National Park Service
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Natural Resource Stewardship and Science

Backcountry Management Plan Indicator Reports by Management Area and Backcountry Unit in Denali National Park and Preserve, 2017 – 2018



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Rose Keller and Jessica Toubman

National Park Service
Denali National Park and Preserve
PO Box 9
Denali Park, AK 99755

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ON THE COVER
Backpackers hiking the Alaska Range
Photo: NPS/Kent Miller

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List of Terms & Acronyms

Backcountry – a part or parts of a park beyond the main developed use areas and generally not accessible to vehicular travel. Backcountry is characteristic of primitive or wilderness nature.

Backcountry (BMP) Indicators- attributes of a backcountry resource or social condition, monitored and managed for visitor experience by the Denali Backcountry Management Plan.

Backpackers – individual participants in the 2017 Denali Backcountry Visitor Experience survey. Backpackers are noted as *N* in tables and graphs.

Day hikers - individual participants in the 2018 Denali Backcountry Visitor Experience survey. Day hikers are noted as *N* in tables and graphs.

Observations – a day of recorded BMP indicators by visitors on the social science survey. Observations are noted as *n* in tables and graphs.

Two-way tests: t-test & chi-square – Statistical tests between group means and among groups. Used to identify important differences in reporting means or values between backpackers or units.

Content validity- an assessment of how well the survey questions as written agree with how visitors interpreted the questions. The content validity ratio, $CVR = \frac{\frac{ne-N}{2}}{\frac{N}{2}}$, measures the agreement of survey items to visitor interpretation. The *CVR* ranges from 0 (no agreement, low validity) to 1 (complete agreement, high validity).

BMP - Denali National Park and Preserve Backcountry Management Plan

OP1 – Old Park 1: a management area listed in the Backcountry Management Plan

A – management area listed in the Backcountry Management Plan

B- management area listed in the Backcountry Management Plan

D – management area listed in the Backcountry Management Plan

RSU – Ruth Glacier Special Use area – management area overlay in the Backcountry Management Plan

Organization of Report

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Executive Summary

Overview

The Denali Backcountry Management Plan (BMP) specifies indicators of resource conditions that contribute directly to visitor experience. This study captured the visitor experience of Denali's backcountry, while measuring the indicators established in the BMP. The plan lists five indicators of resource conditions and four indicators of social conditions. The indicators in bold were used for the development of the visitor survey, while the indicator in italics was addressed in this study using administrative (NPS staff collected) data.

The indicators of resource conditions are:

- *Trail and campsite disturbance*
- **Natural sound disturbance**
- **Evidence of modern human use**
- **Landscape modifications**
- **Litter and human waste**

The indicators of social conditions are:

- **Accessibility**
- **Encounters with people**
- **Administrative presence**
- **Camping density**

As specified in the BMP, resource and social indicators are measured by visitor survey once every five years. The first backcountry visitor experience survey conducted by Fix and Hatcher (2011); the study in 2017-2018 was the second visitor experience survey since the adoption of the BMP.

Response rate

The 2017-2018 backcountry study had a complete survey response rate of 81%, compared to a 72% response rate in the 2011 study. Total backpackers who completed a full or partial survey was 490. Total day hikers who completed a full or partial survey was 409.

After data processing, complete visitor surveys totaled 795. However, incomplete surveys that were returned by backcountry users were still used where appropriate in analyses (N=899). The sample of backcountry visitors was large enough to generate 95% confidence intervals around each statistic. A non-response test between visitors who participated in the survey vs. those who did not revealed no significant differences that would bias results (see Methods). Throughout this report, sampled visitors are represented by *N*, and total observations or frequency of events are represented as *n*.

Study Area

Management Areas

The BMP divides the backcountry into four Preserve management areas (A, B, C, D), and two "old" Park management areas (OP1, OP2), in addition to special use area overlays (e.g., Portal, Corridor, Ruth Glacier Special Use (RSU)). Each management area has different standards related to visitor experience. All but six of the backcountry units sampled were in the "Old Park 1" (OP1) management area. The sampled population of backpackers encompassed backcountry units 1-20, 23-39, 41-43, 74, 77 & 82 (Figure 1). Due to very small sample sizes in RSU & D areas, RSU was considered as part of management area A units (74 & 77) and D (unit 82) was dropped from the management area and unit reports. Other units that do not appear in unit reports due to small sample size were: 20, 23, and 27.

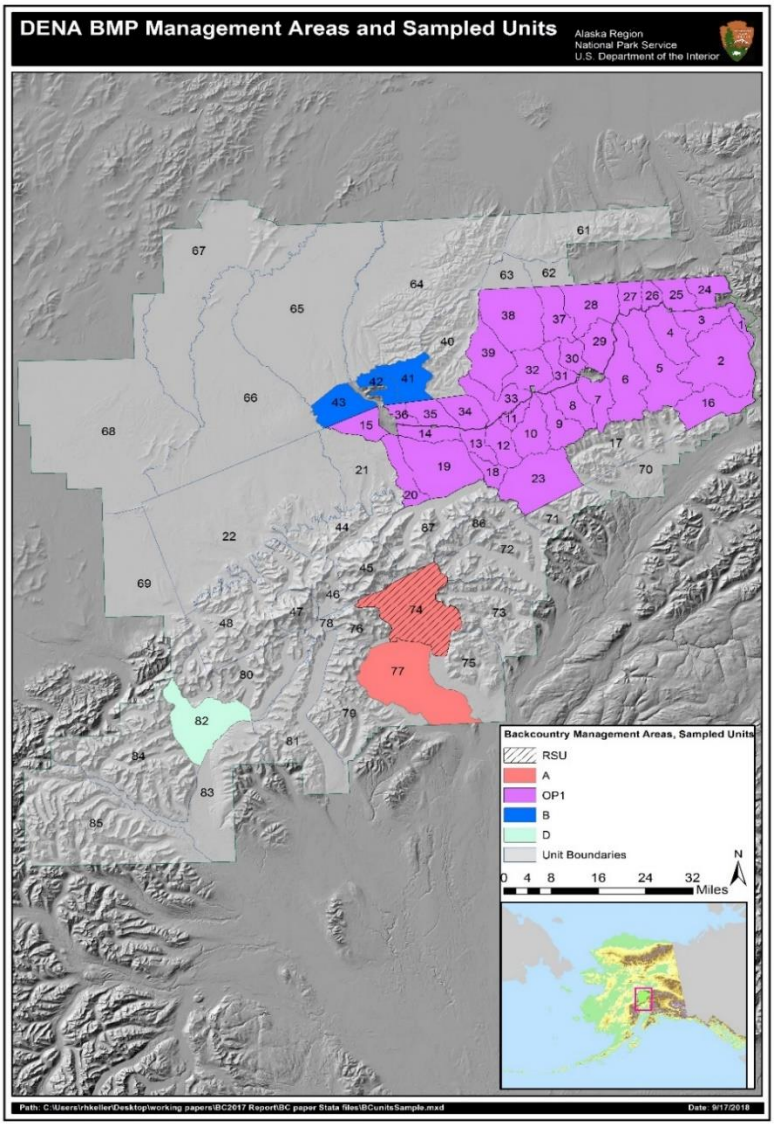


Figure 1. Map of Backcountry Management Plan Management Areas Represented in the 2017-2018 Backcountry Unit Sample.

Summary of Unit Use: 2010 – 2017

Visitors are required to get a free Backcountry Permit (BC Permits) for overnight stays in most of Denali National Park. These permits allow the group of visitors to stay in a specific backcountry unit for designated nights. During the summer season, permits are issued in person at the Backcountry Desk and the permitting process has not changed significantly in the last 20 years allowing us to compare data from year to year.

Overall, the permit numbers have been on the rise since 2010 (Figure 2) following the trend of more overall visitors to Denali during that time. The chart below shows the number of BC Permits issued to visitors during peak season (June 8 – Sept 8).

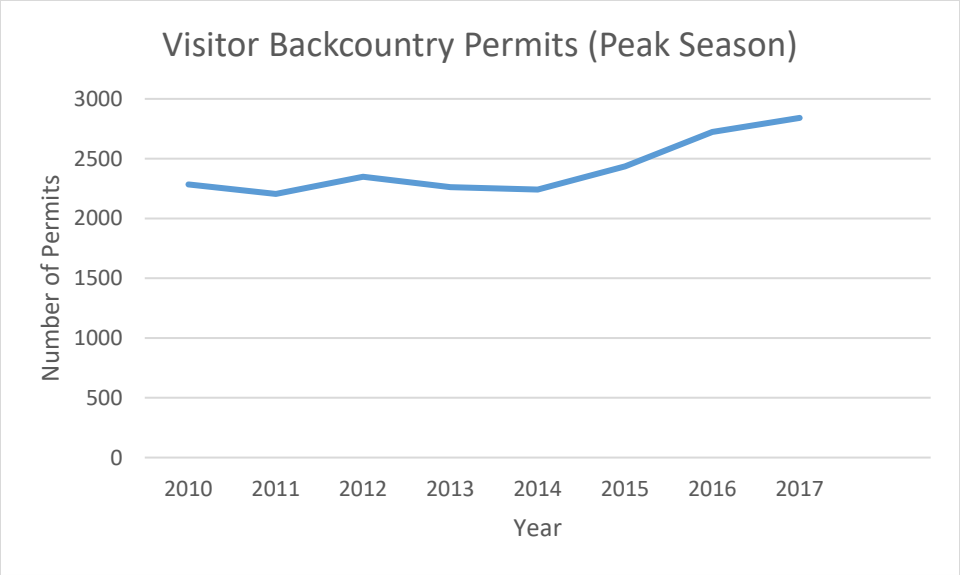


Figure 2. Number of backcountry permits issued during peak season in Denali by year.

The number of permits for each backcountry unit is not evenly distributed and some units have more use then others. The map below (Figure 3) shows the total number of permits by Backcountry Unit from 2010-2017 to demonstrate where use is concentered. Permits are not required in the Preserve or 1980 National Park Additions except in the Kantishna area (Units 40-43) so those numbers only represent those who voluntarily filled permits and are likely higher.

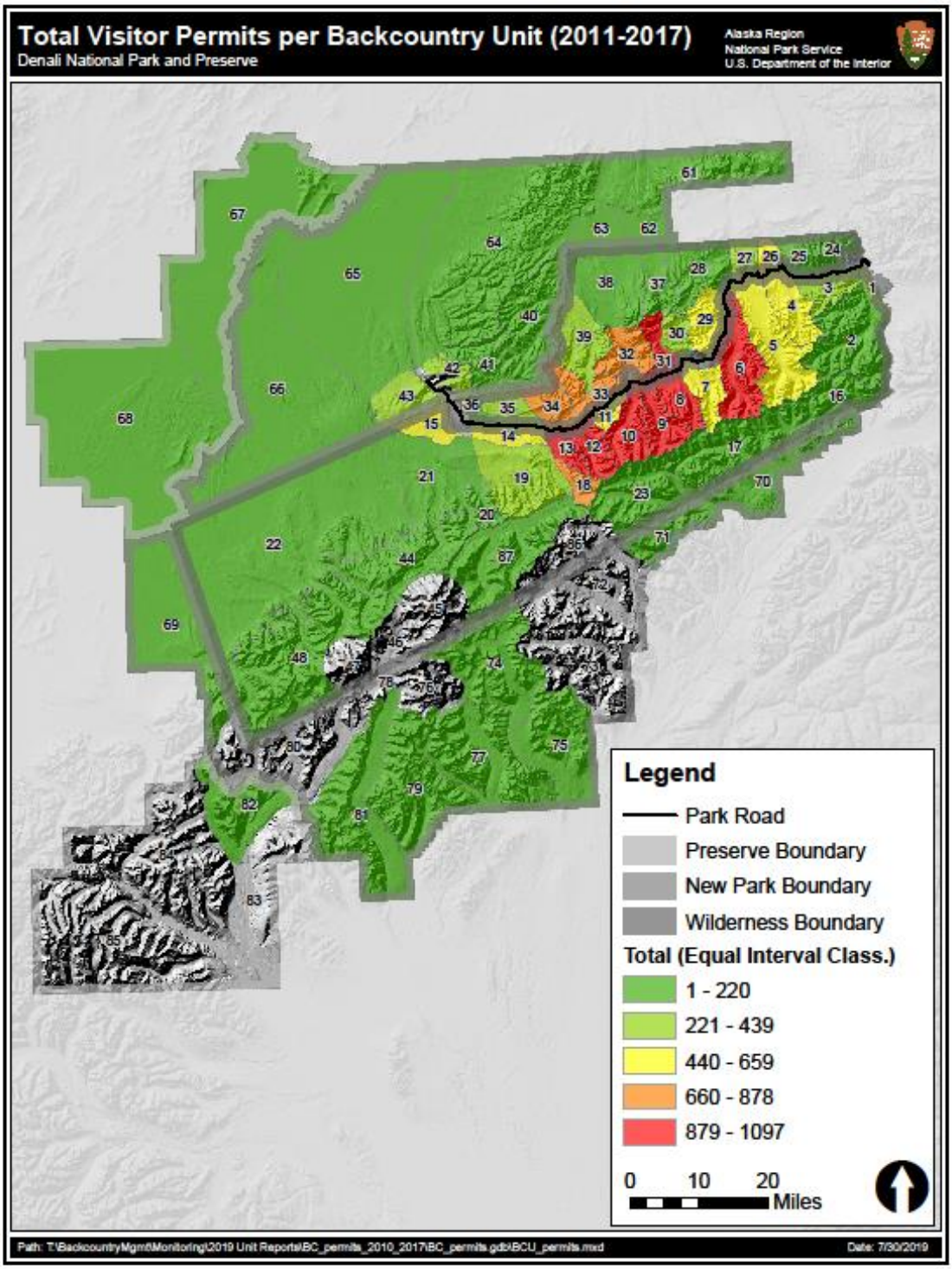


Figure 3. Backcountry permits issued by unit: 2011 - 2017

Summary of Visitor Survey Main Findings: 2017-2018

- Total survey participants (2018 -2017) N = 899
- Total Day hikers N = 409
- Total Backpackers N = 490
- Total hikers (survey participants + reported group size) N = 2,975[1]

BMP Indicators

- 89% of backcountry users reported at least one indicator exceeding standards for one or more days of their backcountry trip
- The unit with highest daily average above BMP standard observations for natural sound disturbance according to visitor survey was unit 19 (M = 14.2)
- The unit with the highest daily average above BMP standard observations for visitor encounters according to visitor survey was unit 25 (M = 5.5)
- The unit with the highest daily average of observations for group encounters according to visitor survey was unit 2 (M = 2.0)
- The unit with the highest daily average above BMP standard observations for modern equipment encounters according to visitor survey was unit 36 (M = 2.6)
- The unit with the highest daily average above BMP standard observations for landscape modifications encounters according to visitor survey was unit 16 (M = 3.6)
- The unit with the highest daily average observations for administrative presence according to visitor survey was unit 1 (M = 0.73)
- The unit with the highest daily average above BMP standard observations for litter/human waste according to visitor survey was unit 42 (M = 0.22, 22% affirmative observation)
- The indicator with the most out of standard days was natural sound disturbance:
    - 99% of recorded total days in OP1 units exceeded the BMP standard of one or fewer events per day,
    - 19% of recorded total days in B units exceeded the BMP standard of 10 or fewer events per day,
    - 5% of recorded total days in A units exceeded the BMP standard of 25 or fewer events per day.
- The indicator with the least out of standard days was administrative presence:
    - 9% of recorded total days exceeded standard of “medium” (routine patrols) in OP1 units,
    - 8% of total recorded days exceeded standard of “low” (emergency only) in B units,
    - 1% of total days exceeded standard of “medium” (routine patrols) in A units

[1] one reported group size of 32 people is not included in total

Introduction

The purpose of the 2017-2018 Backcountry Visitor Experience study was to measure backcountry resource and social indicators as well as assess visitor experience. The Denali National Park and Preserve Backcountry Management Plan (BMP), adopted in 2006, uses measurable indicators and standards under the Visitor Experience and Resource Protection (VERP) Management Framework (National Park Service, 2005). Standards are defined as the maximum allowable impacts to resources. We used four indicators of resource conditions and four indicators of social conditions to develop the visitor survey (Table 1).

Table 1. BMP Indicators and their Associated Survey Item. Participants kept track of the conditions of the landscape and soundscape during their trip and reported the number of events specific to each indicator.

Resource Indicators	**Survey Measure**
Natural sound disturbance	"Aircraft noise events, Other motorized noise events"
Evidence of modern human use	"Encounters with modern equipment"
Landscape modifications	"Evidence of human impact, landscape modifications"
Litter & human waste	"Encounters with litter/human waste"
Social Indicators	
Accessibility	Density of hikers per unit
Encounters with people	"Encounters with other Park visitors," & "Encounters with groups larger than 6"
Administrative presence	"Encounters with Rangers" & "Encounters with researchers/research teams"
Camping density	"Ability to camp out of sight and sound of others"

Study Objectives

The BMP specifies that the indicators in the plan should be measured once every five years by visitor survey. The objectives of the 2017-2018 study were:

- Survey a representative sample of backcountry visitors accessing the Denali backcountry and examine the levels of the indicators they experienced;
- Quantify results and compare the levels of indicators measured by the survey to the BMP standards;
- Determine how BMP standards impact visitor experience;
- Compare 2017-2018 findings with the previous visitor survey (Fix and Hatcher 2011).

Definitions of Indicators

Natural Sound Disturbance

Natural sound disturbance is audible anthropogenic incursions on the natural soundscape. “Audible” means perception of sound to a person of normal hearing. Maximum sound levels assume a person/measurement device is more than 50 feet from the noise source (NPS 2006). One of three metrics to measure natural sound disturbance is the number of noise events a person experiences during their trip in the backcountry.

Evidence of Modern Human Use

Evidence of human use is number of encounters with modern equipment that did not belong to the participant group and is non-portable. Modern equipment includes communication facilities, research equipment, chain saws, motorized or mechanized vehicles on the ground, and other similar devices. This definition does not include portable devices that a person could reasonably carry without assistance (e.g., cell phones, GPS units, fuel-burning stoves), subsistence equipment such as traps or firearms, or aircraft in flight (NPS 2006).

Landscape Modifications

Landscape modifications are visible mitigations for, or due to, visitor use. Landscape modifications specifically do not include historic or cultural resources (e.g. historic structures, gravesites, artifacts) or permitted modifications for subsistence (e.g. cabins or trap-line trails), (NPS 2006).
Landscape modifications key defining terms are: trails, rock cairns, trampled vegetation, former campsites, and etched or installed markers (NPS 2006).

Accessibility

Accessibility is the degree of ease or difficulty to travel to or within an area of the Park. This indicator is descriptive only. Since the status of accessibility would not change without additional action, monitoring is unnecessary (NPS 2006). However, it is possible to measure the degree of accessibility by using social science surveys as the aggregate density of human use in backcountry units, management areas, or Park.

Encounters with People

An encounter is the unaided recognition by sight or sound of another park user by a park user (NPS 2006). Encounters with people include other recreationalists, subsistence users, and groups of people.

An encounter does not include the passengers in aircraft during flight. Encounters with people is divided into two measures of encounters with other visitors in groups less than 6, and encounters with other visitors in groups larger than six. Encounters with people do not include researchers, research teams, or rangers (NPS 2006).

Administrative Presence

Administrative Presence is unaided recognition by sight or sound of NPS personnel or permitted researchers and teams (NPS 2006). This category only includes interactions with administrative and research personnel; interactions with park aircraft, research equipment, snow-machines, or other equipment are included in the standards for evidence of modern human use and natural sound disturbance (NPS 2006).

Camping Density

Camping density is the number of active campsites at a given time or location in the backcountry (NPS 2006). This category refers to the opportunity to camp out of sight or sound of other park visitors. *Sight or sound* refers to unaided recognition of another campsite from the site where a visitor camps for the night (NPS 2006).

Standards of Indicators

The BMP established standards targeted for desired visitor experience qualities. These standards were specific to each of the management areas (Table 2).

Table 2. BMP Resource and Social Indicators with their Associated Standards. Standards are specific to management areas in the backcountry. Table cells show the standard of each indicator relative to management area.

BMP Indicators	A	RSU	B	OP1	D
Resource Indicators					
Natural Sound Disturbance	"High" Motorized noise may be audible up to 25% of any hour, or 25 motorized noise intrusions per day that exceed natural ambient sound.	"Very High" Motorized noise may be audible up to 50% of any hour, or 50 motorized noise intrusions per day that exceed natural ambient sound.	"Medium" Motorized noise may be audible up to 15% of any hour, or 10 motorized noise intrusions per day that exceed natural ambient sound.	"Low" Motorized noise may be audible up to 5% of any hour, or 1 motorized noise intrusions per day that exceed natural ambient sound.	"Low" Motorized noise may be audible up to 5% of any hour, or 1 motorized noise intrusions per day that exceed natural ambient sound.
Evidence of Modern Human Use	"Medium" Visitors have at most 3 encounters with modern equipment each day of their trip.	"Medium" Visitors have at most 3 encounters with modern equipment each day of their trip.	"Low" Visitors have at most 1 encounter with modern equipment each day of their trip.	"Low" Visitors have at most 1 encounter with modern equipment each day of their trip.	"Low" Visitors have at most 1 encounter with modern equipment each day of their trip.
Landscape Modifications	"Medium" Visitors have at most 3 encounters with landscape modifications each day of their trip.	"Medium" Visitors have at most 3 encounters with landscape modifications each day of their trip.	"Low" Visitors have at most 1 encounter with landscape modifications	"Low" Visitors have at most 1 encounter with landscape modifications each day of their trip.	"Low" Visitors have at most 1 encounter with landscape modifications each day of their trip.

			each day of their trip.		
Seeing Litter/Human Waste	"Low" No more than 5% of visitors encounter human waste, toilet paper, or litter in the backcountry.	"Low" No more than 5% of visitors encounter human waste, toilet paper, or litter in the backcountry.	"Low" No more than 5% of visitors encounter human waste, toilet paper, or litter in the backcountry.	"Low" No more than 5% of visitors encounter human waste, toilet paper, or litter in the backcountry.	"Low" No more than 5% of visitors encounter human waste, toilet paper, or litter in the backcountry.
Social Indicators					
Accessibility	Descriptive: unit densities	Descriptive: unit densities	Descriptive: unit densities	Descriptive: unit densities	Descriptive: unit densities
Encounters with People	"High" Visitors commonly encounter others: 5 or fewer per day. 1 or 2 encounters could be large groups (> 6).	"High" Visitors commonly encounter others: 5 or fewer per day. 1 or 2 encounters could be large groups (> 6).	"Medium" Visitors occasionally encounter others: 2 or fewer per day. 1 encounter could be a large group (> 6).	"Medium" Visitors occasionally encounter others: 2 or fewer per day. 1 encounter could be a large group (> 6).	"Low" Visitors can expect not encounter others. Chance encounters could occur: less than 3 per week. No encounter could be a large group (> 6).
Administrative Presence	"Medium" Rangers may make routine visitor contacts. Visitors may encounter staff or permitted researchers involved in inventory and monitoring in some areas.	"Medium" Rangers may make routine visitor contacts. Visitors may encounter staff or permitted researchers involved in inventory and monitoring in some areas.	"Low" Administrative presences is generally limited to emergency activities, occasional patrols, with research in some areas.	"Medium" Rangers may make routine visitor contacts. Visitors may encounter staff or permitted researchers involved in inventory and monitoring in some areas.	"Low" Administrative presences is generally limited to emergency activities, occasional patrols, with research in some areas.
Camping Density	Visitors are always able to camp out of sight/sound of others.	Visitors are always able to camp out of sight/sound of others.	Visitors are always able to camp out of sight/sound of others.	Visitors are always able to camp out of sight/sound of others.	Visitors are always able to camp out of sight/sound of others.

Adapted from source: Denali Backcountry Management Plan, NPS 2006.

State of change in the backcountry: percent days reported BMP indicators were within standard 2011 vs. 2017-2018

Each unit report card displays the means and percent days each BMP indicator was reported to be within standard. For ease of interpretation, an arrows guide is used to show the state of change within each unit (Table 3).

Table 3. State of change in units' percent days within BMP standards. Colored arrows relate the condition and direction of change for each backcountry indicator. Arrow thresholds are defined as declining condition, deteriorating condition, or no change to condition.

decline	(-1% to -10%)	
significant decline	(-11% to -15%)	
significant deterioration	(-16% to -25%)	
severe deterioration	(-26% to -100%)	
no change	(1 to 10%)	
improvement	(11% to 100%)	

Methods

Survey Intercepts

To determine the best intercept method, a pilot study was conducted in May – September 2016. Results informed the survey design and intercept method of contacting backpackers pre-trip and day hikers post-trip. The United States Office of Management and Budget (OMB) reviewed the survey for ethical standards of human research review and approval of survey and study design. A three year OMB approval was granted in February 2017.

Sampling and Participation

Backpackers were sampled at the Backcountry Information Center (BIC). Sampling occurred from May 31 to September 14, a 106 day span[2]. Departing backpackers were systematically selected (1 in 3) in a simple random sample of days by a trained survey administrator. The survey backpackers took with them on their trip had a total of four indicator tables that they recorded observations for four days in the backcountry. Backpackers returned the surveys to a collection box at the BIC.

Day hikers were sampled across the park as they returned from their day hike. Sampling occurred from May 31 to Sept. 12, a 104 day span for each year. In 2017, day hikers were severely under-represented in the sample. In 2018, effort redoubled to ensure a statistically robust sample *size* but not a statistically systematic sample. A simple random sample of days was not used for the day hiker sample, due to the difficulty of collecting enough day hiker surveys in 2017. Volunteers (Kantishna lodge guides, Wonder Lake interpretation staff) and DENA road ecology staff helped in the survey

[2] 2018 sampling occurred at the Backcountry Information Desk in the Denali Visitor Center from June 1 – Sept. 12

effort. That means, all 104 days were sampled and every willing day hiker was given a survey to participate.

Response Rate

The 2017-2018 backcountry study had an 81% full survey response rate. After data processing, the full or partial completed surveys totaled 899. Incomplete surveys were still used where appropriate in analyses. The sample of backcountry users was well within the established power bound (90) and alpha (.05) that generates 95% confidence intervals around each test statistic (e.g. mean). A non-response test between visitors who participated in the survey vs. those that did not revealed no significant differences that would bias results.

Indicators Reported by Backpackers and Day hikers

Backcountry visitors were asked to report encounters, events, and experiences during their trip that, when aggregated, describe the state of each indicator. Visitors recorded their observations in an indicator table (up to four indicator tables for backpackers), where each indicator was defined and listed in table rows. Each indicator was measured by unique categories of number of encounters or events backpackers may have experienced during their day. A *day* for backcountry hikers was defined as the time elapsed when they entered the backcountry (hiked beyond ½ mile from the road) and 00:00 of the following day. The indicator tables also recorded hiking time, weather, and unit number(s). Every backpacker reported location, with a high degree of accuracy (following their permit). Day hikers were aided by survey volunteers to determine general location of hike. Total hike days were compiled for each unit (Figure 4).

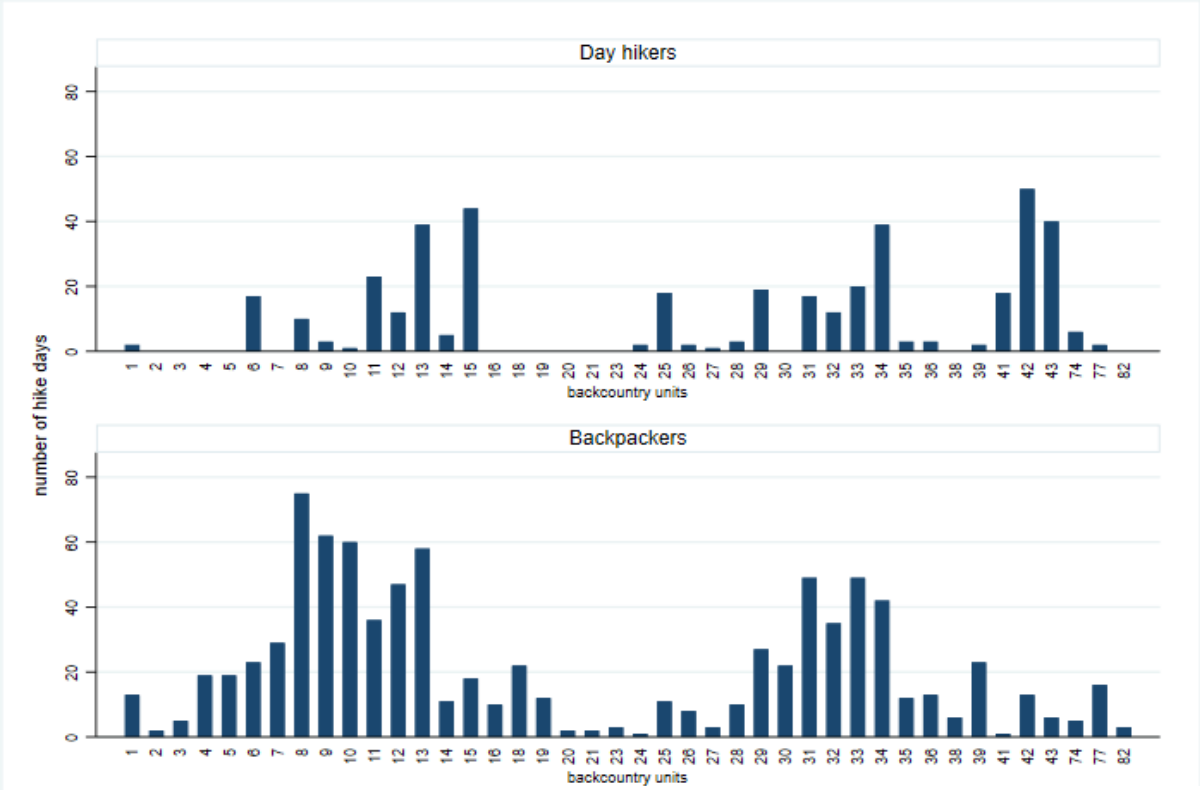


Figure 4. Total days hiked in the visitor social science survey 2017-2018 sample by unit: day hikers vs. backpackers

Data Analysis Tools

Visitor responses to survey questions described the state of each indicator for their day and unit (Table 4). Means were reported for variables with continuous data, and Analysis of Variance (ANOVA) or two-way tests (t- or chi-square) were used when comparisons were appropriate (Vaske, 2008). Proportions (percent) or frequencies were reported for variables with categorical and dichotomous data.

All analyses were based on unit $n \geq 10$, unless noted in specific unit reports. Observations (recorded indicator data) were noted as *n* in all analyses, graphics & tables. Backpackers (individual survey participants) were noted as *N* in all analyses, graphics & tables. Units with $n \geq 10$ resulted in a reliability coefficient of 1.33 (Cohen's d) when tested against the total data (Cortina 1993; Keller and Vance 2013), meaning units with an *n* of 10 or more are generalizable.

Table 4. Measurement of Variables Created from Survey Items. The visitor survey had three different ways to measure response. Continuous variables were responses provided by the visitor without prompt. Categorical were responses to categories already provided. Dichotomous variables were limited to categories of occurrence ("yes") or non-occurrence ("no"). Open variables were text responses provided by visitors without prompts.

Questions	Measurement level of variables
Solitude threshold, group size, trip length, previous visits, income, age, hike time, residency, household size, trip cost	Continuous/Open
Reported encounters, attitudes, preference, wilderness character, social media use, education, group type	Categorical
Gender, race, prior wilderness experience, level of trust in governance	Categorical
Seasonal residency, litter, camping, trail use	Dichotomous
Non-response questions: Group size, trip length, residency, trip cost	Continuous

Backpacker Non-Response

Due to the difference in sampling procedure in 2018 for day hikers, we can only calculate non-response for backpackers sampled in 2017. To determine if those who responded to the survey differed from those who did not respond the mean or proportion of the following list of variables were compared between respondents and non-respondents by the use of t-tests *(t)* or chi-square (χ^2). The only significant difference was found for residency (Table 5).
The test statistics and significance (*p)* are:

- Age ($t = 4.77$, $p = 0.15$)
- Group size ($t = 6.18$, $p = 0.21$)
- Length of trip ($t = 3.55$, $p = 0.30$)

- Trip cost (t = 8.24, p = 0.33)
- Gender (χ^2 = 1.08, p = 0.78)
- Residency (χ^2 = 9.89, p = 0.02)

Table 5. Non-Response Test for Backpackers. Respondents' age, group size, trip length, trip cost, gender, and residency were compared to non-respondents. Non-respondents differed from respondents only in residency.

