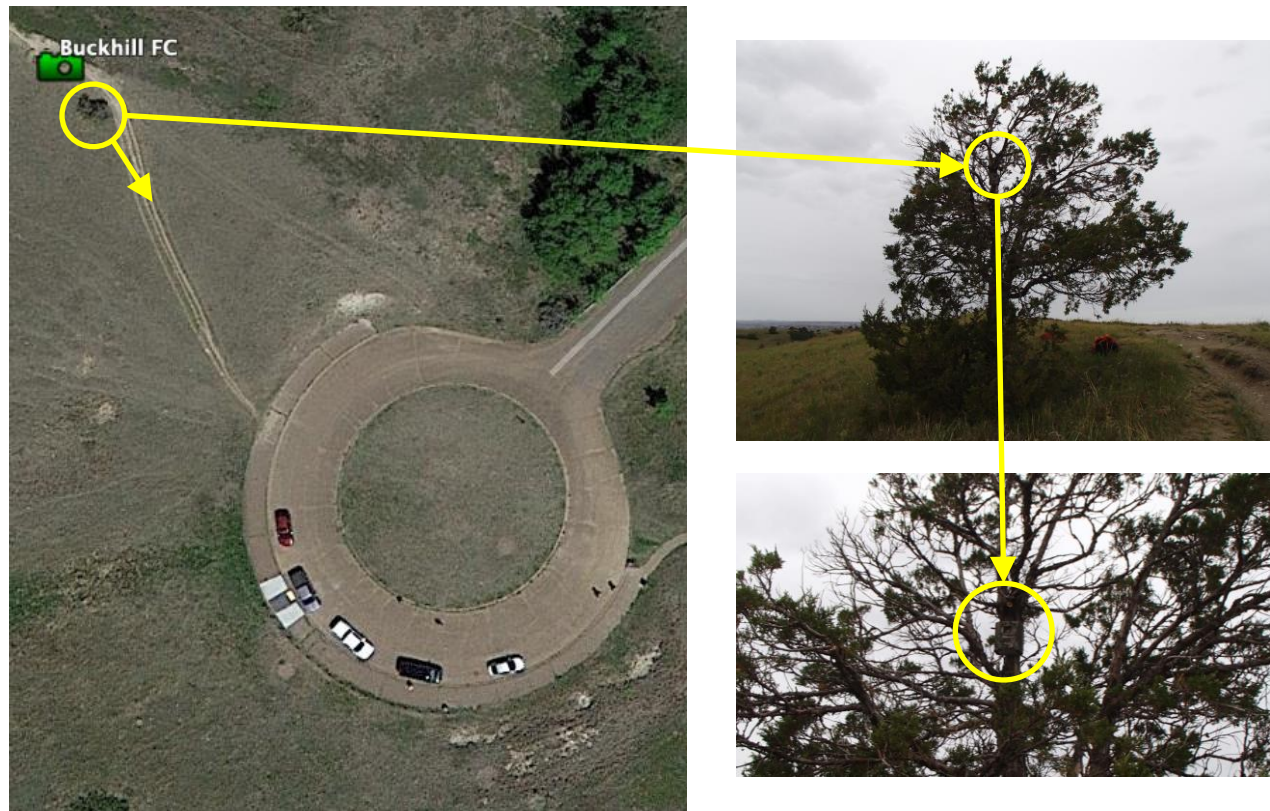


Figure 122. Researchers mounted the Buck Hill FC/PLC (Spypoint D12) in cedar tree seven feet above ground facing southeast towards the Buck Hill overlook. Equipment coordinates are located in Appendix F.

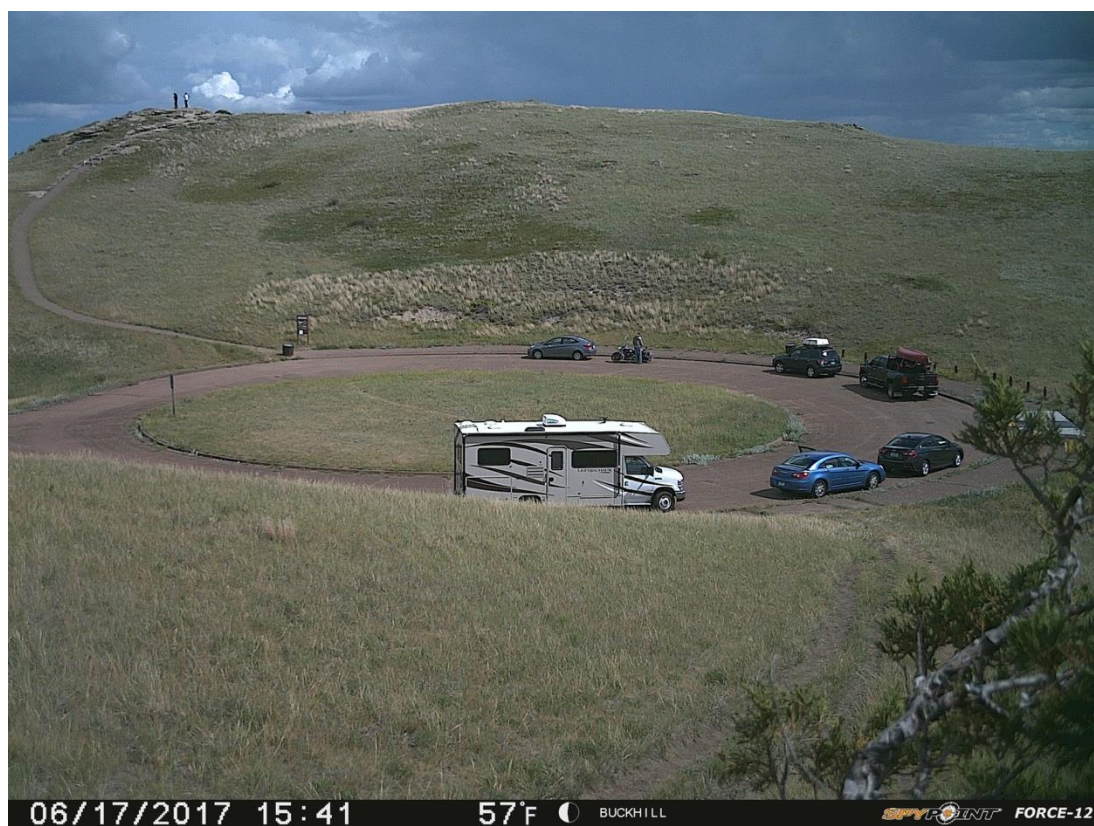


Figure 123. Parking lot camera image from Buck Hill showing 8 vehicles.

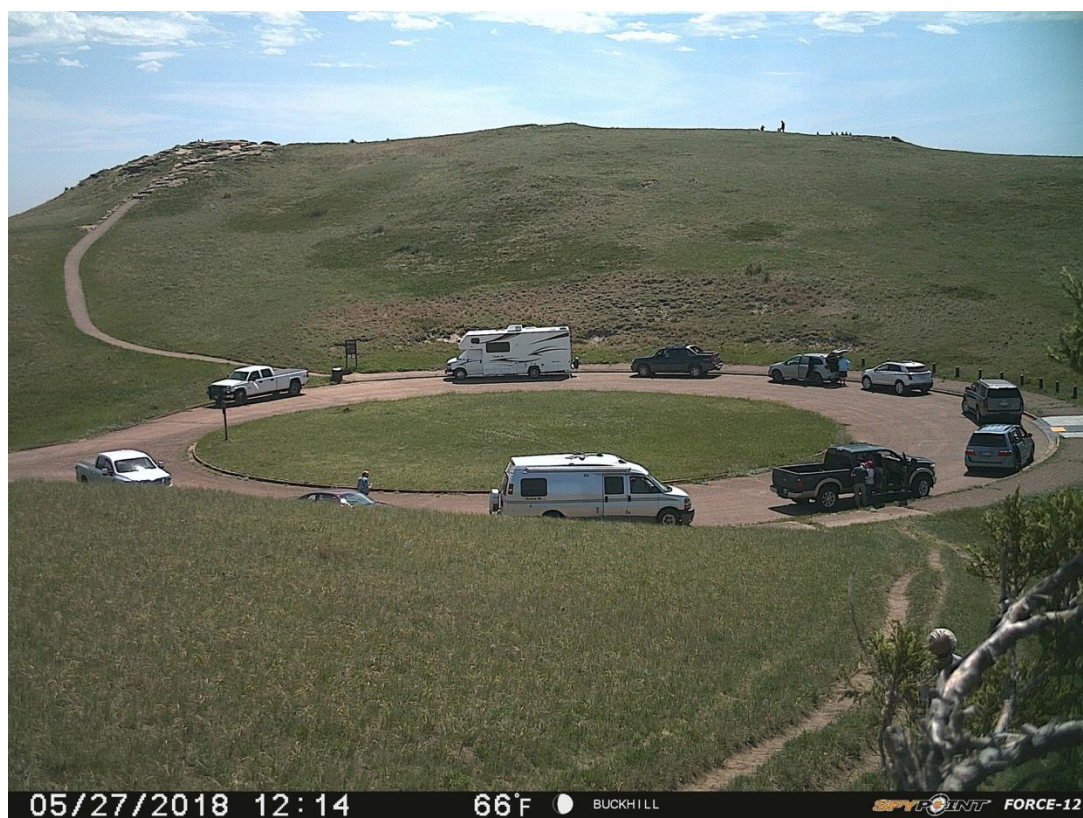


Figure 124. Parking lot camera image from Buck Hill showing 11 vehicles.

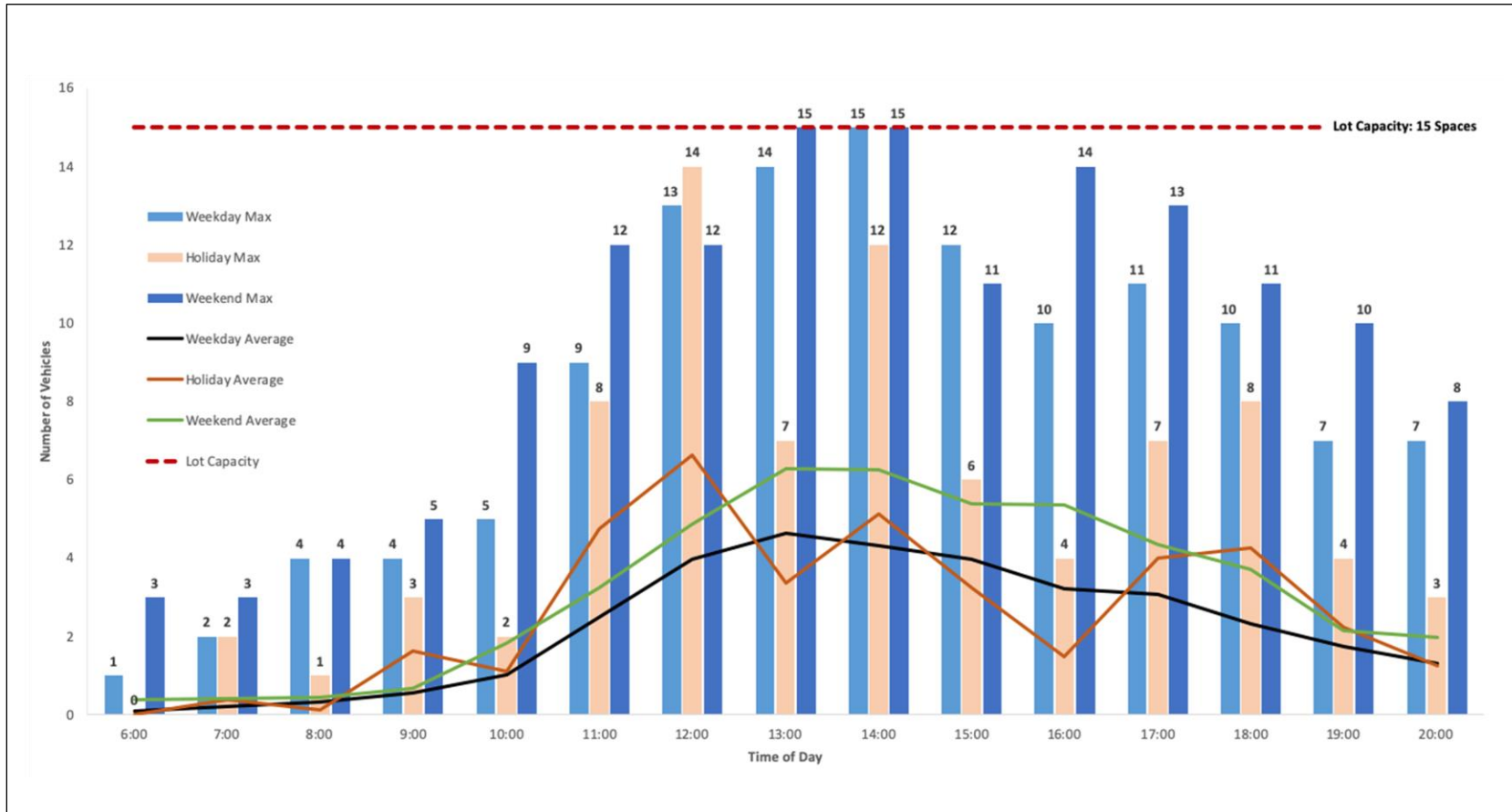
2017 PLC at Buck Hill Parking Lot

Figure 125. PLC data for Buck Hill parking lot showing midday lot reaching capacity, primarily during weekend early afternoons.

Petrified Forest Parking Lot Camera Data

The 2017 PLC data for the Petrified Forest indicated that average weekday, weekend, and holiday vehicle counts remained well below half of lot capacity from 7:00 am to 7:00 pm. However, weekday and weekend vehicle maximums occasionally approach and exceed the parking lot's capacity of 18 spaces. The 2018 PLC data indicated that both the average of maximum number of vehicles remained below lot capacity of 18 spaces.



Figure 126. The Petrified Forest PLC (Spypoint D12) was mounted to a fence post east-southeast of the parking lot, and the trail counter mounted to a post east of the parking lot.



Figure 127. Parking lot camera image from Petrified Forest showing 13 vehicles (including trailers).

Petrified Forest Trail Counter Data

One trail counter (TC) was placed at on the at Petrified Forest. Average trail use collected from June 6, 2016 through September 9, 2017 shows an average of 4-5 daily users, with a monthly average of 136 trail users from June through September.

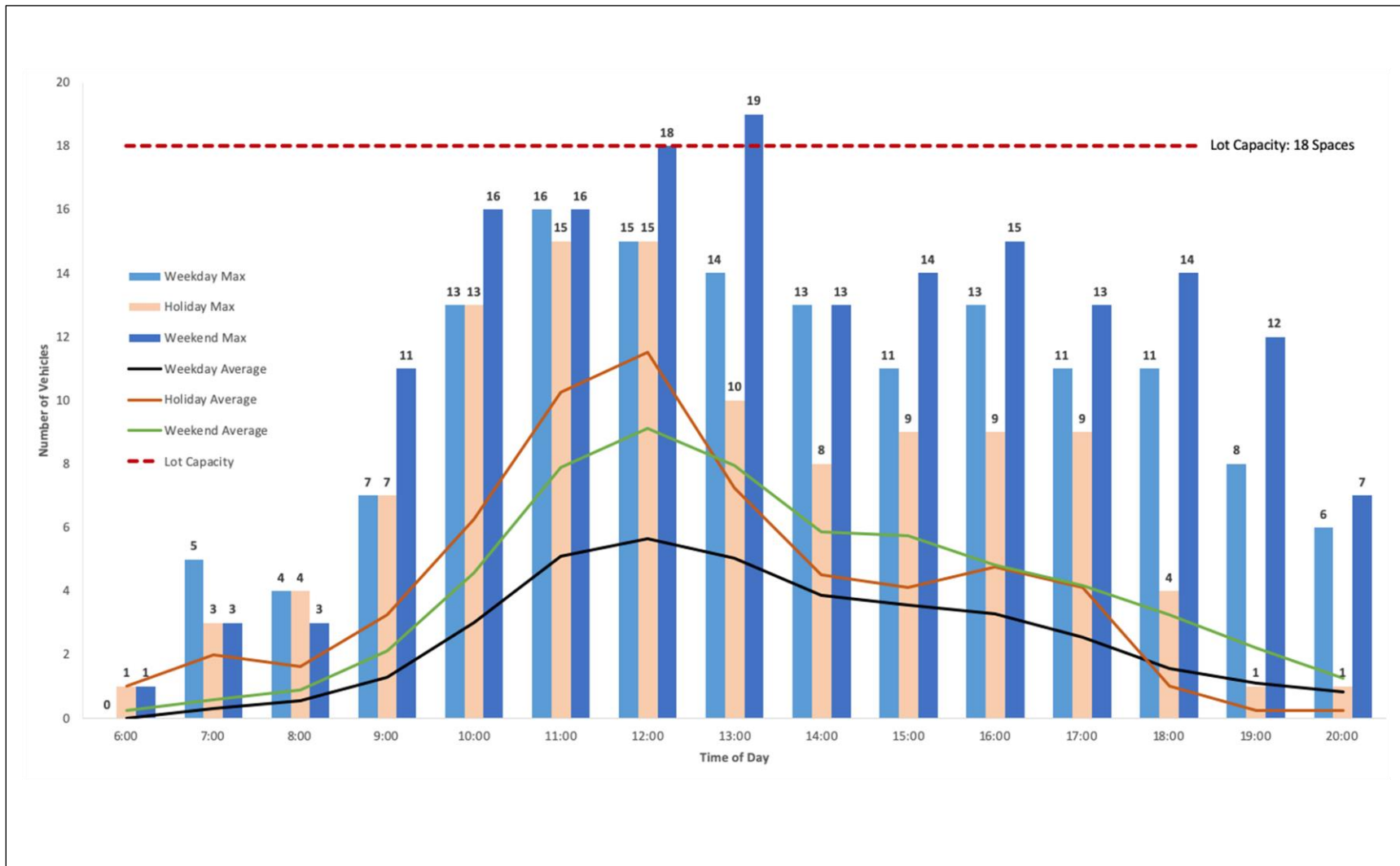
2017 PLC at Petrified Forest Parking Lot

Figure 128. 2017 PLC data for the Petrified Forest parking lot showing midday lot reaching and exceeding capacity, primarily during weekend early afternoons.

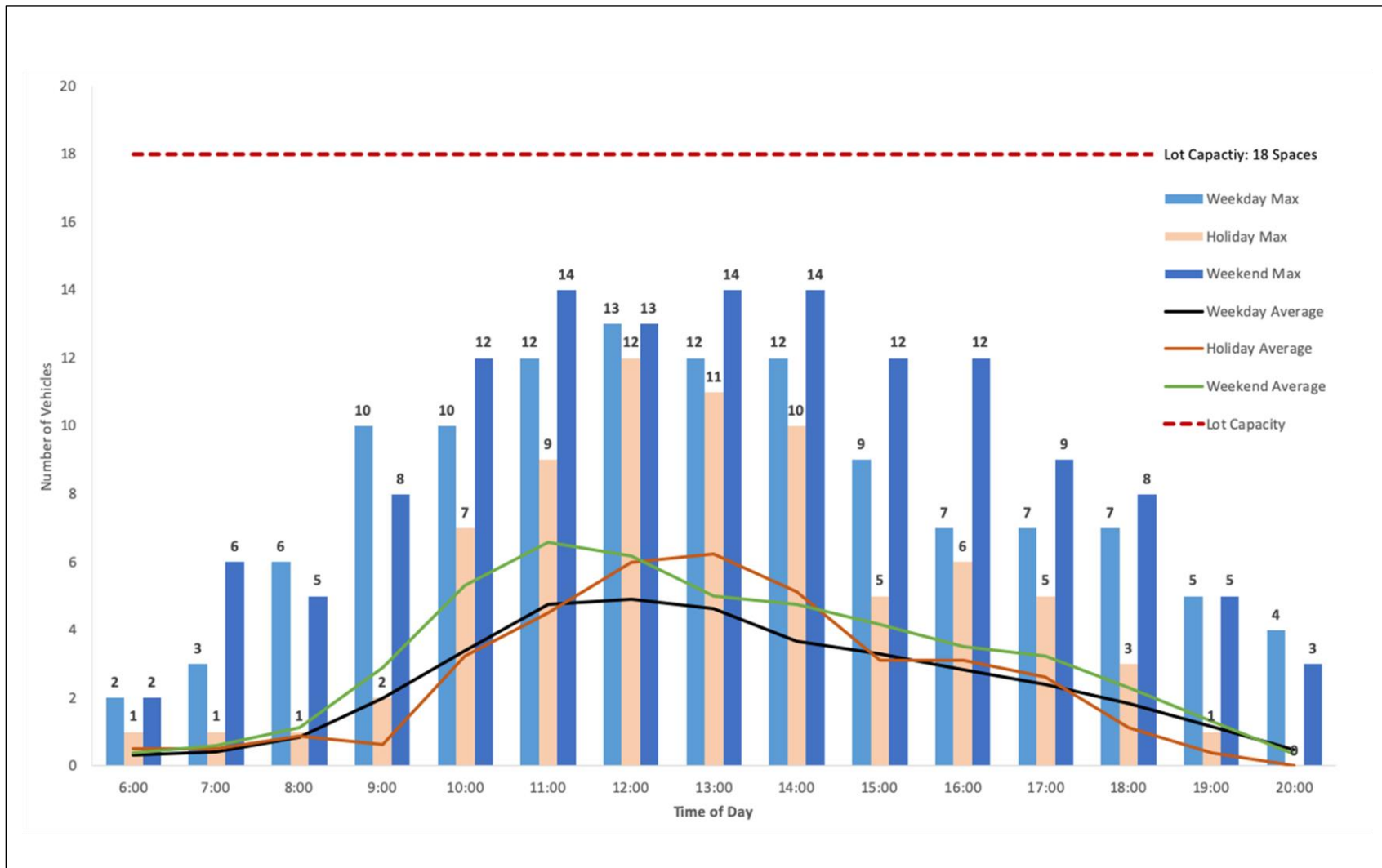
2018 PLC at Petrified Forest Parking Lot

Figure 129. 2018 PLC data for the Petrified Forest parking showing number of vehicles remaining below lot capacity of 18 spaces.