	Respondents	**Non-Respondents**	***t***
Residency^			
Denali Local	3.6 %	26 %	1.56*
Alaska	15 %	34 %	2.22*
Other US	64 %	20 %	1.81*
Canada	2.4 %	0 %	.091
International	20 %	10 %	2.36*
N	*382*	*30*	

NPS Backcountry Ranger Data

Since the 1990s, NPS Backcountry Rangers have collected information on a variety of impacts and conditions in the park while on patrol, including visitor contacts, recreational litter, non-recreational litter and sanitation. Due to information being stored in different databases and some changes to collection procedures, you cannot easily compare the results over time without some effort.

For the purpose of this report, the NPS data manager used the information collected in the Backcountry Operations Database (BOD) between 2011-2017 to provide a picture of what rangers are finding on the ground in these areas as well as giving data on the amount of administrative presence in a unit (miles patrolled). For analyzing the data, only patrols that include a spatial track were used as the GIS information showed which unit the impacts were collected and the total miles patrolled in the unit each year. This means observations were dropped if they did not include a spatial track; including 106 visitor contacts, 15 counts of sanitation and 132 counts of recreation litter. The exception was in Unit 1 (Triple Lakes) where BC monitoring staff went through the written patrol reports to do a count of miles, contacts and litter/sanitation.

Results: BMP Indicators

Natural Resource and Social Indicators: Mean Levels of Indicators by Management Area and Unit

Results for the indicators are described by:

- backcountry management area
- backcountry unit

Analyses that required larger sample sizes (e.g. trip motivation of visitors and predicted solitude thresholds of visitors) are shown only in the management area reports. An overview of indicators for the entire park follows.

Comparison of 2011 and 2017-2018 Indicator Results in Brief

Generalized means for BMP indicators are shown in Table 6. The binary indicators of litter/human waste and camping density are shown as ratios. Significant differences are noted by (*).

As was found in 2011, the resource indicator of natural sound disturbance was generally out of standard for most backcountry units visited. Other resource indicators' means (large groups and administrative presence), were within standard. Overall, the mean level of natural sound disturbance exceeded the OP1 BMP standard. Taken together, natural sound disturbance (aircraft + other motorized noise) accounts for the majority of standard violation by percent of days. Encounters with people was above the standard with a mean of 2.7 (Table 6). Generalized means of evidence of modern human use (encounters with modern equipment, landscape modifications), and encounters with large groups were slightly above or at standard. The percent of visitors reporting litter and human waste is above standard (13.4% reporting positive sightings), and there were 48 unit-nights (2.4% of total sample) in which backpackers did not camp out of sight or sound of others. Administrative presence was below all management area BMP standards.

Table 6. Generalized Mean of Indicators Reported by Backcountry users: 2011 vs. 2017-2018. The BMP indicators' aggregate means are across all sampled backcountry units. The standard deviation (σ) is the standardized distance from the mean. The mode displays the most common range of events participants recorded. The CI lower and upper report the 95% confidence interval bounds.

Indicator	Year	N	Mean	Mode	Max	σ	CI lower	CI upper
Natural Sound Disturbance	**2011**	637	3.21	1-2	40	4.16	2.85	3.56
Natural Sound Disturbance	**2017-18**	899	4.79	3-5	30	3.1	3.2	5.7
Aircraft			5.73	3-5	30	4.7	3.7	6.9
Other motorized sound			2.91	1-2	15	1.8	1.2	3.5
Evidence of Modern Human Use: modern equipment	**2011**	637	1.0*	0	27	4.7	.77	2.2
Evidence of Modern Human Use: modern equipment	**2017-18**	881	1.4*	0	15	1.3	.12	1.9
Landscape Modifications	**2011**	637	1.0*	1-2	25	1.0	.89	1.1
Landscape Modifications	**2017-18**	887	1.9*	3-5	15	1.4	1.0	2.8
Encounters with People: Other park visitors	**2011**	637	1.2*	0	15	1.1	.93	1.8
Encounters with People: Other park visitors	**2017-18**	899	2.7*	1-2	17	1.8	1.4	3.2
Encounters with People: Groups > six	**2011**	637	.14*	0	2	.21	.02	.05
Encounters with People: Groups > six	**2017-18**	899	.92*	1-2	7	.75	.11	1.8
Administrative Presence	**2011**	637	.14*	0	2	.17	0	.71
Administrative Presence	**2017-18**	899	1.0*	0	5	.85	0	1.9
Binary Indicators^		**N**	**yes**					
Litter/Human waste	**2011**	637	.11	.	.	.	7.4%	12.6%
Litter/Human waste	**2017-18**	899	.13	.	.	.	7.1%	14.3%
Camp out of sight/sound	**2011**	191	.93	.	.	.	90%	97%
Camp out of sight/sound	**2017-18**	490	.96	.	.	.	92%	100%
Desired campsite			.90	.	.	.	89%	97%
Desired company			.04				0%	8.2%

*$p < 0.05$
^Imputed population used to project CIs for binary variables

Change in the Percent of Total Days within Standard: 2011 vs. 2017-18

BMP indicator observations by visitor survey were compiled for each day sampled in Denali's backcountry. A day was considered "in standard" if **all visitors** to backcountry units did not report any events above the standard specific to each BMP indicator. The ratio of total "in standard days" to total sample days in 2017-18 was calculated, graphed and compared with 2011(Figure 5).

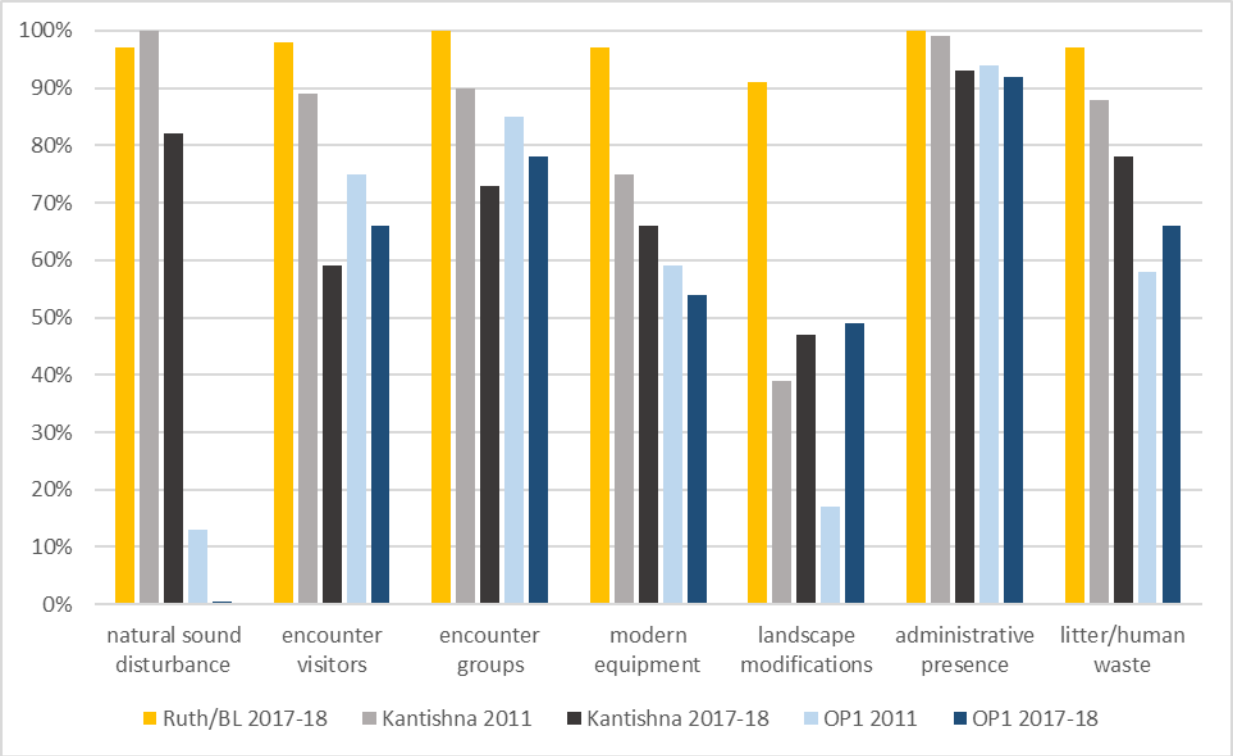


Figure 5. Percent of total days BMP indicators were within standard. Graph compares the percent of days all visitors in all management areas did not report events exceeding BMP standards; 2011 vs. 2017-18. Note there are no observations from 2011 for Ruth/BL. Only 1% of days for all visitors in Old Park1 (OP1) natural sound disturbance was <= 1 events per day; the BMP standard for OP1.

Comparison of BMP Indicators by Management Area: Ruth/Backside Lake (A), Kantishna (B), and Old Park (OP1)

BMP indicator observations by visitor survey were compiled for each sampled management area in Denali's backcountry. The distributions vary widely for encounters with visitors, groups, modern equipment and landscape modifications among OP1, Kantishna, and Ruth/Backside Lake. Natural

sound disturbance and administrative presence have similar distributions across all management areas (Figure 6).

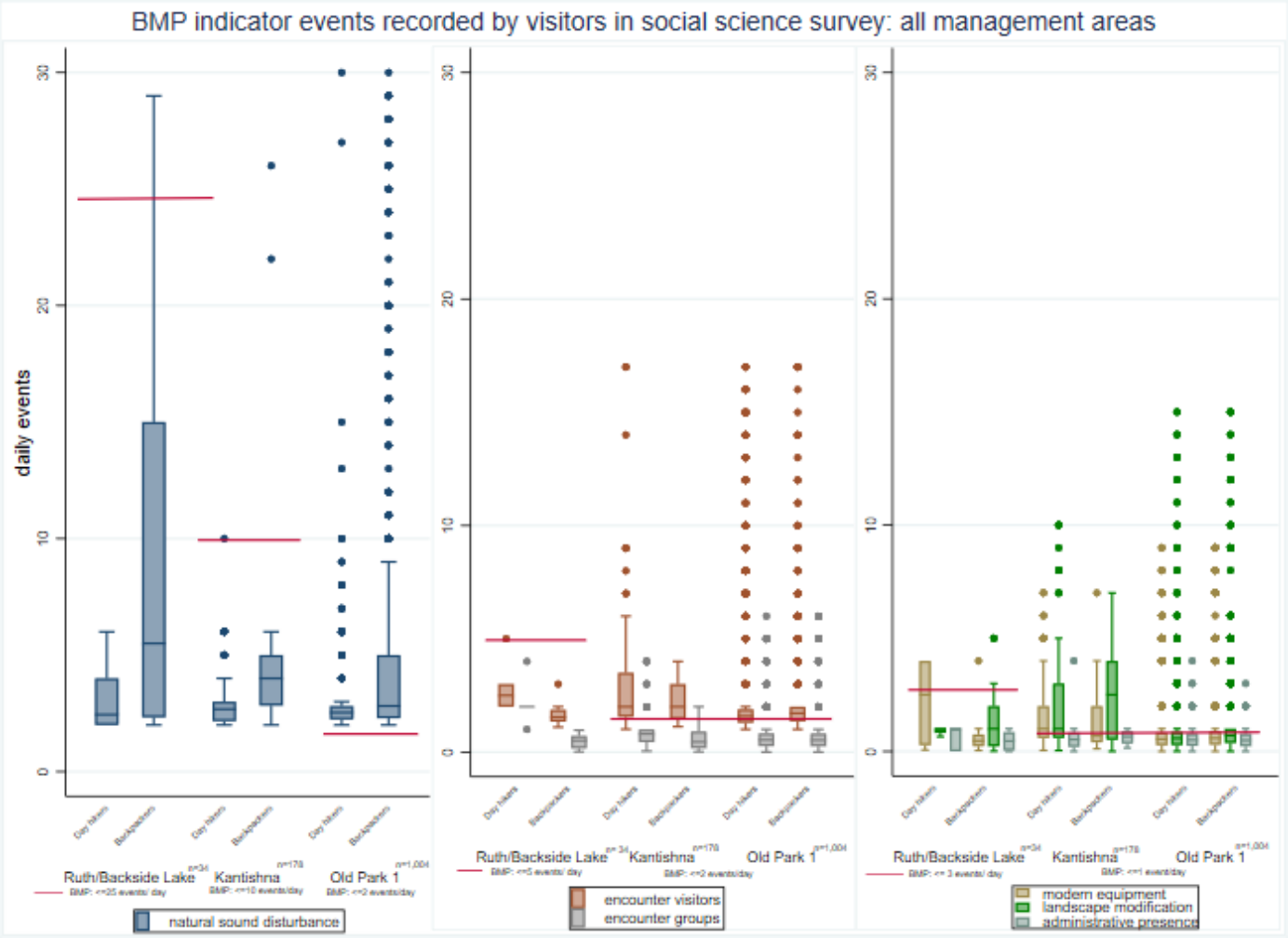


Figure 6. Backcountry Management Plan indicators recorded by visitors in a social science survey. Comparison of BMP indicators by management area. Distributions are similar in indicators across units apart from natural sound disturbance. OP1 visitors recorded more outlier events compared to other management areas.

Comparison of Trails Preference of Visitors by Management Area: Old Park (OP1), Kantishna (B), and Ruth/Backside Lake (A)

Visitors answered questions regarding their trail use and preferences in the social science survey. Visitor use of informal trails and their preferences regarding trail-less experience vs. expansion of maintained trail systems were compared between management areas (Figure 7).



Figure 7. Visitors reported trail preferences and hours spent on informal trails (day hikers vs. backpackers).

Backcountry Visitor Demographics

Visitors reported their age, residency, income and other demographic characteristics in the survey. Visitor demographics (Table 7) include all management areas in the study. Backpackers and day hikers differed in some characteristics such as dominant age group, income, and residence.

Table 7. Standard Demographics, Backpackers vs. Day hikers 2017-2018

Age Group of Respondents (yrs)	**Backpackers**	**Day hikers**
Under 25	18%	10%
26-35	56%	29%
36-45	12%	11%
46-55	4%	10%
56-65	6.5%	21%
Over 65	4%	19%
Gender	**Backpackers**	**Day hikers**
Female	47%	56%
Male	53%	42%
Other	>1%	1.3%
Race[ł]	**Backpackers**	**Day hikers**
White	89%	89%
Black or African American	<1%	<1%
Asian	5%	6.5%
Alaska Native	2%	1.3%
Pacific Islander	<1%	0%
Other	3%	3%
Hispanic	5%	4%
Income	**Backpackers**	**Day hikers**
av. household income	$64,575	$100,778
Residency	**Backpackers**	**Day hikers**
Denali Local*	2%	3.2%
Alaskan	13%	8.5%
Other U.S.	61%	80%
International	24%	9.5%
Denali Seasonal^	14%	16%
N	490	409

ł more than once race selection possible *Denali Borough year round resident ^ separate question from residency

Visitor Comments Written on Survey

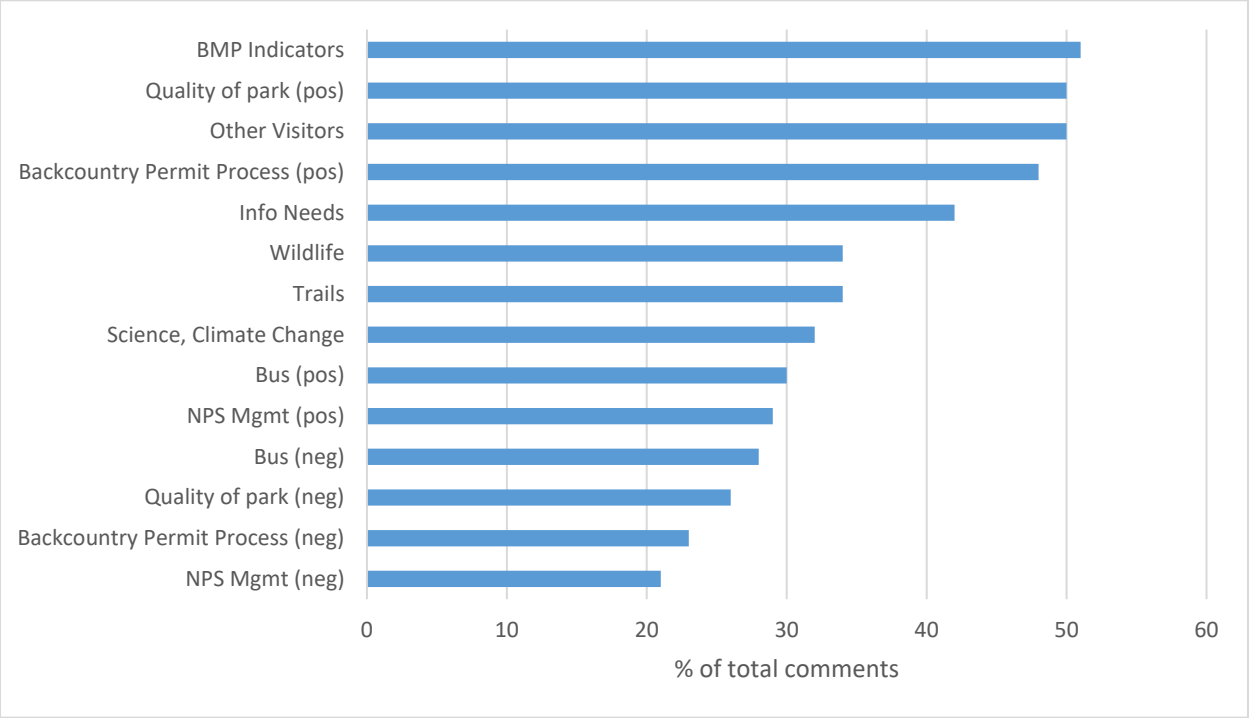


Figure 8. Distribution of main themes: comments written on survey. Comments written by backpackers on the survey were transcribed, coded, and compiled to identify main themes and distribution therein. Comments do not sum to 100%.

Visitor comments were compiled from multiple sources: interviews, emails from backcountry visitors, drawings and written comments on the survey. Transcribed interviews told us how visitors perceived survey questions (Dillman et al., 2009), and provided the information needed to assess the content validity of the survey (CVR = .74, high content validity). Emails that pertained to the survey are included in the written comments analysis. Comments were compiled by phrase and analyzed to find themes relevant to the BMP. 14 distinct themes were uncovered using this approach. Comment components were then compiled by theme and percent of total comments calculated. The majority of written comments related to the BIC, the quality of park, other visitors, bus, BMP indicators (e.g. natural sound disturbance) and trails comments (Figure 8). Of the total BMP indicator comments, 38% were about aircraft noise.

Satisfaction with Backcountry Information Center & Unit Choice

Backpackers were given an option in the survey to comment specifically on the BIC and permit system. Of the backpackers who left comments about the BIC (N = 68) the major theme was to create a future reservation system. 25% of these comments referred to an online reservation system, while 8% referred to a way to call ahead (48hr) or receive email updates if your unit choice opens up. 14% referred to the need for in-person reservation to keep a first-come first-serve model, while another 14% added that only popular units should have a reservation system or waiting list. 10% suggested a reorganization of units into “beginner” and “advanced” to filter technical challenges and improve the

quality of backcountry experience for novice backpackers. 9% commented they wanted additional time with the backcountry rangers at the BIC. 29% of backpackers did *not* get their first choice unit.

Discussion

The Denali Backcountry Management Plan (BMP) resource and social indicators were measured by a social science survey for backcountry visitors in the summer seasons of 2017-2018. The study compared levels reported by backpackers to the standards of each indicator as established in the BMP. Whether a BMP standard was violated depends on the scale (single backpacker trip vs. unit vs. management area) and resolution of the data (aggregate events by day vs. aggregate hours of event), just as much as the applied comparison (mean vs. frequency). The reported visitor experience of each BMP indicator provided important context for BMP standard violation. Every indicator in the study was tested against an array of other factors, including: actual and perceived weather, distance from road, time spent reporting, importance of wilderness characteristics, and perceptions of quality.

Backpackers were asked to rate how BMP indicators that were over BMP standards would affect their experience. Indicators that were over standard were primarily reported as having a negative impact on visitor experience with the exception of administrative presence. Previous visits to the park were negatively correlated (Pearson's $r = .35$) with ratings of visitor experience given high BMP indicator events: backpackers or day hikers who visited the park more than once was associated with more negative ratings of BMP standard violation on their backcountry experience.

Backcountry indicators are not the only aspect of visitor experience managers have available to them in order to assess the quality of visitor experience. Wilderness character is a central aspect of visitor experience. While the ability to experience unconfined recreation in the wilderness was important for 67% of backcountry visitors, 92% stated the experience of being in pristine nature is highly important for wilderness experience.

The data from the survey revealed a solitude threshold for backpackers. On average, backcountry visitors could tolerate 8 visitors a day before negatively impacting their experience of solitude in the backcountry. The range (right-skewed) was 0 – 250[3]. This threshold may be used for capacity planning.

Future work is needed to estimate the actual number of day hikers in the backcountry during the summer season. While this survey collected surveys from 409 day hikers, the majority of surveys were collected by convenience in Kantishna and around the Eileson visitor center. The collected data provides valuable and reliable comparisons between backpackers and day hikers' recorded BMP

[3] 6 outliers of 400 visitors per day was removed from analysis. Distribution had a 12.12 standard deviation. Day hikers' mean was 16, whereas backpackers' mean was 4 (excluding outliers).

indicator distributions, but the differences found between perceptions of visitor experience and demographic differences may be data artefact.

Future work could examine the economic indicators of change- trip cost, relative cost per household, household size, income, and consumptive/use values of wilderness. These indicators are common to surveys and easily duplicated. For example, in 2017-2018 we found a distinct difference in backpackers and day hikers average trip cost ($2,515 vs. $6,331 respectively) and average household income ($64,575 vs. $100,778 respectively). Managers could conclude that day hikers are better situated to take advantage of commercial opportunities in the park, compared to backpackers.

Additional future analysis is needed in the perceptions of backpackers and day hikers. Surveys that that collect visitors' perceptions of quality in key wilderness characteristics over time could help the park track how visitor experience is impacted by landscape, climate, or policy changes.

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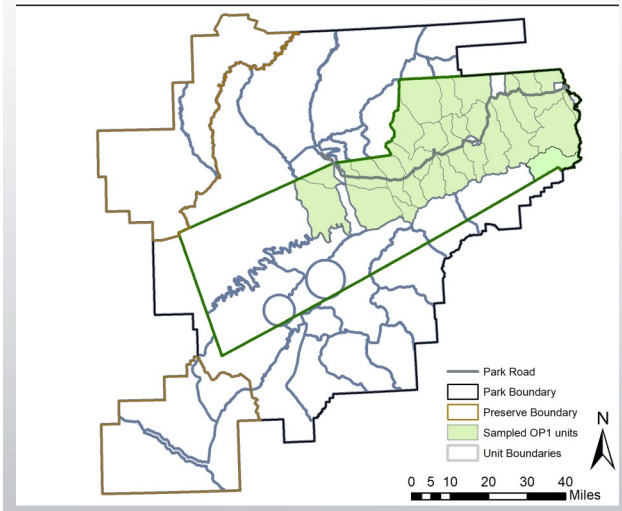
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Backcountry Visitor Experience
Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Visitor Survey Data(2017-2018):
Number of Units surveyed: 35 of 42 total OP1 units
Number of survey participants:
Backpackers (N =434)
Day hikers (N =287)
Pooled total (N =721)
Total recorded days (observations) in unit (n = 1,004)
Percent of visitors self-reported on guided hike: 18%

Wilderness Experience:

Visitors reported what they perceived are the most important aspects of a true wilderness experience. From a choice-set of 13 aspects, the top three things that were most important for a wilderness experience by percent of visitors were:

92% ability to connect with nature

93% pristine nature

80% experience solitude

BMP Indicator events and standards:

Visitors recorded natural sound disturbance events, encounters with people, and evidence of modern human use during the day(s) they hiked in the backcountry. These indicators are used to examine the quality of visitor experience in Denali's backcountry. We aggregated these data and calculated each indicator mean. We compared 2018 means to similar data collected in 2011 (Table 1). For example, the pooled mean for landscape modification encounters is above the standard of ≤ 1 per day, (M = 1.70) and 71% of total days visitors recorded more than one landscape modification seen per day (Figure 1), a 9% decrease in compliance compared with the 2011 average days in standard.

Table 1. Mean BMP indicators and standards, recorded by visitors in social science

Indicator	Mean daily events (2011) n = 932	Mean daily events (2018) n = 1,004	Percent change days in standard: 2011 - 2018
Natural sound disturbance	3.21	5.0	-21% in standard
Encounter visitors	4.0	3.1	+4% in standard
Encounter groups	0.64	0.81	-13% in standard
Modern equipment	1.51	1.22	+4% in standard
Landscape modification	1.45	1.70	-9% in standard
Admin. presence	0.32	0.54	-2% in standard
Litter	0.12 (12% yes)	0.13 (13% yes)	-8% in standard

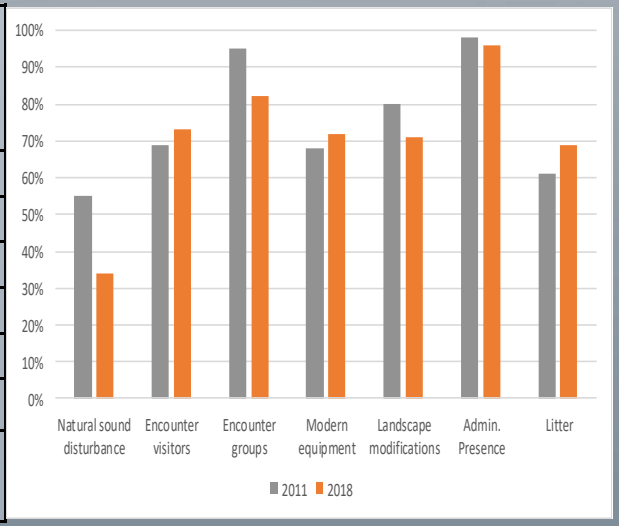
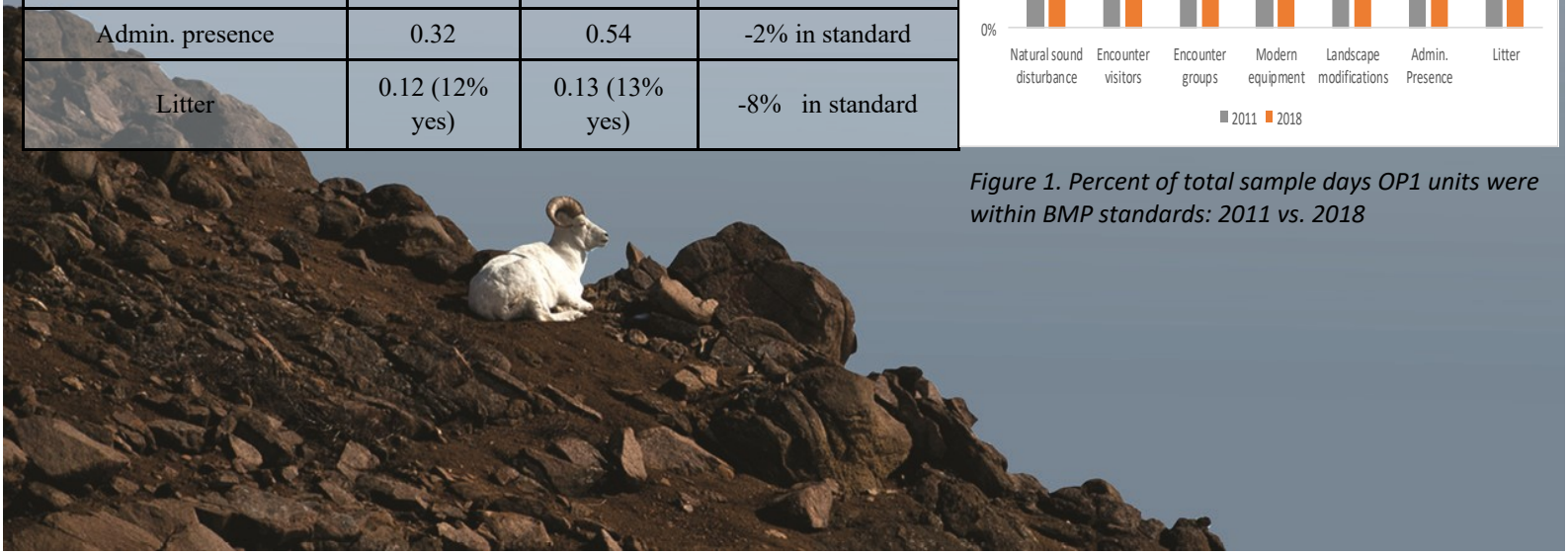
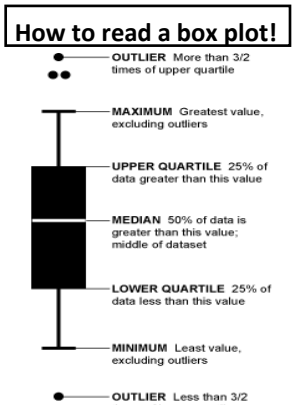


Figure 1. Percent of total sample days OP1 units were within BMP standards: 2011 vs. 2018



BMP indicators distribution, reported by visitors in social science survey : The plots (Figure 2) demonstrate that day hikers and backpackers in OP1 units experienced BMP indicators during their hike days that **exceeded** BMP standards. For example, day hikers had a higher median encounters with visitors, though backpackers had outlier events equal to those of day hikers. For both day hikers and backpackers the distribution of natural sound disturbance **exceeded** the BMP standard. BMP indicator exceptions where the recorded range is primarily **within** BMP standards are encounters with large groups and administrative presence.

NPS sound monitoring program (2005-2018): The natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols averaged for OP1 units was **.76 events per hour** or 12 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 3 (day hikers) or 5 (backpackers) daily events; the maximum ranges recorded by visitors is 12, with outliers extending to 30 events per day. The sound station estimate of 12 is captured in the maximum recorded by backpackers, but not for day hikers. The corroboration of NPS and backpacker maximum range events suggests a average estimate of natural sound disturbance between 2 & 12 events daily.