Daily Petrified Forest Trail Counter Data

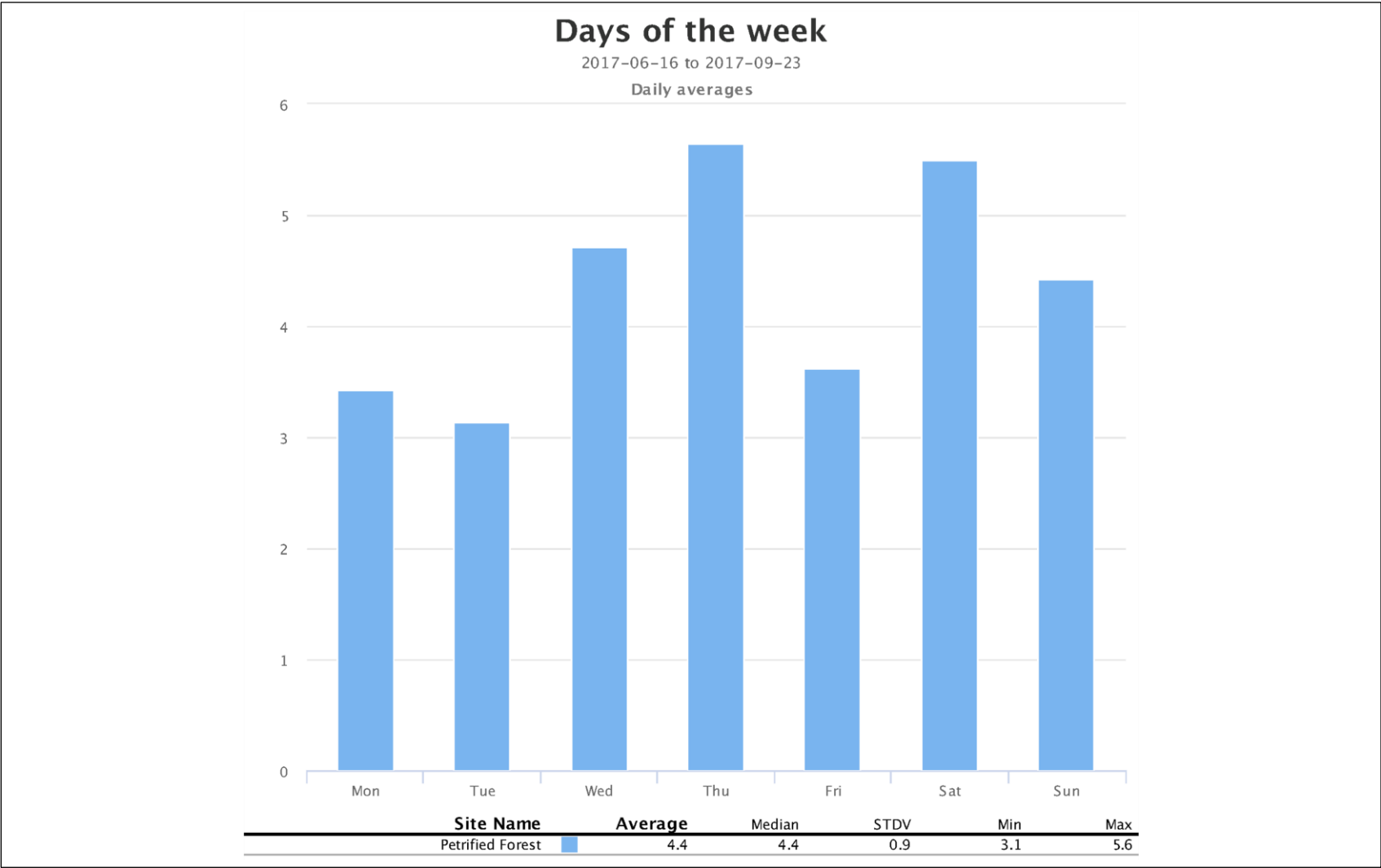


Figure 130. Daily trail counter data for Petrified Forest showing an average of 4.4 users per day.

Monthly Petrified Forest Trail Counter Data

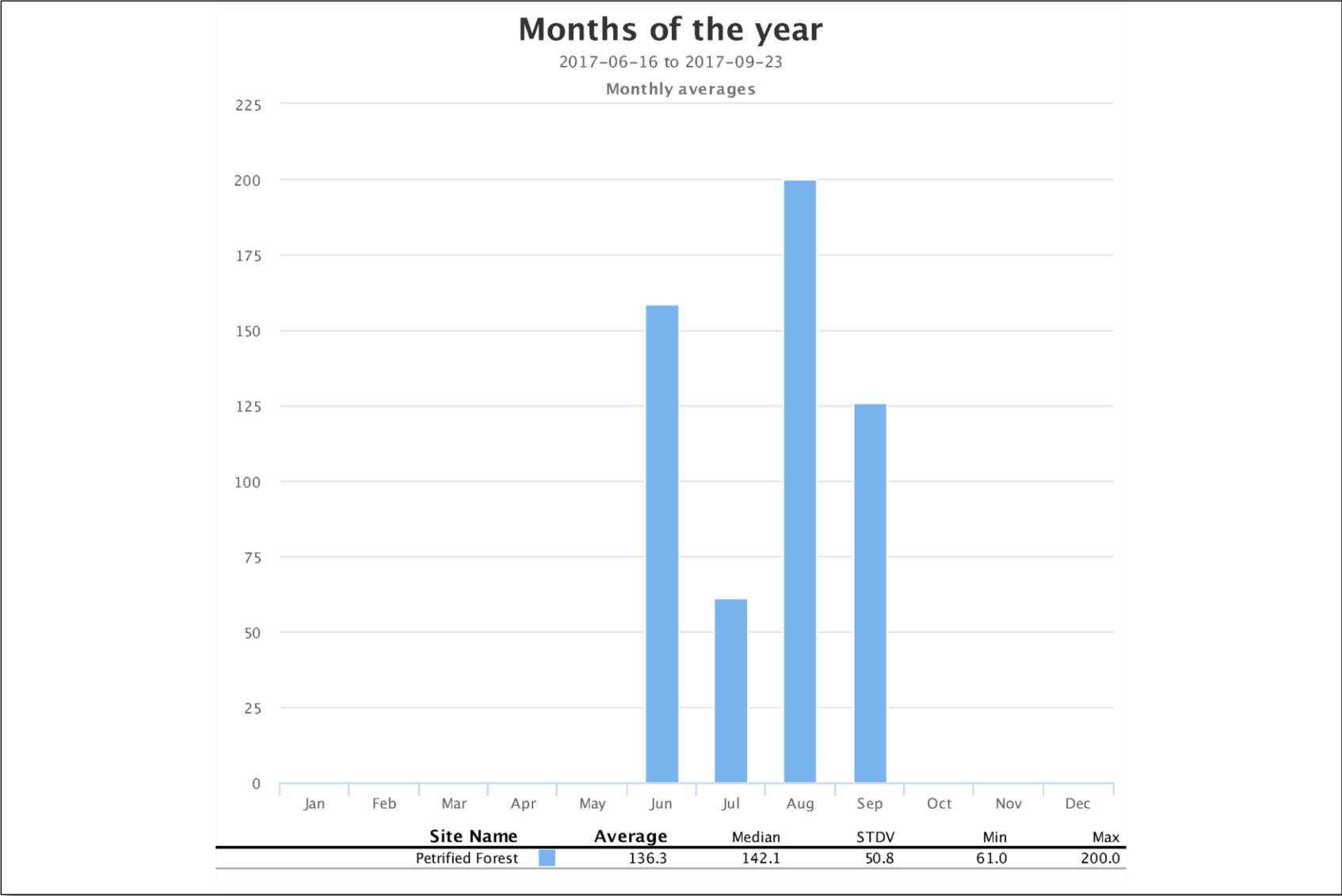


Figure 131. Monthly trail counter data for Petrified Forest showing an average of 136 users per month.

Painted Canyon Trail Counters

Two trail counters (TCs) were placed at Painted Canyon. Average trail use collected by TC #1 from June 6, 2016 through September 9, 2017 shows an average of 146 daily users, with a monthly average of 4,290 trail users from June through September. Average trail use recorded by TC #2 during the same period shows an average of 27 daily users, with a monthly average of 846 trail users from June through September.



Figure 132. Painted Canyon Trail Counter #1 was located on wooden post adjacent to trail. Equipment coordinates are located in Appendix F.



Figure 133. The Painted Canyon Plateau Trail Counter was located on a cement post. Equipment coordinates are located in Appendix F.

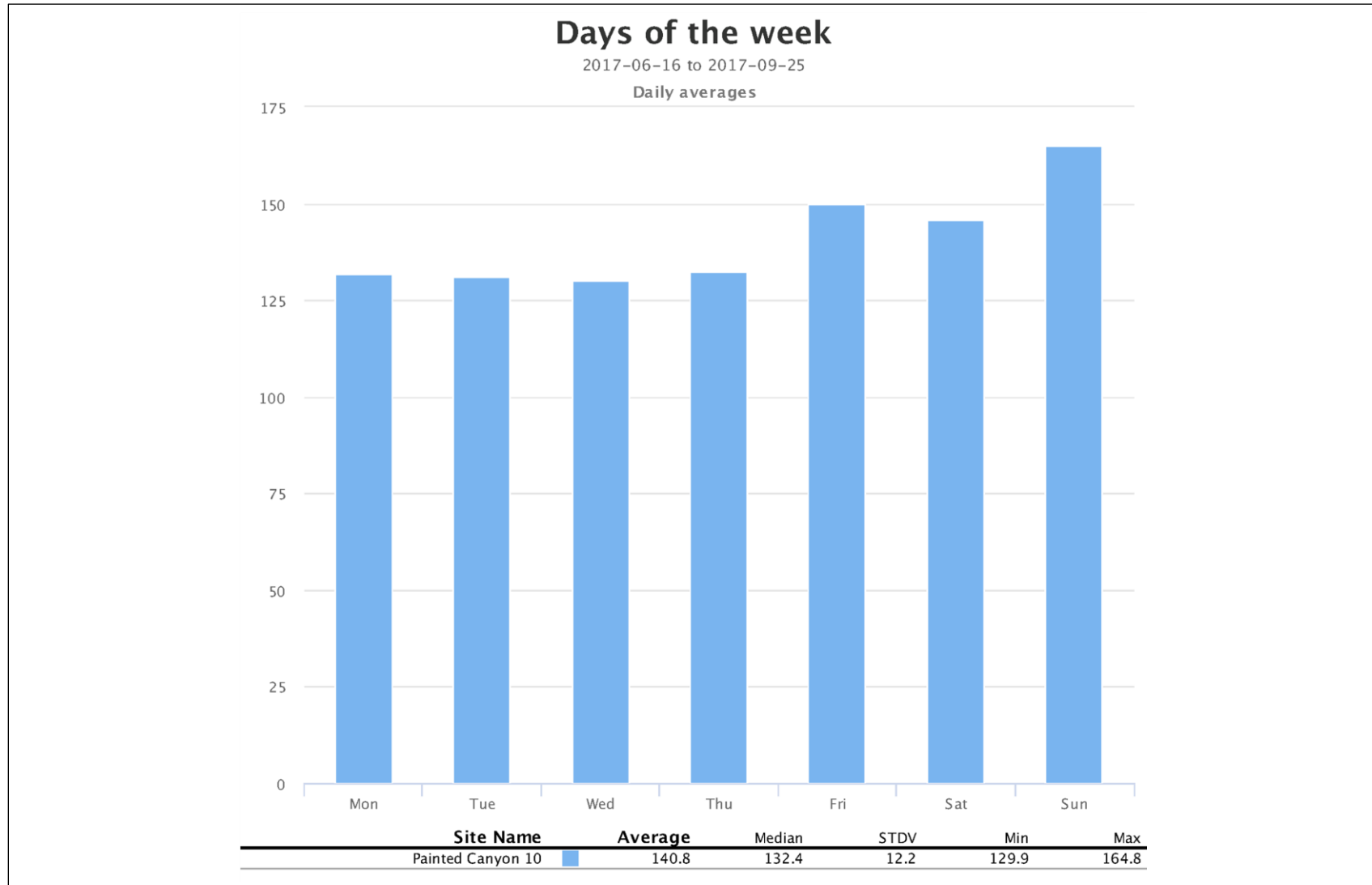
Daily Painted Canyon Trail Counter Data for TC#1

Figure 134. Trail Counter Data for Painted Canyon TC #1 showing an average of 146 users per day.

Monthly Painted Canyon Trail Counter Data for TC#1

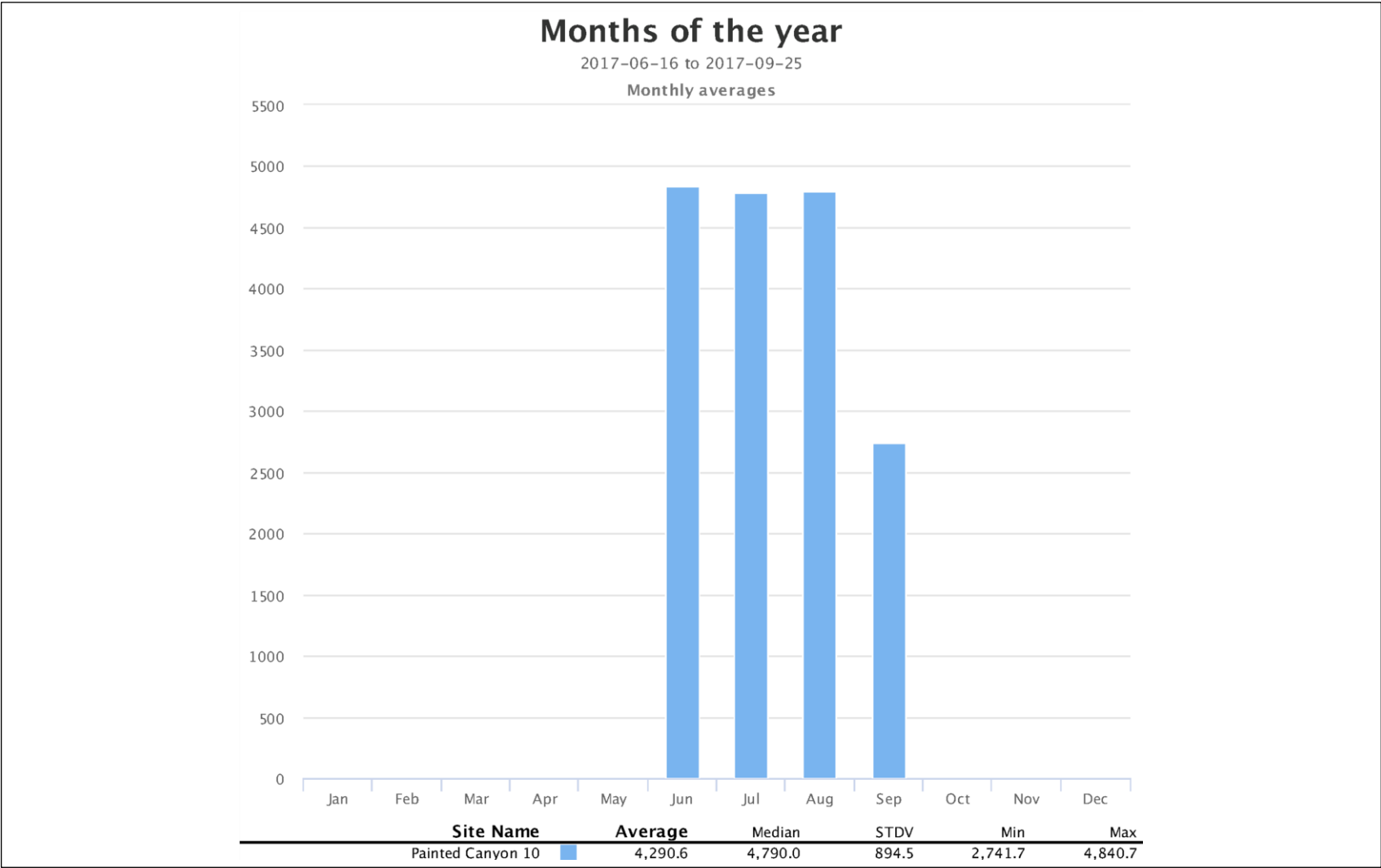


Figure 135. Trail Counter Data for Painted Canyon TC #1 showing an average of 4,290 users per month.

Daily Painted Canyon Trail Counter Data for TC#2

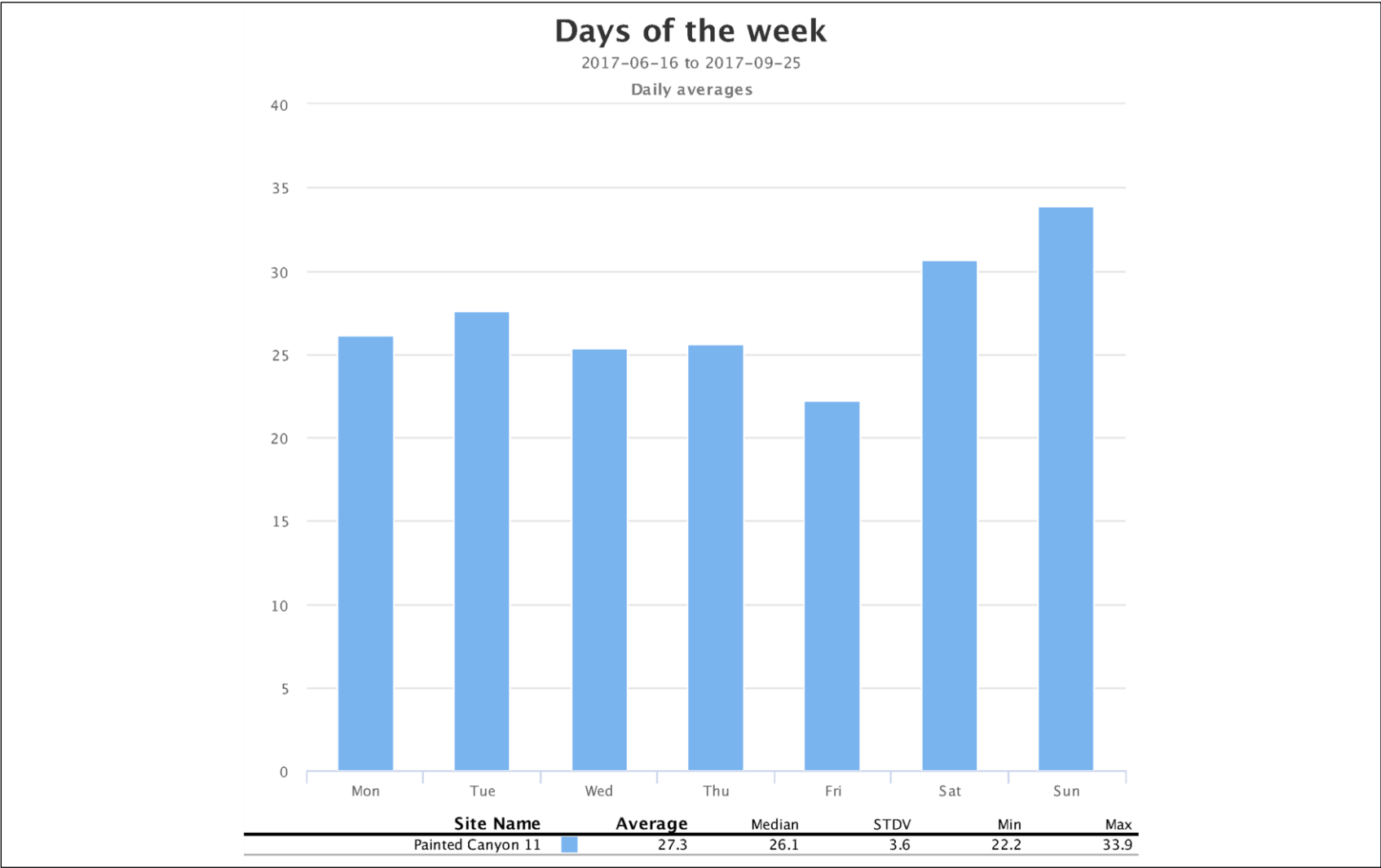


Figure 136. Trail Counter Data for Painted Canyon TC #2 showing an average of 27 users per day.

Monthly Painted Canyon Trail Counter Data for TC#2

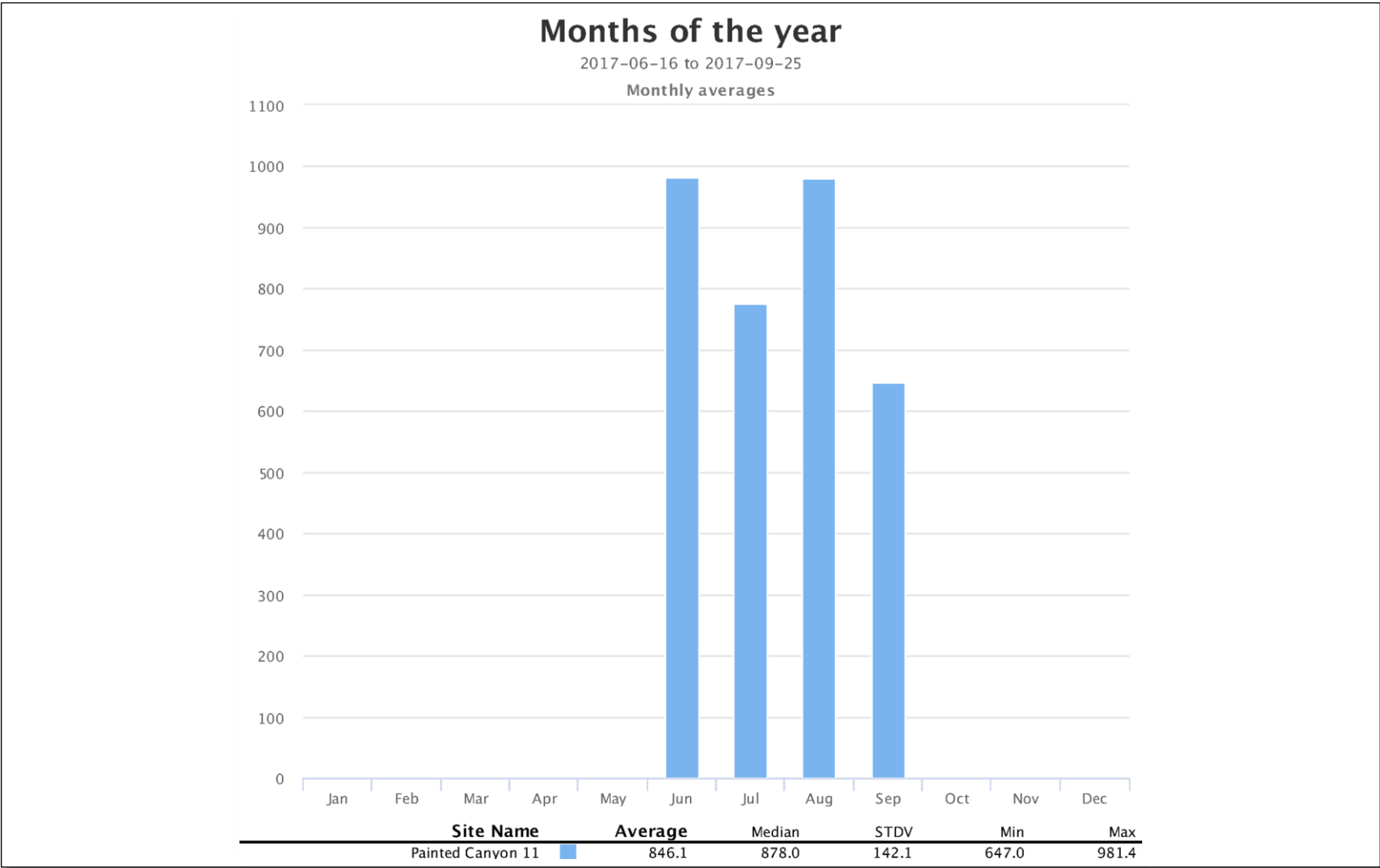


Figure 137. Trail Counter Data for Painted Canyon TC #2 showing an average of 846 users per month.

*Spatial and Temporal Distributions for Day Use Visitors in the South Unit**Time and distance in the South Unit*

On average, visitors stay at the park for approximately 2 hours and 45 minutes and drive 35 miles during their stay. Approximately 42% of visitors stop at the South Unit Visitor Center and stay approximately 24 minutes, on average.

Approximately 50% of visitors venture away from the road and hike approximately 1 mile during their visit, on average. This distance away from the road constitutes approximately 12% of their total visit time. Results reveal that 39% of visitors use the Skyline Vista Trail, 30% use the Wind Canyon Trail, and 23% use the Old East Entrance Trail, which represents the three most used trails in the South Unit by day visitors. However, the amount of time spent at each of these locations is relatively limited, ranging from 8 minutes to 21 minutes, on average.

Approximately 68% of visitors visit at least one official park overlook during their visit. On average, visitors spend approximately 18% of their total visit time at official park overlooks. Results reveal that 56% of visitors stop at Johnson's Plateau, 46% stop at Badlands Overlook, and 32% use Buck Hill Overlook, which represents the three most used official park overlooks in the South Unit by day visitors. The amount of time spent at each of these locations ranges from 5 minutes to 22 minutes, on average.

Spatial distribution in the South Unit

The point density results indicate that visitors spend most of their time driving on the park road and stopping at official park overlooks. Relatively limited number of day visitors frequent the trails in the Theodore Roosevelt Designated Wilderness in the South Unit. When trails are used, they are directly related to overlook use or are contained within the interior section of the park road (e.g., Lower Paddock Creek Trail, Jones Creek Trail). Furthermore, this spatial characterization of visitor use remains relatively consistent across the hours of the day. However, it appears that use is generally more evenly distributed and higher during the morning and mid-day hours compared to use after 5:00 pm.

Table 54. *South Unit overlook and trail use in 2017 by day visitors displayed by percent time of total visit and distance hiked.*

Travel attribute	Minutes, miles, or percent	
	<i>M (SD)</i>	Min-max
Total minutes of visit	2:42 (1:17)	12-507
Total miles driving during visit	35 (7.61)	0.10-62
Total miles hiked during visit	1.2 (1.52)	0.02-11
Percent time of total visit at overlooks	18% (4.6%)	0-30%
Percent time of total visit not on road	12% (15%)	0-78
Percent of visitors venturing away from the road	49%	-

Note. *M* = mean; *SD* = standard deviation; 2017 data was used to approximate typical travel patterns without road construction.

Table 55. *South Unit overlook and attraction area use in 2017 by day visitors displayed by average minutes spent in each location and percent of visitors who visited each location.*

Overlooks and attractions	Minutes	
	<i>M (SD)</i>	Min-max
South Unit Visitor Center	0:24 (0:18)	2-87
Percent of visitors	41.2%	
Johnson's Plateau	0:05 (0:04)	1-35
Percent of visitors	55.8%	
River Woodland Overlook	0:03 (0:02)	1-10
Percent of visitors	7.5%	
Picnic Area – Cottonwood	0:30 (0:29)	4-130
Percent of visitors	12.7%	
Round-up Horse Camp	0:16 (0:04)	12-20
Percent of visitors	1.1%	
Boicourt Overlook	0:06 (0:07)	1-46
Percent of visitors	24.3%	
Buck Hill Overlook	0:22 (0:15)	2-82
Percent of visitors	32.6%	
Badlands Overlook	0:05 (0:06)	1-65
Percent of visitors	46.1%	
Scoria Point Overlook	0:05 (0:04)	1-35
Percent of visitors	17.09%	

Note. *M* = mean; *SD* = standard deviation; 2017 data was used to approximate typical travel patterns without road construction.

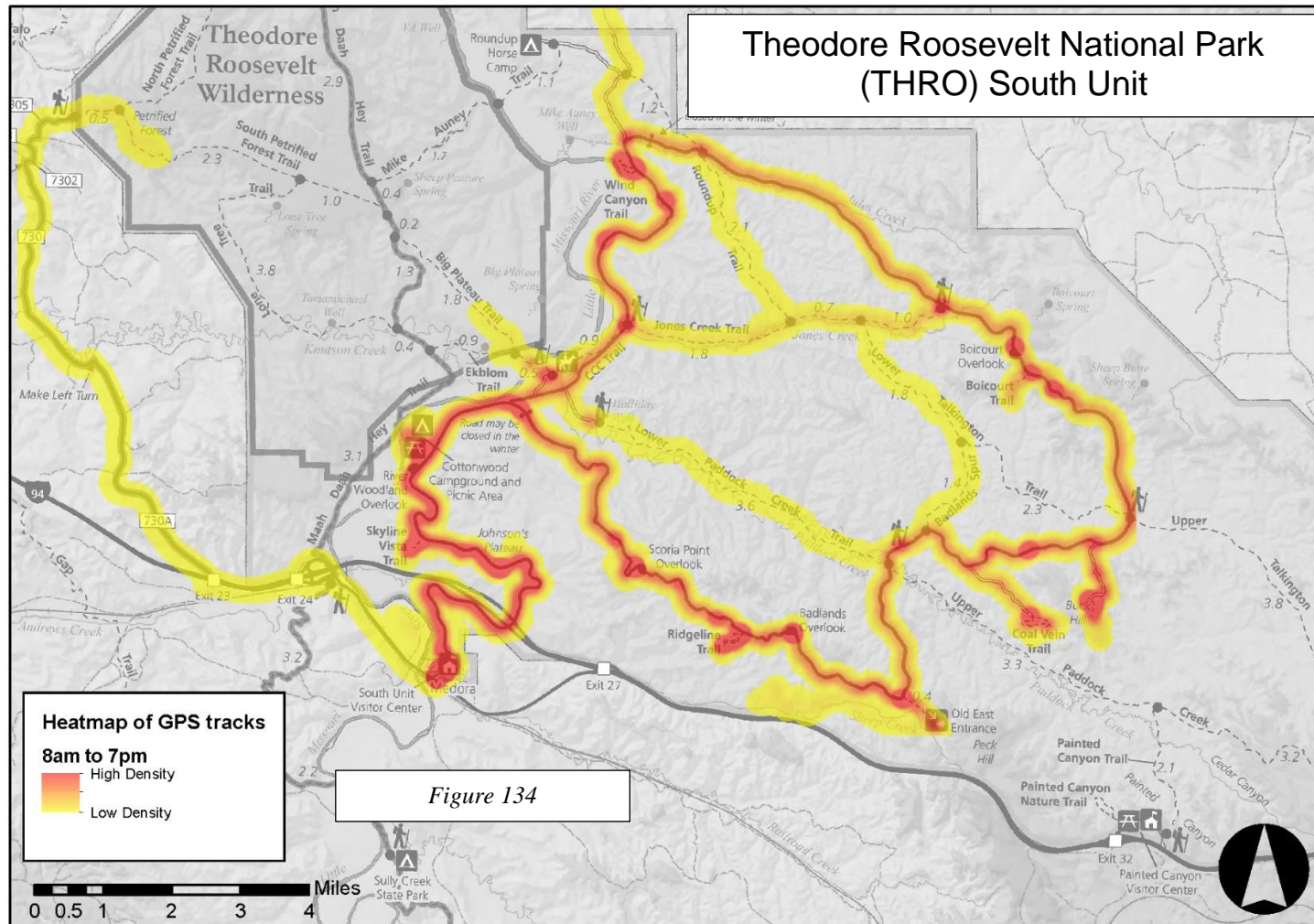
Table 56. *South Unit trail use in 2017 by day visitors displayed by average minutes spent in each location and percent of visitors who visited each location.*

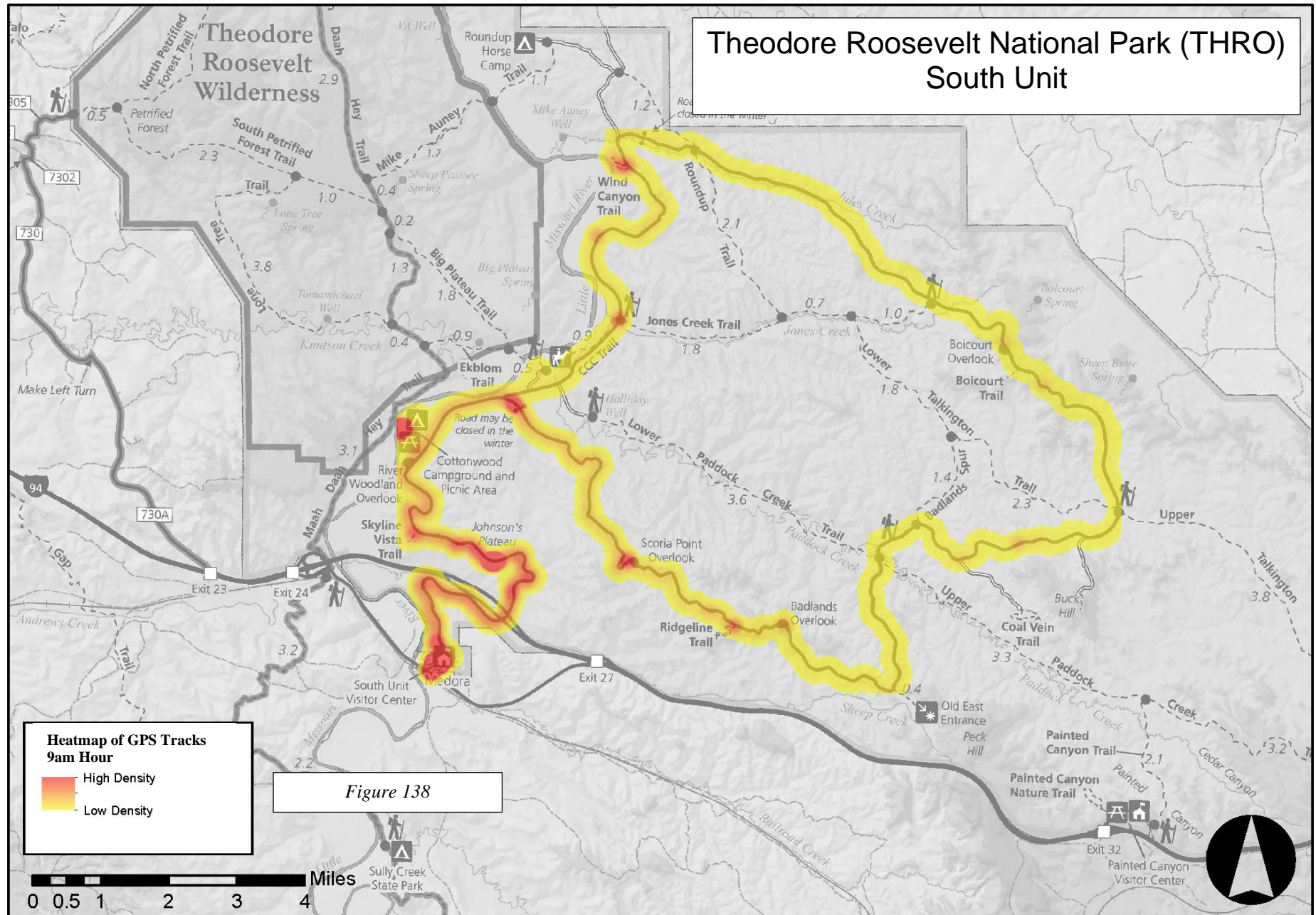
Trails	Minutes	
	<i>M (SD)</i>	Min-max
Skyline Vista Trail	0:08 (0:08)	1-34
Percent of visitors	38.6%	
Maah Daah Hey Trail	0:00 (0:00)	-
Percent of visitors	0.0%	
Eklblom Trail	0:18 (0:12)	3-29
Percent of visitors	12.7%	
CCC Trail	1:18 (1:26)	3-173
Percent of visitors	1.1%	
Big Plateau Trail	1:12 (1:12)	66-79
Percent of visitors	0.7%	
Lone Tree Trail	0:00 (0:00)	-
Percent of visitors	0.0%	
South Petrified Forest Trail	1:07 (0:06) ^a	67-67
Percent of visitors	0.4%	
North Petrified Forest Trail	0:00 (0:00) ^a	-
Percent of visitors	0.0%	
Mike Aune Trail	0:00 (0:00) ^a	-
Percent of visitors	0.0%	
Wind Canyon Trail	0:21 (0:23)	1-183
Percent of visitors	29.6%	
Lower Paddock Trail	0:28 (0:38)	3-103
Percent of visitors	2.2%	
Upper Paddock Trail	0:00 (0:00)	-
Percent of visitors	0.0%	
Boicourt Trail	0:15 (0:14)	1-48
Percent of visitors	11.6%	
Badlands Spur Trail	0:18 (0:18)	1-48
Percent of visitors	1.1%	
Coal Vein Trail	0:21 (0:18)	1-35
Percent of visitors	15.4%	
Old East Entrance Trail	0:13 (0:27)	1-183
Percent of visitors	22.8%	
Ridgeline Trail	0:24 (0:17)	1-75
Percent of visitors	18.0%	
Jones Creek Trail	0:26 (0:43)	1-188
Percent of visitors	15.4%	
Roundup Trail	0:33 (0:54)	1-113
Percent of visitors	1.5%	
Lower Talkington Trail	0:15 (0:21)	5-46
Percent of visitors	1.5%	
Upper Talkington Trail	0:05 (0:01)	5
Percent of visitors	1.3%	

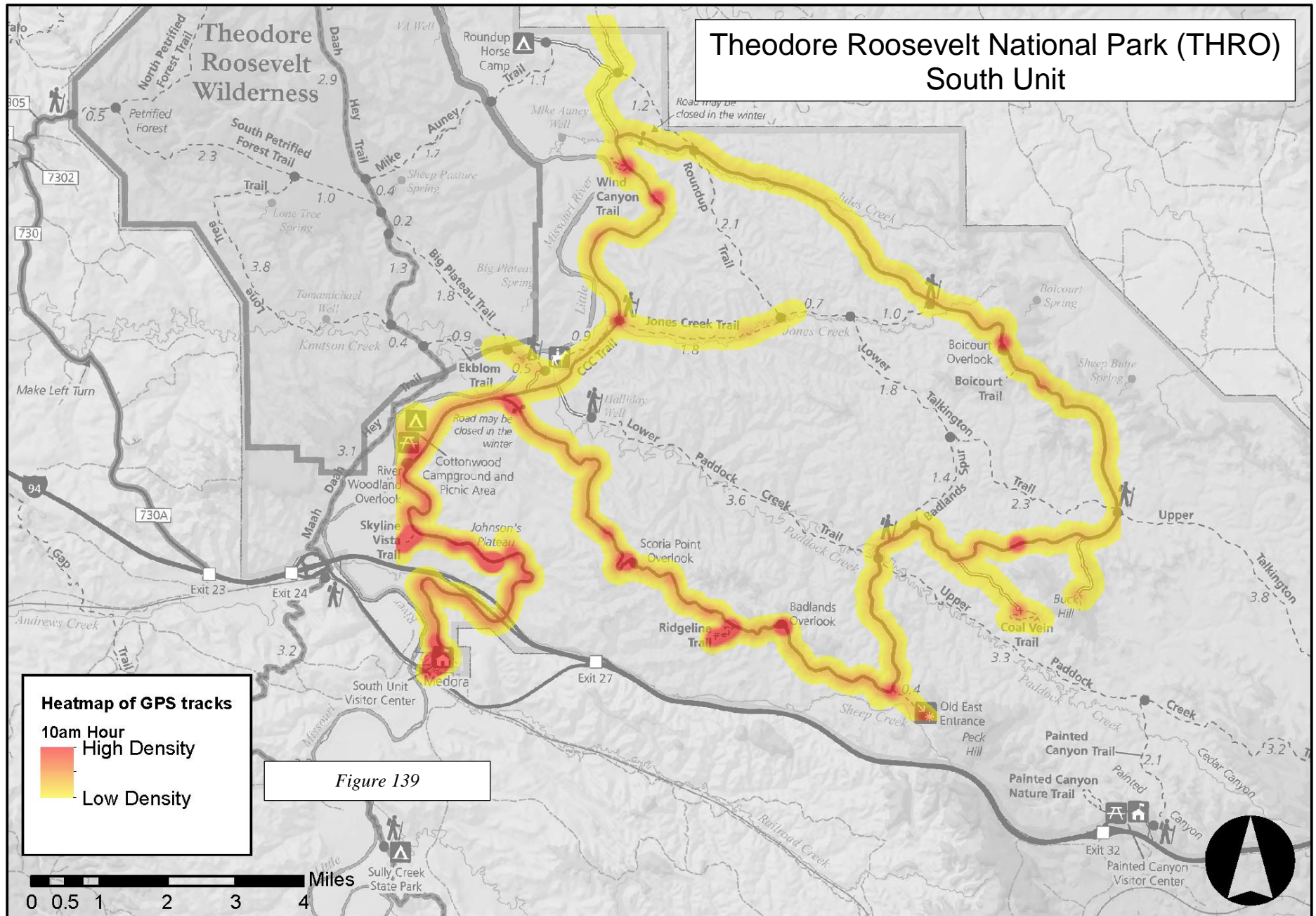
Note. ^a limited sample likely attributed to intercept location at South Entrance by South Unit Visitor Center – see trail counter information for use levels; *M* = mean; *SD* = standard deviation; 2017 data was used to approximate typical travel patterns without road construction.

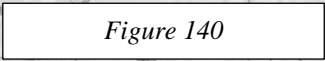
South Unit density maps

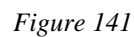
The following section contains a series of density maps representing areas of higher visitor use (high density) and lower visitor use (low density). The first map displays the overall density of visitor use, across the day from 8:00 am to 7:00 pm. The subsequent maps display locations of higher and lower density at each hour of the day (e.g., 9:00 am, 10:00 am).