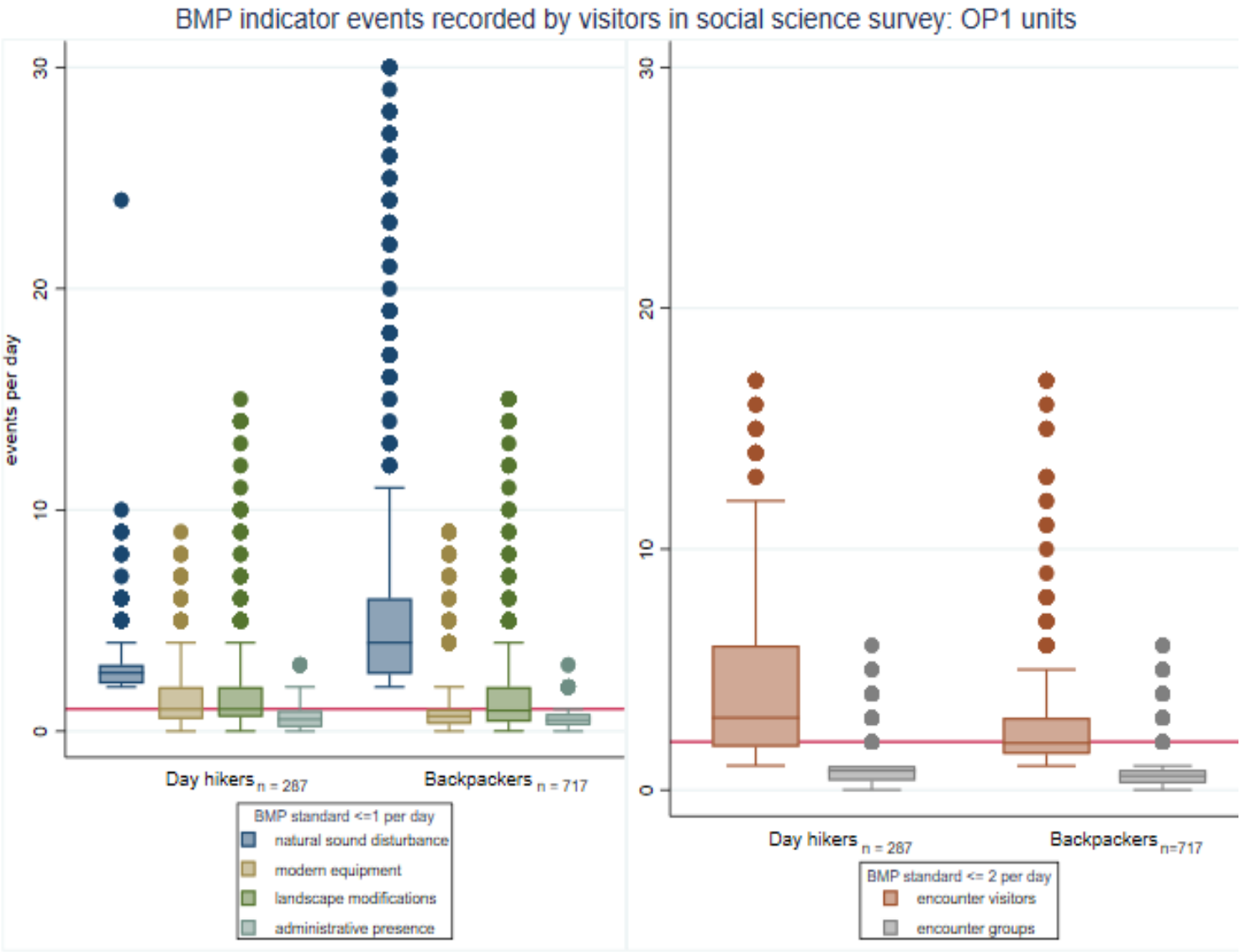


Figure 2. BMP indicator event distribution from aggregated observations by visitors in social science survey

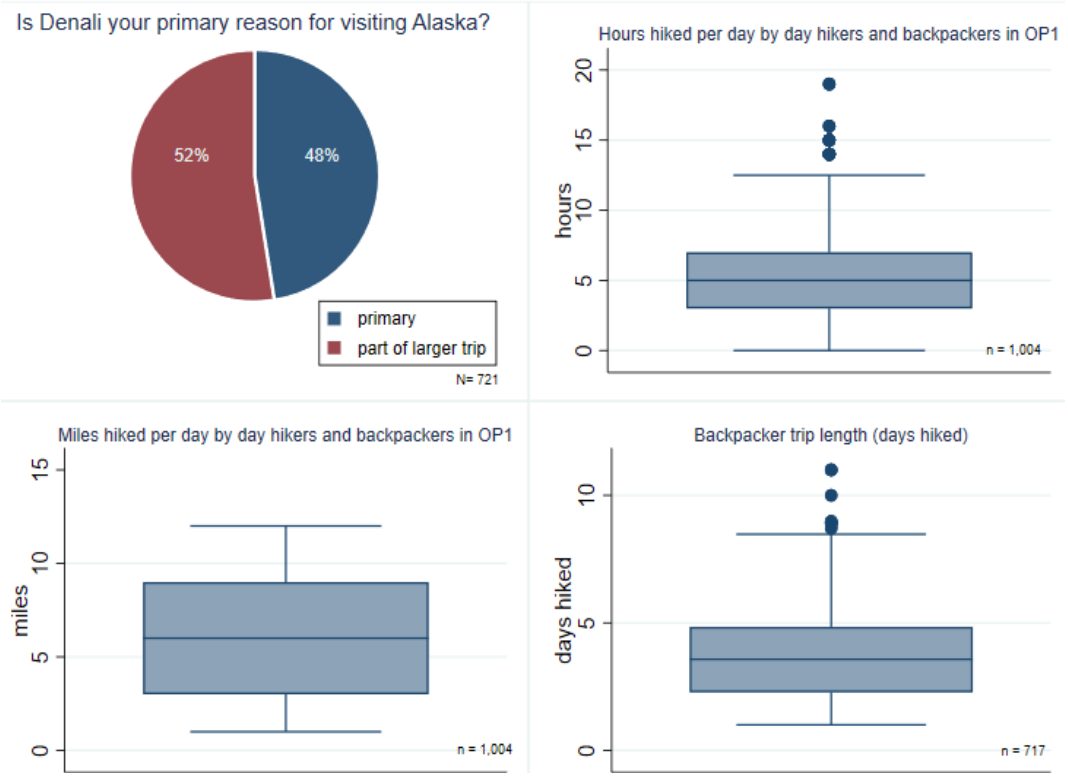


Figure 3. Hike distance, time, days, and visitors primary trip: OP1

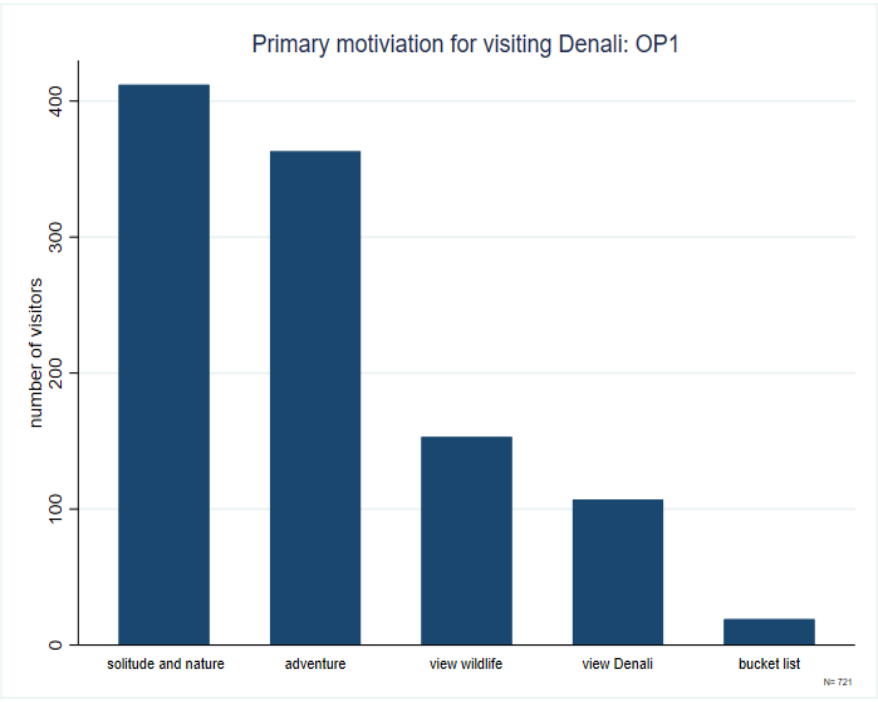


Figure 4. OP1 visitors' primary motivation for visiting Denali.

Trip Characteristics:

Visitors reported how many hours and perceived miles they hiked per day, and backpackers reported number of total days spent in the backcountry. Visitors also reported if their trip to Denali was the primary reason for travelling to Alaska (Figure 3). Visitors reported their primary motivation for visiting Denali specifically (Figure 4).

The median hours hiked by backcountry users in OP1 was 5, with a maxiumum range extending to 14 hours per day. The median miles hiked per day by visitors to OP1 was 6.5, with an interquartile range from 1 to 13 miles. Backpackers to OP1 had a maximum range of trip days up to 8, but the median was 4 days. The **average** trip length was 3.7 days.

The primary trip motivations for visitors to OP1 essentially mirror the primary motivations of backcountry visitors in the other areas of the park. The only significant difference between day hikers and backpackers in OP1 compared to Kantishna units was the frequency of the "I made it/bucket list" response. OP1 visitors chose this response less often than visitors to Kantishna; 2% vs. 8 %, respectively and ($t = 6.13$, $df = 1{,}112$ $p<0.001$). There was no significant difference between day hikers and backpackers in OP1 for primary motivations.

BMP indicator events impact to visitor experience:

Visitors to OP1 also rated on a five point scale how BMP indicator events they heard or felt affected their backcountry experience. Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 5) for natural sound disturbance daily events above 5 per day; encounters with visitors, groups, and administrative presence above 2 per day. The indicators that visitors to OP1 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 13.5% of backcountry users in OP1 said encounters with visitors were a positive impact, but 26% stated it was a negative impact.

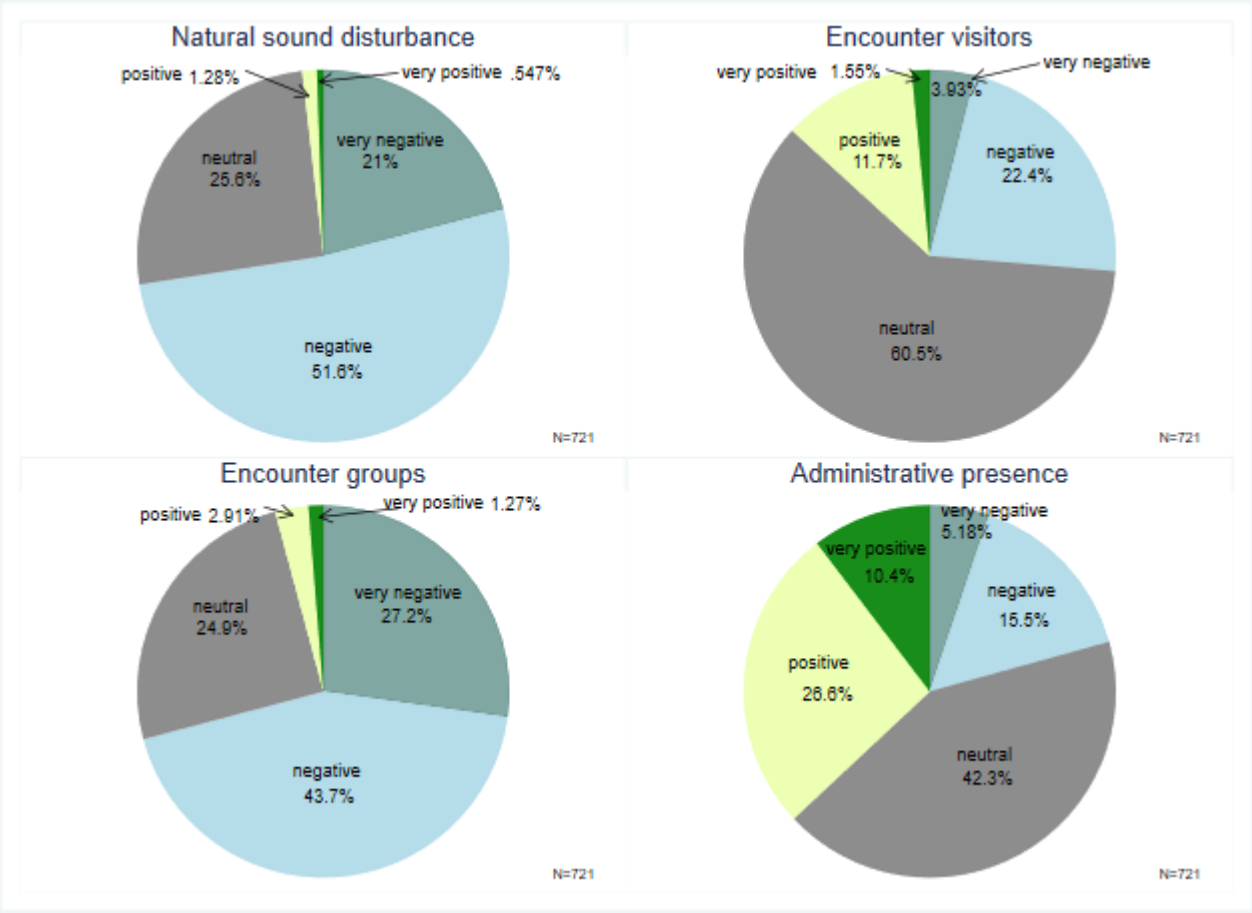


Figure 5. BMP indicator events impact on visitor experience reported by visitors in social science survey

Solitude threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" The pooled average for OP1= **8.**

Backpackers' average was **4.2** (Standard deviation = 5.2); range 0 – 100.

Day hikers' average was **17** (Standard deviation = 19.3); range 0 – 200.

Predicted thresholds: Modelling solitude threshold on visitors' age and whether they were day hikers or backpackers yields predicted thresholds at any given age and type of backcountry visitor per management area. This allows comparison of how solitude was diminished among age groups and type of backcountry use across units. For the OP1 units, there was a large difference between day hikers' and backpackers' maximum allowable encounters across all ages, but the older the visitor was, the greater the tolerance for visitor encounters before a sense of solitude was diminished. Compared to all park units, younger day hikers in OP1 were more sensitive to visitor encounters during their trip if they sought solitude. The solitude thresholds of day hikers mirror one another in the OP1 vs. all park model. The all park model shows that day hikers' threshold of visitor encounters was slightly higher the older the visitor, and the large disparity between day hikers' and backpackers' threshold of visitor encounters remained across all ages. Only at 80 years did the confidence intervals overlap between day hikers and backpackers, due to a very small sample seed in that age (N = 16). The models suppress solitude thresholds reported by visitors 2+ standard deviations above the mean for each age group.

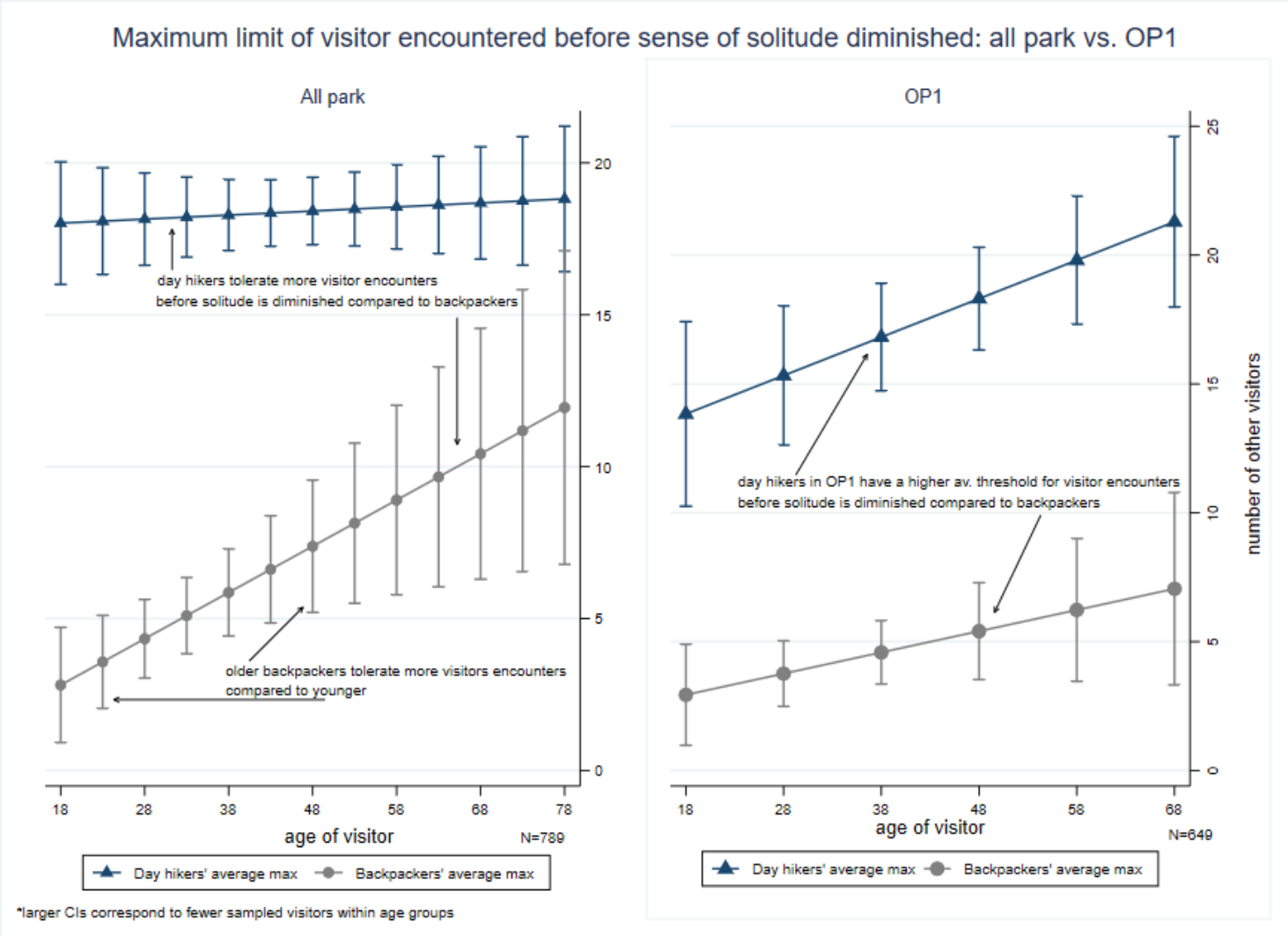
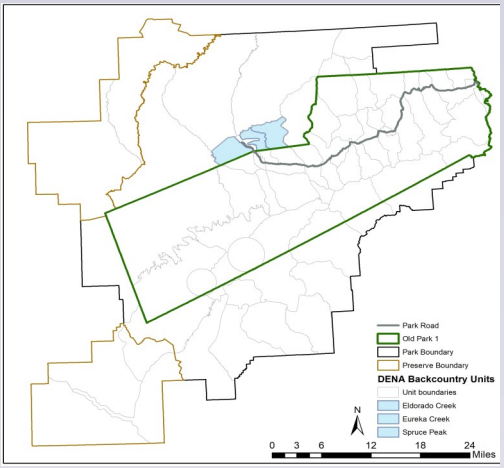


Figure 6. Observed and predicted values of solitude thresholds of day hikers and backpackers in OP1 vs. entire park

Backcountry Visitor Experience
Kantishna: Backcountry Units 41, 42, 43

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Visitor Survey Data(2017-2018):
Units surveyed: 41, 42, 43
Number of survey participants:
Backpackers (N =50)
Day hikers (N =105)
Pooled total (N =155)
Total recorded days (observations) in unit (n = 178)
Percent of visitors self-reported on guided hike: 74%

Wilderness Experience:
Visitors reported what they perceived are the most important aspects of a true wilderness experience. From a choice-set of 13 aspects, the top three by percent of visitors who said they were very important to wilderness were:

94% ability to connect with nature

93% pristine nature

92% surrounded by natural sounds

BMP Indicator events and standards, Kantishna:
Visitors recorded natural sound disturbance events, encounters with people, and evidence of modern human use during the day(s) they hiked in the backcountry. These indicators are used to examine the quality of visitor experience in Denali's backcountry. We aggregated these data and calculated each indicator mean. We compared 2018 means to similar data collected in 2011 (Table 1). For example, the pooled mean for landscape modification encounters is well above the standard of ≤ 1 per day, (M = 2.44) and 62% of total days visitors recorded more than one landscape modification seen per day (Figure 1), a 28% decrease in compliance compared with the 2011 average days in standard.

Table 1. Mean BMP indicators and standards, recorded by visitors in social science survey

Indicator	Mean daily events (2011) n = 12	Mean daily events (2018) n = 150	Percent change days in standard: 2011 - 2018
Natural sound disturb-ance	2.0	3.74	-16% in standard
Encounter visitors	1.59	2.93	-19% in standard
Encounter groups	0.22	1.01	-8% in standard
Modern equipment	1.20	1.67	-11% in standard
Landscape modification	1.53	2.44	-28% in standard
Admin. presence	0.0	0.52	-0.5%in standard
Litter	0.12 (12% yes)	0.14 (14% yes)	-2% in standard

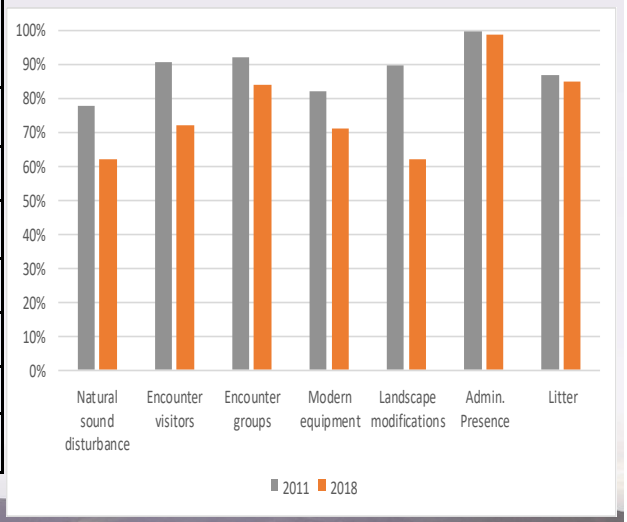
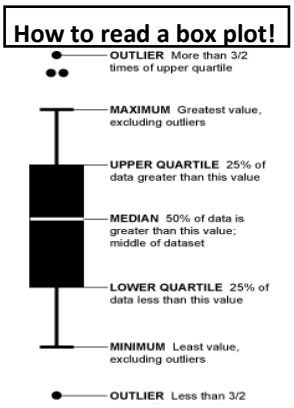


Figure 1. Percent of total sample days Kantishna units were within BMP standards: 2018 vs. 2011

BMP indicators distribution, reported by visitors in social science survey : The plots (Figure 2) demonstrate that day hikers and backpackers in Kantishna mostly experienced BMP indicators during their hike days that were **within** standard. Exceptions are encounters with visitors, encounters with groups, and landscape modifications. For example, day hikers had the largest range and most extreme outliers for encounters with visitors: the distribution is primarily **exceeded** the BMP standard.



NPS sound monitoring program (2005-2018): The natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols averaged for Kantishna units 41 & 42 was **1.3 events per hour** or 20 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 4.2 (day hikers) or 4.6 (backpackers) daily events; the maximum ranges recorded by visitors is below 10. The sound station estimate of 20 is captured in the outliers recorded by backpackers, but not for day hikers. The lack of corroboration of NPS and visitor maximum range events (not including outliers) suggests a daily average estimate of natural sound disturbance at least above 2 (min range) & below 20 (within visitor recorded outliers).

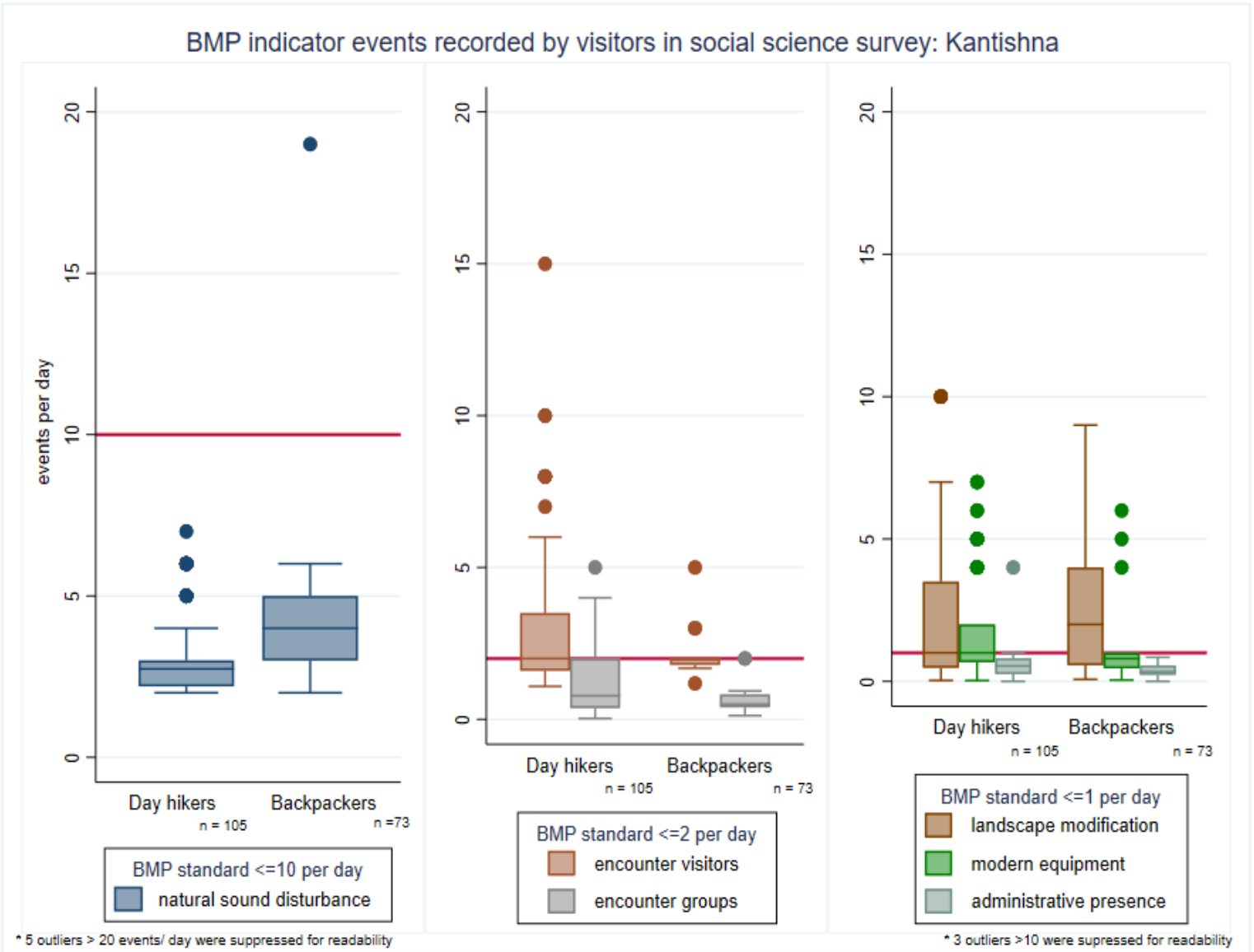


Figure 2. BMP indicator event distribution from aggregated observations by visitors in social science survey

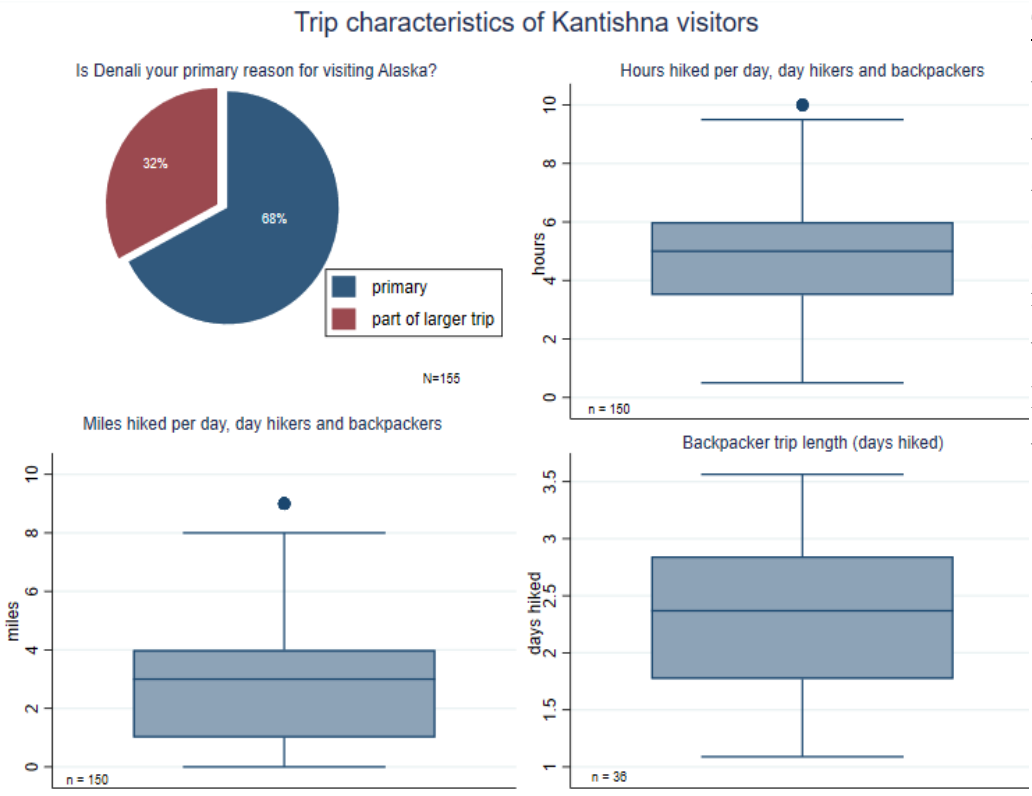


Figure 3. Hike distance, time, days, and visitors primary trip

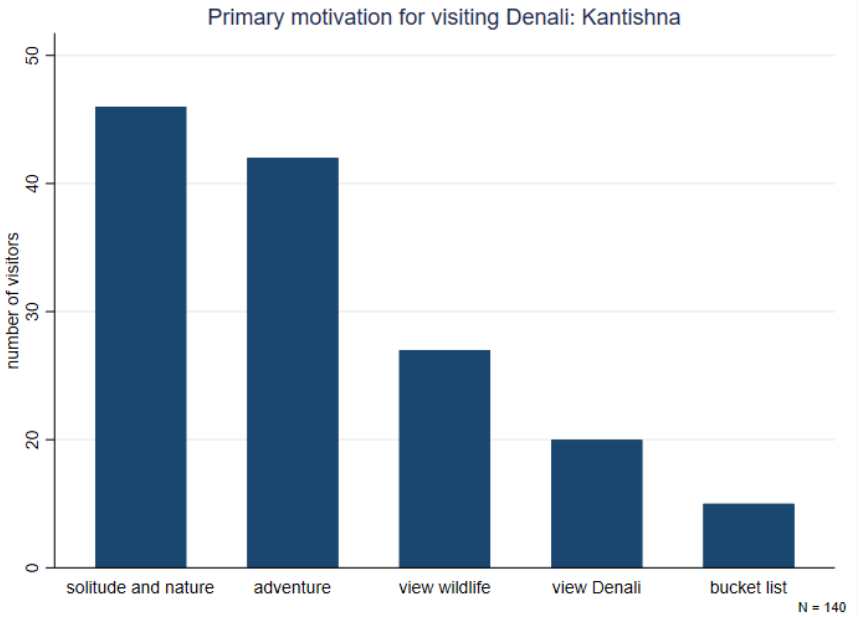


Figure 4. Kantishna visitors' primary motivation for visiting Denali.

Trip Characteristics:

Visitors reported if their trip to Denali was the primary reason for travelling to Alaska (Figure 3). In Kantishna, 68% said their Denali trip was the main reason for coming to Alaska, whereas only 47% of OP1 and Ruth/ Backside Lake visitors said Denali was their primary trip.

Visitors also reported how many hours and perceived miles they hiked per day, and backpackers reported number of total days spent in the backcountry. The median hours hiked per day by Kantishna visitors was 5, with a maximum range up to 9 hours per day (outlier of 10). Median miles hiked was a little over 3, with a range up to 8 miles per day. Backpackers in Kantishna had a median trip length less than 2.5 days, and an average trip length of 3 days.

Visitors reported their primary motivation for visiting Denali specifically (Figure 4).

The primary trip motivations for visitors to Kantishna essentially mirror the primary motivations of backcountry visitors in the other areas of the park. There was a significant difference between Kantishna vs. all park units in the frequency of the "I made it/bucket list" response (8% total in Kantishna, vs. 2% in OP1 and 0% in Ruth/BL). Also significant, day hikers chose this response whereas backpackers did not ($t = 3.43$, df 1,007, $p<0.001$).

BMP indicator events impact to visitor experience:

Visitors to Kantishna also rated on a five point scale how BMP indicator events they heard or felt affected their backcountry experience. Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 5) for natural sound disturbance daily events above 5 per day; encounters with visitors, groups, and administrative presence above 2 per day. The indicators that visitors to Kantishna stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. Only 6% of backcountry users in Kantishna said encounters with visitors were a positive impact, but 9.5% said group encounters was a positive impact. This finding could be a reflection of the visitor on their guided group experience, but this relationship cannot be determined by the data collected.

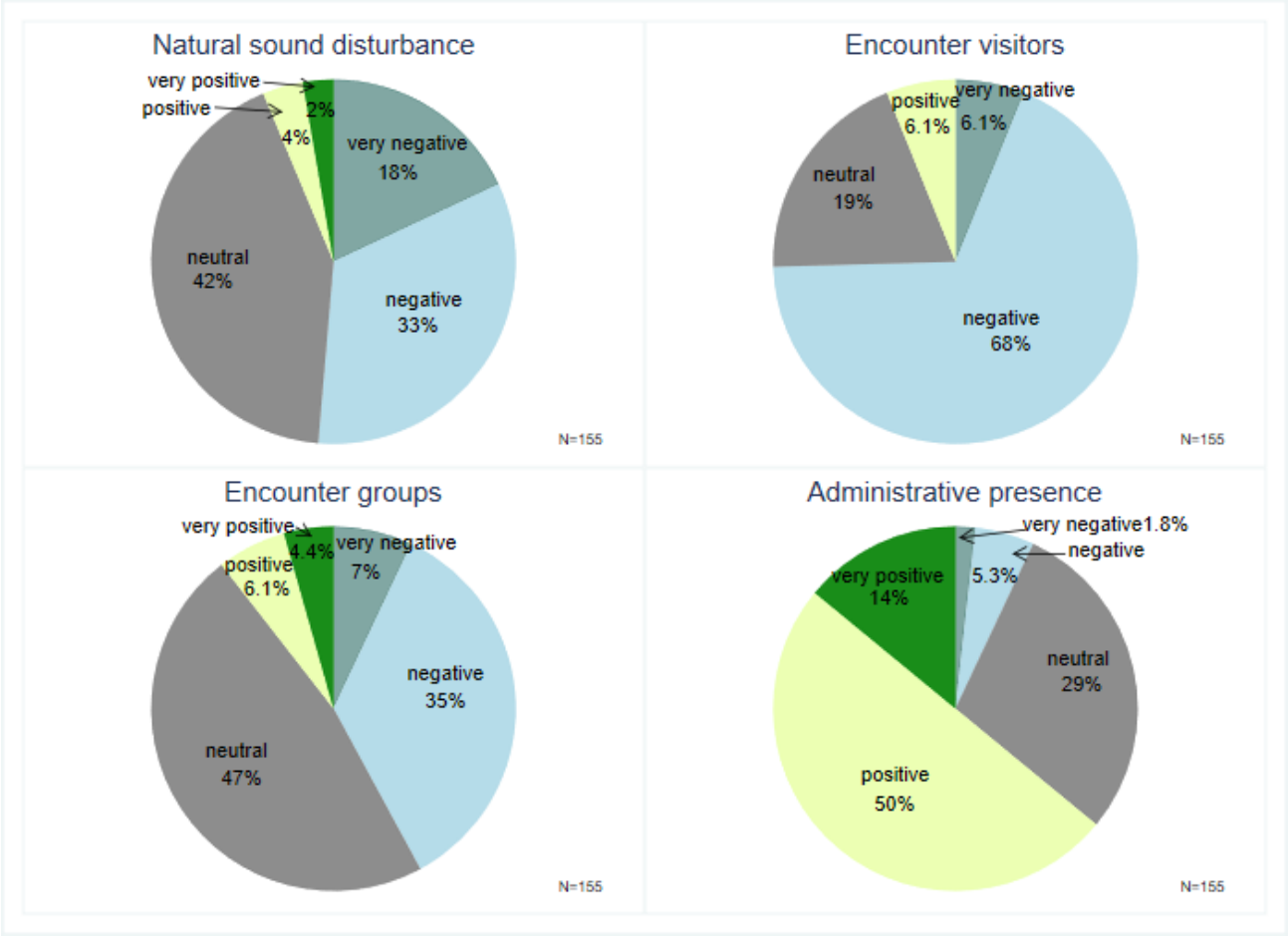


Figure 5. BMP indicator events impact on visitor experience reported by visitors in social science survey

Solitude threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" The pooled average for Kantishna was: **17.5.**

Backpackers' average was **16** (Standard deviation = 17.03); range 0 – 150.
Day hikers' average was **22** (Standard deviation = 38.71); range 2 – 400.

Predicted thresholds: Modelling visitors' age, whether they were day hikers or backpackers, and their reported solitude thresholds enables predicted thresholds at any given age and type of backcountry user. This allows comparison of how the experience of solitude contingent on other visitor encounters differs among age groups and type of backcountry use across units. For the Kantishna units, we see a convergence of maximum allowable encounters at higher ages, but this is due to a drop in day hiker's reported thresholds as age increased. Compared to all park units, Kantishna day hikers were more sensitive to visitor encounters during their trip the older they were. Despite this convergence, the marginal mean thresholds of visitor encounters was higher in Kantishna than in the pooled park sample. Alternatively, the all park units model shows that day hikers' threshold of visitor encounters was slightly higher the older the visitor, and the large disparity between day hikers' and backpackers' threshold of visitor encounters remained across all ages. Only at 80 years do the confidence intervals overlap between day hikers and backpackers, but the sample seed was very small in this age (N = 16). Compared to the pooled park sample, day hikers and backpackers in Kantishna reported a higher threshold of encountering others (Figure 6). The models suppress solitude thresholds reported by visitors 2+ standard deviations above the mean for each age group.

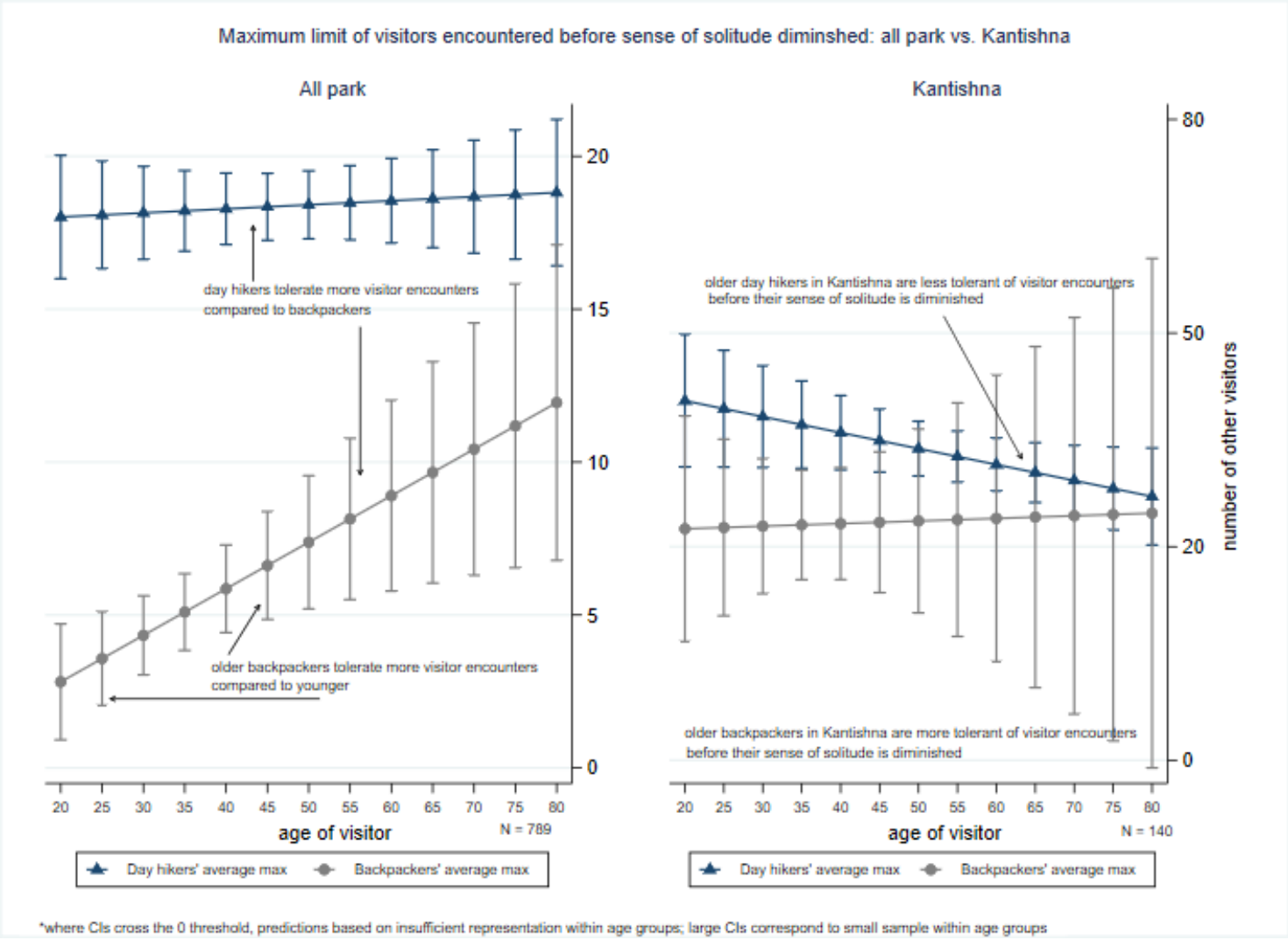
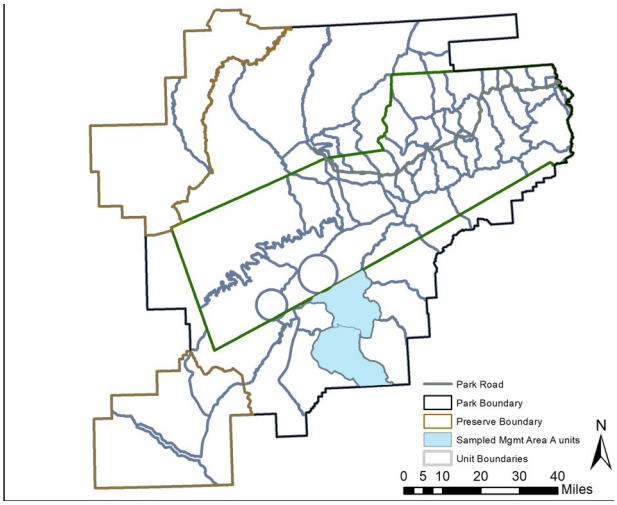


Figure 6. Observed and predicted values of solitude thresholds of day hikers and backpackers in Kantishna vs. entire park



Visitor Survey Data (2017-2018):
Units sampled: 74 & 77
Number of survey participants:
Backpackers (N =16)
Day hikers (N =7)
Pooled total (N =23)
Total recorded days (observations) in unit (n = 34)
Percent of visitors self-reported on guided hike: 100%

Wilderness Experience:
Visitors reported what they perceived are the most important aspects of a true wilderness experience. From a choice-set of 13 aspects, the top three things that were most important for a wilderness experience by percent of visitors were:

95% unconfined recreation

92% pristine nature

82% away from anthropogenic noise

BMP Indicator events and standards:

Visitors recorded natural sound disturbance events, encounters with people, and evidence of modern human use during the day(s) they hiked in the backcountry. These indicators are used to examine the quality of visitor experience in Denali's backcountry. We aggregated these data and calculated each indicator mean (Table 1). These units were not sampled in 2011 for a means comparison. In 2017-2018 the pooled mean for natural sound disturbance is within the standard of ≤ 25 per day, (M = 9.5) and only 8% of total days visitors recorded more than 25 natural sound disturbance events per day; 92% of sampled days were within the BMP standard (Figure 1).

Table 1. Mean BMP indicators and standards, recorded by visitors in social science survey

Indicator	Mean daily events (2017-2018) n = 34	Pooled percent days in standard: 2017-2018
Natural sound disturbance	9.5	92% in standard
Encounter visitors	2.1	93% in standard
Encounter groups	0.92	100% in standard
Modern equipment	1.5	88% in standard
Landscape modification	1.7	84% in standard
Admin. presence	1.0	100% in standard
Litter	0.15 (15% yes)	86% in standard

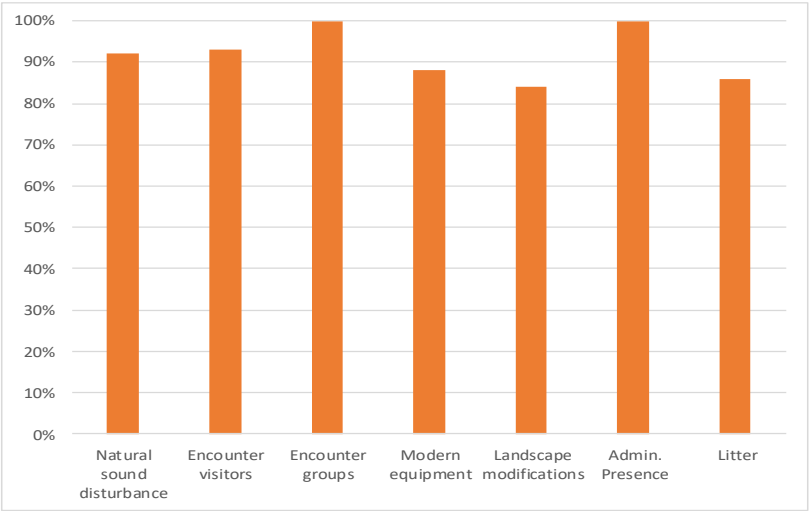
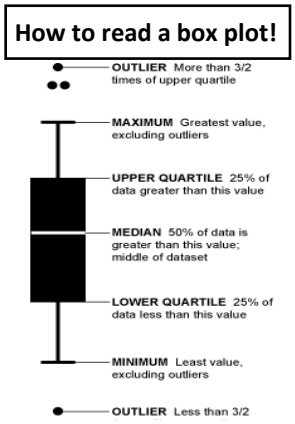


Figure 1. Percent of total sample days mgmt. area A units were within BMP standards: 2018

BMP indicators distribution, reported by visitors in social science survey : The plots (Figure 2) demonstrate that day hikers and backpackers in Mgmt. Area A units experienced BMP indicators during their hike days that were primarily **within** BMP standards. For example, day hikers had a higher median encounters with visitors, though backpackers had outlier events surpassing those of day hikers. For both day hikers and backpackers the distribution of natural sound disturbance met the BMP standard, apart from five high event outliers. BMP indicators where the recorded range entirely met BMP standards was encounters with large groups and administrative presence.



NPS sound monitoring program (2005-2018): The natural sound disturbance events per hour recorded by sound station averaged for 74 & 77 units was **1.3 events per hour** or 20.8 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 4 (day hikers) or 6 (backpackers) daily events; the maximum ranges recorded by visitors is 18, with outliers extending beyond 30 events per day (two outliers of 30+ events are not shown). The sound station estimate of 20 is within the range of outliers recorded by backpackers, but not for day hikers. Some corroboration of NPS and visitor recorded events resulted in a conservative average estimate of natural sound disturbance between 3 & 18 events daily.

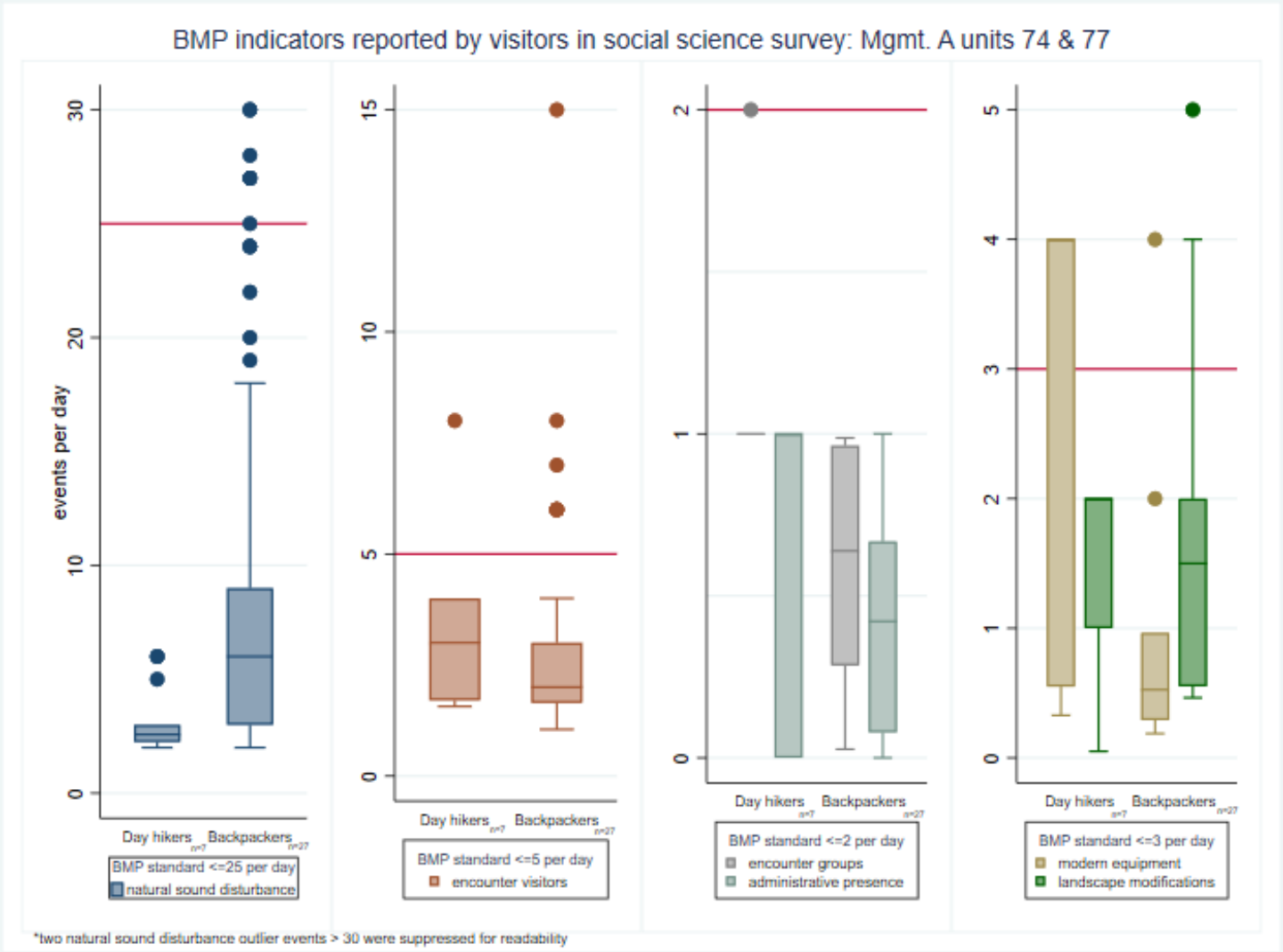


Figure 2. BMP indicators recorded by visitors in a social science survey.

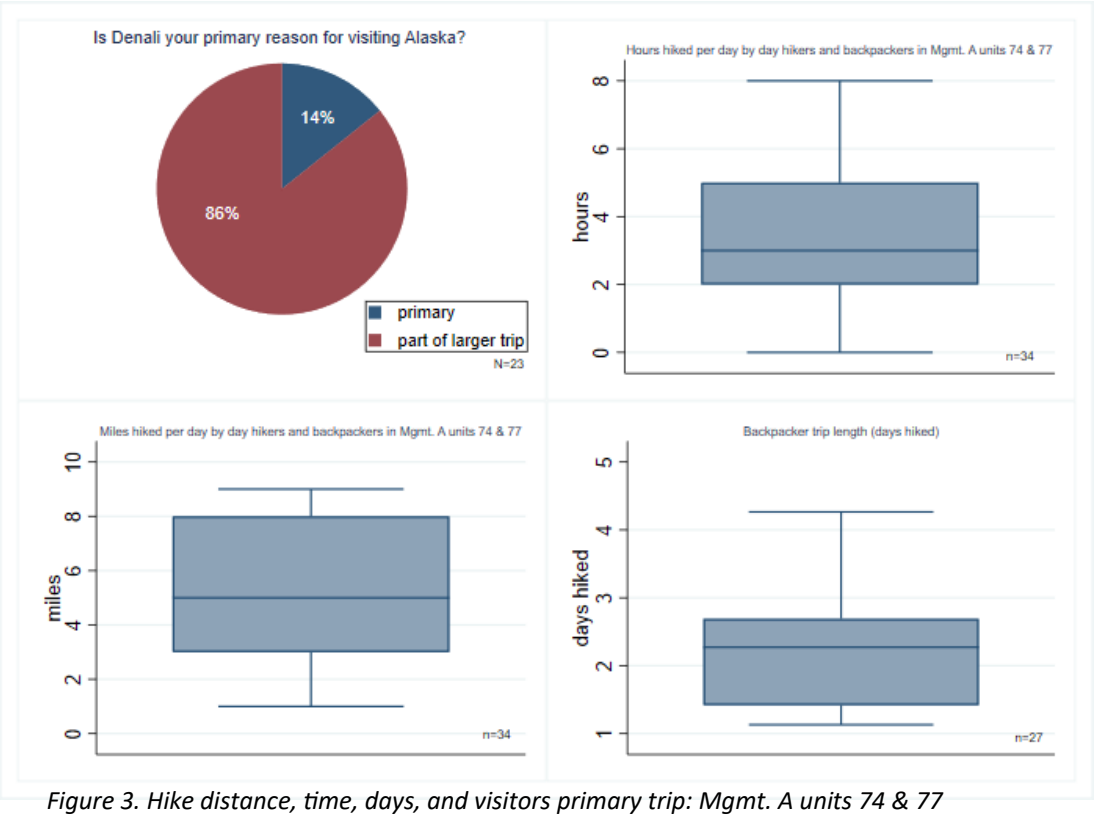


Figure 3. Hike distance, time, days, and visitors primary trip: Mgmt. A units 74 & 77

Trip Characteristics:

Visitors reported how many hours and perceived miles they hiked per day, and backpackers reported number of total days spent in the backcountry. Visitors also reported if their trip to Denali was the primary reason for travelling to Alaska (Figure 3). Visitors reported their primary motivation for visiting Denali specifically (Figure 4).

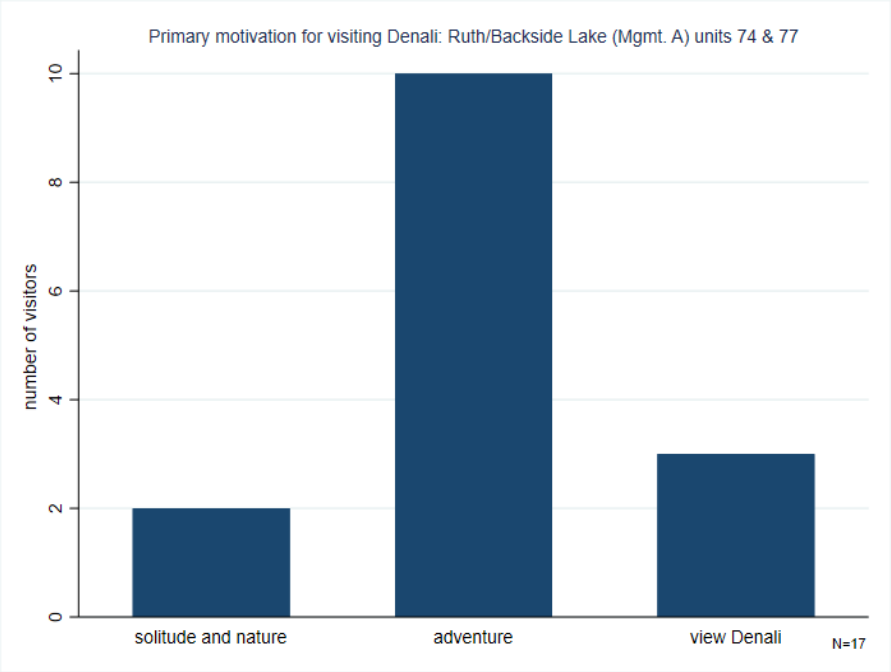


Figure 4. Ruth/Backside Lake visitors' primary motivation for visiting Denali.

The median hours hiked by backcountry users in units 74 & 77 was 3, with a maxiumum range extending to 8 hours per day. The median miles hiked per day in units 74 & 77 was 5, with an interquartile range from 1 to 9 miles. Backpackers to units 74 & 77 had a maximum range of trip days up to 4.5 but the median was 2.5 days. The **average** trip length was 2.2 days.

The primary trip motivations for visitors to Ruth/Backside Lake are different from the motivations of other backcountry visitors. The most significant difference between day hikers and backpackers in Ruth/Backside Lake units compared to Kantishna and OP1 units was the absence of the responses: “wildlife viewing,” and “bucket list” response. Additionally, Ruth/Backside Lake visitors chose “solitude and nature” much less frequently (13%) than Kantishna (35%) or OP1 visitors (39%), ($t = 8.74$, $df = 22$ $p<0.001$).

BMP indicator events impact to visitor experience:

Visitors to Ruth/Backside Lake also rated on a five point scale how BMP indicator events they heard or felt affected their backcountry experience. Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 5) for natural sound disturbance daily events above 5 per day; encounters with visitors, groups, and administrative presence above 2 per day. The indicators that visitors to units 74 & 77 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 69% of backcountry users in Ruth/Backside Lake said natural sound disturbance had no impact on their wilderness experience (their primary motivation being "adventure"), 19% said it was a positive impact, and 13% stated it was a negative impact. Encounters with rangers/researchers (administrative presence) is more of a positive impact to visitor experience than in the other sampled backcountry areas of the park.

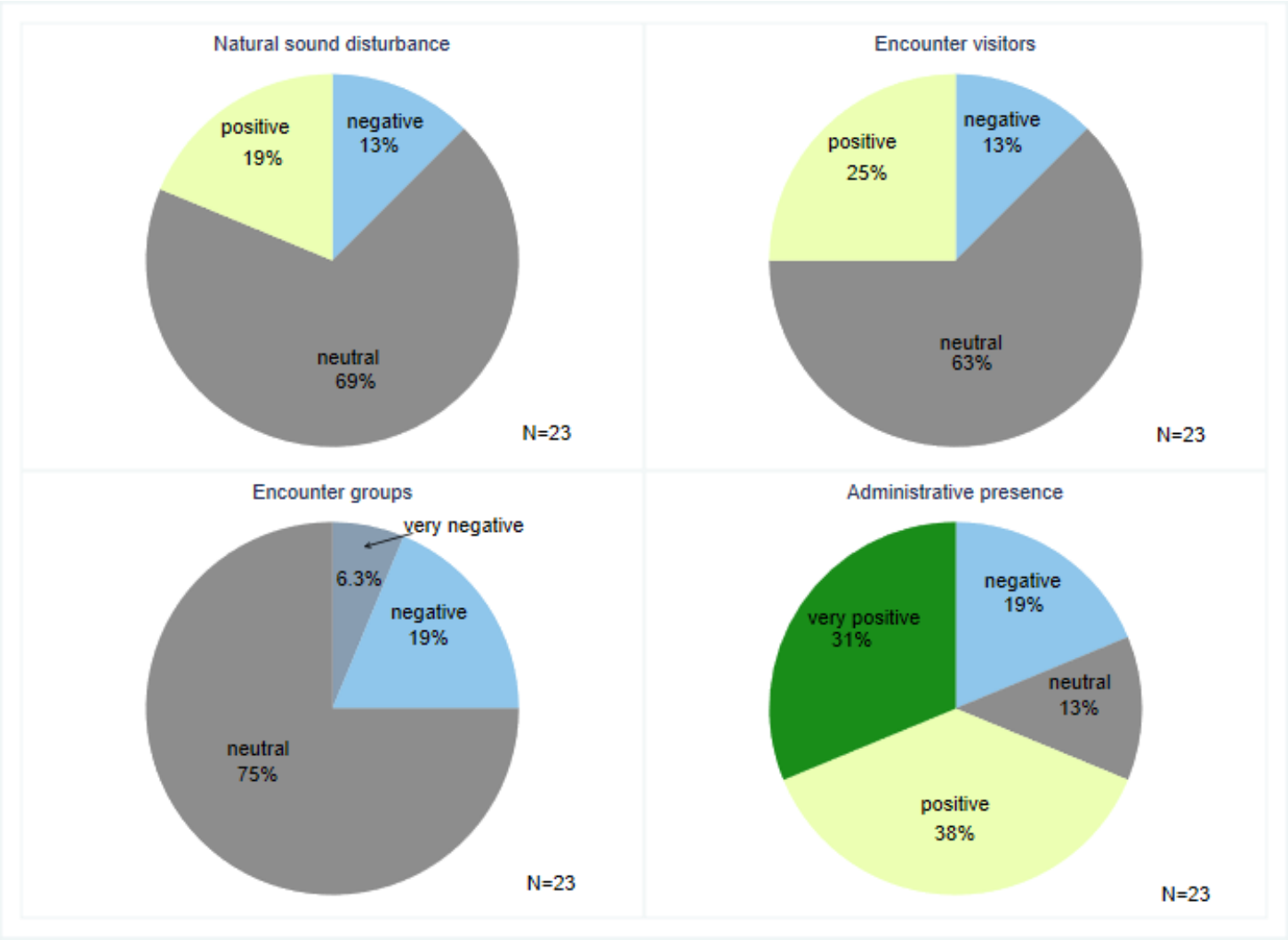


Figure 5. BMP indicator events impact on visitor experience reported by visitors in social science survey

Solitude threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" The pooled average for Ruth/Backside Lake = **14.**

Backpackers' average was **13** (Standard deviation = 4.4); range 1 – 30.

Day hikers' average was **19** (Standard deviation = 7.8); range 8 – 31.

Predicted thresholds: Modelling solitude threshold on visitors' age and whether they were day hikers or backpackers yields predicted thresholds at any given age and type of backcountry visitor per management area. This allows comparison of how solitude was diminished differently among age groups and type of backcountry use across units. For the Ruth/Backside Lake units, there was a large difference between day hikers' and backpackers' maximum allowable encounters across all ages, but younger backpackers were insufficiently sampled, yielding no comparison between day hikers and backpackers younger than 30 (Figure 6). Compared to all park units, younger day hikers in Ruth/Backside Lake were more tolerant of visitor encounters before their sense of solitude was negatively impacted during their trip. The solitude thresholds of day hikers substantially increased the older the day hiker in units 74 & 77. Backpackers to these units had a significantly lower solitude threshold than day hikers ($t = 3.79$, $p < 0.01$). The all park units model shows that day hikers' threshold of visitor encounters was only slightly higher the older the visitor, and the large disparity between day hikers' and backpackers' threshold of visitor encounters remained across all ages. The models suppress solitude thresholds reported by visitors 2+ standard deviations above the mean for each age group.