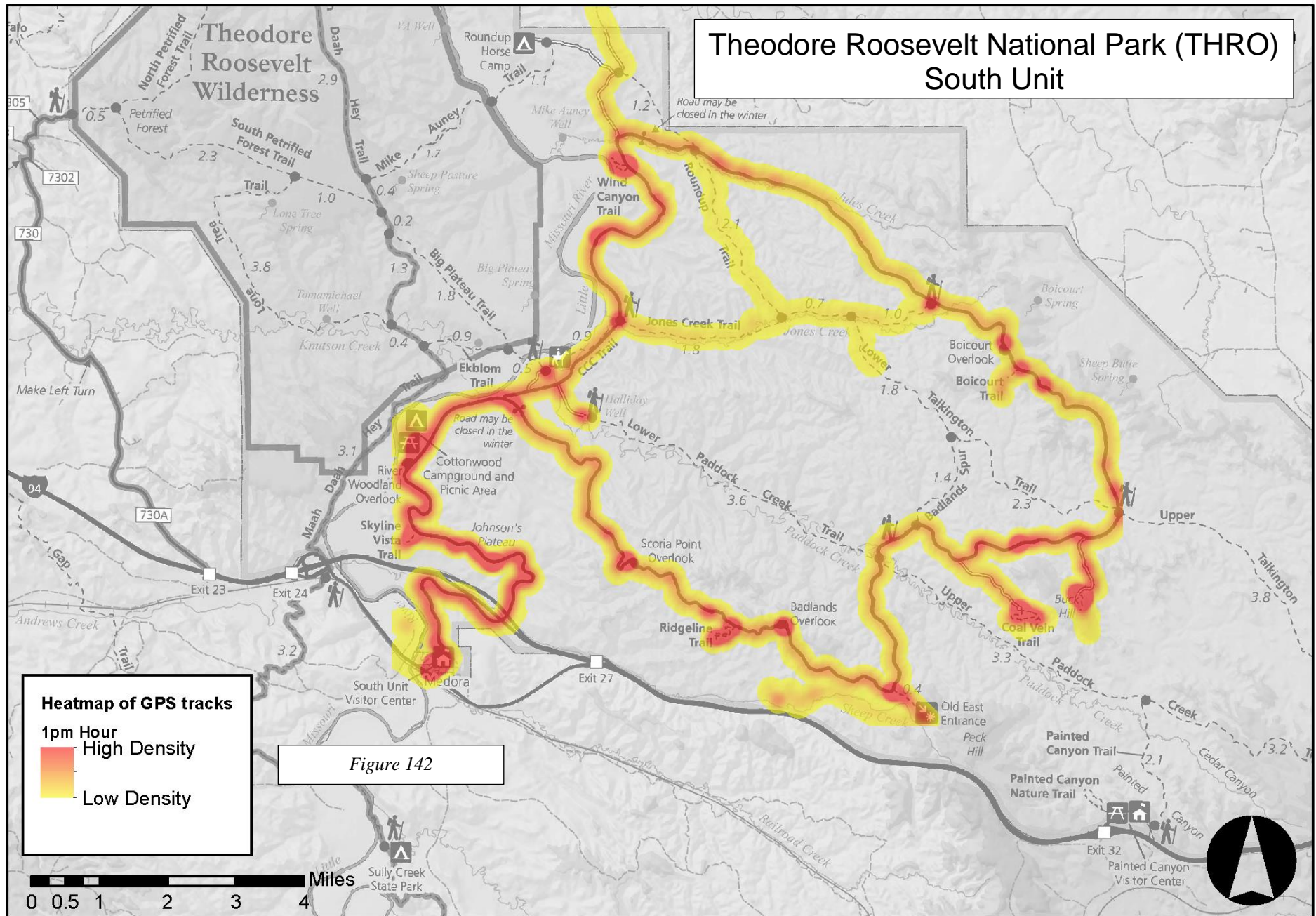


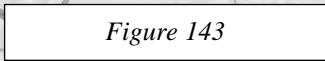


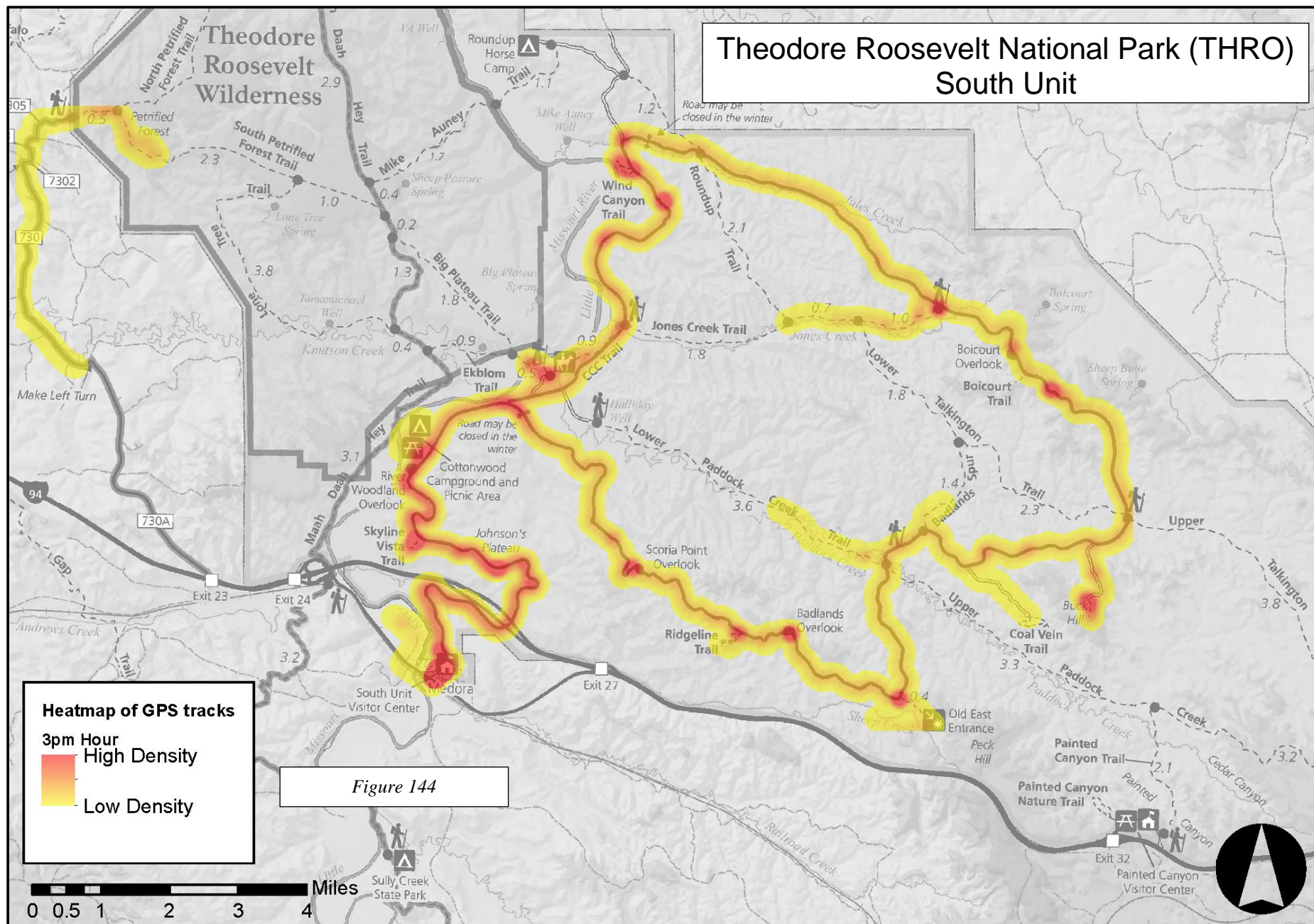


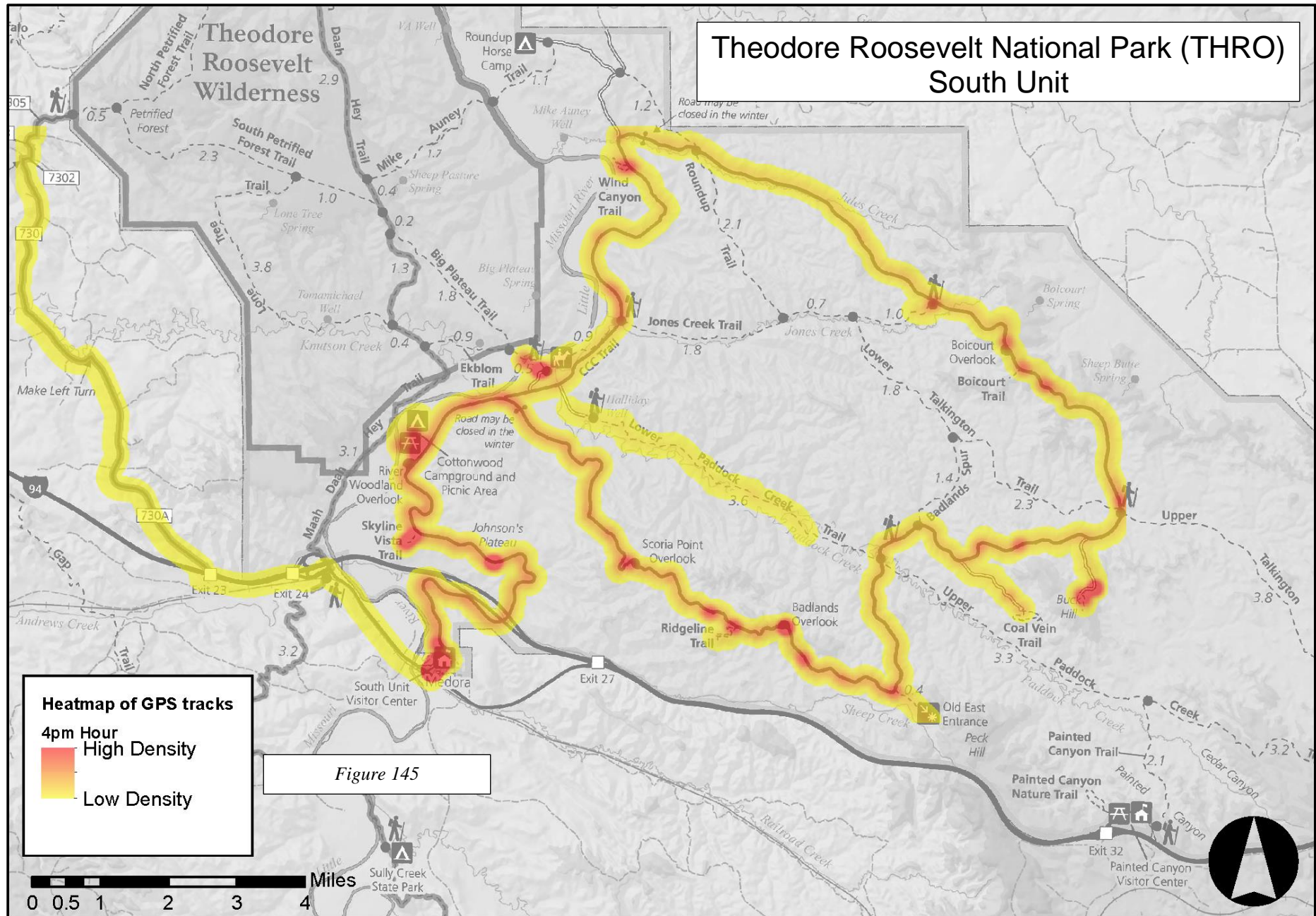


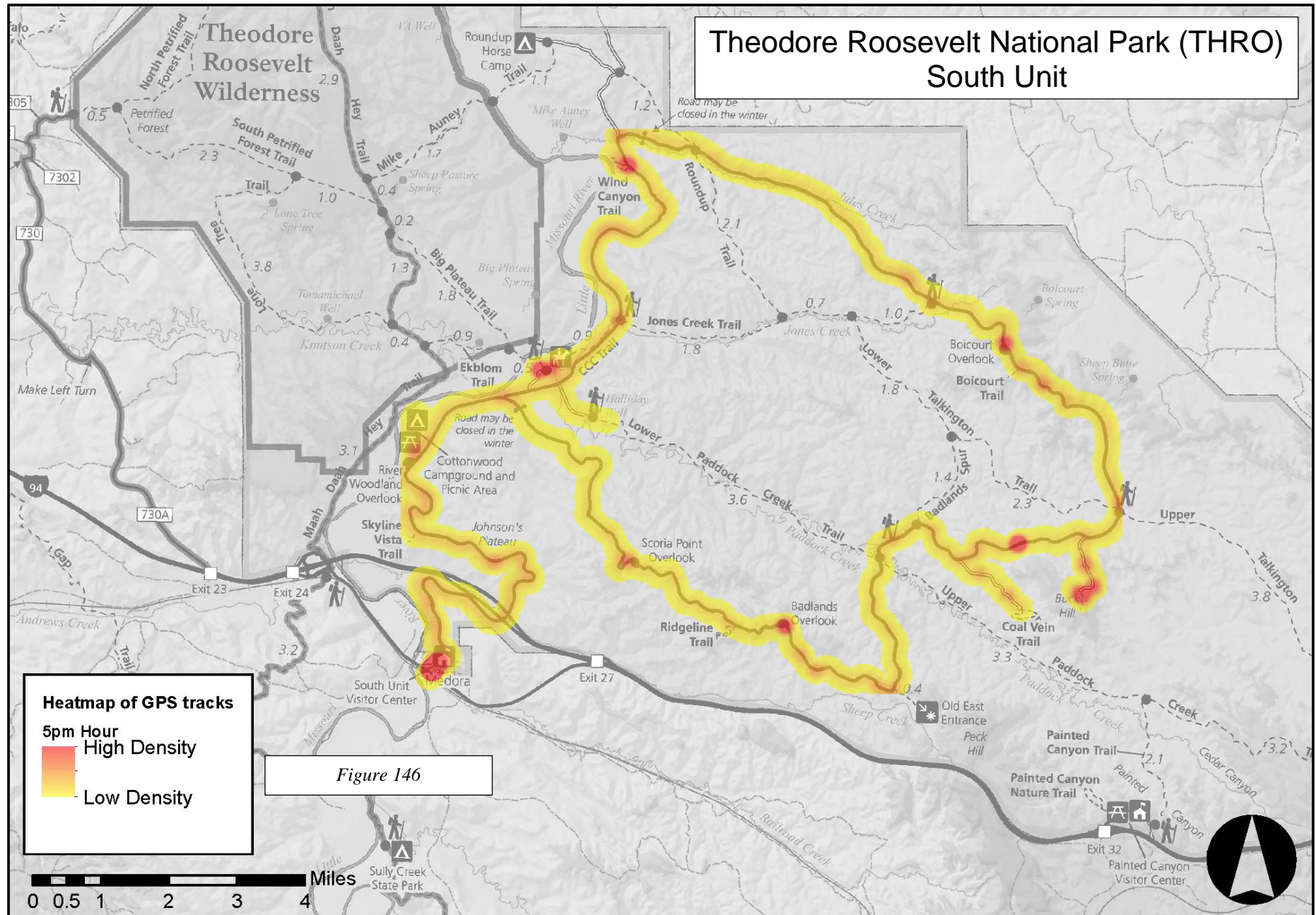


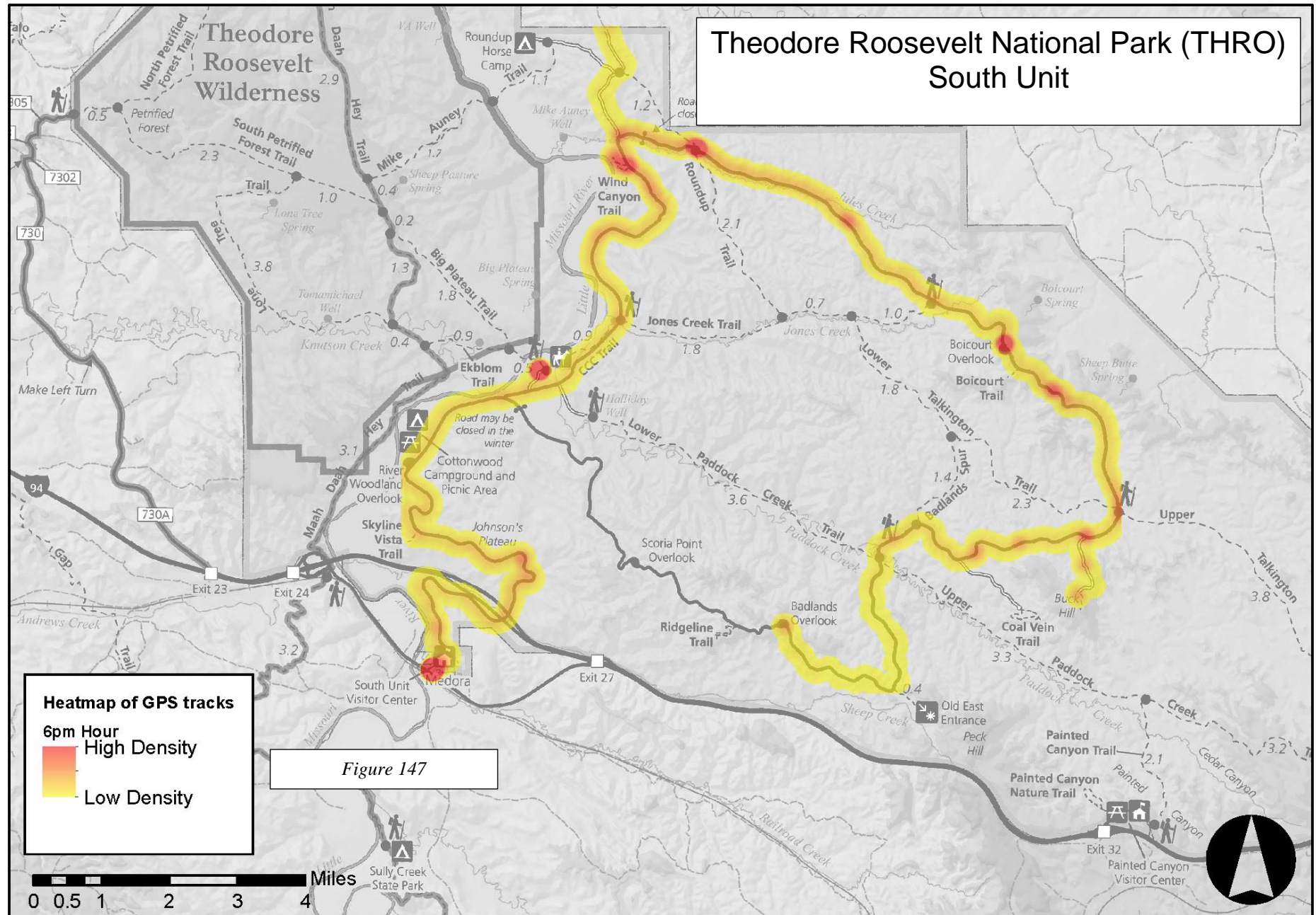


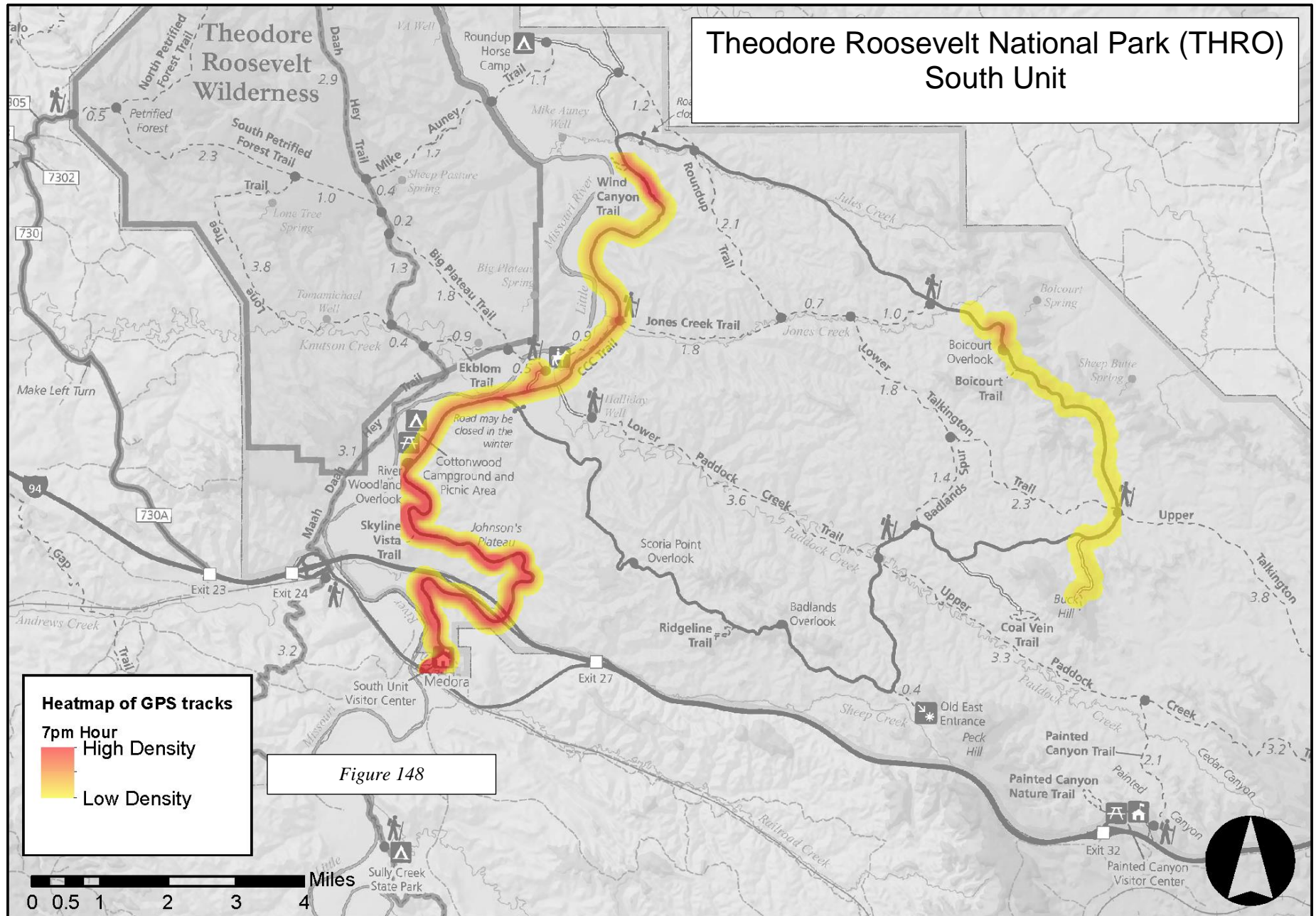












Spatial distribution of use in the Theodore Roosevelt's South Unit Designated Wilderness

Researchers limited the wilderness GPS waypoint analysis to areas within the Theodore Roosevelt Designated Wilderness. Point density analysis in the South Unit and North Unit reveals that the overwhelming majority of visitors hike on designated park trails and do not venture far from these corridors.

In the South Unit, visitors tend to use the Maah Daah Heh Trail, both Petrified Forest Trails, the Lone Tree Trail, and the Big Plateau Trail. Two areas reveal higher densities of use: Petrified Forest and Big Plateau. Specifically, the Big Plateau trail displays higher levels of use than other areas but the density difference in this area is limited to the Ekblom Trail Head area to Tomamichael Well to the west and Sheep Pasture Spring to the northwest. This area also represents a relatively short distance and easy access overnight loop experience from the road.

Figure 149 on the next page provides a heatmap of use-density for THRO's South Unit, with two zoomed-in inset maps provided on the following page that offer greater detail of the trail use at Petrified Forest (Inset 1) and Big Plateau (Inset 2).

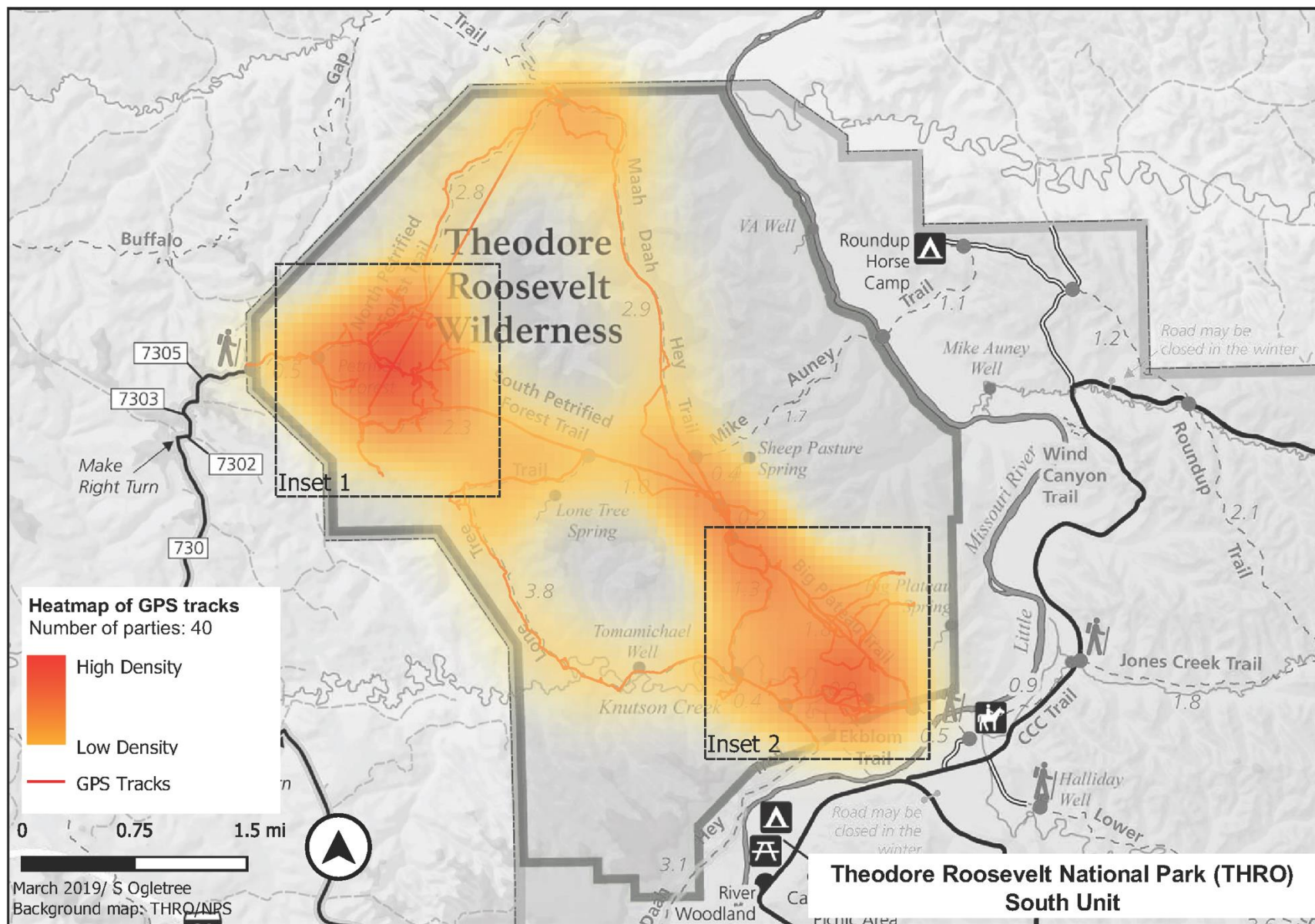


Figure 149: Heatmap of South Unit GPS tracks showing trail use density.

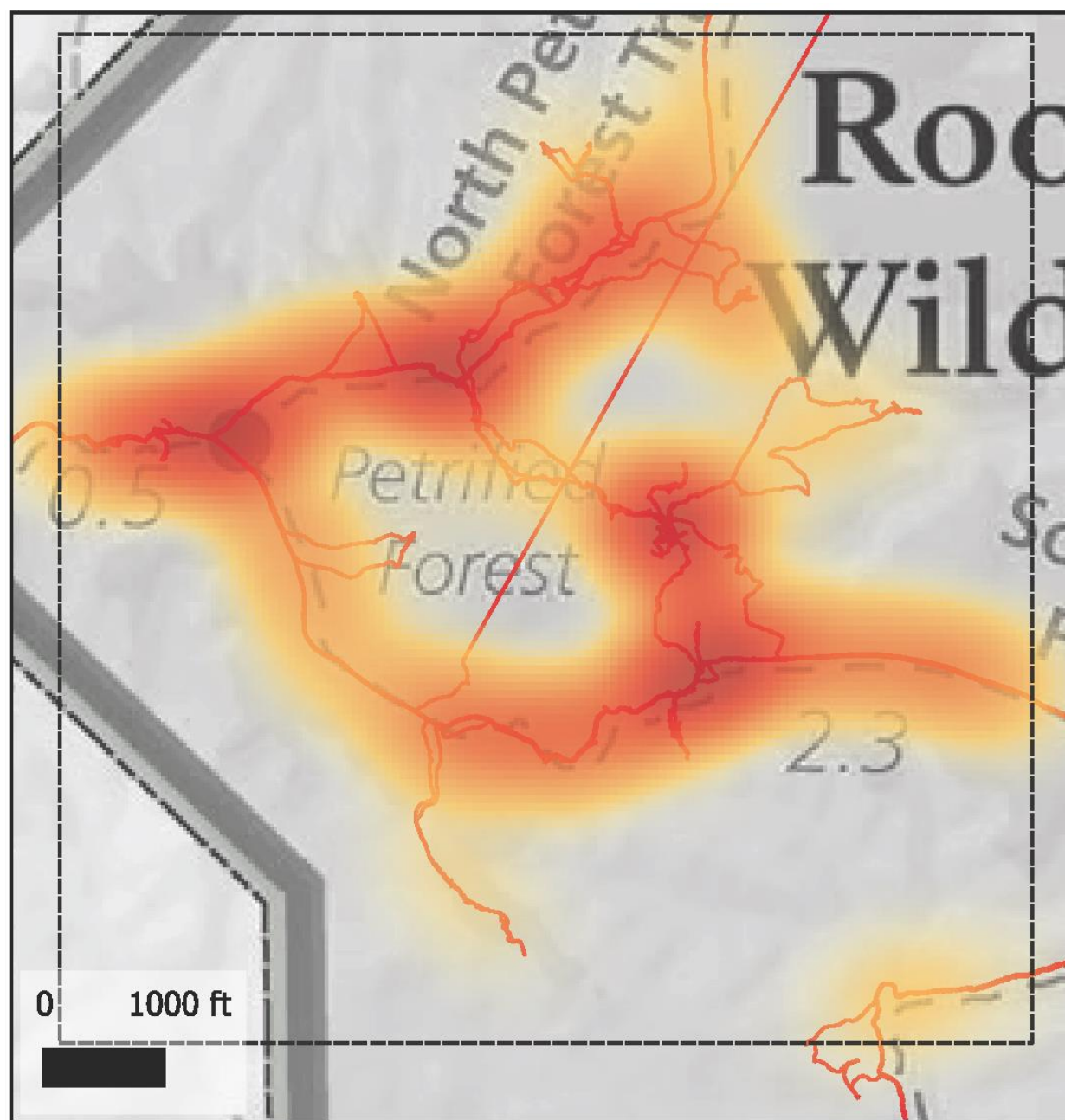


Figure 150 Inset 1: Heatmap for Petrified Forest area showing trail use density.

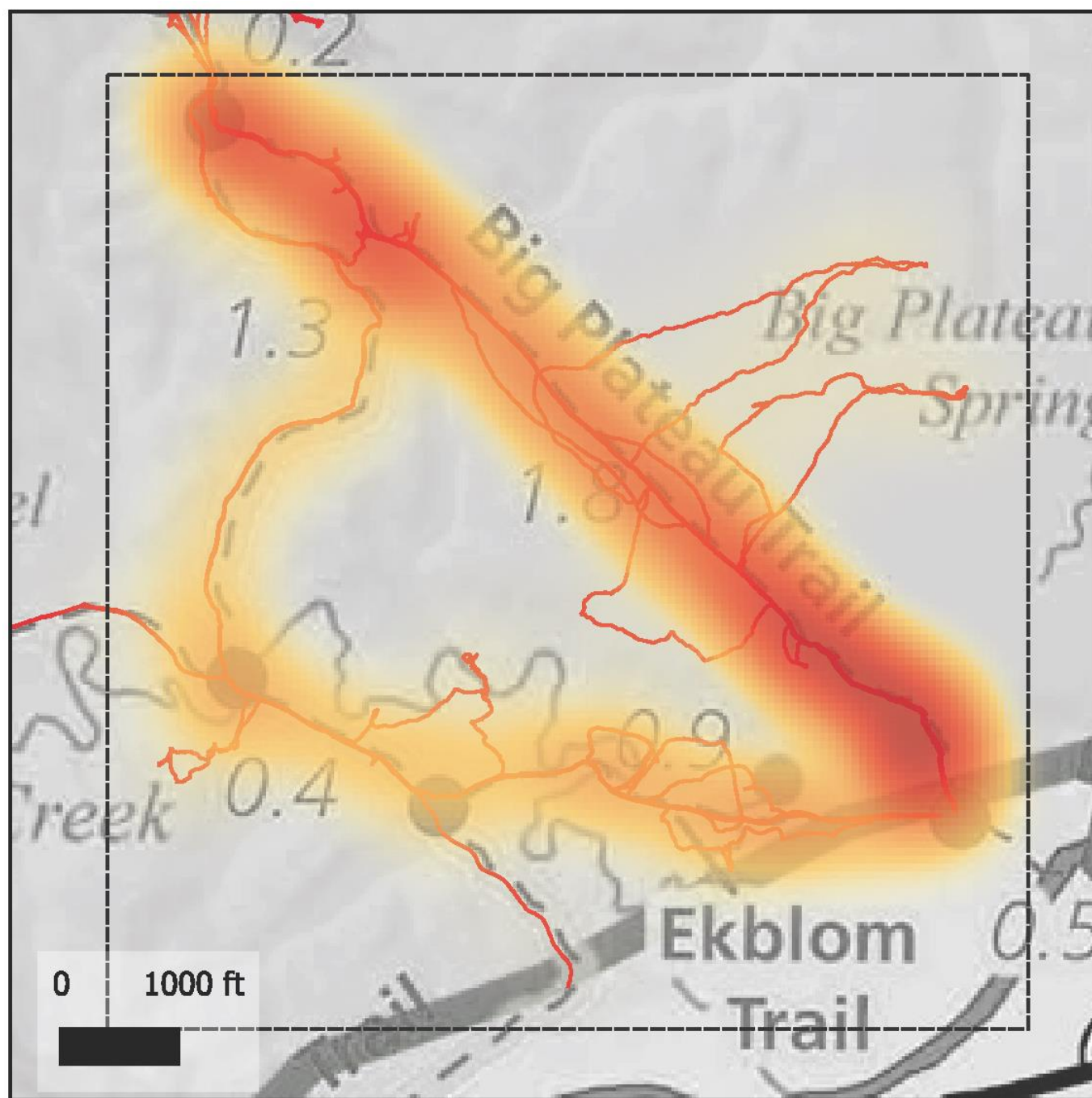


Figure 151 Inset 2: Heatmap for Big Plateau Trail area showing trail use density.

Wilderness Permit Data for South Unit

The figure below shows the percentage of visitors that accessed THRO's wilderness areas through various South Unit locations. Researchers used 2017 NPS Wilderness Permit data to generate the percentages that are displayed in the figure below. The Top 5 of these entry point were—in order of decreasing percentage of visitor ingress—Peaceful Valley Ranch (32.4%), Petrified Forest (22.4%), the Jones Creek trailhead, (8.9%), Halliday Well (3.9%) and the Paddock Creek trailhead near the Painted Canyon VC (3.9%).

These same five locations were also the Top 5 wilderness exits for visitors, but in slightly different percentages (in descending order of visitor egress): Peaceful Valley Ranch (31.2%), Petrified Forest (19.7%), the Jones Creek trailhead, (9.3%), Halliday Well (3.9%) and the Paddock Creek trailhead near the Painted Canyon VC (3.9%).

Further breakdown of these percentages are provided in Tables 53-56.

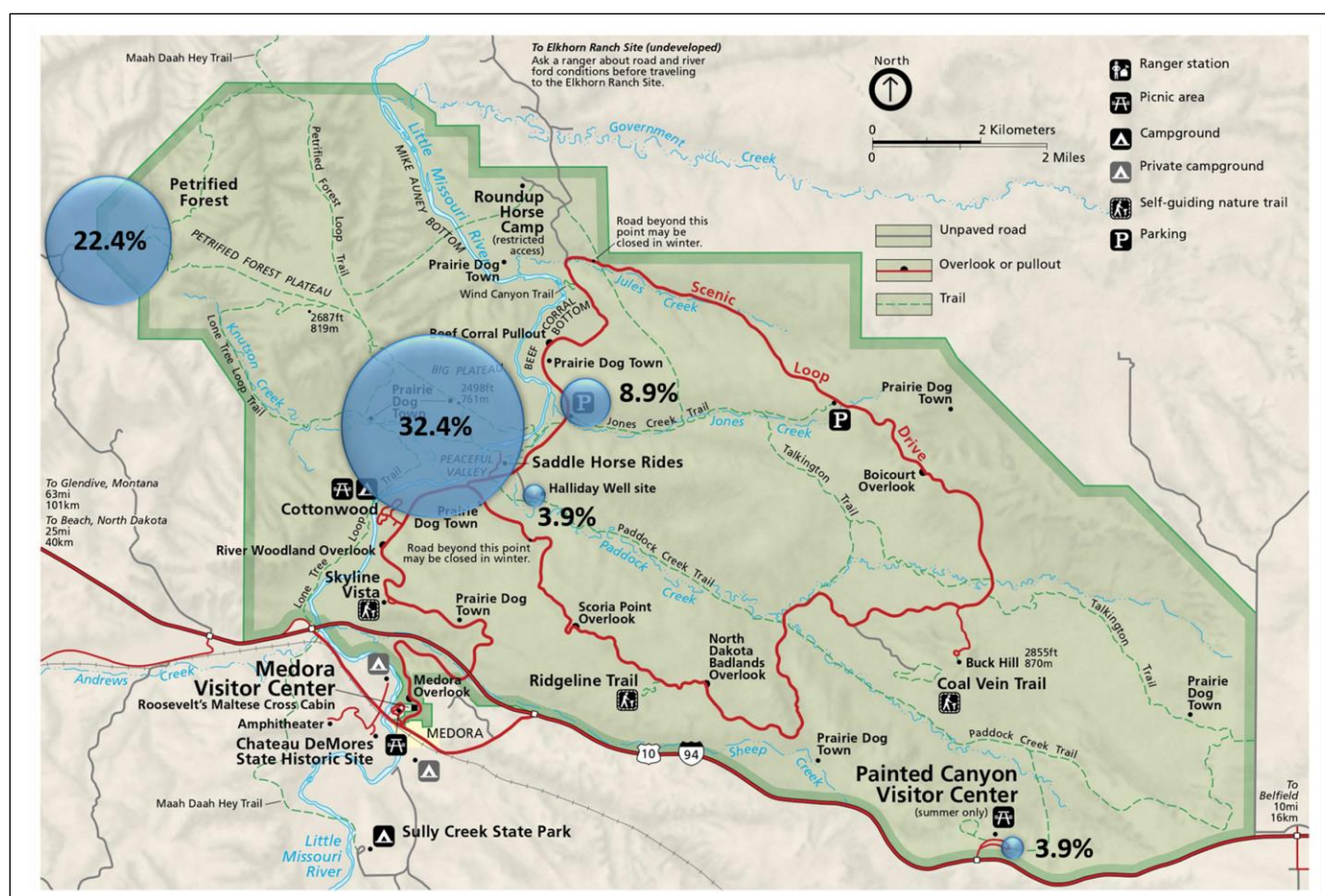


Figure 152. Map of South Unit showing visitors' entry location

Table 57: *South Unit Entry Locations from 2017 Wilderness Permits*

Location of Entry	Number of Recordings	Percent	Location of Entry	Number of Recordings	Percent
Peaceful Valley Ranch	84	32.43	Boicourt Loop Road	1	0.39
Petrified Forest	58	22.39	Boicourt T-20	1	0.39
Jones Creek	23	8.88	CCC	1	0.39
Halliday Well	10	3.86	East River Road	1	0.39
Painted Canyon	10	3.86	Jones Creek 21 Miles	1	0.39
Cottonwood	7	2.70	Jones Creek 27/28 Miles	1	0.39
Badlands Spur	4	1.54	Loop Road 11 Miles	1	0.39
Talkington	4	1.54	Loop Road 15 Miles	1	0.39
Upper Paddock Creek	4	1.54	Loop Road 17 Miles	1	0.39
Zone 2	4	1.54	Loop Road 17.5 Miles	1	0.39
Buck Hill	3	1.16	Loop Road 28.5 Miles	1	0.39
Lower Paddock Creek	3	1.16	Loop Road 29 Miles	1	0.39
Maah Daah Hey South	3	1.16	Lower Jones Creek	1	0.39
Not Given	2	0.77	Maah Daah Hey	1	0.39
Big Plateau	2	0.77	Maah Daah Hey North	1	0.39
Elkhorn Ranch	2	0.77	North Petrified Forest	1	0.39
Loop Road	2	0.77	Scoria Point	1	0.39
Loop Road 17/18 Miles	2	0.77	South Petrified Forest	1	0.39
Loop Road 21 Miles	2	0.77	South Unit	1	0.39
Loop Road 27.5 Miles	2	0.77	Sully Creek Camp	1	0.39
Paddock Creek	2	0.77	Upper Jones Creek	1	0.39
Unreadable	2	0.77	West Gate	1	0.39
Boicourt	1	0.39	Wind Canyon	1	0.39
			TOTAL	259	100.00

Table 58: *South Unit Exit Locations from 2017 Wilderness Permits*

Location of Entry	Number of Recordings	Percent	Location of Entry	Number of Recordings	Percent
Peaceful Valley Ranch	81	31.27	Maah Daah Hey North	2	0.77
Petrified Forest	51	19.69	Maah Daah Hey South	2	0.77
Jones Creek	24	9.27	Boicourt	1	0.39
Halliday Well	10	3.86	Boicourt Loop Road	1	0.39
Painted Canyon	10	3.86	Boicourt T-20	1	0.39
Cottonwood	8	3.09	East River Road	1	0.39
Not Given	5	1.93	Jones Creek 21 Miles	1	0.39
Badlands Spur	4	1.54	Jones Creek 27/28 Miles	1	0.39
Lower Paddock Creek	4	1.54	Loop Road 11 Miles	1	0.39
Talkington	4	1.54	Loop Road 14.5 Miles	1	0.39
Unreadable	4	1.54	Loop Road 15 Miles	1	0.39
Upper Paddock Creek	4	1.54	Loop Road 29 Miles	1	0.39
Zone 3	4	1.54	Lower Jones Creek	1	0.39
Buck Hill	3	1.16	Maah Daah Hey	1	0.39
Paddock Creek	3	1.16	North Unit	1	0.39
Big Plateau	2	0.77	Scoria Point	1	0.39
Eklom	2	0.77	South Unit	1	0.39
Elkhorn Ranch	2	0.77	Sully Creek Camp	1	0.39
Loop Road	2	0.77	Upper Jones Creek	1	0.39
Loop Road 17.5 Miles	2	0.77	Upper Talkington	1	0.39
Loop Road 17/18 Miles	2	0.77	West Gate	1	0.39
Loop Road 21 Miles	2	0.77	Wind Canyon	1	0.39
Loop Road 27.5 Miles	2	0.77	TOTAL	259	100.00

Table 59: *South Unit First Campsites Used from 2017 Wilderness Permits*

First Campsite	Number of Recordings	Percent
Petrified Forest	50	19.31
Zone 4	32	12.36
Not Given	22	8.49
Jones Creek	20	7.72
Maah Daah Hey	15	5.79
Big Plateau	13	5.02
Lone Tree Loop	11	4.25
Zone 1	10	3.86
Upper Talkington	9	3.47
Lower Paddock Creek	8	3.09
Upper Paddock Creek	8	3.09
North Petrified Forest	6	2.32
Peaceful Valley Ranch	6	2.32
Badlands Spur	5	1.93
Paddock Creek	5	1.93
South Petrified Forest	5	1.93
Eklblom	4	1.54
Mike Auney	4	1.54
Zone 2	4	1.54
Elkhorn Ranch	3	1.16
Lower Talkington	3	1.16
Talkington	2	0.77
Unreadable	2	0.77
Zone 3	2	0.77
Boicourt	1	0.39
Boicourt Overlook	1	0.39
Boicort Spring	1	0.39
Buck Hill	1	0.39
Cottonwood	1	0.39
Jules Creek	1	0.39
Loop Road $\frac{3}{4}$ Miles	1	0.39
Lower Jones Creek	1	0.39
Painted Canyon	1	0.39
Scoria Point	1	0.39
TOTAL	259	100.00



ELKHORN RANCH UNIT RESULTS

Parking Lot Camera

•

Trail Counter



Elkhorn Ranch Unit Results

Findings for THRO's North and South Units are in previous sections. This last section of the report focuses specifically on findings for THRO's Elkhorn Ranch Unit (Elkhorn), including information about the locations of field equipment (PLC and TC), data gathered, analyses, and implications.

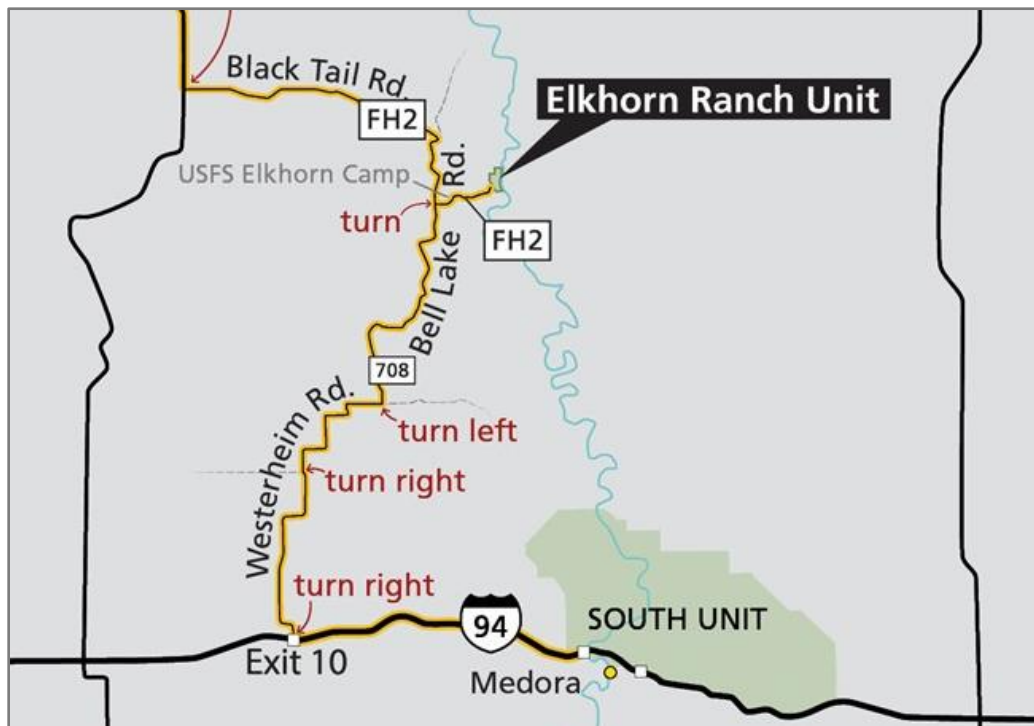


Figure 153. Detailed map of Theodore Roosevelt National Park's Elkhorn Ranch Unit

Included in this section are details about:

- Parking lot camera data at the Elkhorn Ranch Unit
- Trail counter data for Maah Daah Hey Trail segment adjacent to the Elkhorn Ranch Unit

Elkhorn Ranch Unit Parking Lot Camera

The Elkhorn Ranch Unit PLC data indicates that average weekday, weekend, and holiday vehicle counts are well below lot capacity from of 10 spaces 7:00 am to 7:00 pm.



Figure 154. The Elkhorn Ranch Unit PLC (Spypoint D12) was mounted in a cedar tree facing parking lot. Equipment coordinates are located in Appendix F.

2017 PLC Data for the Elkhorn Ranch Unit Parking Lot

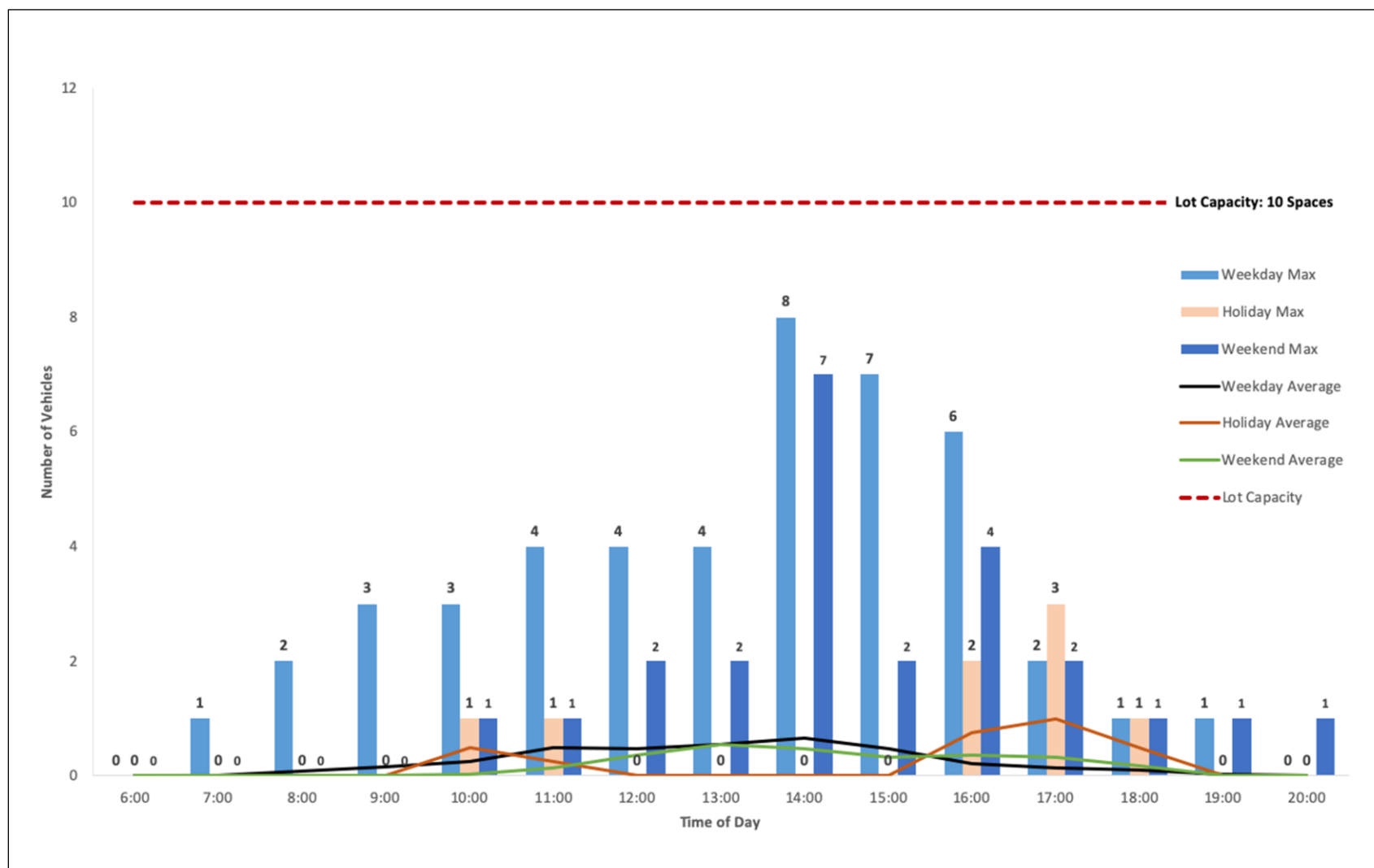


Figure 155. 2017 PLC data for the Elkhorn Ranch Unit parking lot showing relatively low vehicle numbers, despite weekend maximums midday nearing the lot's 10-vehicle capacity.