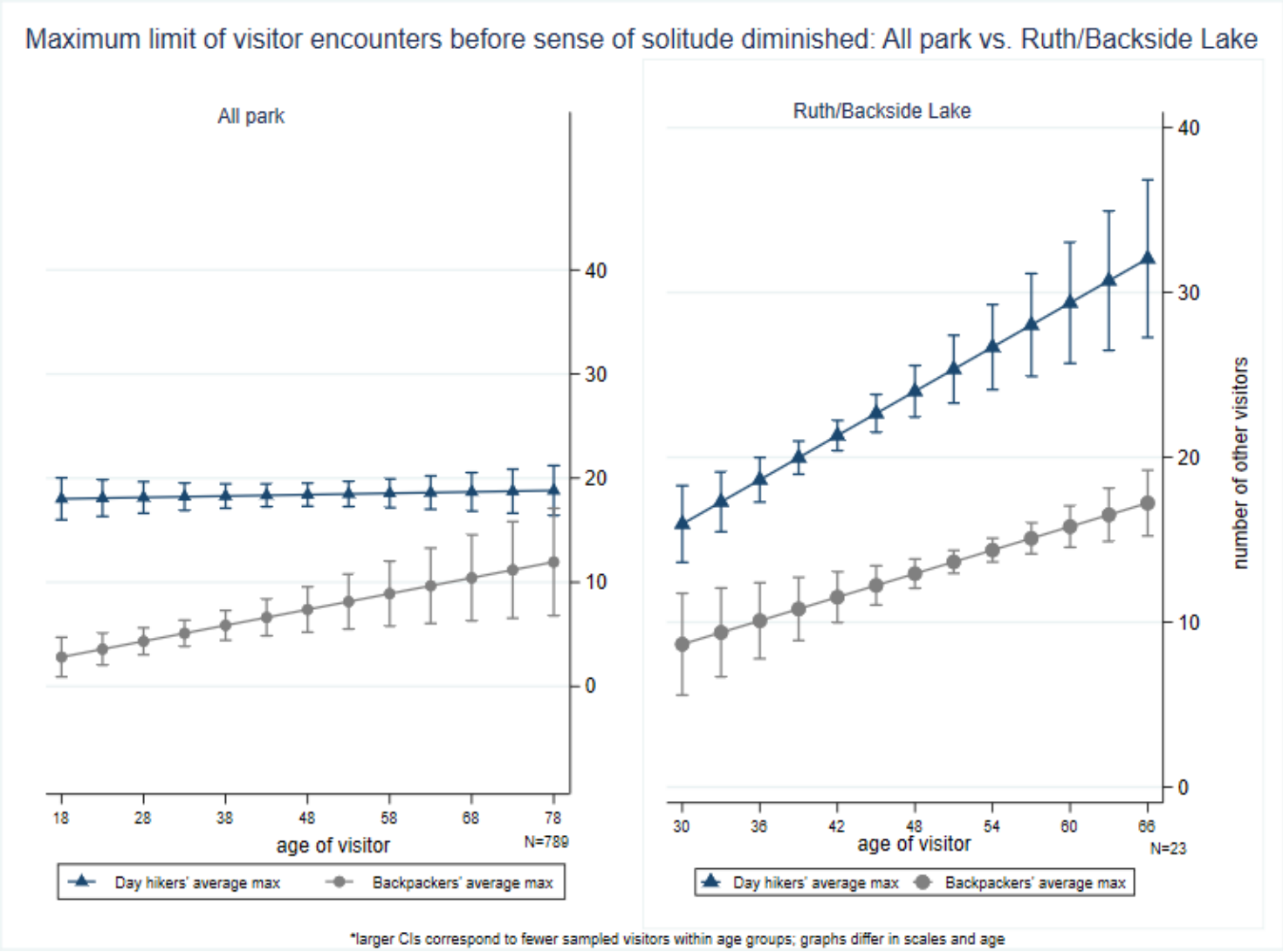


Figure 6. Observed and predicted values of solitude thresholds of day hikers and backpackers in OP1 vs. entire park

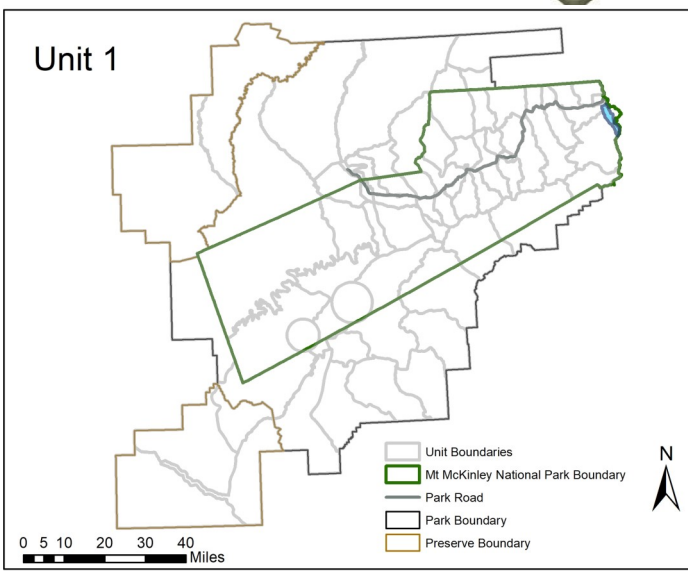
Backcountry Unit 1
"Triple Lakes"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



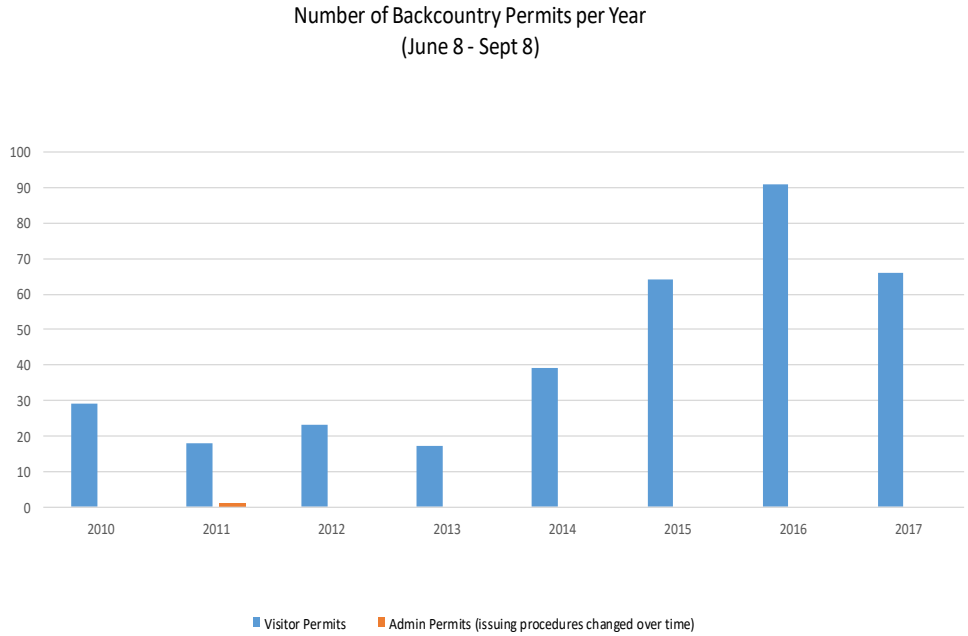
Triple lakes, looking northwest

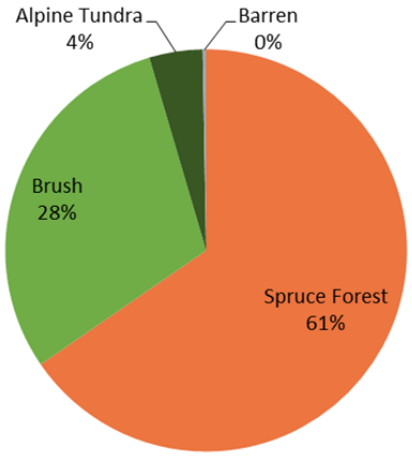


Park boundaries and Denali backcountry units: unit 1

Backcountry Permit Data:
Quota: 12
Percent visitors with bicycle: 2%

Unit Size: 6,550 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N=13)
Day hikers (N=3)
Pooled total (N=16)
Total recorded days (n= 20)

Percent visitors on guided hike: 8%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **78% yes**, 22% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" The pooled average was 22 (Standard Deviation 35.2); range: 3—100 people

Backcountry Indicators in Unit 1: Backpackers to unit 1 typically experienced Backcountry Management Plan (BMP) indicators during their hike days that **exceeded** the BMP standard (Figure 1). The exceptions were encounters with groups and administrative presence; these indicators were **within** BMP standards.

Backcountry Indicators in Unit 1: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others (Figure 1).

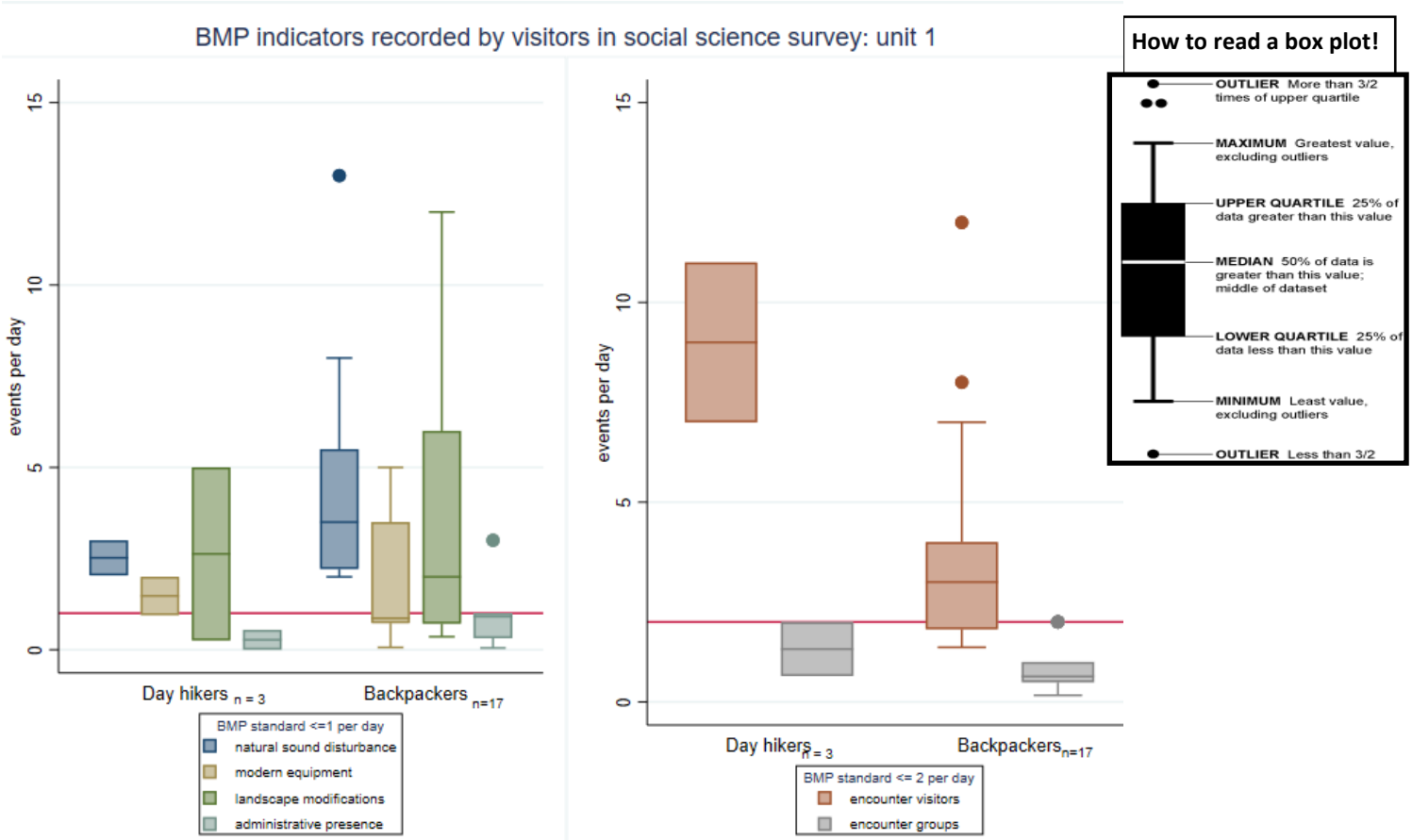


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, 100% of observations of natural sound disturbance for day hikers and backpackers were above 2 events per day and have a larger maximum range than lower range. Three outliers of natural sound disturbance events per day (22, 25, & 30) were suppressed in the plots for readability.

Camping Density: 100% of backpackers to unit 1 were able to camp away from others; 100% reported they wanted to camp out of sight/sound. This meets the standard of always being able to camp out of sight/sound of others.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.69 events per hour** or 11 events per defined backcountry visitor day (16 hours). 11 is well within the maximum range recorded by visitors. The median reported by visitors is lower than the sound station day average, but the corroboration of NPS and visitor data tells us the daily average is between 3 & 13 events. Visitors had a similar detection rate to NPS staff & equipment.

NPS Data Collection and Administrative Presence (2011-2017)* :

Total miles patrolled: 77

Average Miles: 11 miles/year

Average Visitors Encountered: 10/year Average Litter/Sanitation Encountered: 11/year

*Note: the 2015-2017 data was tallied using written patrol reports rather then using the Backcountry Observations Database to get a more accurate picture of what is happening on the Triple Lakes Trail. In 2016, staff changed protocols on formal trails to list encounters of visitors and litter rather then use waypoints and a search of the database cannot easily provide these numbers.

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 1. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 20% of total days sampled in Unit 1 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey

Indicator	BMP standard	Mean daily events (2011), n = 14	Mean daily events (2018), n = 20	Percent change days in standard: 2011 - 2018	State of change in Unit 1: 2011 to 2018
Natural Sound Disturbance	≤ 2 / day	.83	6.5	-80% in standard	↓
Encounter Visitors	≤ 2 / day	2.33	4.72	-50% in standard	↓
Encounter Groups	≤ 2 / day	.17	1.15	-30% in standard	↓
Modern Equipment	≤ 1 / day	1.17	1.72	+5% in standard	↔
Landscape Modification	≤ 1 / day	1.17	3.41	-30% in standard	↓
Admin. Presence	≤ 1 / day	.17	.73	-19% in standard	↔
Litter	< 5%	0.0	0.0	-0% in standard	↔

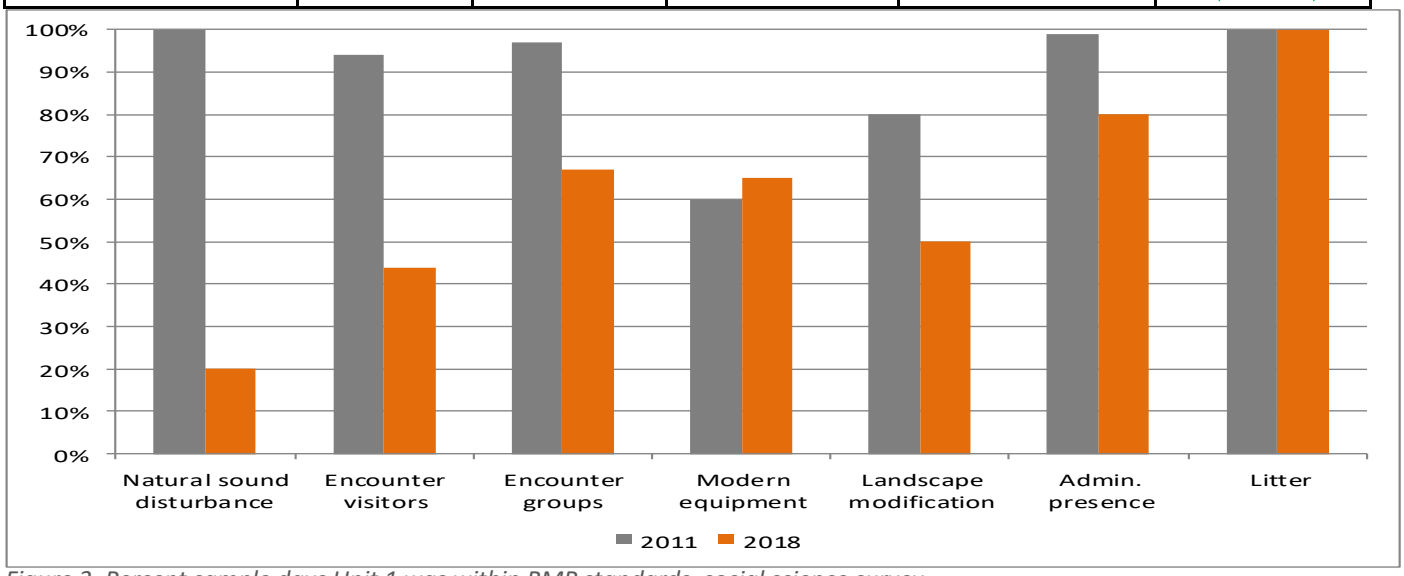


Figure 3. Percent sample days Unit 1 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 1 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

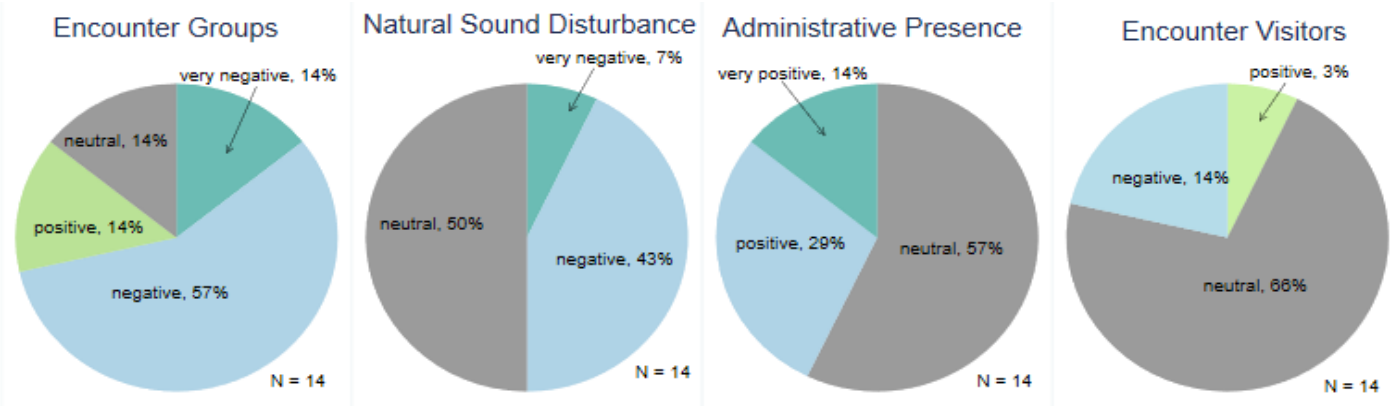


Figure 3. Positive or negative impact to visitor experience by BMP indicator

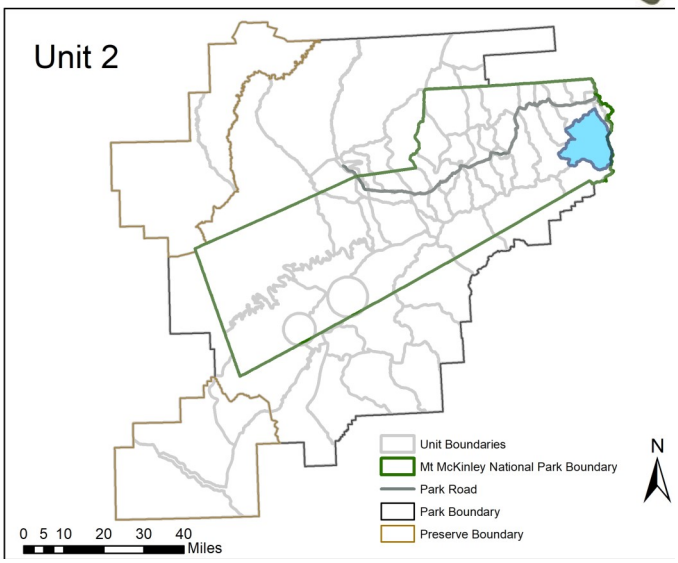
Backcountry Unit 2
"Riley Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



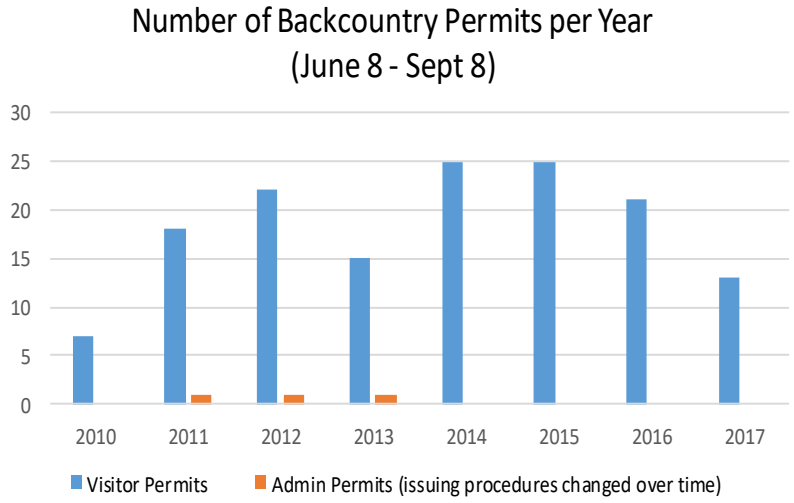
Riley creek, looking north

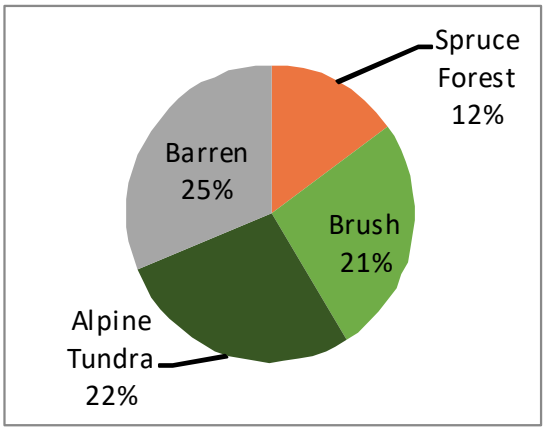


Park boundaries and Denali backcountry units: unit 2

Backcountry Permit Data:
Quota: 12
Percent visitors with bicycle: 0%

Unit Size: 79,017 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=3)
Day hikers (N=0)
Pooled total (N=3)
Total recorded days (n=8)

Percent visitors on guided hike: 0%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **100% yes**

Solitude Threshold: Visitors to this unit did not report a maximum threshold for visitor encounters.

Backcountry Indicators in Unit 2: Backpackers to unit 2 typically experienced Backcountry Management Plan (BMP) indicators during their hike days that were within standard. The exceptions were natural sound disturbance and encounters with visitors in which all recorded events which **exceeded** the BMP standard (Figure 1).

Backcountry Indicators in Unit 2: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others (Figure 1).

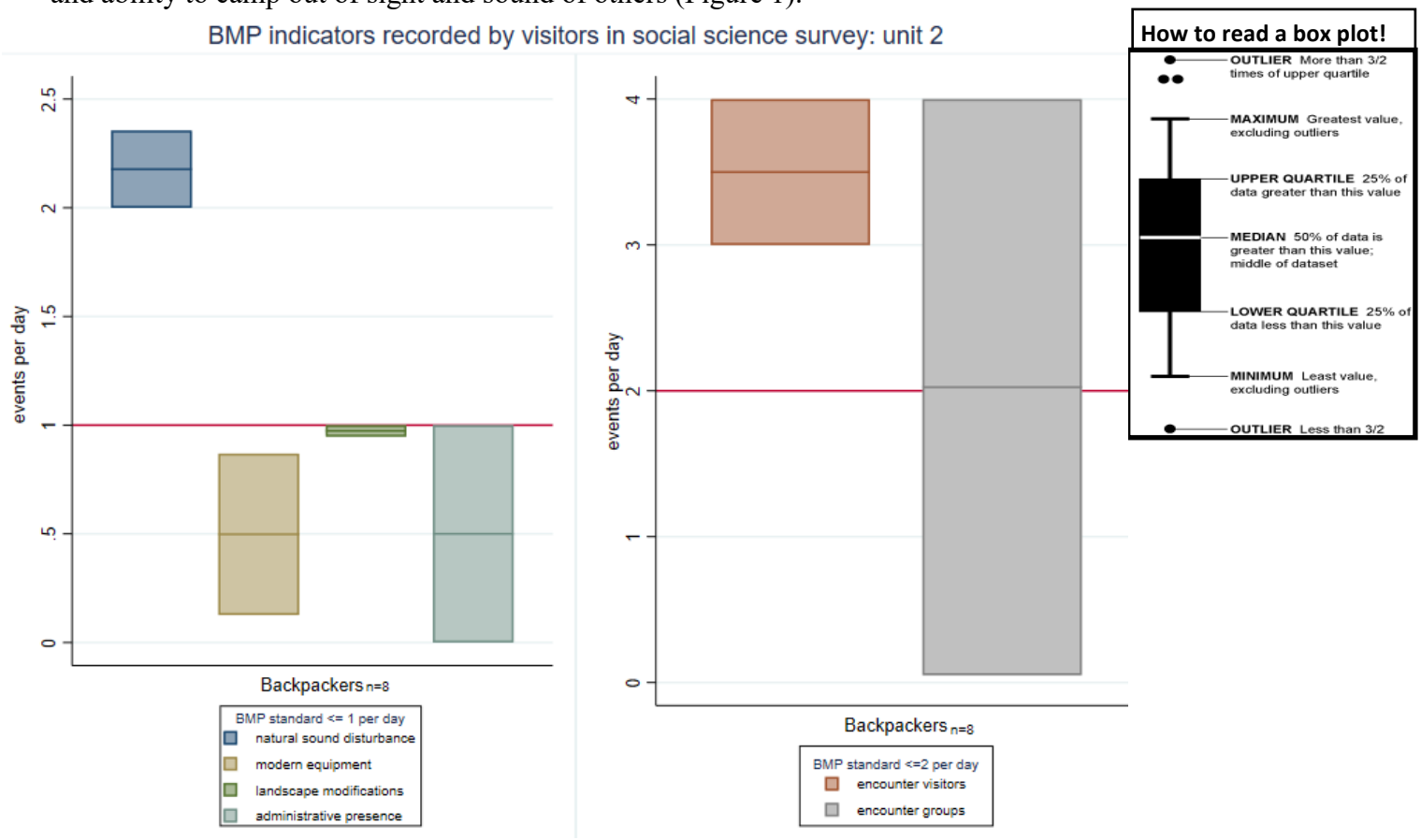


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, 100% of observations of natural sound disturbance for backpackers was above 2 events per day but have a small range and above and below the median of 2.2 events per day.

Camping Density: 100% of backpackers to unit 2 were able to camp away from others; 100% reported they wanted to camp out of sight/sound. This meets the standard of always being able to camp out of sight/sound of others.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **1.79 events per hour** or 29 events per defined backcountry visitor day (16 hours). 29 is far above any events recorded by visitors (note: only 8 total observations). The lack of corroboration of NPS and visitor data tells us that visitors are not recording or perceiving as much natural sound disturbance in this unit, there are not enough visitor observations for this unit, or that backcountry patrol observations or sound station data averaged over 13 years captured extreme outliers in natural sound disturbance events that resulted in a biased daily detection rate.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 51

Average Miles: 7 miles/year

Average Visitors Encountered: 0/year Average Litter/Sanitation Encountered: 0/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 4. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 61% of total days sampled in Unit 2 were within the BMP standard (Table 1, Figure 2). 100% of backpackers were able to camp away from others.

Table 1. BMP indicator means and percent days in standard 2018 vs. 2011: social science survey data

Indicator	BMP standard	Mean daily events (2018), n = 8	Percent days in standard: 2018	State of Unit 2, by percent days in 2018
Natural Sound Disturbance	≤ 1 / day	2.7	61%	
Encounter Visitors	≤ 2 / day	3.5	72%	
Encounter Groups	≤ 2 / day	2.02	87%	
Modern Equipment	≤ 1 / day	.497	94%	
Landscape Modification	≤ 1 / day	.973	91%	
Admin. Presence	≤ 1 / day	.7	99%	
Litter	< 5%	.16	56%	

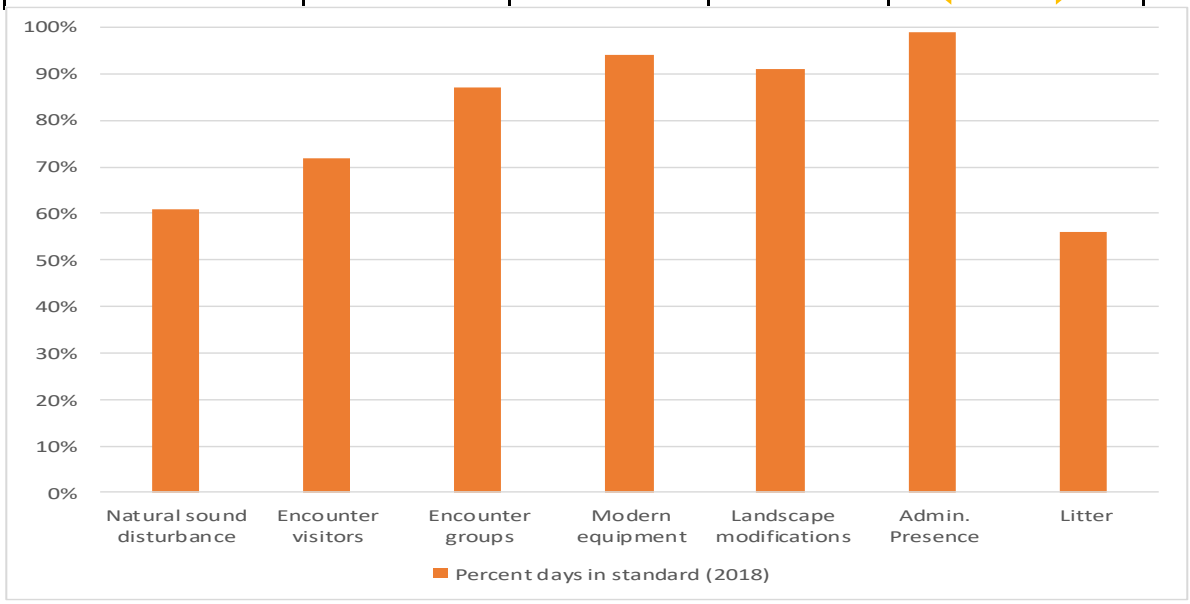


Figure 3. Percent sample days Unit 2 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 2 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

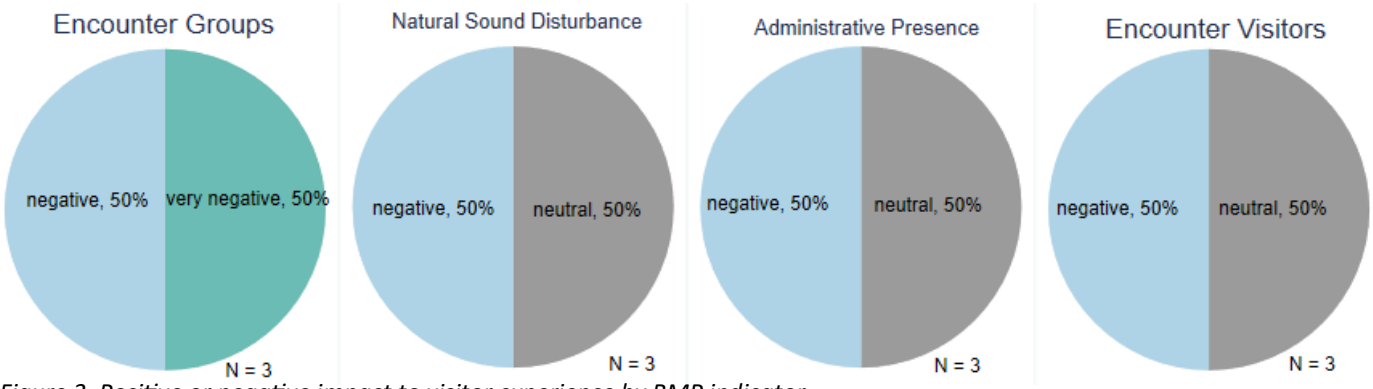


Figure 3. Positive or negative impact to visitor experience by BMP indicator

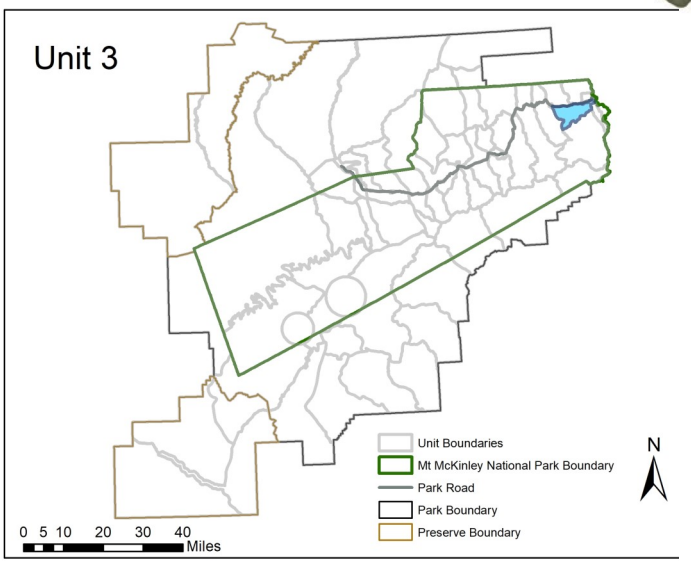
Backcountry Unit 3
"Jenny Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska

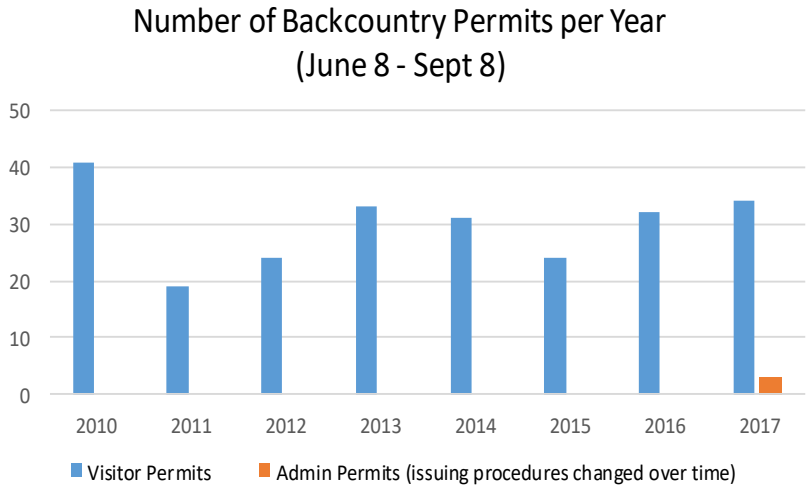


Jenny creek drainage, looking south

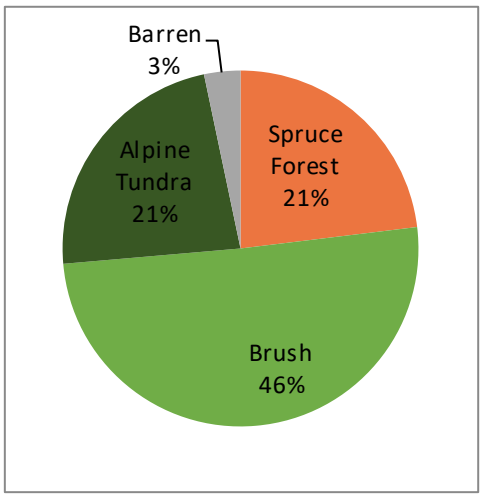


Park boundaries and Denali backcountry units: unit 3

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 16%



Unit Size: 22,757 acres



Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N=6)
Day hikers (N=0)
Pooled total (N=6)
Total recorded days (n=14)

Percent visitors on guided hike: 0%
Ability to camp out of sight sound:
Percent "visitor first choice" unit: **40% yes**, 60% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 3.5** (Standard Deviation 2.12); range: 2—5 people

Backcountry Indicators in Unit 3: Backpackers to unit 3 typically experienced Backcountry Management Plan (BMP) indicators during their hike days that were within standard. The exceptions were natural sound disturbance and modern equipment; they **exceeded** the BMP standard.

Backcountry Indicators in Unit 3: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others. The plots (Figure 1) demonstrate that the median modern equipment encounters was close to 1, meaning 1/2 of the total observations exceeded BMP standard for OP1.

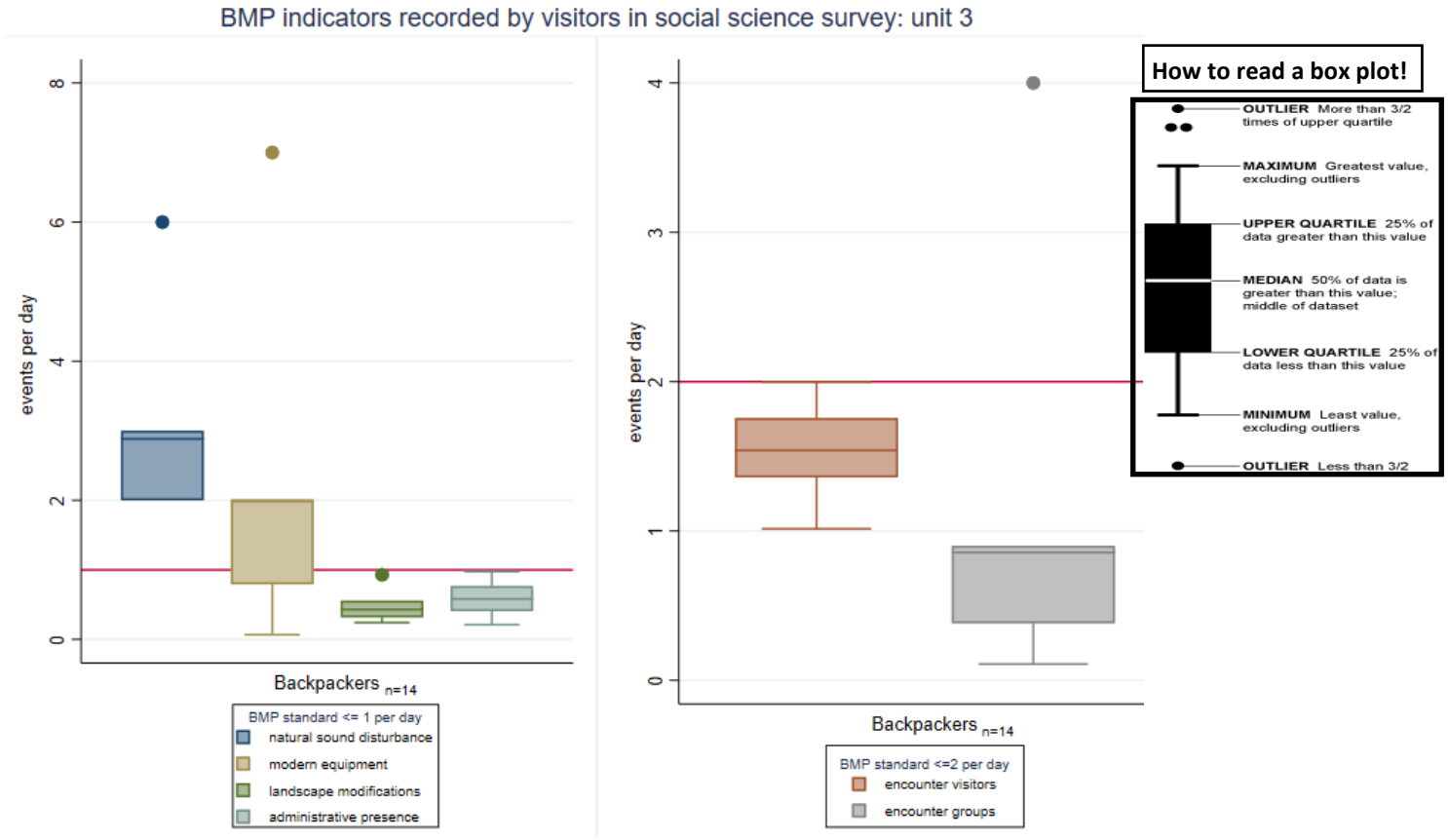


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, 100% of observations of natural sound disturbance for backpackers was above 2 events per day and have a median of 3, meaning 50% of observations were over 3 events per day (Figure 1).

Camping Density: 100% of backpackers to unit 3 were able to camp away from others; 100% reported they wanted to camp out of sight/sound. This meets the standard of always being able to camp out of sight/sound of others.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **3.5 events per hour** or 56 events per defined backcountry visitor day (16 hours). 56 is far above any events recorded by visitors (note: only 14 total observations). The lack of corroboration of NPS and visitor data tells us that visitors are not recording or perceiving as much natural sound disturbance in this unit, or that backcountry patrol observations or sound station data averaged over 13 years captured extreme outliers in natural sound disturbance events that resulted in a biased daily detection rate.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 23

Average Miles: 3 miles/year

Average Visitors Encountered: 0.4/year Average Litter/Sanitation Encountered: .03/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 4. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 72% of total days sampled in Unit 3 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2018: social science survey data

Indicator	BMP standard	Mean daily events (2018), n = 14	Percent days in standard: 2018	State of Change in Unit 3: 2011 vs. 2017-18
Natural sound disturbance	≤ 1 / day	3.7	72%	
Encounter visitors	≤ 2 / day	1.5	79%	
Encounter groups	≤ 2 / day	1.04	90%	
Modern equipment	≤ 1 / day	2.14	40%	
Landscape modification	≤ 1 / day	.581	93%	
Admin. presence	≤ 1 / day	.56	99%	
Litter	< 5%	.16	78%	

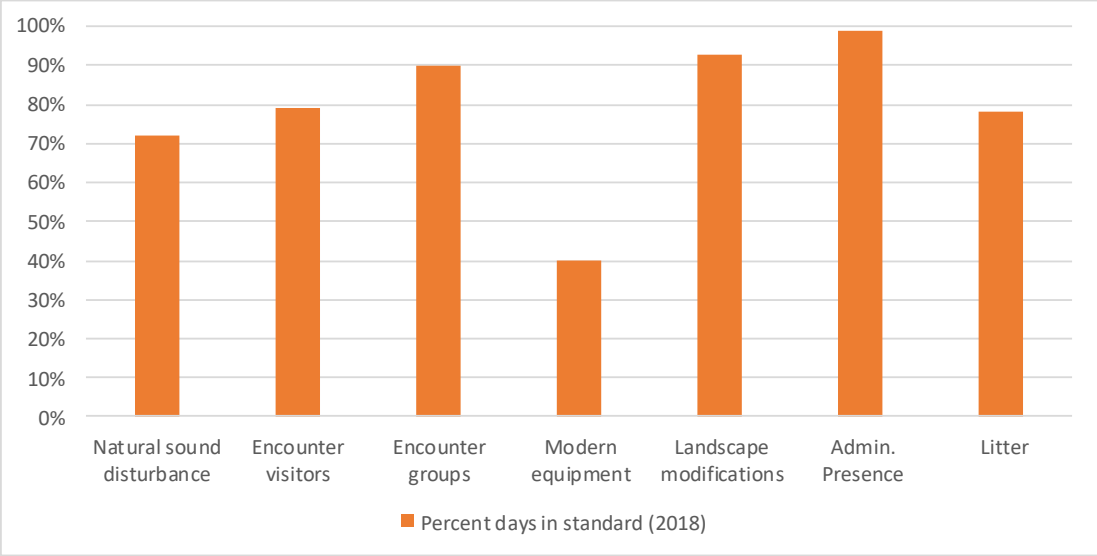


Figure 3. Percent sample days Unit 3 was within BMP standards, social science survey 2018

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 3 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

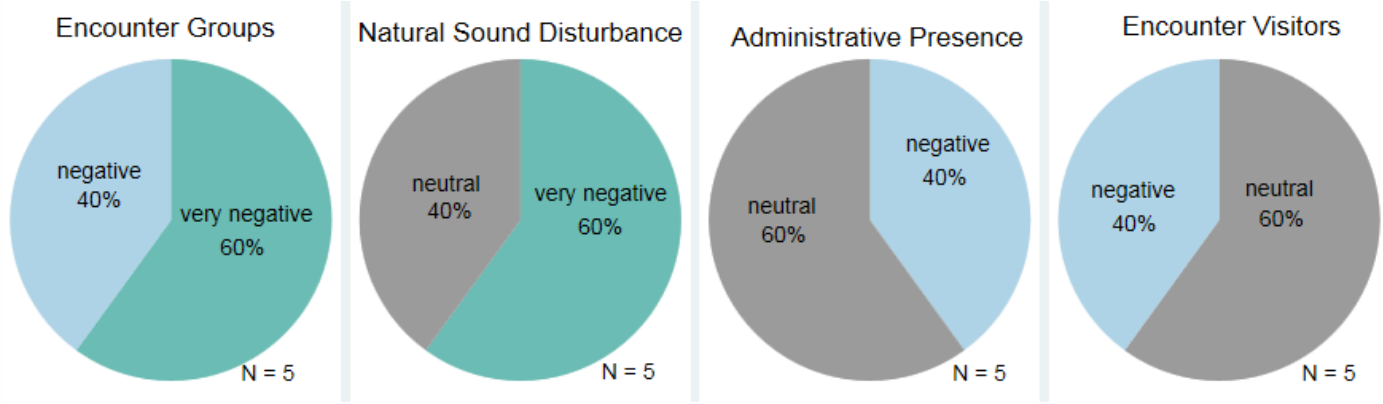
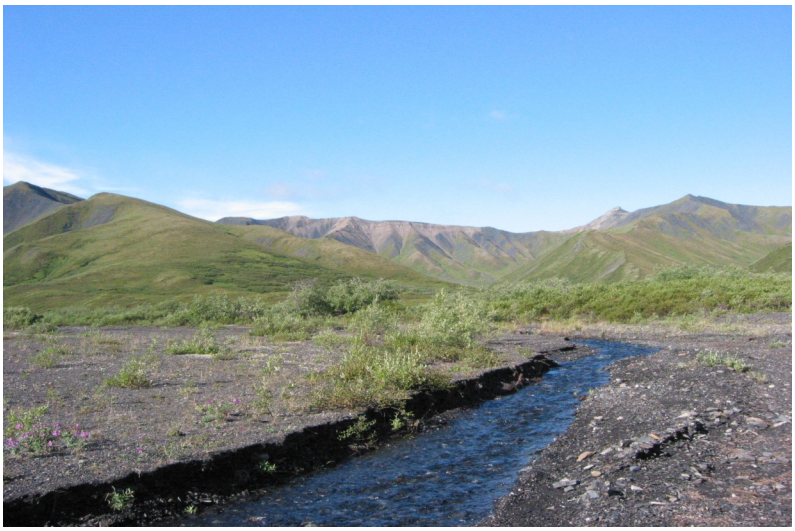


Figure 3. Positive or negative impact to visitor experience by BMP indicator

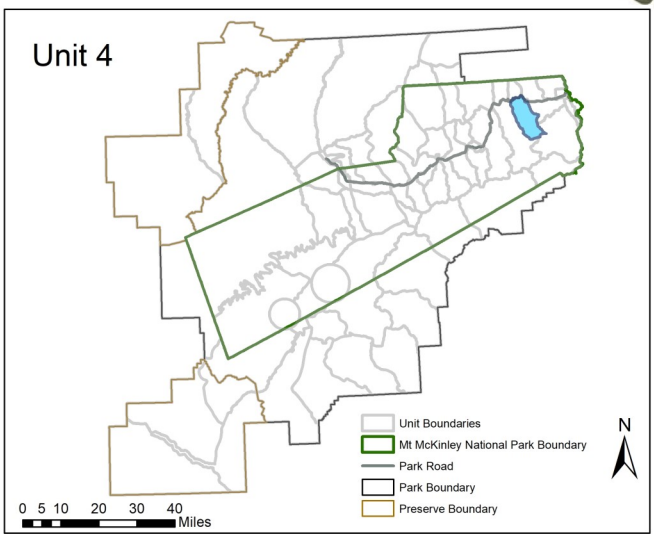
Backcountry Unit 4
"Upper Savage"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



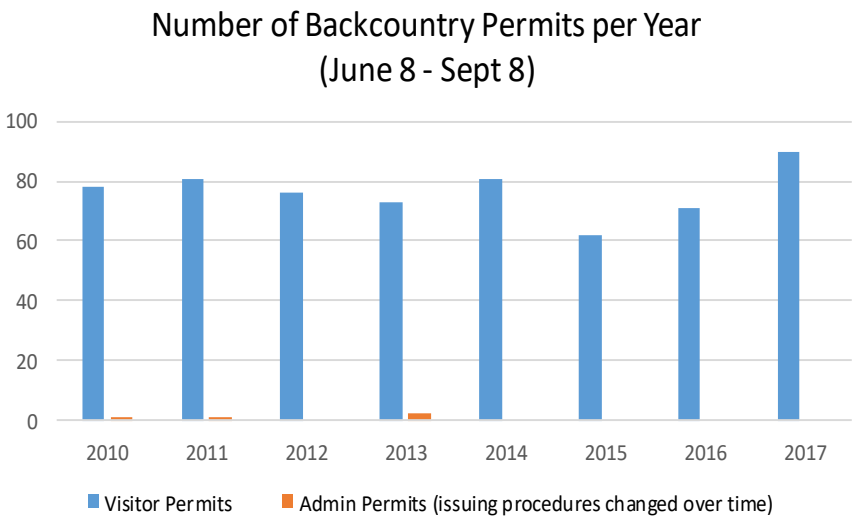
Savage river, looking south

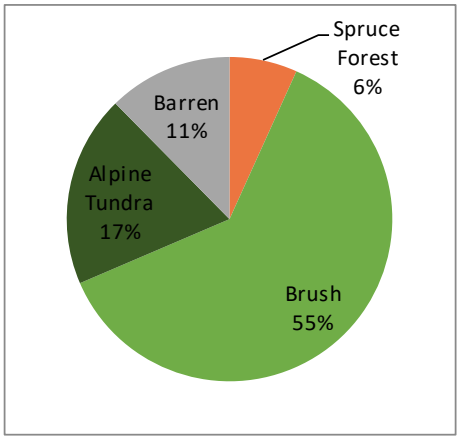


Park boundaries and Denali backcountry units: unit 4

Backcountry Permit Data:
Quota: 6
Percent visitors with bicycle: 15%

Unit Size: 32,566 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=29)
Day hikers (N=0)
Pooled total (N=29)
Total recorded days (n=43)

Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **70% yes**, 30% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 5** (Standard Deviation 4.8); range: 1—20 people

Backcountry Indicators in Unit 4: Backpackers to unit 4 typically experienced BMP indicators during their hike days that were within standard. The exception is natural sound disturbance in which the distribution of events **exceeded** the BMP standard.

Backcountry Indicators in Unit 4: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others. The plots (Figure 1) show that backpackers did not typically encounter other visitors more than twice per day, but the maximum range extends to 5 daily encounters.

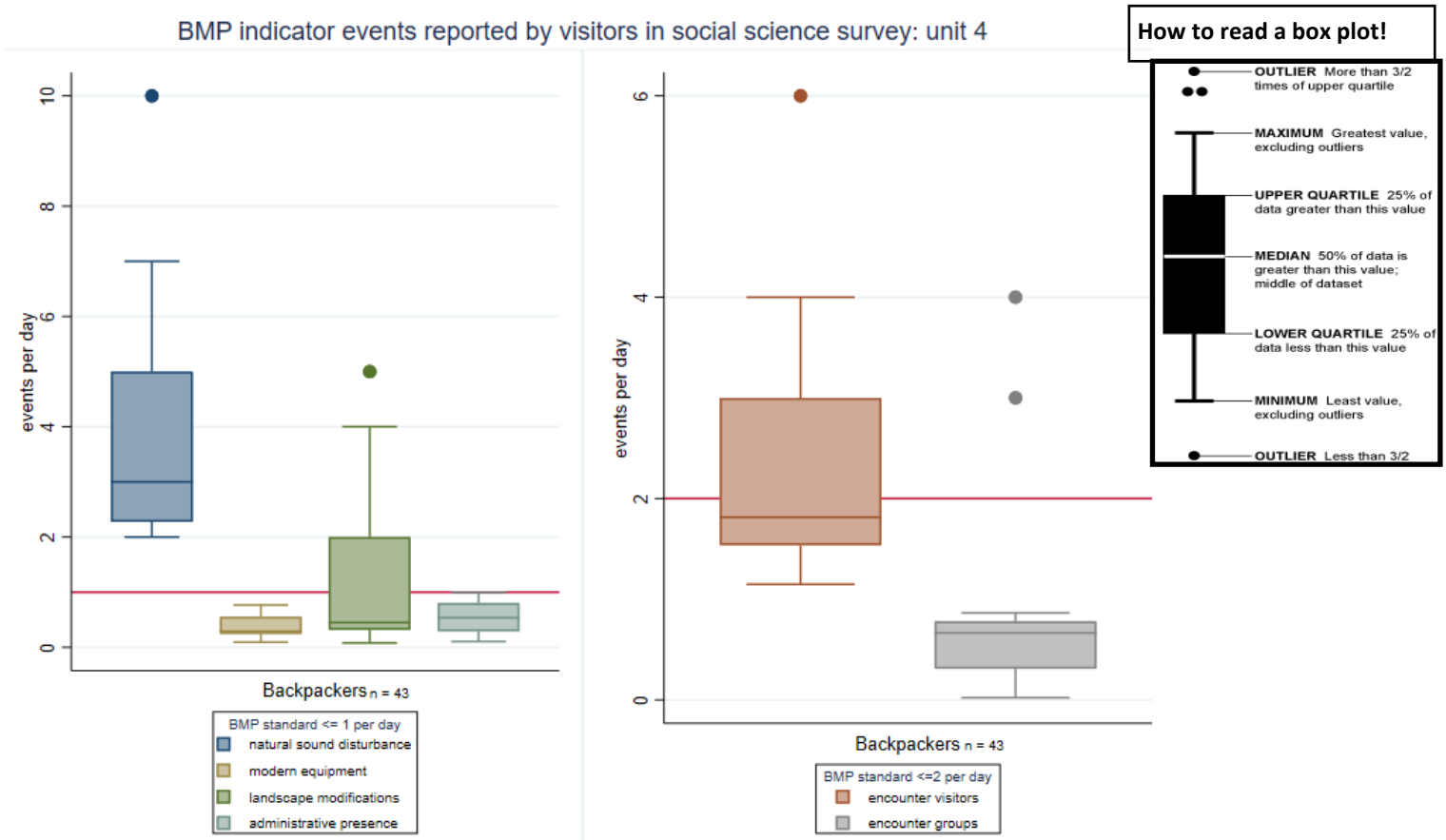


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, 100% of observations of natural sound disturbance for backpackers was above 2 events per day and have a larger maximum range than lower range. The top 50% of observations were between 3.5 & 9, whereas the bottom 50% of observations were between 2 & 3.5. Note 2 events greater than 25/ day were suppressed for readability.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.46 events per hour** or 7.36 events per defined backcountry visitor day (16 hours). 7.36 is well within the maximum range recorded by visitors. The median reported by visitors is lower than the sound station day average, but the corroboration of NPS and visitor data tells us the daily average is between 3 & 9 events.

Camping Density: 100% of backpackers to unit 4 were able to camp away from others; 100% reported they wanted to camp out of sight/sound. This meets the standard of always being able to camp out of sight/ sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 133

Average Miles: 19 miles/year

Average Visitors Encountered: 0.71/year Average Litter/Sanitation Encountered: 0.71/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 4. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 30% of total days sampled in Unit 4 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP stand-ard	Mean daily events (2011), n=24	Mean daily events (2018), n=43	Percent change days in standard: 2011- 2018	State of change in Unit 4: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	3.15	5.3	-27% in standard	
Encounter Visitors	≤ 2 / day	4.23	2.3	-1% in standard	
Encounter Groups	≤ 2 / day	0	.71	-12% in standard	
Modern Equipment	≤ 1 / day	.8	.541	+5% in standard	
Landscape Modification	≤ 1 / day	1.6	1.14	-5% in standard	
Admin. Presence	≤ 1 / day	0	.59	-1% in standard	
Litter	< 5%	.13	0	+20% in standard	

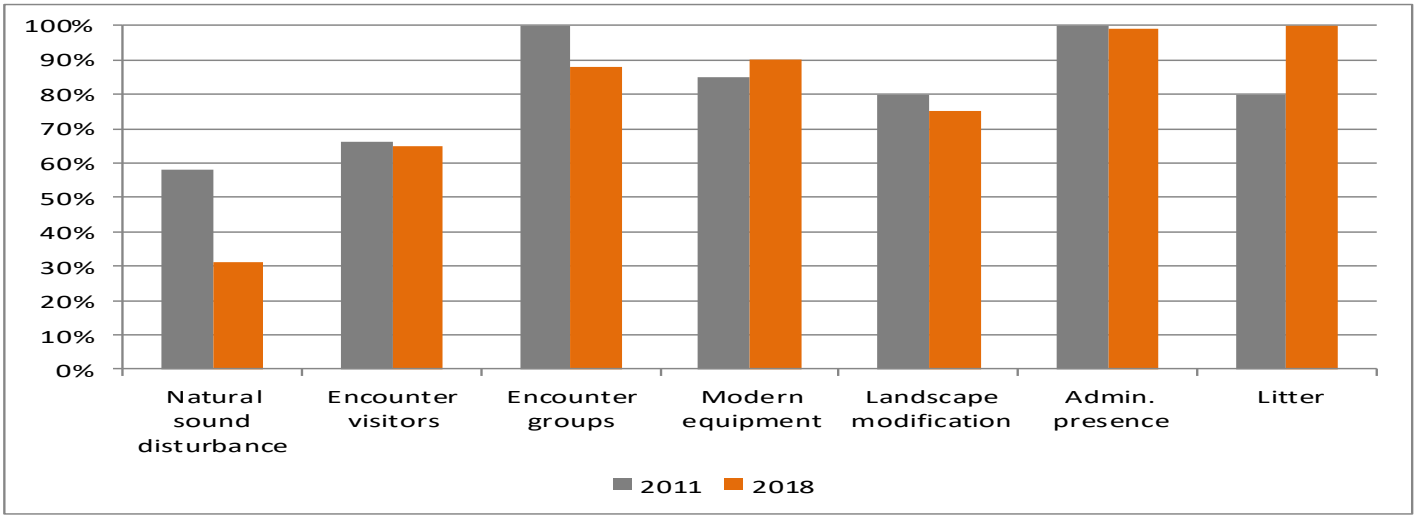


Figure 2. Percent sample days Unit 4 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 4 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

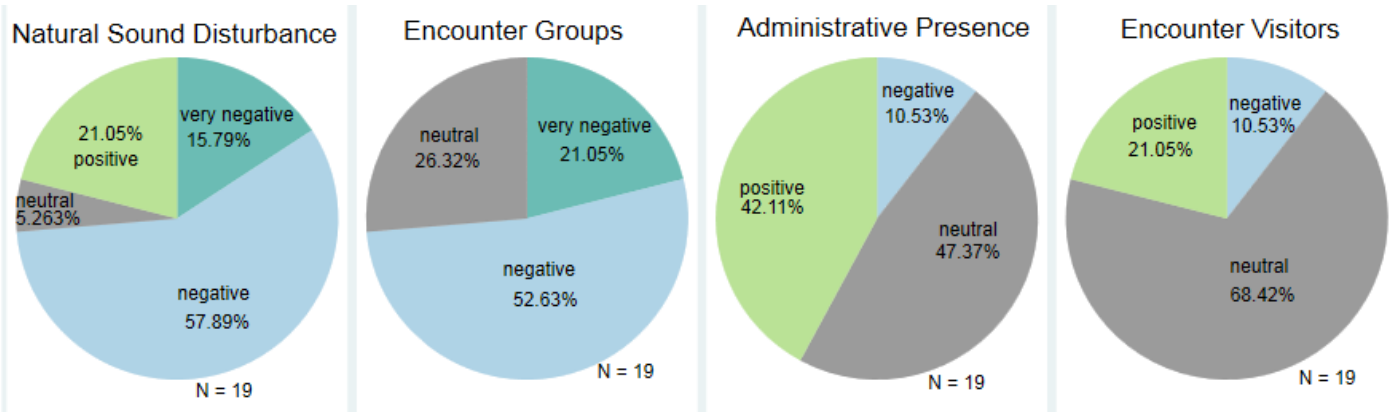


Figure 3. Positive or negative impact to visitor experience by BMP indicator

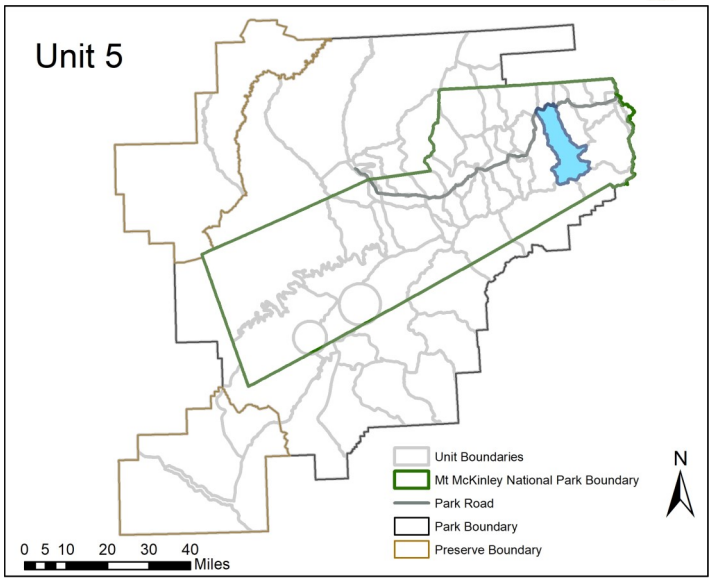
Backcountry Unit 5
"Upper Sanctuary"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Sanctuary river, looking north

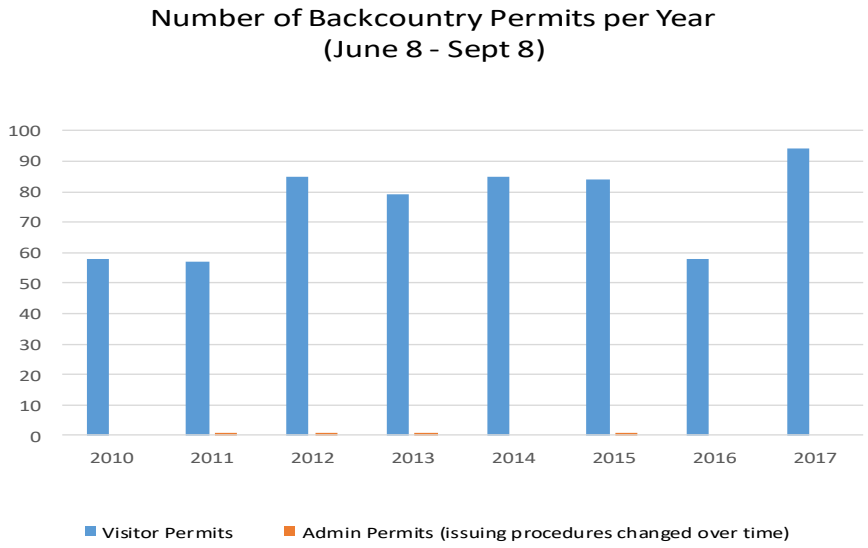


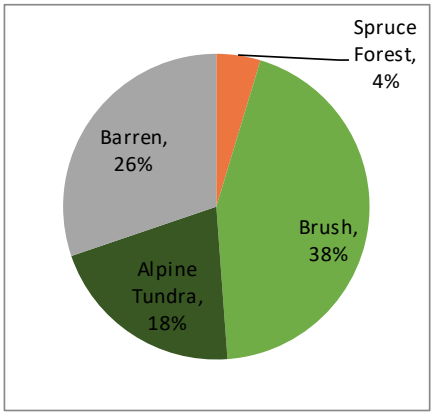
Park boundaries and Denali backcountry units: unit 5

Backcountry Permit Data:

Quota: 6
Percent visitors with bicycle: 16%

Unit Size: 67,061 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=20)
Day hikers (N=0)
Pooled total (N=20)
Total recorded days (n=41)

Percent visitors on guided hike: 5%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **53% yes**, 47% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 4.8** (Standard Deviation 4.0); range: 0—10 people

Backcountry Indicators in Unit 5: Backpackers to unit 5 typically experienced BMP indicators during their hike days that were within standard. The exception is natural sound disturbance in which the distribution of events **exceeded** the BMP standard.

Backcountry Indicators in Unit 5: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others (Figure 1).The plots demonstrate that backpackers did not encounter many landscape modifications, but there are three outliers of encounters above 3 events per day.

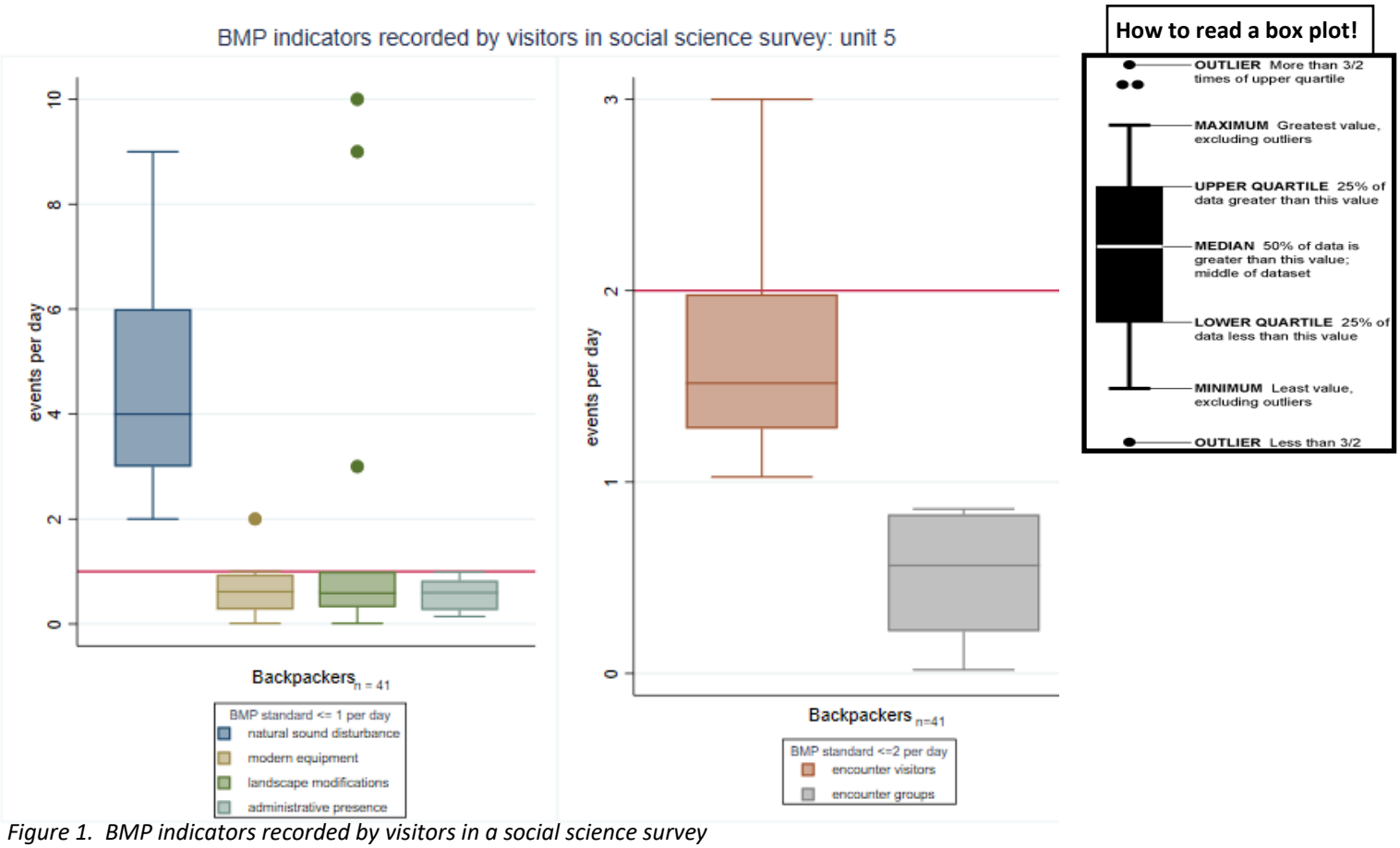


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, the top 50% of observations for backpackers was above 4 events per day and have a larger high-event extreme range than low-event range. 100% of backpackers' observations **exceeded** the BMP standard of 2 events per day.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.97 events per hour** or 15.52 events per defined backcountry visitor day (16 hours). 15.52 is not within the maximum range recorded by visitors. The median reported by the social science survey is lower than the sound station day average, and a lack of corroboration of NPS and visitor data means we cannot currently estimate a true day average.