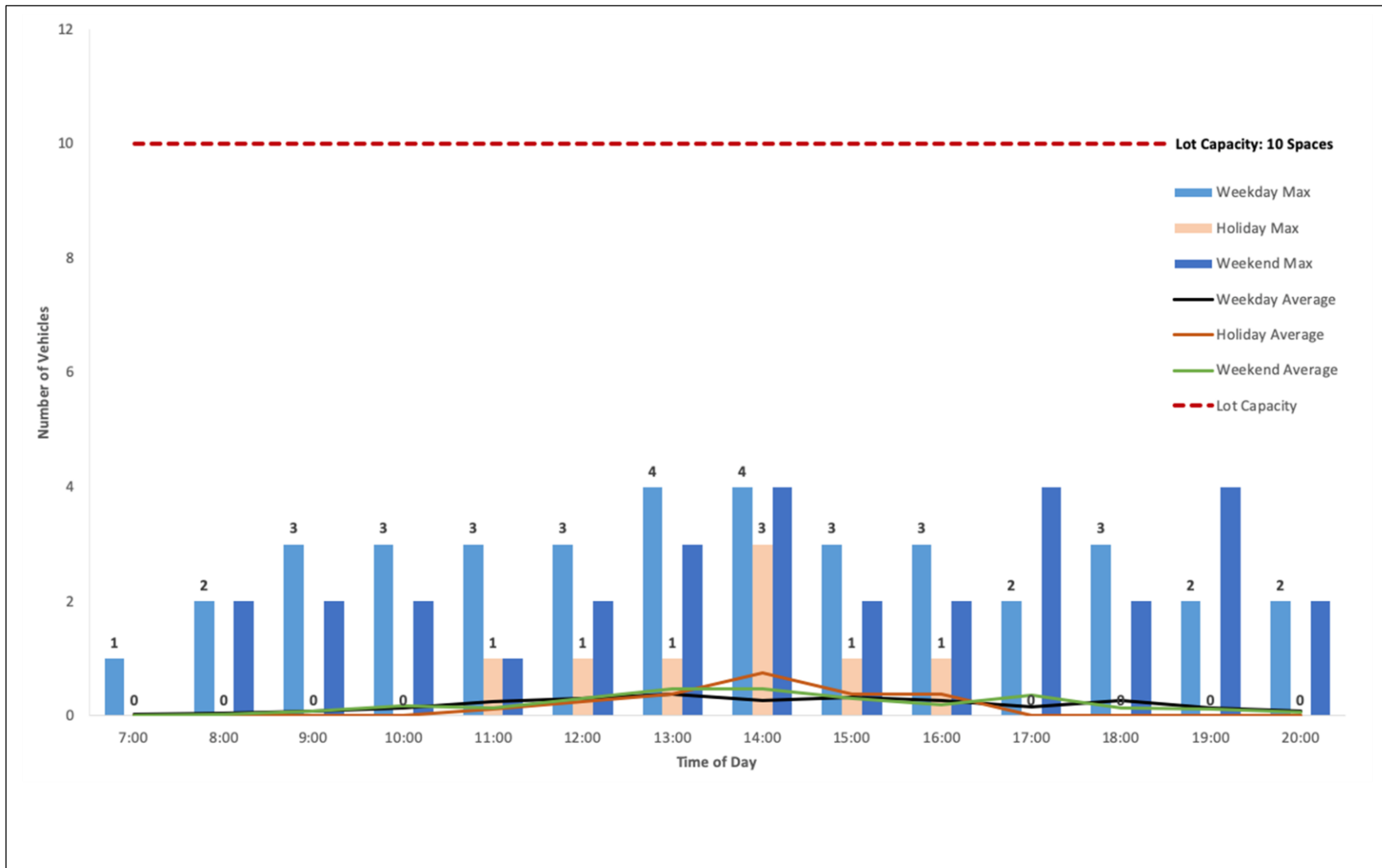
2018 PLC Data for the Elkhorn Ranch Unit Parking Lot

Figure 156. 2018 PLC data for Elkhorn Ranch Unit parking lot showing relatively low vehicle numbers across all times of day.

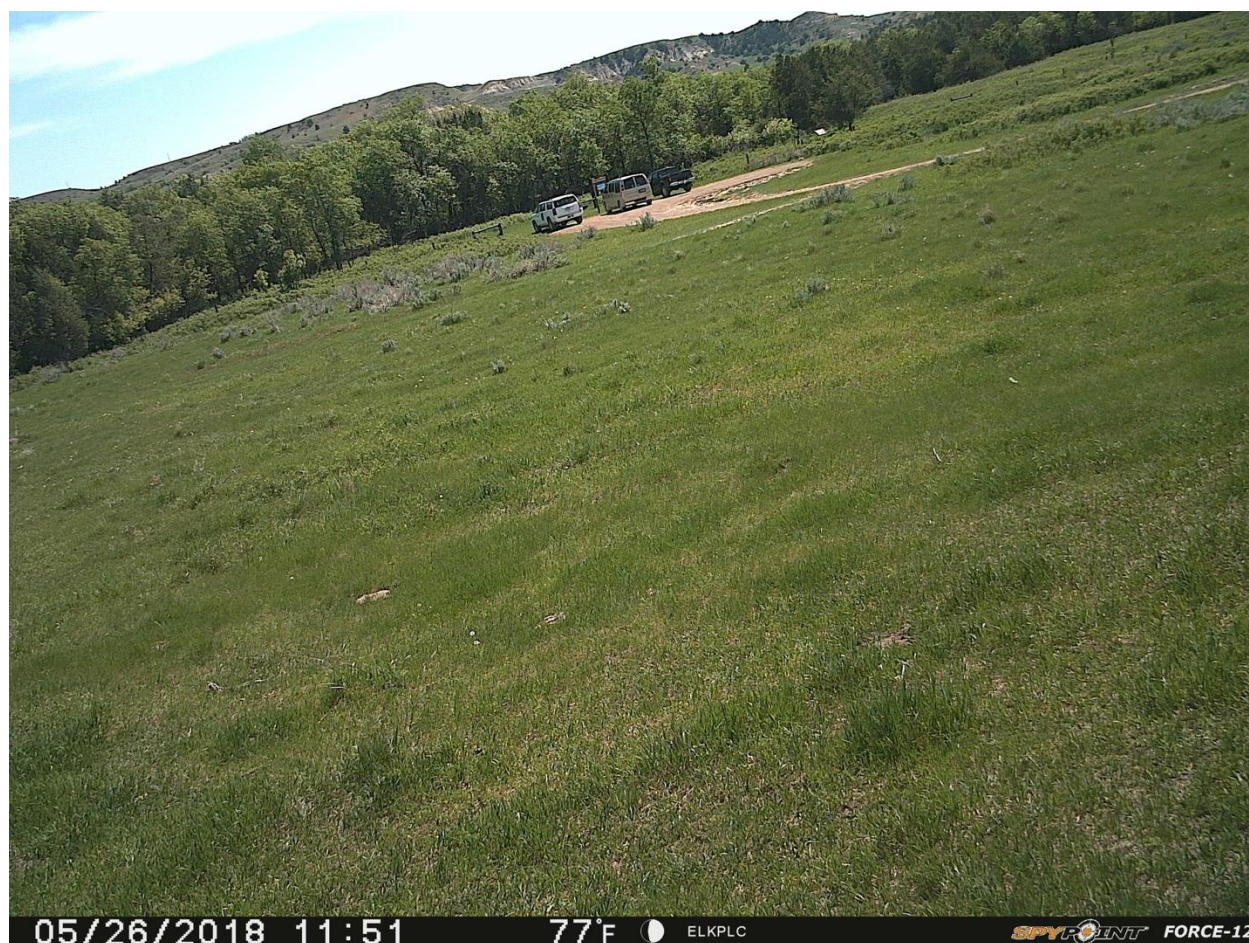


Figure 157. Parking lot camera image from the Elkhorn Ranch Unit parking lot showing 3 vehicles.

Elkhorn Ranch Unit TC on the Maah Daah Hey Trail

One trail counter (TC) was placed near THRO's Elkhorn Ranch Unit on the Maah Daah Hey Trail. Average trail use collected from June 6, 2016 through September 9, 2017 shows an average of 6.5 daily users, with a monthly average of 195 trail users from June through September.

Maah Daah Hey Daily Trail Counter Data (Adjacent to the Elkhorn Ranch Unit)

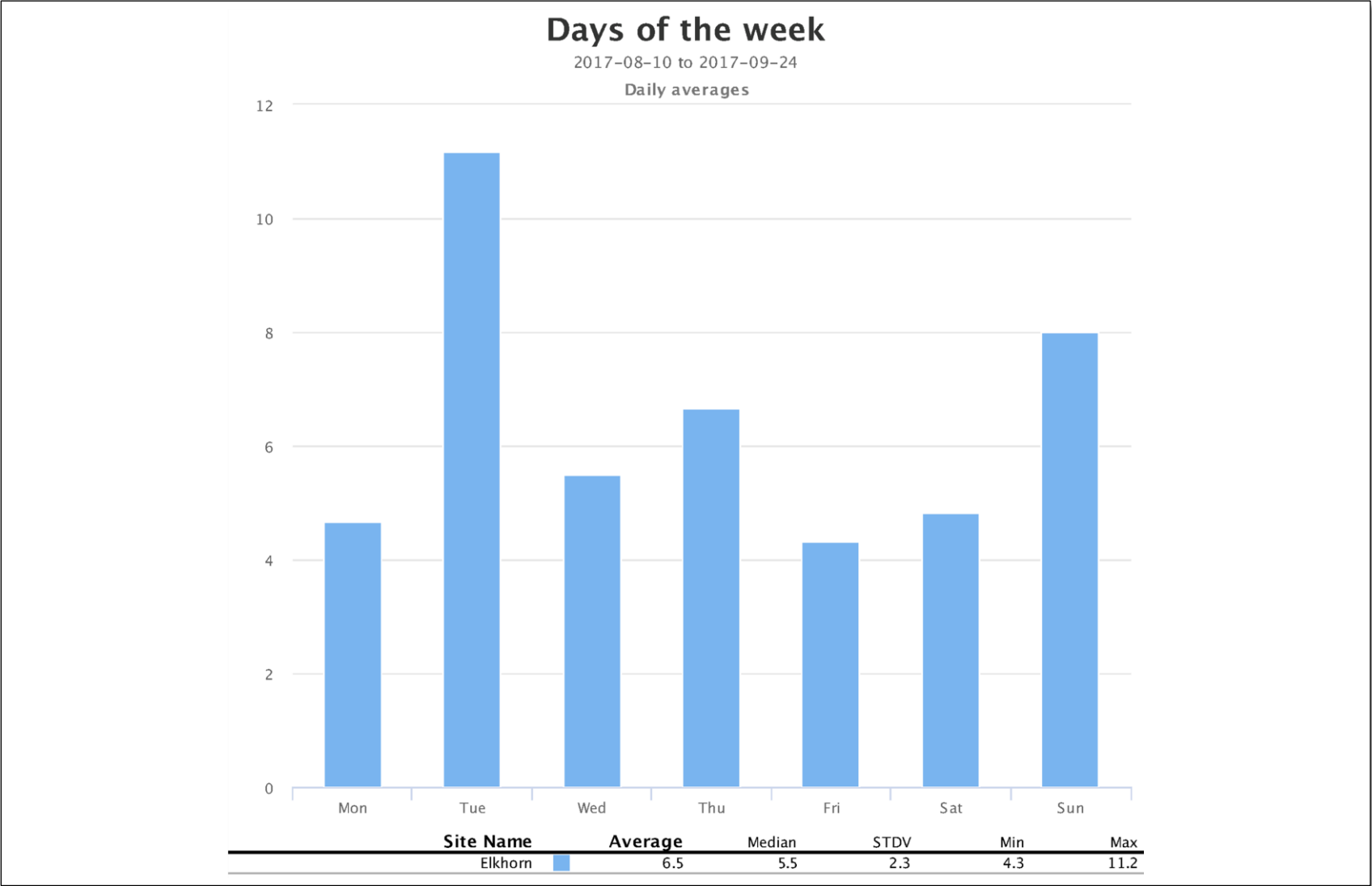


Figure 158. Trail Counter Data for the Maah Daah Hey Trail adjacent to the Elkhorn Ranch Unit showing an average of 6.5 users per day.

Maah Daah Hey Monthly Trail Counter Data (Adjacent to the Elkhorn Ranch Unit)

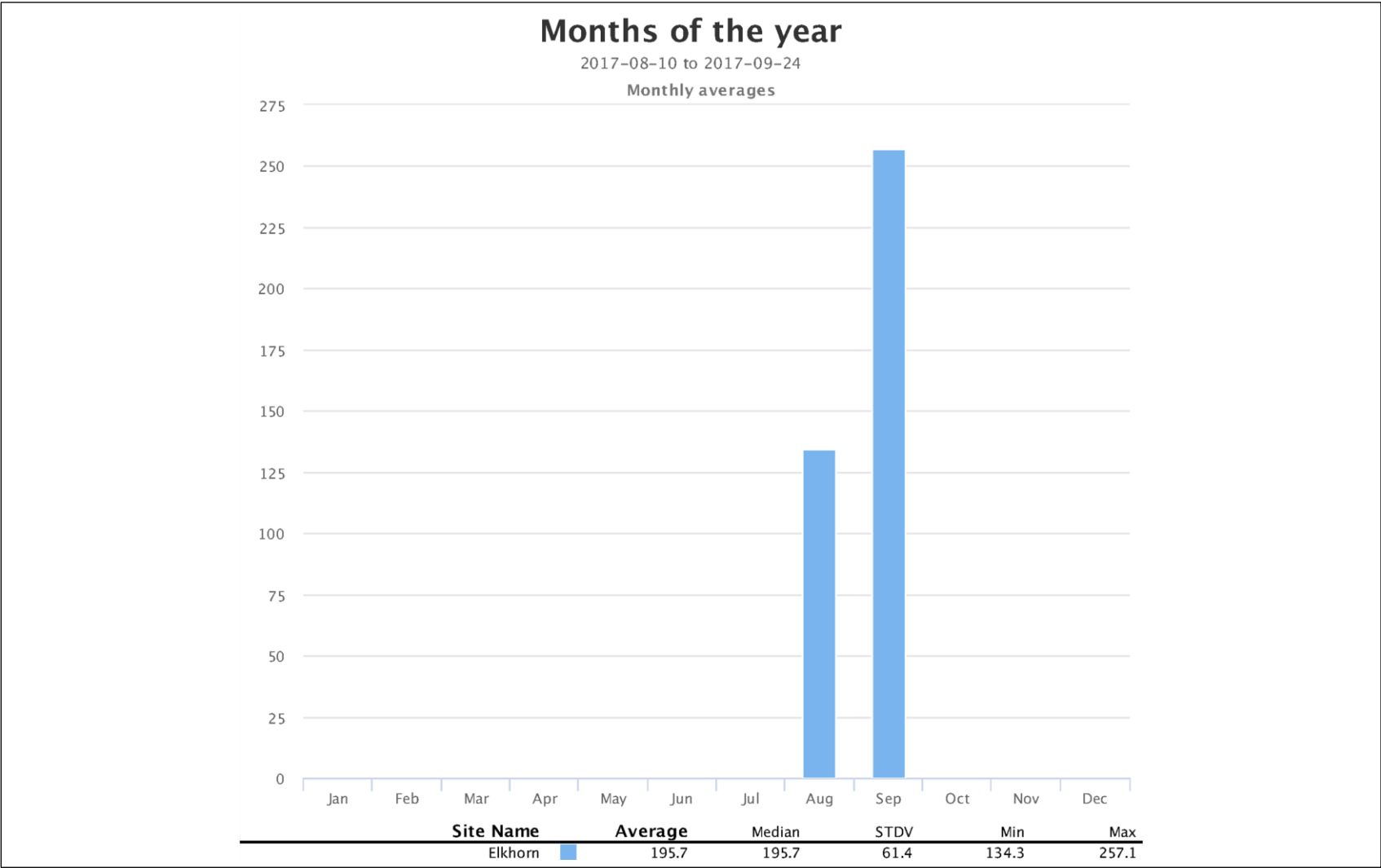


Figure 159. Trail Counter Data for the Maah Daah Hey Trail adjacent to the Elkhorn Ranch Unit showing an average of 195 users per month

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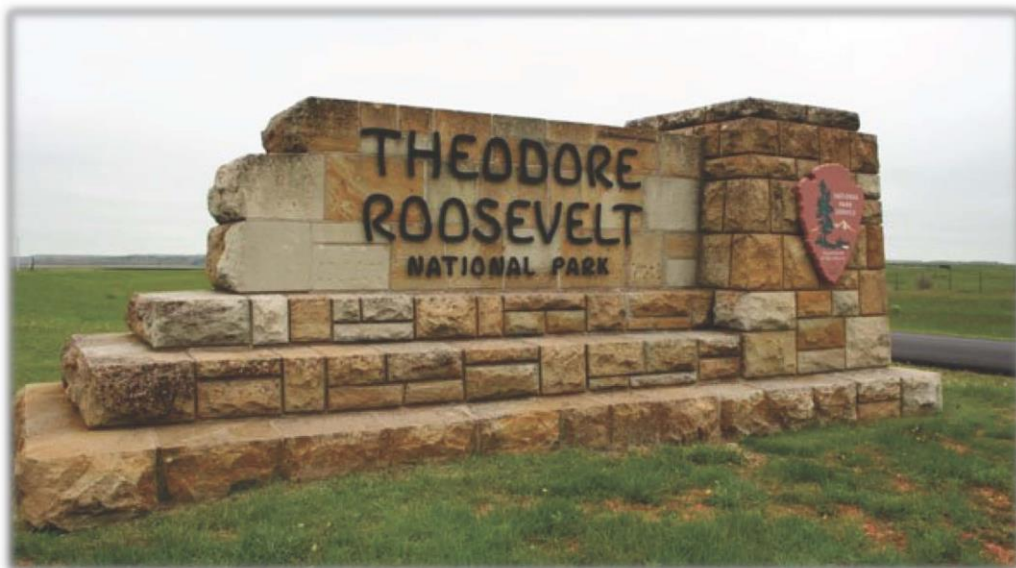
Appendix A: Management Questionnaire

OMB Number: xxxx-xxxx
Expiration Date: xx/xx/xxxx

Theodore Roosevelt National Park

Visitor Survey

Management Questionnaire
2017



To be completed by field staff:

ID _____ Travel party ID _____ Tracker number _____ Date _____

Location _____ Field staff _____

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary and anonymous. Your name will never be associated with your answers, and all contact information will be destroyed when the data collection is concluded. No action may be taken against you for refusing to supply the information requested. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

BURDEN ESTIMATE STATEMENT: Public reporting burden for this form is estimated to average 10 minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to:

SECTION 2: PREFERENCES AT THEODORE ROOSEVELT NATIONAL PARK

4. Please indicate your level of opposition or support for the following management scenarios at Theodore Roosevelt National Park. **The list of items below are not necessarily actions that are definitely going to occur at the park.** However, we are interested in your opinions about these potential actions. *(select one box for each row)*

[illegible]

5. Please allocate 100 “preference points” for the potential expansion or creation of the following within Theodore Roosevelt National Park. For example, you might assign 100 points to one item and zero to all the others, or assign 50 points to one, 25 to another and 25 yet to another. Regardless of how you assign points, the points you assign should total 100. Please read through the list below and use the boxes to assign 100 preference points any way you would like. If you oppose any and all expansion or creation of infrastructure within Theodore Roosevelt National Park, you may indicate that below.

	Preference points
Expand existing campgrounds by providing larger loops, larger pull-offs, and additional RV sites	
Create new reserved group campgrounds	
Install water, sewer, and electrical hookups in campgrounds	
Improve accessibility at existing park facilities	
Construct a permanent visitor center at the North Unit	
TOTAL	100

☐ I am choosing not to assign preference points to the list below because I oppose all expansion or creation of infrastructure within Theodore Roosevelt National Park.

6. If you could choose only one of the following to be potentially created or expanded within Theodore Roosevelt National Park, which one would you choose? *(please select only one)*

- ☐ Expand existing campgrounds by providing larger loops, larger pull-offs, and additional RV sites
☐ Create new reserved group campgrounds
☐ Install water, sewer, and electrical hookups in campgrounds
☐ Improve accessibility at existing park facilities
☐ Construct a permanent visitor center at the North Unit

☐ I am choosing not to select one item from the list above because I oppose any and all expansion or creation of infrastructure within Theodore Roosevelt National Park.

8.

7. On your most recent visit, how satisfied or dissatisfied were you with the quality of the services and facilities at Theodore Roosevelt National Park? (select one box for each row)

[illegible]

SECTION 4: ABOUT YOU

9. What is your zip code? _____
10. What year were you born? _____
11. What is your gender? *(select one)* ☐ Male ☐ Female ☐ Other
12. What is the highest level of school you have completed? *(select one)*
- | | | |
|------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------|
| <input type="checkbox"/> Less than high school | <input type="checkbox"/> Some college | <input type="checkbox"/> Graduate or professional degree |
| <input type="checkbox"/> Some high school | <input type="checkbox"/> Two-year college graduate | <input type="checkbox"/> Do not wish to answer |
| <input type="checkbox"/> High school graduate | <input type="checkbox"/> Four-year college graduate | |
13. What is your race? *(select all that apply)*
- | | | |
|-----------------------------------------------------------|-------------------------------------------------------|------------------------------------------------|
| <input type="checkbox"/> American Indian or Alaska Native | <input type="checkbox"/> Hawaiian or Pacific Islander | <input type="checkbox"/> Other |
| <input type="checkbox"/> Asian | <input type="checkbox"/> Hispanic or Latino/Latina | <input type="checkbox"/> Do not wish to answer |
| <input type="checkbox"/> Black or African American | <input type="checkbox"/> White | |
14. Which category best describes your total household income in U.S. dollars during 2016 before taxes?
(select one)
- | | | |
|-----------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> Less than \$24,999 | <input type="checkbox"/> \$50,000 to \$74,999 | <input type="checkbox"/> \$150,000 to \$199,999 |
| <input type="checkbox"/> \$25,000 to \$34,999 | <input type="checkbox"/> \$75,000 to \$99,999 | <input type="checkbox"/> \$200,000 or more |
| <input type="checkbox"/> \$35,000 to \$49,999 | <input type="checkbox"/> \$100,000 to \$149,999 | <input type="checkbox"/> Do not wish to answer |

Thank you for your help with this survey!
Please return it to the person who gave it to you.

If you have any question or concern, please contact:
Dr. Ryan Sharp – ryansharp@ksu.edu
Dr. Matt Brownlee – brownlee@clemson.edu

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary and anonymous. Your name will never be associated with your answers, and all contact information will be destroyed when the data collection is concluded. No action may be taken against you for refusing to supply the information requested. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

BURDEN ESTIMATE STATEMENT: Public reporting burden for this form is estimated to average 10 minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to:

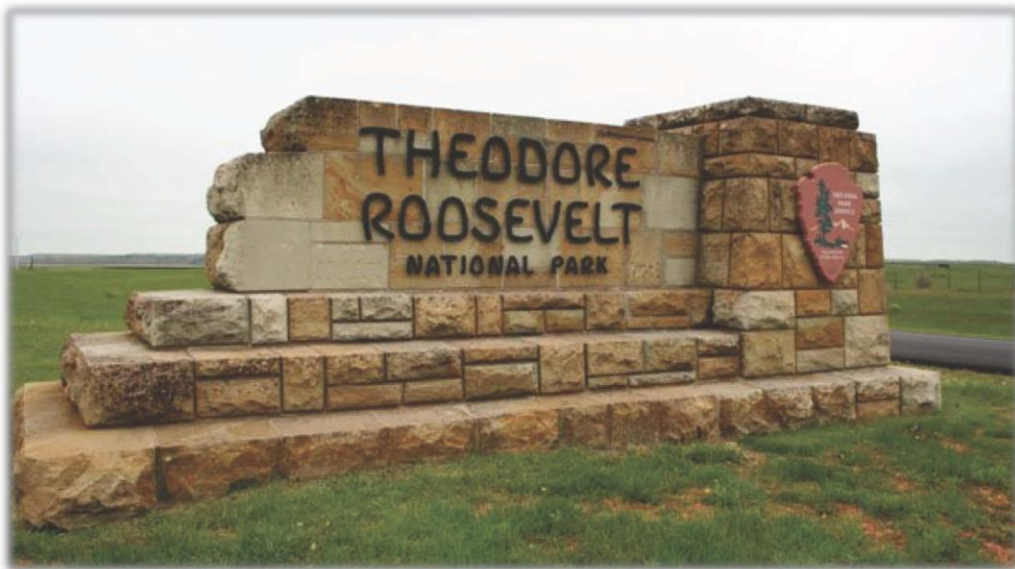
Appendix B: 2001 vs 2017 Comparative Questionnaire

OMB Number: xxxx-xxxx
Expiration Date: xx/xx/xxxx

Theodore Roosevelt National Park

Visitor Survey

2001 Comparative Questionnaire
2017



To be completed by field staff:

ID _____ Travel party ID _____ Tracker number _____ Date _____

Location _____ Field staff _____

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary and anonymous. Your name will never be associated with your answers, and all contact information will be destroyed when the data collection is concluded. No action may be taken against you for refusing to supply the information requested. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

BURDEN ESTIMATE STATEMENT: Public reporting burden for this form is estimated to average 10 minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to:

**SECTION 1: YOUR VISITS TO
THEODORE ROOSEVELT NATIONAL PARK**

1. Please tell us about your past visitation to Theodore Roosevelt National Park.

- a. Including today, how many **days in the last month** (30 days) have you visited Theodore Roosevelt National Park? _____
- If you visited Theodore Roosevelt National Park for only one day, how many hours did you spend in the park? _____ hours
- b. Including today, how many **days in the last year** (12 months) have you visited Theodore Roosevelt National Park? _____
- c. Including today, how many **years (total)** have you visited Theodore Roosevelt National Park? _____

2. On your most recent visit to Theodore Roosevelt National Park, what activities did you participate in **at the Park**? (*check all that apply*):

- | | | |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------|
| <input type="checkbox"/> Hiking outside a designated trail | <input type="checkbox"/> Viewing wildlife in the park | <input type="checkbox"/> Horseback riding in the park |
| <input type="checkbox"/> Hiking on a designated trail | <input type="checkbox"/> Viewing wildflowers and plants in the park | <input type="checkbox"/> Picnicking in the park |
| <input type="checkbox"/> Participating in ranger-led programs in park | <input type="checkbox"/> Viewing museum exhibits in the visitor centers | <input type="checkbox"/> Bicycling in the park |
| <input type="checkbox"/> Shopping in one or more visitor centers | <input type="checkbox"/> Camping | |
- ☐ Other (specify) _____

3. During this current **visit to the area** (the park and local communities), what activities did you or do you plan to participate in, and what sites or attractions did you or do plan to visit? (*select only one*):

- ☐ Attended the Medora Musical
- ☐ Visited the Chateau de Mores State Historic Site
- ☐ Traveled on the Maah Daah Hey Trail (*check all that apply*)
- ☐ by foot ☐ by bike ☐ by horseback
- ☐ Mountain biked on other trails in the area
- ☐ Played golf in the area
- ☐ Visited the Dakota Dinosaur Museum in Dickinson, ND
- ☐ Visited other museums in the area
- ☐ Visited Fort Union Trading Post National Historic Site near Williston, ND
- ☐ Visited Knife River Indian Villages National Historic Site near Stanton, ND
- ☐ Visited Fort Buford National Historic Site near Williston, ND
- ☐ Toured the Little Missouri National Grasslands
- ☐ Other (specify): _____

4. Please check the following types of businesses, if any, you patronized during your most recent visit to Theodore Roosevelt National Park and the surrounding area. For each type of business you patronized, please circle the community(ies) where it was located.

Business	Communities (circle the community where you patronized each type of business)					
<input type="checkbox"/> Lodging	Beach	Belfield	Dickinson	Medora	Watford City	Williston
<input type="checkbox"/> Restaurant	Beach	Belfield	Dickinson	Medora	Watford City	Williston
<input type="checkbox"/> Gas station	Beach	Belfield	Dickinson	Medora	Watford City	Williston
<input type="checkbox"/> Grocery store	Beach	Belfield	Dickinson	Medora	Watford City	Williston
<input type="checkbox"/> Retail/gift store	Beach	Belfield	Dickinson	Medora	Watford City	Williston

Casino (please specify name of casino) _____

Other (please specify) _____

- ☐ I did not patronize any of the businesses near the park
☐ Don't know/don't remember

5. Below is a list of possible detractors you may have experienced while visiting Theodore Roosevelt National Park. Please look over the list and for each possible detractor indicate how much it detracted from your experience during your current visit to the park. (select one box for each row)

[illegible]

SECTION 3: CROWDING AT THEODORE ROOSEVELT NATIONAL PARK

6. On the page below is a list of places in the park. Look over the list and the provided map. Check all the places you visited. For each place you visited, please tell us how crowded, if at all, you felt and what made you feel crowded at that place.

In general, how crowded did you feel? *(check one box for each row)*

If you felt crowded, what made you feel crowded *(circle all that apply)*
The number of....

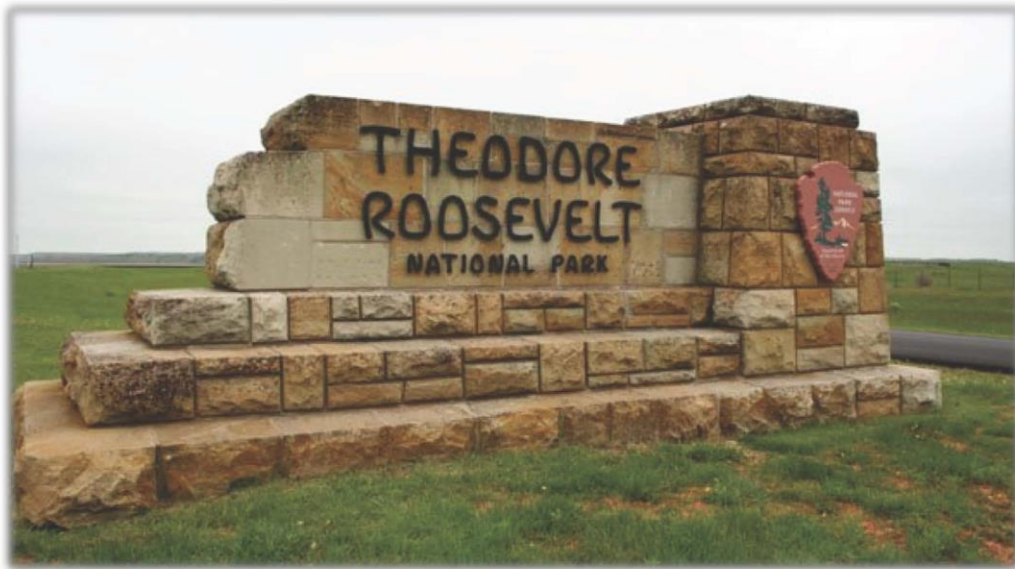
Places you visited	<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">Not crowded at all</div> <div style="text-align: center;"> </div> <div style="text-align: center;">Extremely crowded</div> </div>									Don't recall	People	Vehicles	Horseback Riders	Other
SOUTH UNIT														
Painted Canyon Visitor Center	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Medora Visitor Center	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Roosevelt's Maltese Cross Cabin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Pullouts near Prairie Dog Town on Johnson's Plateau	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Cottonwood Campground	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Peaceful Valley Ranch	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Scenic Loop Drive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Jones Creek Trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Ridgeline Nature Trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Coal Vein Trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Buck Hill	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Wind Canyon Nature Trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Petrified Forest	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Backcountry Trails (Wilderness Trails)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Frontcountry Trails (Non-wilderness Trails in an near pullouts, access points, and visitor centers)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
NORTH UNIT														
North Unit Visitor Center	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Juniper Campground and Picnic Area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Little Mo Nature Trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Caprock Coulee Nature Trail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Scenic Drive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
Oxbow Overlook	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other
River Bend Overlook	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		People	Vehicles	Horseback Riders	Other

Appendix C: 2017 Indicators Questionnaire

Theodore Roosevelt National Park

Visitor Survey

Indicators Questionnaire
2017



To be completed by field staff:

ID _____ Travel party ID _____ Tracker number _____ Date _____

Location _____ Field staff _____

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary and anonymous. Your name will never be associated with your answers, and all contact information will be destroyed when the data collection is concluded. No action may be taken against you for refusing to supply the information requested. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

BURDEN ESTIMATE STATEMENT: Public reporting burden for this form is estimated to average 10 minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to:

SECTION 1: YOUR VISITS TO THEODORE ROOSEVELT NATIONAL PARK

1. Please tell us about your past visitation to Theodore Roosevelt National Park.
 - a. Including today, how many **days in the last month** (30 days) have you visited Theodore Roosevelt National Park? _____
 - If you visited Theodore Roosevelt National Park for only one day, how many hours did you spend in the park? _____ hours
 - b. Including today, how many **days in the last year** (12 months) have you visited Theodore Roosevelt National Park? _____
 - c. Including today, how many **years (total)** have you visited Theodore Roosevelt National Park?

SECTION 2: YOUR CURRENT VISIT TO THEODORE ROOSEVELT NATIONAL PARK

2. What are three things you enjoyed most about your visit to Theodore Roosevelt National Park?
 1. _____
 2. _____
 3. _____
3. What are three things you enjoyed least about your visit to Theodore Roosevelt National Park?
 1. _____
 2. _____
 3. _____
4. If you could ask the National Park Service to change some things about the way they manage Theodore Roosevelt National Park, what would you ask them to change?

5. If you could ask the National Park Service **not** to change some things about the way they manage Theodore Roosevelt National Park, what would you ask them **not** to change?

SECTION 3: IMPORTANT EXPERIENCES AT THEODORE ROOSEVELT NATIONAL PARK

6. Below is a list of experiences that might be important to some visitors at Theodore Roosevelt National Park. Please circle the number that indicates how *important each experience* is to you in relation to your visit to Theodore Roosevelt National Park. *(circle select one box for each row)*

"The opportunity to..."	Not important at all	Slightly important	Moderately important	Very important	Extremely important
view stars without seeing human lights	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
enjoy natural views without human structures within sight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
opportunity to view wildlife	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
be away from crowds of people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
experience natural sounds without human produced noise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
enjoy overlooks without lots of other people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
understand the geologic history of the area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
participate in ranger led activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
find parking spaces without waiting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
reserve/find campsites without adjusting preferred dates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
hike on trails without lots of other people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
drive without seeing lots of other cars	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
learn about Theodore Roosevelt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
read roadside signs containing information about the area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
learn about the past people that lived in and visited the area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
experience clean air free of haze and pollutants	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
experience a place free of litter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
experience solitude	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
learn about wildlife	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
participate in citizen science projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
learn about the importance of geologic history to current energy development in North Dakota	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
reserve/find horse group campsites without adjusting preferred dates	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Using the same list from the previous question, please use the first answer column to select the top five experiences that are most important in relation to your visit to Theodore Roosevelt National Park. Next, use the second answer column to select the experience that is the most important during your visit.

“The opportunity to...”	Please select the <u>top five</u> experiences important during your visit (select five boxes)	Please select the experience that is <u>most</u> important during your visit (select one)
view stars without seeing human lights	<input type="checkbox"/>	<input type="checkbox"/>
enjoy natural views without human structures within sight	<input type="checkbox"/>	<input type="checkbox"/>
opportunity to view wildlife	<input type="checkbox"/>	<input type="checkbox"/>
be away from crowds of people	<input type="checkbox"/>	<input type="checkbox"/>
experience natural sounds without human produced noise	<input type="checkbox"/>	<input type="checkbox"/>
enjoy overlooks without lots of other people	<input type="checkbox"/>	<input type="checkbox"/>
understand the geologic history of the area	<input type="checkbox"/>	<input type="checkbox"/>
participate in ranger led activities	<input type="checkbox"/>	<input type="checkbox"/>
find parking spaces without waiting	<input type="checkbox"/>	<input type="checkbox"/>
reserve/find campsites without adjusting preferred dates	<input type="checkbox"/>	<input type="checkbox"/>
hike on trails without lots of other people	<input type="checkbox"/>	<input type="checkbox"/>
drive without seeing lots of other cars	<input type="checkbox"/>	<input type="checkbox"/>
learn about Theodore Roosevelt	<input type="checkbox"/>	<input type="checkbox"/>
read roadside signs containing information about the area	<input type="checkbox"/>	<input type="checkbox"/>
learn about the past people that lived in and visited the area	<input type="checkbox"/>	<input type="checkbox"/>
experience clean air free of haze and pollutants	<input type="checkbox"/>	<input type="checkbox"/>
experience a place free of litter	<input type="checkbox"/>	<input type="checkbox"/>
experience solitude	<input type="checkbox"/>	<input type="checkbox"/>
learn about wildlife	<input type="checkbox"/>	<input type="checkbox"/>
participate in citizen science projects	<input type="checkbox"/>	<input type="checkbox"/>
learn about the importance of geologic history to current energy development in North Dakota	<input type="checkbox"/>	<input type="checkbox"/>
reserve/find horse group campsites without adjusting preferred dates	<input type="checkbox"/>	<input type="checkbox"/>

SECTION 3: ABOUT YOU

8. What is your zip code? _____
9. What year were you born? _____
10. What is your gender? *(select one)* ☐ Male ☐ Female ☐ Other
11. What is the highest level of school you have completed? *(select one)*
- | | | |
|------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------|
| <input type="checkbox"/> Less than high school | <input type="checkbox"/> Some college | <input type="checkbox"/> Graduate or professional degree |
| <input type="checkbox"/> Some high school | <input type="checkbox"/> Two-year college graduate | <input type="checkbox"/> Do not wish to answer |
| <input type="checkbox"/> High school graduate | <input type="checkbox"/> Four-year college graduate | |
12. What is your race? *(select all that apply)*
- | | | |
|-----------------------------------------------------------|-------------------------------------------------------|------------------------------------------------|
| <input type="checkbox"/> American Indian or Alaska Native | <input type="checkbox"/> Hawaiian or Pacific Islander | <input type="checkbox"/> Other |
| <input type="checkbox"/> Asian | <input type="checkbox"/> Hispanic or Latino/Latina | <input type="checkbox"/> Do not wish to answer |
| <input type="checkbox"/> Black or African American | <input type="checkbox"/> White | |
13. Which category best describes your total household income in U.S. dollars during 2016 before taxes?
(select one)
- | | | |
|-----------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> Less than \$24,999 | <input type="checkbox"/> \$50,000 to \$74,999 | <input type="checkbox"/> \$150,000 to \$199,999 |
| <input type="checkbox"/> \$25,000 to \$34,999 | <input type="checkbox"/> \$75,000 to \$99,999 | <input type="checkbox"/> \$200,000 or more |
| <input type="checkbox"/> \$35,000 to \$49,999 | <input type="checkbox"/> \$100,000 to \$149,999 | <input type="checkbox"/> Do not wish to answer |

Thank you for your help with this survey!
Please return it to the person who gave it to you.

If you have any question or concern, please contact:
Dr. Ryan Sharp – ryansharp@ksu.edu
Dr. Matt Brownlee – brownle@clemson.edu

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:

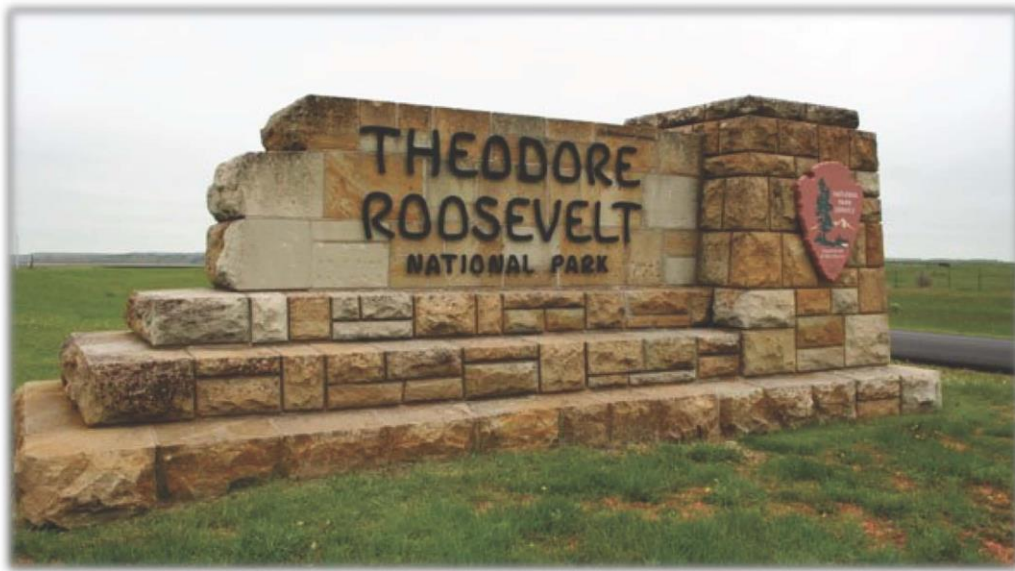
16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary and anonymous. Your name will never be associated with your answers, and all contact information will be destroyed when the data collection is concluded. No action may be taken against you for refusing to supply the information requested. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

BURDEN ESTIMATE STATEMENT: Public reporting burden for this form is estimated to average 10 minutes per response. Direct comments regarding the burden estimate or any other aspect of this form to:

Appendix D: Technology Questionnaire

OMB Number: xxxx-xxxx
Expiration Date: xx/xx/xxxx

Theodore Roosevelt National Park Visitor Survey Technology Questionnaire 2018



To be completed by field staff:

ID _____ Travel party ID _____ Tracker number _____ Date _____
Location _____ Field staff _____

PAPERWORK REDUCTION and PRIVACY ACT STATEMENT: The Paperwork Reduction Act requires us to tell you why we are collecting this information, how we will use it, and whether or not you have to respond. We are authorized by the National Park Service Protection Interpretation and research in System (54 USC §100702) to collect this information. The information collected for this survey will assist park managers in understanding how you engage with technology while at Theodore Roosevelt National Park. Your responses to this collection are completely voluntary and will remain anonymous. You can end the process at any time and will not be penalized in any way for choosing to do so. All contact information collected for the purpose of the follow-up survey will be destroyed at the end of the collection period and no personal identifiable records will be maintained or stored for any purposes. Data collected will only be reported in aggregates and no individually identifiable responses will be reported. A Federal agency may not conduct or sponsor, and you are not required to respond to, a collection of information unless it displays a currently valid OMB Control Number (1024-0224). We estimate that it will take about 10 minutes to complete and return this on-site questionnaire. You may send comments concerning the burden estimates or any aspect of this information collection to: Dr. Ryan Sharp, Assistant Professor, Park Management and Tourism, 221 Throckmorton, Manhattan, KS 66506, Kansas State University (address) or ryansharp@ksu.edu (email); or Phadrea Ponds NPS Information Collection Coordinator at pponds@nps.gov (email).

SECTION 1: YOUR VISITS TO THEODORE ROOSEVELT NATIONAL PARK

1. Please tell us about your past visitation to Theodore Roosevelt National Park.
 - a. Including today, how many **days in the last month** (30 days) have you visited Theodore Roosevelt National Park? _____
 - If you visited Theodore Roosevelt National Park for only one day, how many hours did you spend in the park? _____ hours
 - b. Including today, how many **days in the last year** (12 months) have you visited Theodore Roosevelt National Park? _____
 - c. Including today, how many **years (total)** have you visited Theodore Roosevelt National Park? _____

SECTION 2: TECHNOLOGY AT THE PARK

2. Please tell us how much you agree or disagree with the following statements about mobile devices.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Mobile devices enhance my personal life	-2	-1	0	1	2
Mobile devices help me connect with friends and family	-2	-1	0	1	2
Mobile devices enhance my work life	-2	-1	0	1	2
Mobile devices enable me to stay connected to work wherever I am	-2	-1	0	1	2
Staying connected to work allows me more time away from the office	-2	-1	0	1	2
Mobile devices enhance my outdoor experiences	-2	-1	0	1	2
I use mobile devices to search for information about my outdoor experiences	-2	-1	0	1	2
I like being constantly connected	-2	-1	0	1	2
Being constantly connected decreases my enjoyment of outdoor experiences	-2	-1	0	1	2
Mobile devices distract me from immersing myself in an outdoor experience	-2	-1	0	1	2

3. Please tell us how mobile devices influenced your experiences at Theodore Roosevelt National Park (NP).

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Mobile devices improved my experiences at Theodore Roosevelt NP	-2	-1	0	1	2
Using Mobile devices will help me share my experiences at Theodore Roosevelt NP with my family and friends	-2	-1	0	1	2
I was able to spend more time at Theodore Roosevelt NP today because I was able to be connected to work during my visit	-2	-1	0	1	2

Mobile devices detract from my experiences at Theodore Roosevelt NP	-2	-1	0	1	2
I was distracted because I felt connected to work	-2	-1	0	1	2
Mobile devices distracted me from immersing myself in my experiences at Theodore Roosevelt	-2	-1	0	1	2
Mobile devices prevented me from feeling disconnected	-2	-1	0	1	2
Mobile devices prevented me from connecting to nature	-2	-1	0	1	2
It is annoying seeing people using their mobile devices at Theodore Roosevelt NP	-2	-1	0	1	2

4. Please tell us about your preferences for WiFi access at Theodore Roosevelt NP.

How important to you is it that there is:	Extremely Unimportant	Unimportant	Neutral	Important	Extremely Important
WiFi in all buildings	-2	-1	0	1	2
WiFi in all campgrounds	-2	-1	0	1	2
WiFi park-wide	-2	-1	0	1	2
Cell service park-wide	-2	-1	0	1	2
Cell service park-wide in all national parks	-2	-1	0	1	2

5. Please rank the following reasons for using mobile devices in outdoor experiences in order of importance to you. Please rank the following statements from 1 = most important to 6 = least important.