Camping Density: 100% of backpackers to unit 5 were able to camp away from others; 100% reported they wanted to camp out of sight/sound. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 170

Average Miles: 24 miles/year

Average Visitors Encountered: 0.14/year Average Litter/Sanitation Encountered: 0.29/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 5. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 30% of total days sampled in Unit 5 were within the BMP standard—an improvement from 2011 (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011), N = 21	Mean daily events (2018), N = 20	Percent change days in standard: 2010 - 2018	State of change in Unit 5: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	6	4.4	+13% in standard	
Encounter Visitors	≤ 2 / day	1	1.7	-12% in standard	
Encounter Groups	≤ 2 / day	0	.527	-8% in standard	
Modern Equipment	≤ 1 / day	.67	.65	-3% in standard	
Landscape Modification	≤ 1 / day	.63	1.54	-12% in standard	
Administrative Presence	≤ 1 / day	0	.55	-1% in standard	
Litter	< 5%	0	0	+0% in standard	

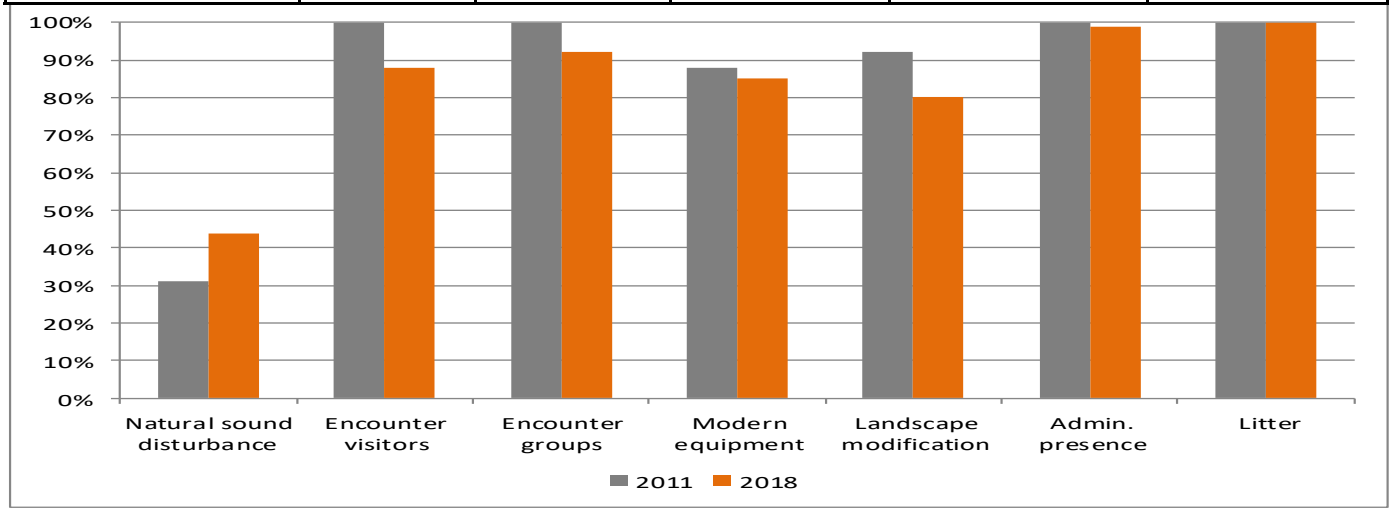


Figure 2. Percent sample days Unit 5 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 5 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

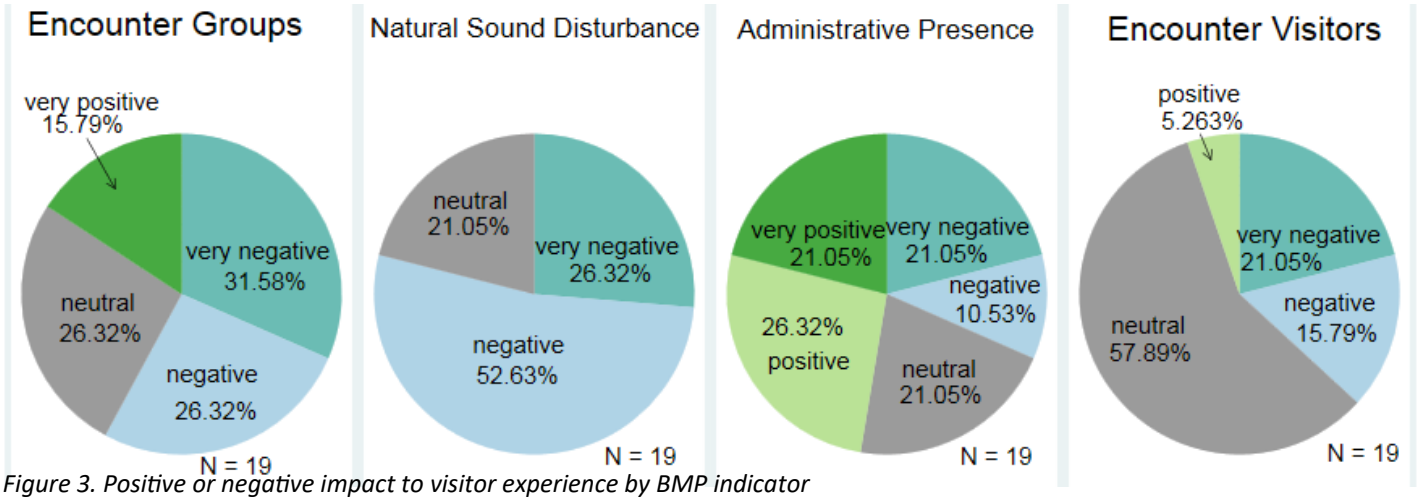


Figure 3. Positive or negative impact to visitor experience by BMP indicator

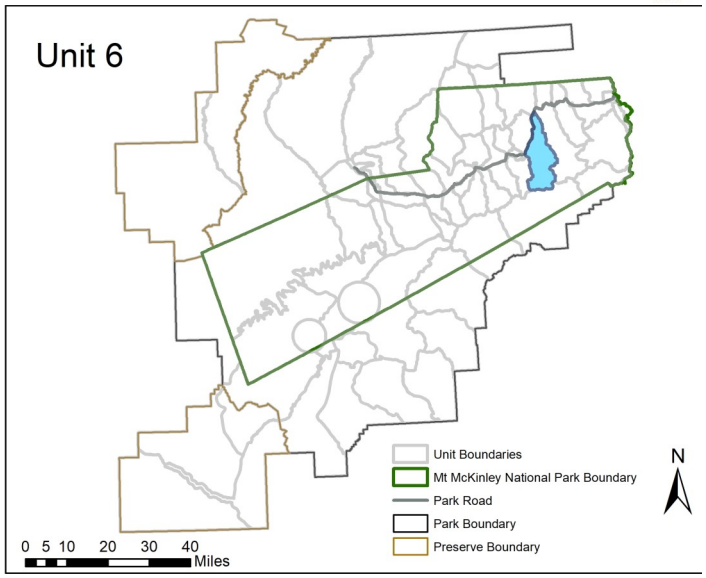
Backcountry Unit 6
"Upper Teklanika"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Teklanika river, looking north

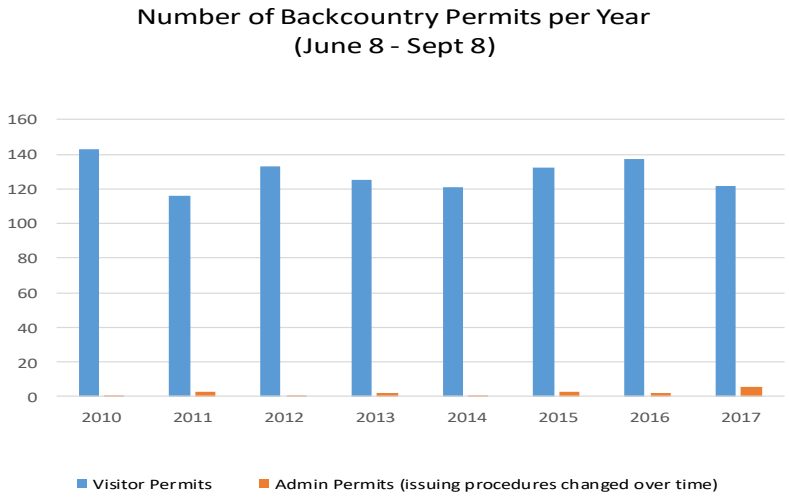


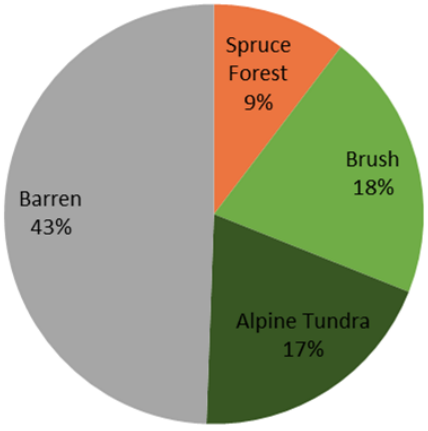
Park boundaries and Denali backcountry units: unit 6

Backcountry Permit Data:

Quota: 6
Percent visitors with bicycle: 15%

Unit Size: 54,041 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=21)
Day hikers (N=14)
Pooled total (N=35)
Total recorded days (n=51)

Percent visitors on guided hike: 6%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **80% yes**, 20% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 10** (Standard Deviation 17.5); range: 2—100 people

Backcountry Indicators in Unit 6: Day hikers and backpackers to unit 6 typically experienced Backcountry Management Plan (BMP) indicators during their hike days that **exceeded** BMP standards for natural sound disturbance, modern equipment, landscape modification, and litter/sanitation encounters. Exceptions were encounters with visitors, large groups, and administrative presence in which the distribution of events are primarily below the BMP standard.

Backcountry Indicators in Unit 6: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others (Figure 1).

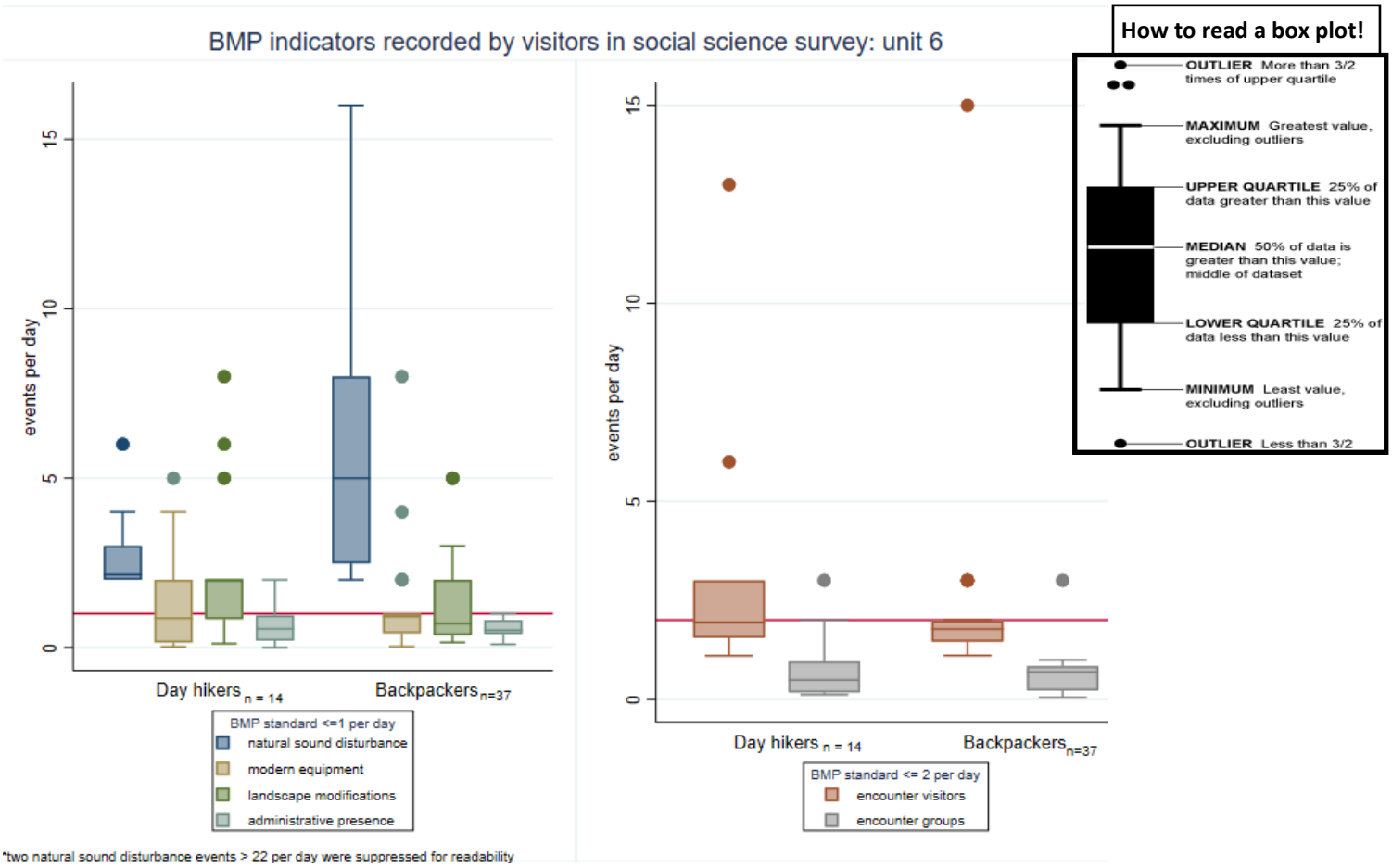


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, 100% of observations for day hikers and backpackers was above 2 events per day and have a larger maximum range than lower range. The top 50% of backpackers' observations were between 5 & 17 events per day. Note two natural sound disturbance outliers greater than 22 events per day were suppressed for readability.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **1.22 events per hour** or 19.52 events per defined backcountry visitor day (16 hours). 19.52 is not within the maximum range recorded by visitors, but there are two outliers greater than 22 per day. The median reported by the social science survey is lower than the sound station day average, but the corroboration of high daily events recorded by visitors and NPS tells us the 'true' average lies between 5 & 20 per day.

Camping Density: 100% of backpackers to unit 6 were able to camp away from others; 5% (2 groups) reported they *wanted* to camp with others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 202

Average Miles: 29 miles/year

Average Visitors Encountered: 0.86/year Average Litter/Sanitation Encountered: 0.43/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 6. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 41% of total days sampled in Unit 6 were within the BMP standard—an improvement from 2011 (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011), n=30	Mean daily events (2018), n=51	Percent change days in standard: 2010 - 2018	State of change in Unit 6: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	3.68	5.23	-25% in standard	
Encounter Visitors	≤ 2 / day	1.03	2.5	-27% in standard	
Encounter Groups	≤ 2 / day	0	.718	-5% in standard	
Modern Equipment	≤ 1 / day	4.5	1.3	+36% in standard	
Landscape Modification	≤ 1 / day	1.13	1.62	-3% in standard	
Administrative Presence	≤ 1 / day	0	.6	-14% in standard	
Litter	< 5%	.1	.02	+16% in standard	

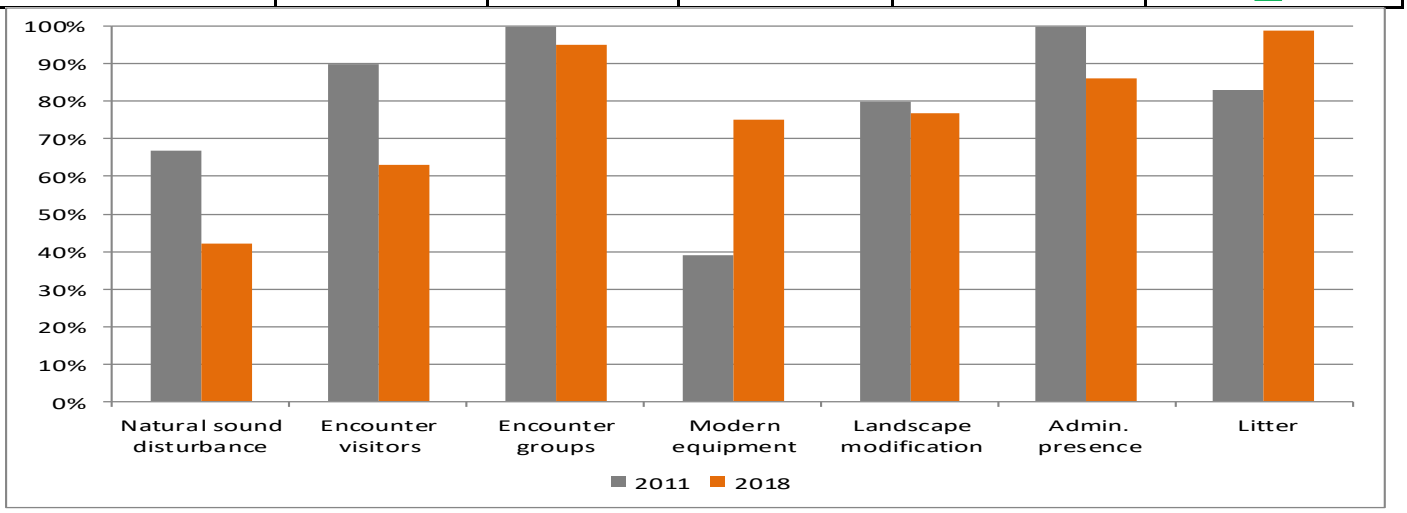


Figure 2. Percent sample days Unit 6 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 6 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

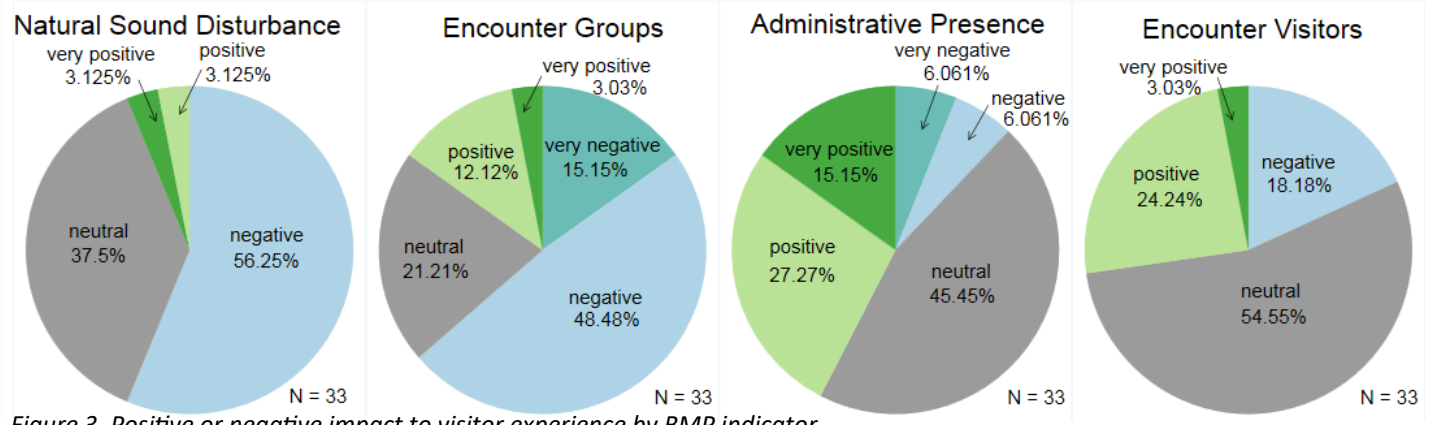


Figure 3. Positive or negative impact to visitor experience by BMP indicator

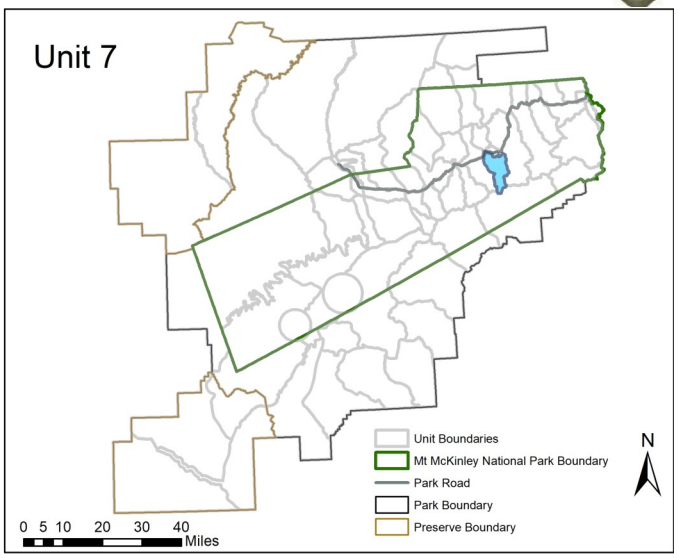
Backcountry Unit 7
"Upper East Fork"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Upper east fork, looking south

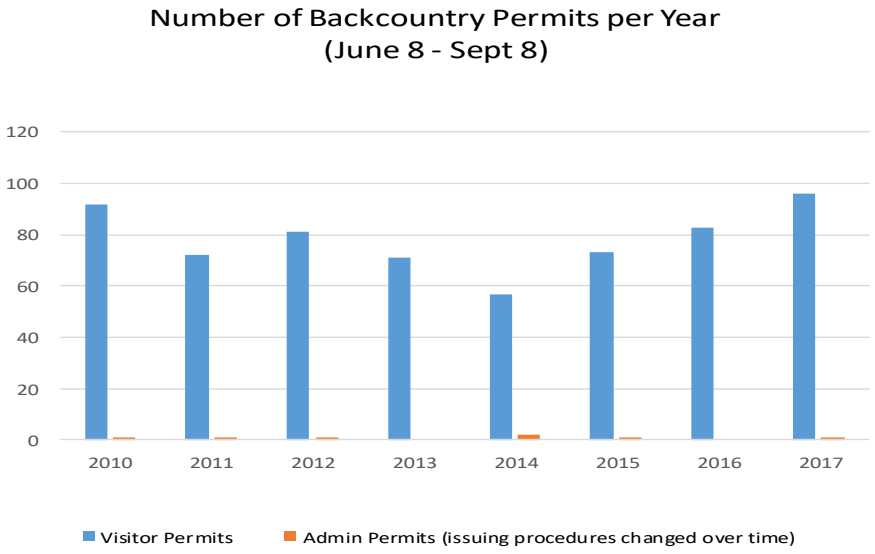


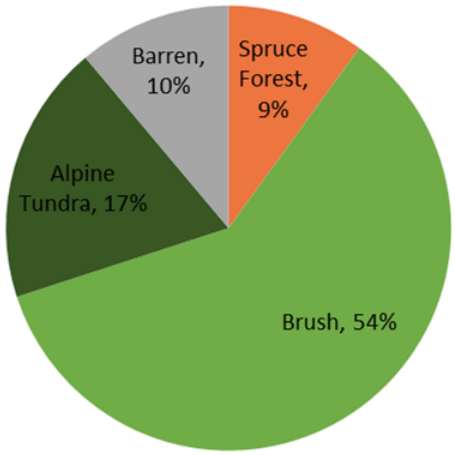
Park boundaries and Denali backcountry units: unit 7

Backcountry Permit Data:

Quota: 4
Percent visitors with bicycle: 2%

Unit Size: 23,438 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N=28)
Day hikers (N=0)
pooled total (N=28)
Total recorded days (n=44)

Percent visitors on guided hike: 2%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **53% yes,** 32% no, (14% missing)

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 3.9** (Standard Deviation 3.28); range: 0—20 people

Backcountry Indicators in Unit 7: Backpackers to unit 7 typically experienced BMP indicators during their hike days that were within standard. The exception is natural sound disturbance in which the distribution of events **exceeded** the BMP standard.

Backcountry Indicators in Unit 7: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others (Figure 1).

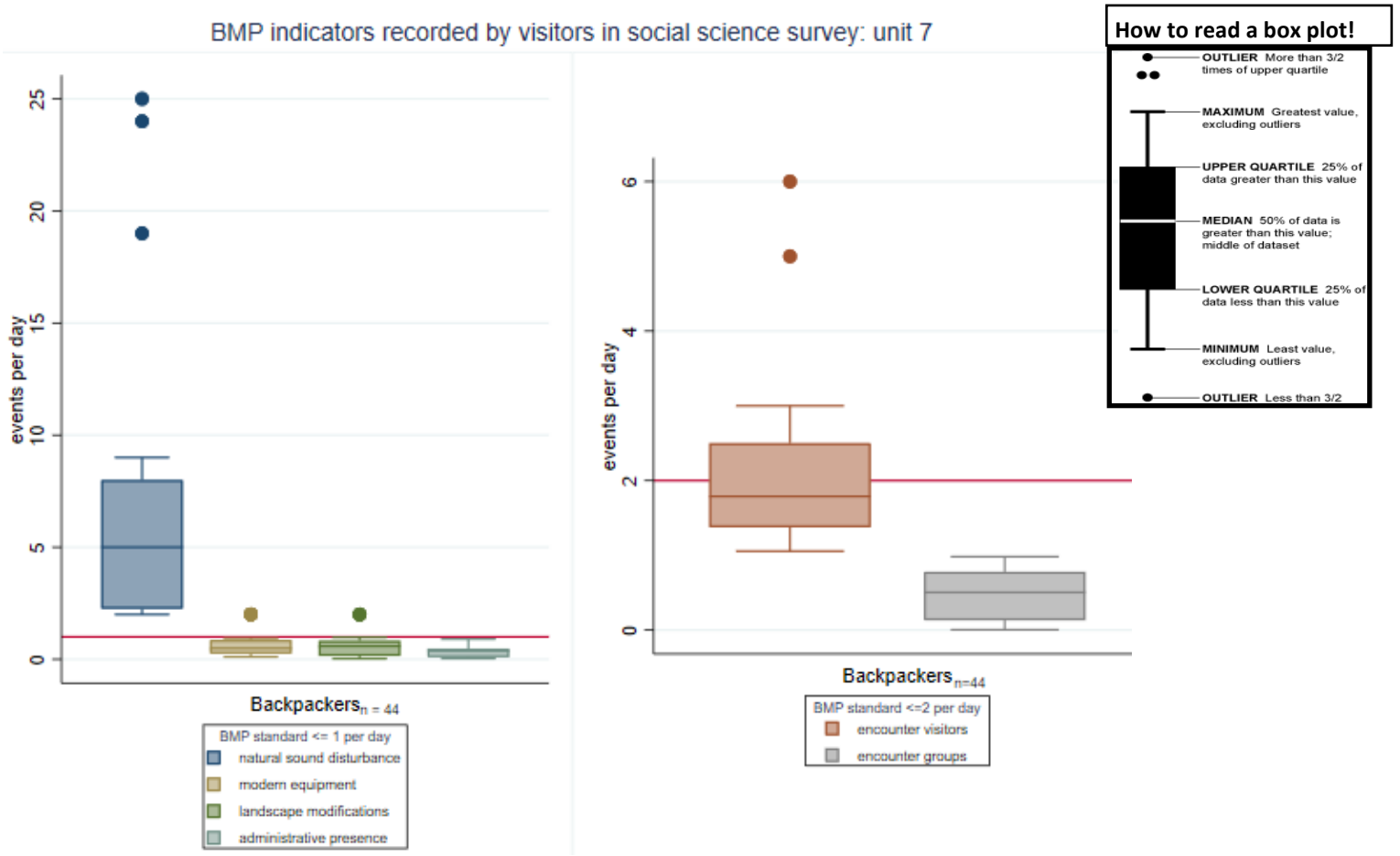


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, the top 50% of observations for backpackers was above 5 events per day, an upper quartile range between 5 & 9 events per day. The dots are outlier data points for BMP indicator events. Two outliers were 24 and 25 events per day.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **1.27 events per hour** or 20.32 events per defined backcountry visitor day (16 hours). 20.32 is not within the maximum range recorded by visitors, but there are three outliers around 20. The median reported by the social science survey is lower than the sound station day average, but the corroboration of high daily events recorded by visitors and NPS tells us the 'true' average lies between 5 & 20 per day.