- To stay connected to friends/family
- ____ To use as a camera
- Sharing important moments during my visit
- ____ To feel safe
- To get information about places I am visiting
- ____ To find local businesses/restaurants I might want to visit

6. Please tell us how much you agree or disagree with the following statements about nature and outdoor experiences.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I enjoy being outdoors, even in unpleasant weather.	-2	-1	0	1	2
My ideal vacation spot would be a remote, wilderness area.	-2	-1	0	1	2
I always think about how my actions affect the environment.	-2	-1	0	1	2
I am very aware of environmental issues.	-2	-1	0	1	2
I take notice of wildlife wherever I am.	-2	-1	0	1	2
I don't often go out in nature.	-2	-1	0	1	2
I am not separate from nature, but a part of nature.	-2	-1	0	1	2
The thought of being deep in the woods, away from civilization, is frightening.	-2	-1	0	1	2
My feelings about nature do not affect how I live my life.	-2	-1	0	1	2
My relationship to nature is an important part of who I am.	-2	-1	0	1	2

7. Did you know that several National Park sites have mobile apps that can be used on phones and tablets? ☐ YES ☐ NO
(go to Q#12)

- (a) If 'yes', have you downloaded any NPS apps to your mobile device(s)?
☐ YES (phone) ☐ YES (tablet) ☐ NO (go to Q#12)

If 'yes', which app(s) did you download?

- (b) If 'Yes': Did you use the mobile app before going to the park?
☐ YES ☐ NO (go to Q#12)

If 'Yes', How often ☐ 1 time a day ☐ 1 time a week ☐ 1time a month ☐ only once

- (c) If 'Yes', did you use the mobile app while at the park?
☐ YES ☐ NO (go to Q#12)

If 'Yes', How often ☐ more than 1 time an hour ☐ 1 time an hour ☐ 1 time per 2 hours ☐ only once

- (d) Do you plan to use the mobile app after your visit to the park?
☐ YES ☐ NO

8. Which of the following social media sites do you use the most often (select only one)?

☐ I do not use social media ☐ Facebook ☐ Twitter ☐ Instagram ☐ Snapchat ☐ Other _____

For the social media site you selected above as using the most, how often do you use it?

More than ☐ 1x/day ☐ 1 time a week ☐ 1time a month ☐ only once

9. Did you use any social media sites while at the park today?

☐ YES ☐ NO (go to Q 16)

- (a) If 'Yes' which social media sites did you use while at the park today?

☐ Facebook ☐ Twitter ☐ Instagram ☐ Snapchat ☐ Other _____

- (b) How often?

☐ more than 1 time per hour ☐ 1 time per hour ☐ 1time per 2 hours ☐ only once

10. Did you use other social media/websites to find information about Theodore Roosevelt NP?

☐ YES ☐ NO (go to Q 17)

- (a) If 'Yes' Did you use any before coming to the park today?

☐ YES ☐ NO

- (b) If 'Yes' which did you use?

☐ Facebook ☐ Twitter ☐ Instagram ☐ Snapchat ☐ Other _____

- (c) How often did you use it before coming to the park today?

☐ 1_time a day ☐ 1_time a week ☐ 1 time a month ☐ only once

11. Please circle only one

I prefer to use: mobile apps websites I do not use either

12. Will you continue to visit Theodore Roosevelt NP related websites when you return home? ☐ YES ☐ NO

Why or why not:

SECTION 3: ABOUT YOU

1. What is your zip code? _____
2. What year were you born? _____
3. What is your gender? (*select one*) ☐ Male ☐ Female ☐ Do not wish to answer
4. What is the highest level of school you have completed? (*select one*)

<input type="checkbox"/> Less than high school	<input type="checkbox"/> Some college	<input type="checkbox"/> Graduate or professional degree
<input type="checkbox"/> Some high school	<input type="checkbox"/> Two-year college graduate	<input type="checkbox"/> Do not wish to answer
<input type="checkbox"/> High school graduate	<input type="checkbox"/> Four-year college graduate	
5. For you only, are you Hispanic or Latino? ☐ YES ☐ NO
6. What is your race? (*select all that apply*)

<input type="checkbox"/> American Indian or Alaska Native	<input type="checkbox"/> Hawaiian or Pacific Islander	<input type="checkbox"/> Asian
<input type="checkbox"/> Black or African American	<input type="checkbox"/> White	<input type="checkbox"/> Do not wish to answer
7. Which category best describes your total household income in U.S. dollars during 2016 before taxes? (*select one*)

<input type="checkbox"/> Less than \$24,999	<input type="checkbox"/> \$50,000 to \$74,999	<input type="checkbox"/> \$150,000 to \$199,999
<input type="checkbox"/> \$25,000 to \$34,999	<input type="checkbox"/> \$75,000 to \$99,999	<input type="checkbox"/> \$200,000 or more
<input type="checkbox"/> \$35,000 to \$49,999	<input type="checkbox"/> \$100,000 to \$149,999	<input type="checkbox"/> Do not wish to answer

Thank you for your help with this survey!
Please return it to the person who gave it to you.

If you have any question or concern, please contact:
Dr. Ryan Sharp – ryansharp@ksu.edu
Dr. Matt Brownlee – brownle@clemson.edu

Appendix E: Thresholds Questionnaire

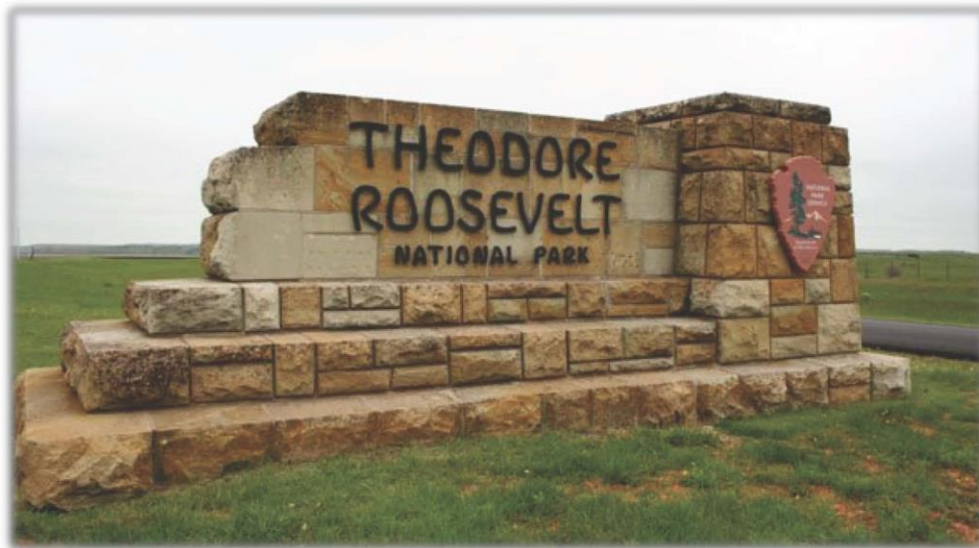
OMB Number: XXXX-XXXX

Expiration Date: X/XX/20XX

Theodore Roosevelt National Park

Visitor Survey

Thresholds Questionnaire
2018



To be completed by field staff:

ID _____ Travel party ID _____ Tracker number _____ Date _____

Location _____ Field staff _____

PAPERWORK REDUCTION and PRIVACY ACT STATEMENT: The Paperwork Reduction Act requires us to tell you why we are collecting this information, how we will use it, and whether or not you have to respond. We are authorized by the National Park Service Protection Interpretation and research in System (54 USC §100702) to collect this information. The information collected for this survey builds upon previous work conducted at Theodore Roosevelt National Park that identified visitors indicators of quality. The data collected in this study will assist managers in understanding visitors thresholds for crowded conditions at specific location within the park. Your responses to this collection are completely voluntary and will remain anonymous. You can end the process at any time and will not be penalized in any way for choosing to do so. All contact information collected for the purpose of the follow-up survey will be destroyed at the end of the collection period and no personal identifiable records will be maintained or stored for any purposes. Data collected will only be reported in aggregates and no individually identifiable responses will be reported. A Federal agency may not conduct or sponsor, and you are not required to respond to, a collection of information unless it displays a currently valid OMB Control Number (1024-0224). We estimate that it will take about 15 minutes to complete and return this on-site questionnaire. You may send comments concerning the burden estimates or any aspect of this information collection to: Dr. Ryan Sharp, Assistant Professor, Park Management and Tourism, 221 Throckmorton, Manhattan, KS 66506, Kansas State University (address) or ryansharp@ksu.edu (email); or Phadrea Ponds NPS Information Collection Coordinator at pponds@nps.gov (email).

SECTION 1: YOUR VISITS TO THEODORE ROOSEVELT NATIONAL PARK

1. Please tell us about your past visitation to Theodore Roosevelt National Park.
 - a. Including today, how many **days in the last month** (30 days) have you visited Theodore Roosevelt National Park? _____
 - a. If you visited Theodore Roosevelt National Park for only one day, how many hours did you spend in the park? _____ hours
 - b. Including today, how many **days in the last year** (12 months) have you visited Theodore Roosevelt National Park? _____
 - c. Including today, how many **years (total)** have you visited Theodore Roosevelt National Park?

SECTION 2: YOUR OPINIONS ABOUT THEODORE ROOSEVELT NATIONAL PARK

2. Using the scale below, please rate the level of crowding you experienced at Theodore Roosevelt National Park today. Please circle the number that best matches your response:

Not Crowded Barely Crowded Slightly Crowded Moderately Crowded Crowded Very Crowded Extremely Crowded
 -3 -2 -1 0 1 2 3

3. Please indicate if you have experienced any of the following during this visit or a previous visit to Theodore Roosevelt National Park.

	Experienced during a <u>previous</u> <u>visit</u> to the park	Experienced <u>during current</u> visit to the park
Chose not to visit <u>the park</u> because there were too many visitors	<input type="checkbox"/>	
Chose not to visit your desired <u>places in the park</u> because there were too many visitors	<input type="checkbox"/>	<input type="checkbox"/>
Chose not to engage in your <u>desired activities</u> because there were too many visitors	<input type="checkbox"/>	<input type="checkbox"/>
Changed the <u>times or days</u> that you visited the park because there were too many visitors	<input type="checkbox"/>	<input type="checkbox"/>

SECTION 3: YOUR EXPERIENCE AT THEODORE ROOSEVELT NATIONAL PARK

4. Please rate each photograph in Binder 1 by indicating how acceptable you think it is based on the conditions displayed. A rating of -4 means the conditions displayed are “very unacceptable”, and a rating of +4 means the conditions displayed are “very acceptable”. (Circle one number for each photograph.)

	Very Unacceptable	Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither acceptable or unacceptable	Slightly Acceptable	Moderately Acceptable	Acceptable	Very Acceptable
Photo 1	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 2	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 3	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 4	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 5	-4	-3	-2	-1	0	+1	+2	+3	+4

- a. Which photograph looks most like the conditions you experienced today during this visit?

Photo number: _____

- b. Considering the conditions in Binder 1 that you indicated you experienced today, please rate the degree that those conditions either increased or decreased the quality of your park experience.

	Extremely decreased the quality of my experience	Decreased the quality of my experience	Did not improve or detract from the quality of my experience	Increased the quality of my experience	Extremely increased the quality of my experience
The conditions in Binder 1 that I experienced today	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- c. Which photo (if any) displays the conditions where you believe park managers should take action to improve the conditions displayed in Binder 1?

Photo number: _____ OR ☐ None of the conditions in the photographs are so unacceptable that park managers should take action to improve the conditions displayed in Binder 1

- d. Which photograph (if any) displays the conditions that are so unacceptable that you would no longer use the area displayed in Binder 1?

Photo number: _____ OR ☐ None of the conditions in the photographs are so unacceptable that I would no longer use the area in Binder 1

- a. Which photograph (if any) in Binder 1 shows the highest level of use you believe that park managers should allow? In other words, at what point should visitor use be limited? (If use should not be limited at any point represented by the photographs, or not restricted at all, you may indicate that)

Photo number: _____ OR ☐ None of the conditions in the photographs are so unacceptable that visitor use should be limited

OR ☐ Visitor use should never be limited

5. Please rate each photograph on **Binder 2** by indicating how acceptable you think it is based on the conditions displayed. A rating of -4 means the conditions displayed are “very unacceptable”, and a rating of +4 means the conditions displayed are “very acceptable”. (Circle one number for each photograph.)

	Very Unacceptable	Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither acceptable or unacceptable	Slightly Acceptable	Moderately Acceptable	Acceptable	Very Acceptable
Photo 1	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 2	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 3	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 4	-4	-3	-2	-1	0	+1	+2	+3	+4
Photo 5	-4	-3	-2	-1	0	+1	+2	+3	+4

- e. Which photograph looks most like the conditions you experienced today during this visit?

Photo number: _____

- f. Considering the conditions in Binder 2 that you indicated you experienced today, please rate the degree that those conditions either increased or decreased the quality of your park experience.

	Extremely decreased the quality of my experience	Decreased the quality of my experience	Did not improve or detract from the quality of my experience	Increased the quality of my experience	Extremely increased the quality of my experience
The conditions in Binder 2 that I experienced today	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- g. Which photo (if any) displays the conditions where you believe park managers should take action to improve the conditions displayed in Binder 2?

Photo number: _____ OR ☐ None of the conditions in the photographs are so unacceptable that park managers should take action to improve the area in Binder 2

- h. Which photograph (if any) displays the conditions that are so unacceptable that you would no longer use the area in Binder 2?

Photo number: _____ OR ☐ None of the conditions in the photographs are so unacceptable that I would no longer use the area in Binder 2

- b. Which photograph (if any) in Binder 2 shows the highest level of use that you believe park managers should allow? In other words, at what point should visitor use be limited? (If use should not be limited at any point represented by the photographs, or not restricted at all, you may indicate that)

Photo number: _____ ☐ None of the conditions in the photographs are so unacceptable that visitor use should be limited

OR ☐ Visitor use should never be limited

6. We would like to know your opinions about the number of large animals that you viewed within one-hour at Theodore Roosevelt National Park during this visit. For this question, a “large animal” is considered a bison, elk, deer, sheep, etc. Using the scale below, please rate the acceptability of the number of large animals that you viewed within one-hour at Theodore Roosevelt National Park. A rating of -4 means the number of large animals viewed in one hour is “very unacceptable”, and a rating of +4 means the number of large animals viewed in one hour is “very acceptable”. (Circle one number for each photograph.)

	Very Unacceptable	Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither acceptable or unacceptable	Slightly Acceptable	Moderately Acceptable	Acceptable	Very Acceptable
0 large animals viewed within one-hour	-4	-3	-2	-1	0	+1	+2	+3	+4
2 large animals viewed within one-hour	-4	-3	-2	-1	0	+1	+2	+3	+4
4 large animals viewed within one-hour	-4	-3	-2	-1	0	+1	+2	+3	+4
6 large animals viewed within one-hour	-4	-3	-2	-1	0	+1	+2	+3	+4
8 large animals viewed within one-hour	-4	-3	-2	-1	0	+1	+2	+3	+4
10 large animals seen within one-hour	-4	-3	-2	-1	0	+1	+2	+3	+4

- a. During an average hour of your park experience, which condition listed below is most like what you experienced today?

- ☐ 0 large animals viewed within one-hour ☐ 6 large animals viewed within one-hour
☐ 2 large animals viewed within one-hour ☐ 8 large animals viewed within one-hour
☐ 4 large animals viewed within one-hour ☐ 10 large animals viewed within one-hour
☐ Other: Please specify the average number of animals seen within one-hour

- b. Considering the average number of large animals that you viewed within one-hour at Theodore Roosevelt National Park during your visit today, please rate the degree that those conditions either increased or decreased the quality of your park experience.

	Extremely decreased the quality of my experience	Decreased the quality of my experience	Did not improve or detract from the quality of my experience	Increased the quality of my experience	Extremely increased the quality of my experience
Average number of large animals seen within one-hour at Theodore Roosevelt National Park during your visit today	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- c. Which condition listed below do you believe would require park managers to take action to change the wildlife viewing experience at Theodore Roosevelt National Park?

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <input type="checkbox"/> 0 large animals viewed within one-hour | <input type="checkbox"/> 6 large animals viewed within one-hour |
| <input type="checkbox"/> 2 large animals viewed within one-hour | <input type="checkbox"/> 8 large animals viewed within one-hour |
| <input type="checkbox"/> 4 large animals viewed within one-hour | <input type="checkbox"/> 10 large animals viewed within one-hour |
| <input type="checkbox"/> None of these conditions required park managers to take action to change the wildlife viewing experience | |

- d. Which condition listed below is so unacceptable that you would no longer visit Theodore Roosevelt National Park?

- | | |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <input type="checkbox"/> 0 large animals viewed within one-hour | <input type="checkbox"/> 6 large animals viewed within one-hour |
| <input type="checkbox"/> 2 large animals viewed within one-hour | <input type="checkbox"/> 8 large animals viewed within one-hour |
| <input type="checkbox"/> 4 large animals viewed within one-hour | <input type="checkbox"/> 10 large animals viewed within one-hour |
| <input type="checkbox"/> None of these conditions are so unacceptable that I would no longer use the area | |

7. We would like to know how long you think it is acceptable to have to wait for parking at Theodore Roosevelt National Park. Please rate the acceptability of each of the following lengths of waiting times for parking. A rating of -4 means the time is “very unacceptable”, and a rating of +4 means the time is “very acceptable”. (Circle one number for each line.)

	Very Unacceptable	Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither acceptable or unacceptable	Slightly Acceptable	Moderately Acceptable	Acceptable	Very Acceptable
No waiting time for parking	-4	-3	-2	-1	0	+1	+2	+3	+4
5 minutes	-4	-3	-2	-1	0	+1	+2	+3	+4
10 minutes	-4	-3	-2	-1	0	+1	+2	+3	+4
20 minutes	-4	-3	-2	-1	0	+1	+2	+3	+4
30 minutes	-4	-3	-2	-1	0	+1	+2	+3	+4
1 hour	-4	-3	-2	-1	0	+1	+2	+3	+4
2 hours	-4	-3	-2	-1	0	+1	+2	+3	+4

- a. How long of a wait is so unacceptable that you would no longer visit Theodore Roosevelt National Park?

- ☐ 5 minutes
 ☐ 30 minutes
☐ 10 minutes
 ☐ 1 hour
☐ 20 minutes
 ☐ 2 hours
☐ None of these conditions are so unacceptable that I would no longer use the area

- b. On average, how long did you wait to find parking on this visit?

- ☐ 0 minutes
 ☐ 30 minutes
☐ 5 minutes
 ☐ 1 hour
☐ 10 minutes
 ☐ 2 hours
☐ 20 minutes

- c. Considering the average time you waited to find parking during this visit, please rate the degree that the average wait time either increased or decreased the quality of your park experience.

	Extremely decreased the quality of my experience	Decreased the quality of my experience	Did not improve or detract from the quality of my experience	Increased the quality of my experience	Extremely increased the quality of my experience
Average wait time to find parking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

d. In your opinion, what length of wait time would require management to take action?

- | | |
|---------------------------------------------------------------------------------------------------------------|-------------------------------------|
| <input type="checkbox"/> 5 minutes | <input type="checkbox"/> 30 minutes |
| <input type="checkbox"/> 10 minutes | <input type="checkbox"/> 1 hour |
| <input type="checkbox"/> 20 minutes | <input type="checkbox"/> 2 hours |
| <input type="checkbox"/> None of these conditions are so unacceptable that it would require management action | |

SECTION 4: ABOUT YOU

8. What is your zip code? _____

9. What year were you born? _____

10. What is your gender? *(select one)* ☐ Male ☐ Female ☐ Do not wish to answer

11. What is the highest level of school you have completed? *(select one)*

- | | | |
|------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------|
| <input type="checkbox"/> Less than high school | <input type="checkbox"/> Some college | <input type="checkbox"/> Graduate or professional degree |
| <input type="checkbox"/> Some high school | <input type="checkbox"/> Two-year college graduate | <input type="checkbox"/> Do not wish to answer |
| <input type="checkbox"/> High school graduate | <input type="checkbox"/> Four-year college graduate | |

12. For you only, are you Hispanic or Latino? ☐ YES ☐ NO

13. What is your race? *(select all that apply)*

- | | | |
|-----------------------------------------------------------|-------------------------------------------------------|------------------------------------------------|
| <input type="checkbox"/> American Indian or Alaska Native | <input type="checkbox"/> Hawaiian or Pacific Islander | <input type="checkbox"/> Do not wish to answer |
| <input type="checkbox"/> Black or African American | <input type="checkbox"/> White | <input type="checkbox"/> Asian |

14. Which category best describes your total household income in U.S. dollars during 2017 before taxes?
(select one)

- | | | |
|-----------------------------------------------|-------------------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> Less than \$24,999 | <input type="checkbox"/> \$50,000 to \$74,999 | <input type="checkbox"/> \$150,000 to \$199,999 |
| <input type="checkbox"/> \$25,000 to \$34,999 | <input type="checkbox"/> \$75,000 to \$99,999 | <input type="checkbox"/> \$200,000 or more |
| <input type="checkbox"/> \$35,000 to \$49,999 | <input type="checkbox"/> \$100,000 to \$149,999 | <input type="checkbox"/> Do not wish to answer |

Thank you for your help with this survey!
Please return it to the person who gave it to you.

Appendix F. Geodetic coordinate locations of THRO field equipment for 2017-2018 study

Site	Use	Latitude	Longitude
NORTH UNIT			
Oxbow	Questionnaire Intercept	47°36'12.10"N	103°26'31.56"W
Overlook	Parking Lot Camera	47°36'9.53"N	103°26'35.71"W
Riverbend Overlook	Questionnaire Intercept	47°36'35.56"N	103°22'39.39"W
	Field Camera	47°36'33.03"N	103°22'32.63"W
	Tripod for Photo Panel 1	47°36'34.18"N	103°22'40.86"W
	Tripod for Photo Panel 2	47°36'32.34"N	103°22'32.67"W
Caprock Coulee	Questionnaire Intercept	47°36'36.17"N	103°21'21.79"W
	Parking Lot Camera	47°36'30.08"N	103°21'18.90"W
	Trail Counter- Nature Trail	47°36'49.10"N	103°21'19.74"W
	Trail Counter	47°36'55.39"N	103°22'22.25"W
Longhorn Pullout	Questionnaire Intercept	47°35'28.17"N	103°17'23.64"W
Visitor Center	Exit Questionnaire Intercept	47°36'0.30"N	103°15'39.47"W
	GPS Visitor Tracking Intercept	47°35'58.23"N	103°15'35.38"W
SOUTH UNIT			
Petrified Forest	Parking Lot Camera	46°59'44.15"N	103°36'13.33"W
	Trail Counter	46°59'49.17"N	103°35'55.37"W
Wind Canyon	Parking Lot Camera	46°59'18.52"N	103°29'2.75"W
Boicourt Overlook	Field Camera 1	46°57'25.42"N	103°24'19.15"W
	Field Camera 2	46°57'27.07"N	103°24'22.70"W
	Tripod for Photo Panel	46°57'27.96"N	103°24'22.28"W
Buck Hill	Field Camera	46°55'37.80"N	103°23'25.96"W
Painted Canyon	Trail Counter	46°53'41.68"N	103°23'4.92"W
	Plateau Trail Counter	46°53'36.82"N	103°22'31.74"W
Medora	Questionnaire Exit Intercept	46°54'55.84"N	103°31'37.89"W
	GPS Visitor Intercept	46°54'55.72"N	103°31'37.73"W
Prairie dog town	Tripod for Photo Panel	46°55'51.11"N	103°30'57.28"W
ELKHORN UNIT			
Elkhorn Ranch Unit	Field Camera	47°14'33.01"N	103°37'22.88"W
	Parking Lot Camera	47°14'5.87"N	103°37'43.61"W