Camping Density: 100% of backpackers to unit 7 were able to camp away from others; 2% (1 group) reported that they *wanted* to camp near others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 201

Average Miles: 29 miles/year

Average Visitors Encountered: 0.29/year Average Litter/Sanitation Encountered: 0.14/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 7. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 30% of total days sampled in Unit 7 were within the BMP standard—an improvement from 2011 (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011), n = 28	Mean daily events (2018), n = 44	Percent change days in standard: 2011 - 2018	State of change in Unit 7: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	7.93	6.18	+5% in standard	
Encounter Visitors	≤ 2 / day	2	2.15	-21% in standard	
Encounter Groups	≤ 2 / day	.67	.454	-1% in standard	
Modern Equipment	≤ 1 / day	1.57	.71	+23% in standard	
Landscape Modification	≤ 1 / day	1.07	.61	+5% in standard	
Admin. Presence	≤ 1 / day	0	.34	-1% in standard	
Litter	< 5%	.12	0	+12% in standard	

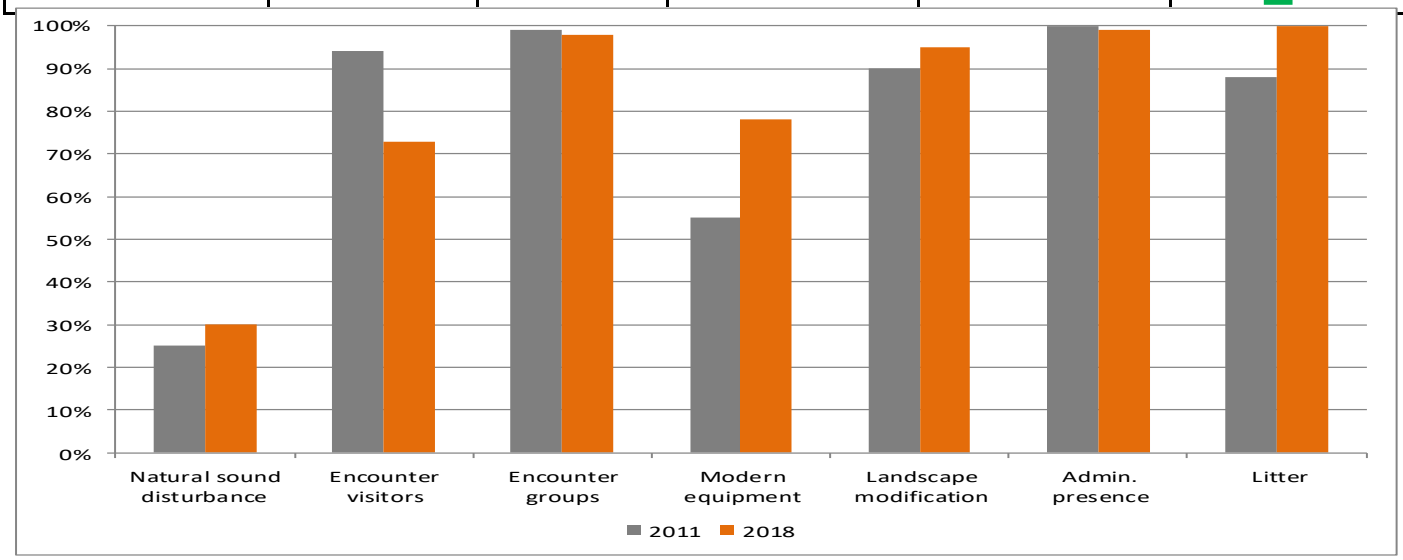


Figure 2. Percent sample days Unit 7 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 7 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

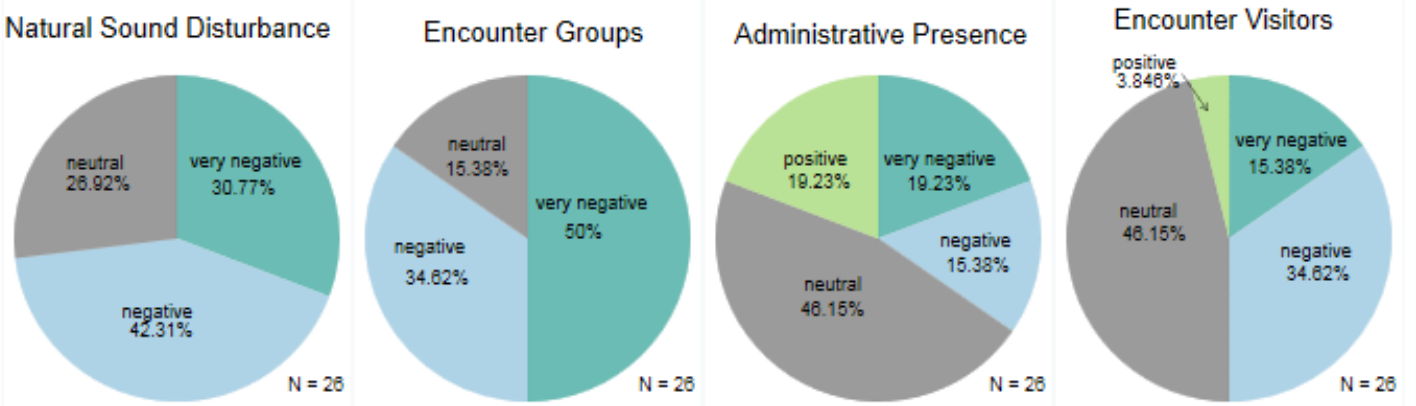


Figure 3. Positive or negative impact to visitor experience by BMP indicator

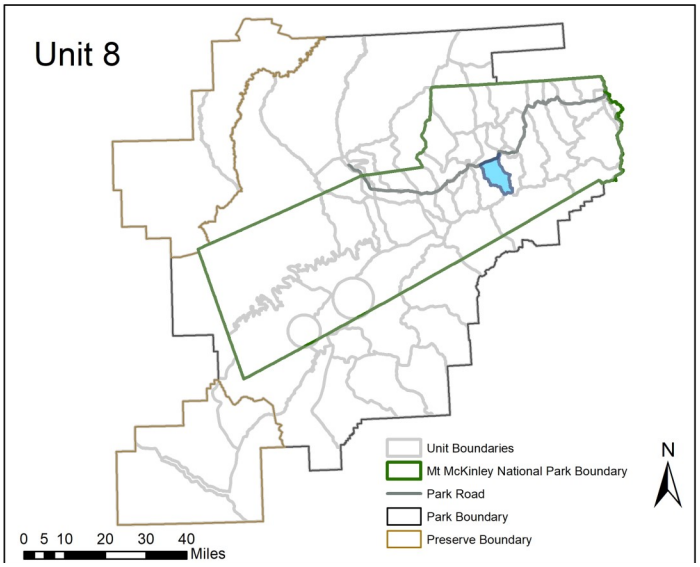
Backcountry Unit 8
"Polychrome Glaciers"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



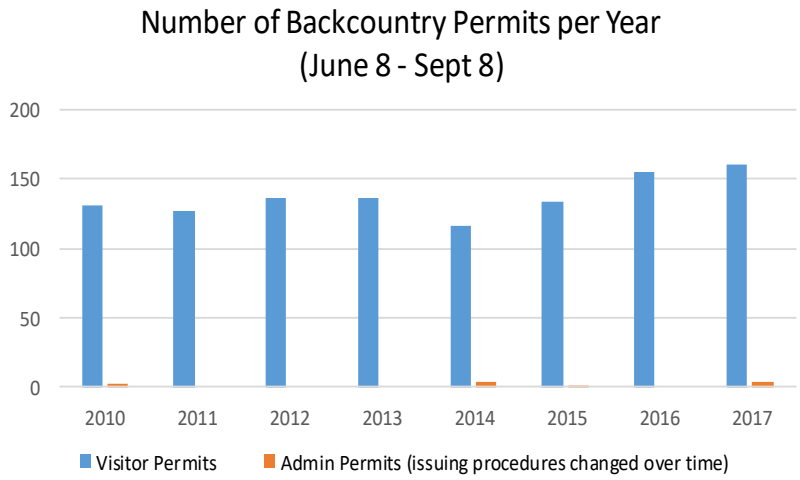
Polychrome mountains, looking south

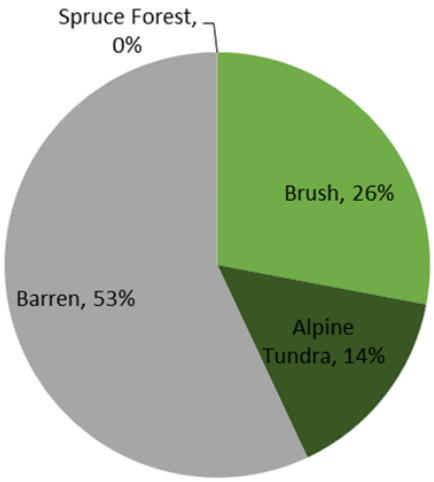


Park boundaries and Denali backcountry units: unit 8

Backcountry Permit Data:
Quota: 6
Percent visitors with bicycle: 11%

Unit Size: 23,378 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=77)
Day hikers (N=6)
Pooled total (N=83)
Total recorded days (n=94)

Percent visitors on guided hike: 4%
Ability to camp out of sight/sound: 96% yes
Percent "visitor first choice" unit: **62% yes,** 33% no, (5% missing)

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 4** (Standard Deviation 3.28); range: 0—20 people

Backcountry Indicators in Unit 8: Day hikers and backpackers to unit 8 typically experienced BMP indicators during their hike days that were within standard. The exception is natural sound disturbance in which the distribution of events **exceeded** the BMP standard.

Backcountry Indicators in Unit 8: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

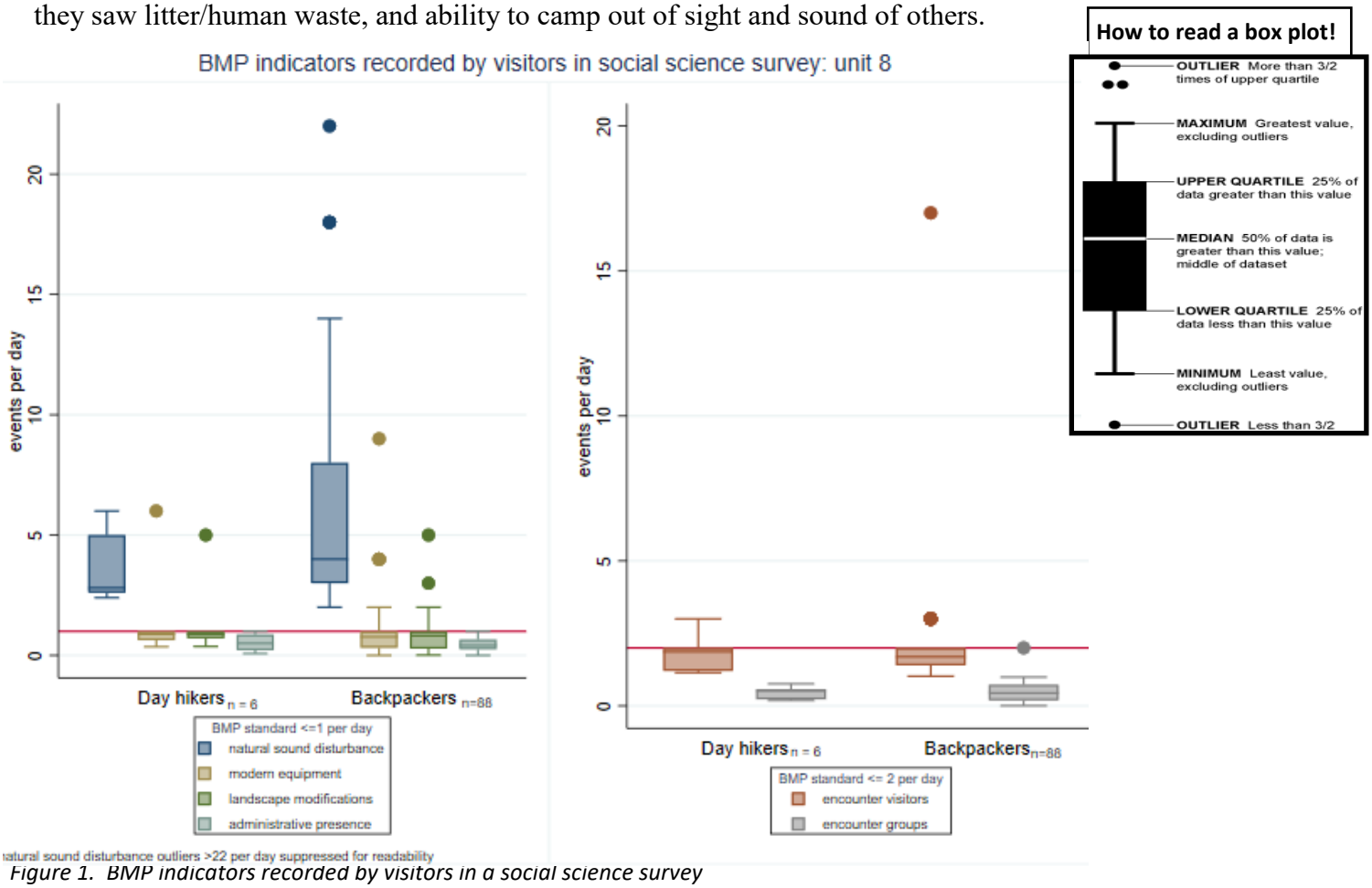


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, the top 50% of observations for backpackers was above 4 events per day and have a larger high-event extreme range than low-event range. The dots are outlier data points for BMP indicator events. Note four outliers of natural sound disturbance greater than 22 per day were suppressed in the plots for readability.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.4 events per hour** or 6.4 events per defined backcountry visitor day (16 hours). 6.4 is within the interquartile range, and well below the maximum range recorded by visitors. The median reported by the social science survey is lower than the sound station day average, but the corroboration of high daily events recorded by visitors and NPS tells us the 'true' average lies between 4 & 14 per day.

Camping Density: 96% of backpackers to unit 8 were able to camp away from others; 2% (3 groups) reported they *wanted* to camp near others. This does not meet the standard of always being able to camp out of sight/sound of others, but some may have purposefully camped within sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 70

Average Miles: 10 miles/year

Average Visitors Encountered: 1/year Average Litter/Sanitation Encountered: 0.86/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 8. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 49% of total days sampled in Unit 8 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011), N = 27	Mean daily events (2018), N = 83	Percent change days in standard: 2010 - 2018	State of change in Unit 8: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	4.67	6.42	-30% in standard	
Encounter Visitors	≤ 2 / day	1.11	1.8	-6% in standard	
Encounter Groups	≤ 2 / day	0	.494	-13% in standard	
Modern Equipment	≤ 1 / day	4.18	1.02	+23% in standard	
Landscape Modification	≤ 1 / day	2.47	.962	+20% in standard	
Admin. Presence	≤ 1 / day	.1	.45	+1% in standard	
Litter	< 5%	.15	.14	-6% in standard	

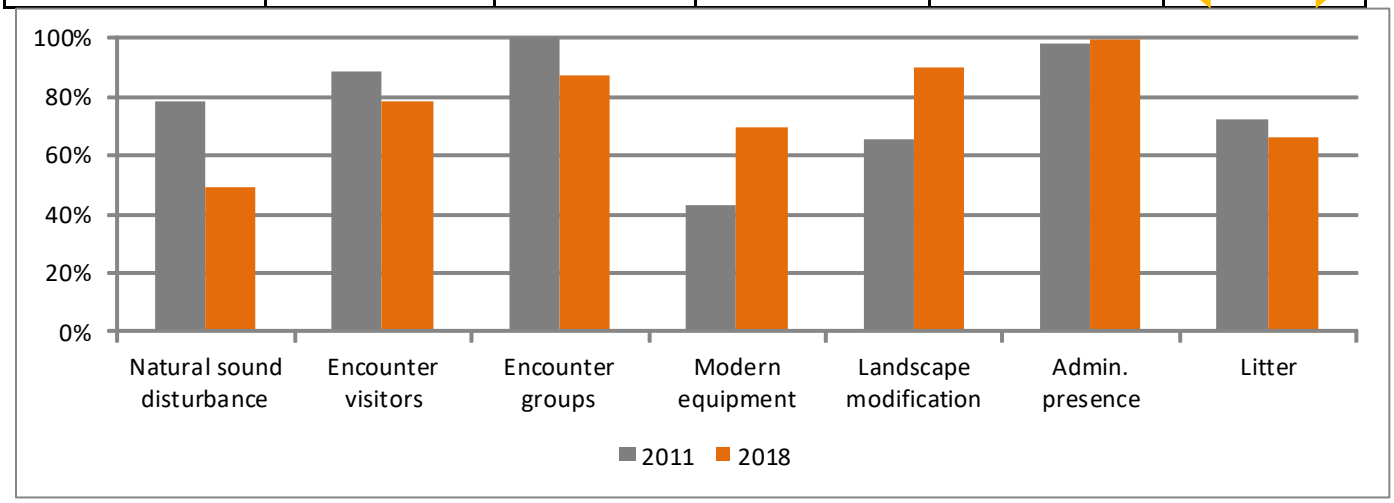


Figure 2. Percent sample days Unit 8 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 8 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

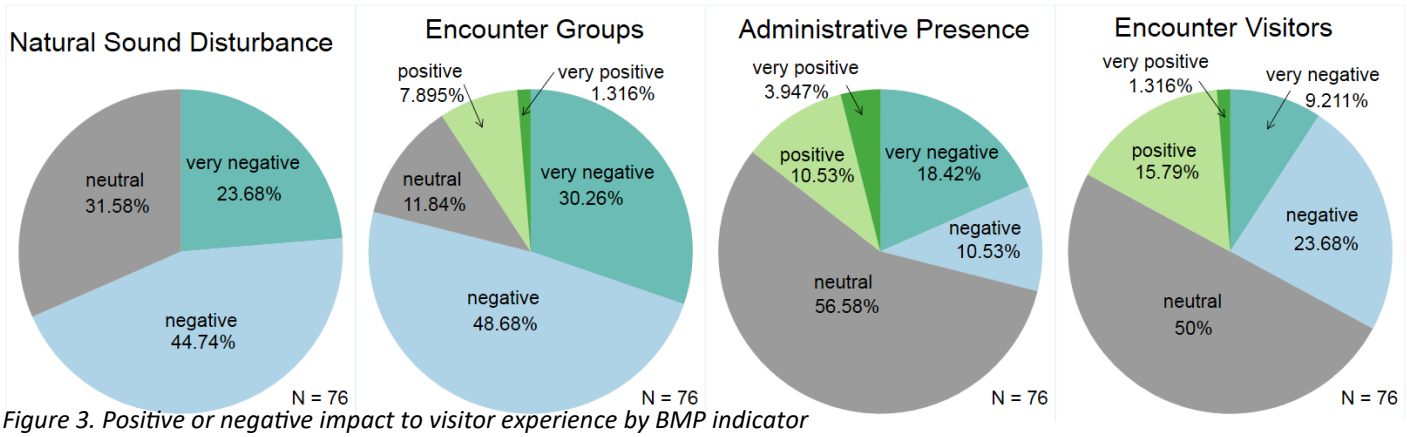


Figure 3. Positive or negative impact to visitor experience by BMP indicator

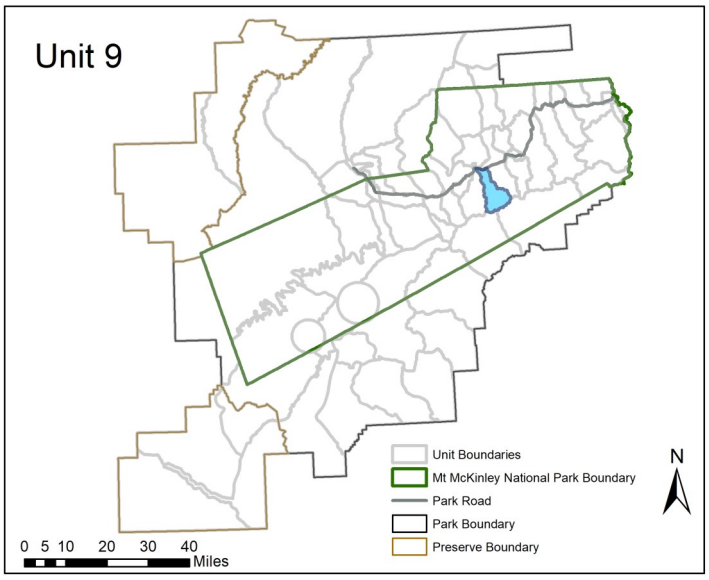
Backcountry Unit 9
"East Branch Upper Toklat"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



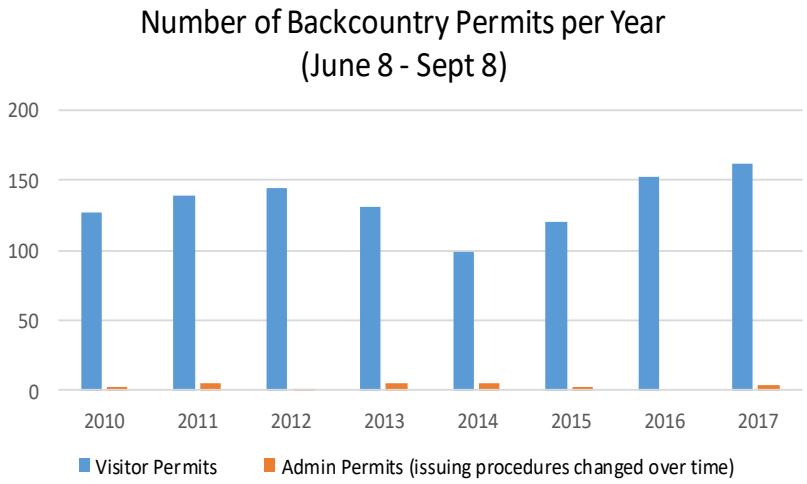
East branch Toklat, looking south



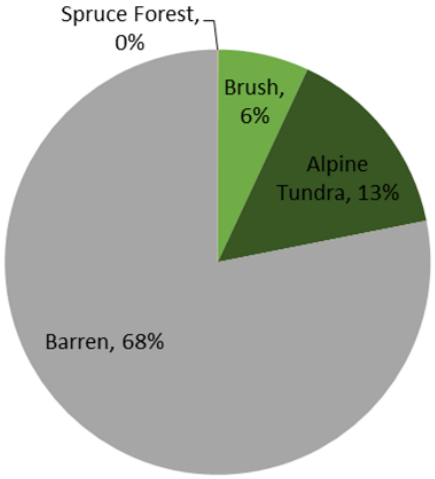
Park boundaries and Denali backcountry units: unit 9

Backcountry Permit Data:

Quota: 6
Percent visitors with bicycle: 14%



Unit Size: 26,247 acres



Broad vegetation class composition

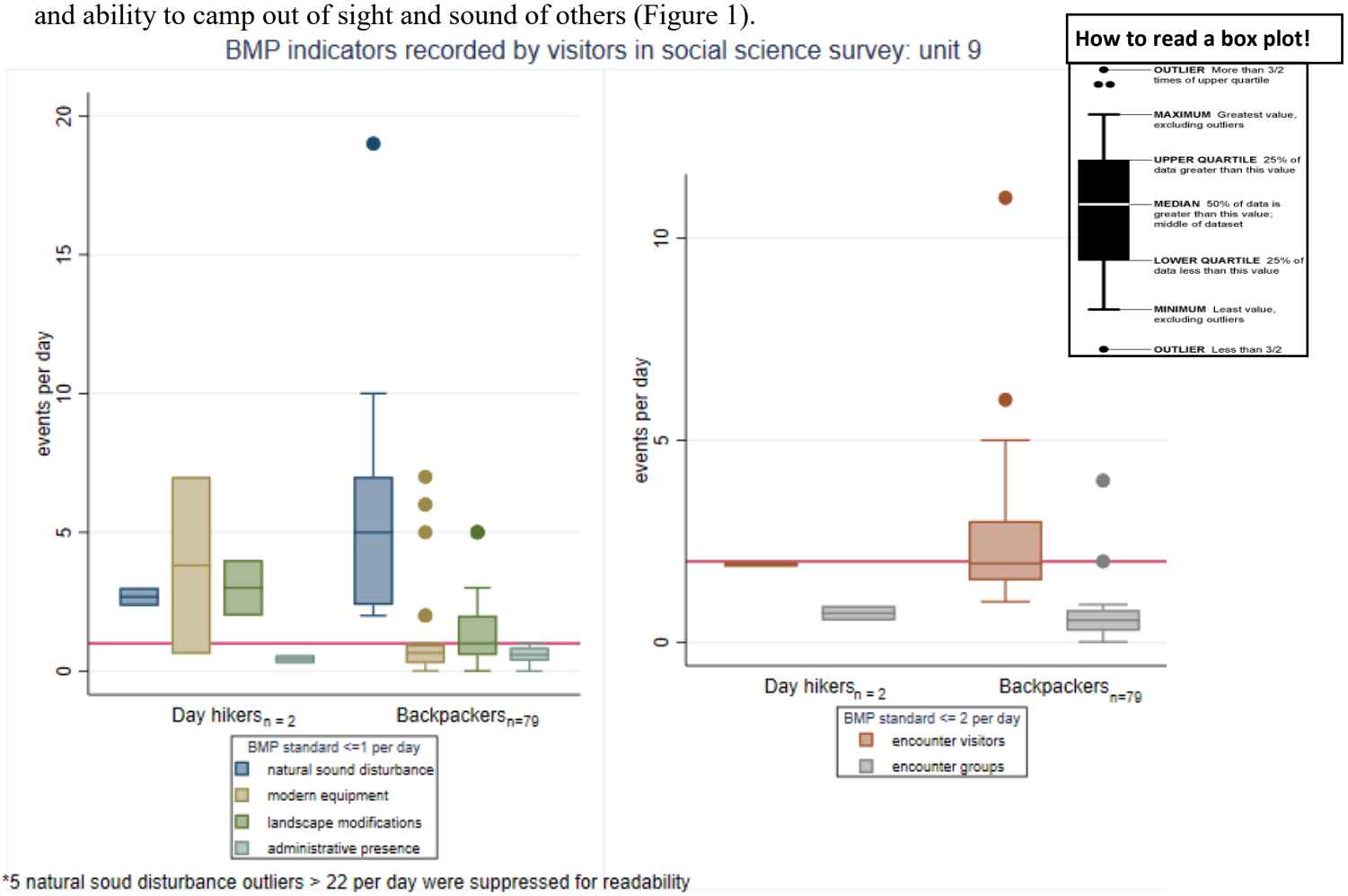
Visitor Survey Data (2017-2018):
Backpackers (N= 63)
Day hikers (N= 2)
Pooled total (N= 65)
Total recorded days (n= 81)

Percent visitors on guided hike 3%
Ability to Camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **82% yes**, 18% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 3.5** (Standard Deviation 3.07); range 0—15

Backcountry Indicators in Unit 9: Day hikers and backpackers to unit 9 typically experienced Backcountry Management Plan (BMP) indicators that **exceeded** standards. Exceptions were encounters with large groups and administrative presence; these indicators were primarily **below** the standard.

Backcountry Indicators in Unit 9: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others (Figure 1).



*5 natural soud disturbance outliers > 22 per day were suppressed for readability

Natural Sound disturbance: In the visitor survey, the top 50% of observations for backpackers was above 5 events per day, with a fairly balanced interquartile range. Day hikers' observations are between 2.2 & 3 events per day (note: n = 2). The dots are outlier data points for BMP indicator events. Note five event outliers (backpackers) of natural sound disturbance greater than 20 per day were suppressed in the plots for readability.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.57 events per hour** or 9.12 events per defined backcountry visitor day (16 hours). 9.12 is directly within the middle range visitors recorded and near the median. Median daily events recorded by visitors (5.25) is lower than the sound station average, but the corroboration of high daily events recorded by visitors and NPS tells us the daily average lies between 5 & 10 per day.

Camping Density: 100% of backpackers to unit 9 were able to camp away from others; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 99

Average Miles: 14 miles/year

Average Visitors Encountered: 1.71/year Average Litter/Sanitation Encountered: 1.71/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 9. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 51% of total days sampled in Unit 9 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011), n = 58	Mean daily events (2018), n = 81	Percent change days in standard: 2010 - 2018	State of change in Unit 9: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	3.7	6.53	-17% in standard	
Encounter Visitors	≤ 2 / day	1.2	2.1	-25% in standard	
Encounter Groups	≤ 2 / day	0	.523	-15% in standard	
Modern Equipment	≤ 1 / day	1.43	1.05	+16% in standard	
Landscape Modification	≤ 1 / day	.98	1.38	-24% in standard	
Admin. Presence	≤ 1 / day	0	.57	-9% in standard	
Litter	< 5%	.042	.1	-18% in standard	

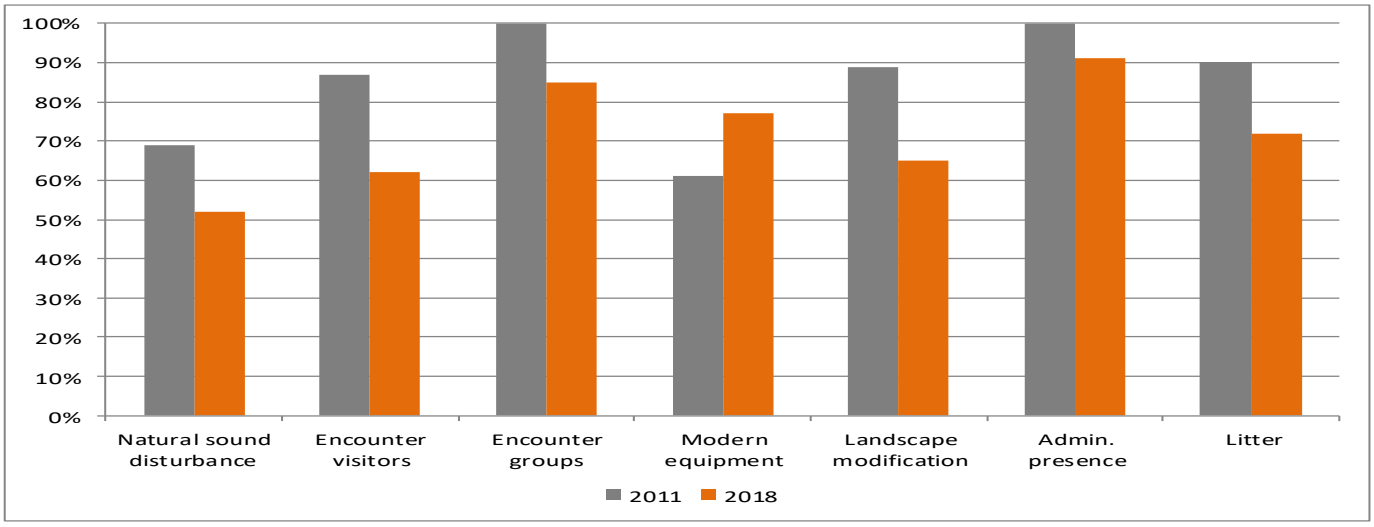


Figure 2. Percent sample days Unit 9 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 9 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

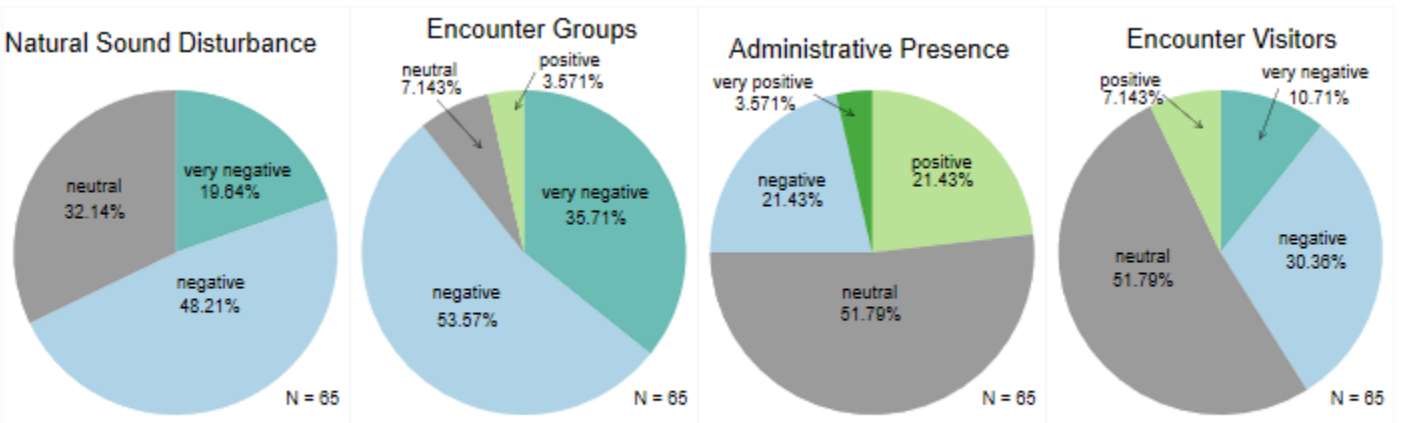


Figure 3. Positive or negative impact to visitor experience by BMP indicator

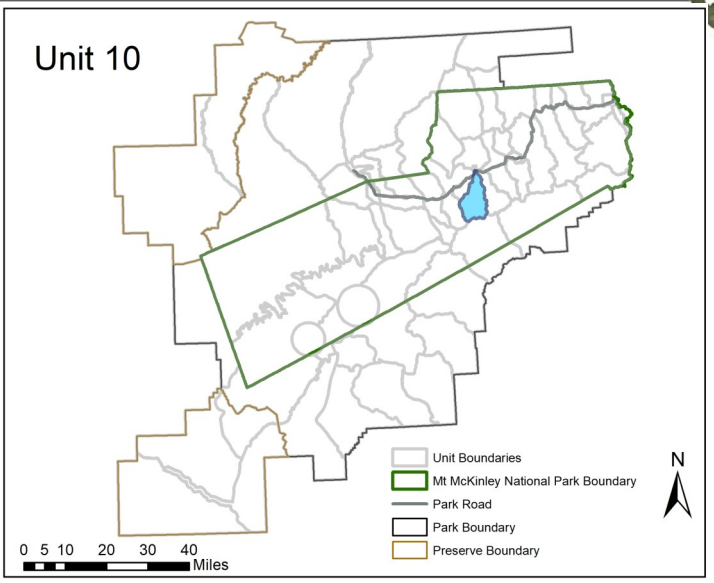
Backcountry Unit 10
"West Branch Upper Toklat"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



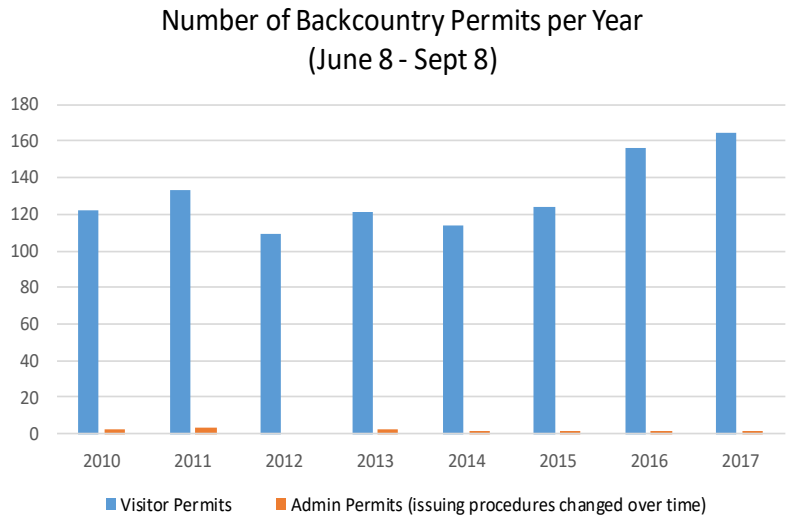
West branch Toklat

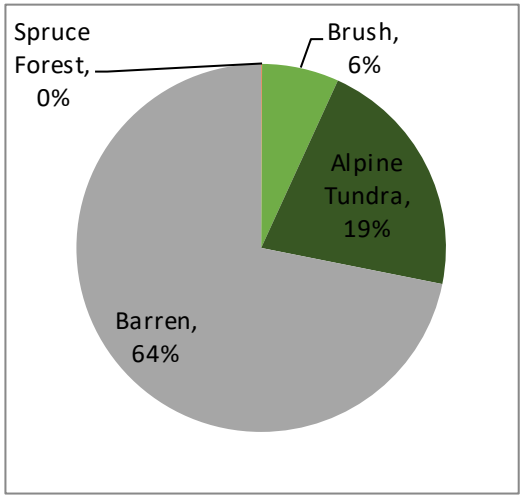


Park boundaries and Denali backcountry units: unit 10

Backcountry Permit Data:
Quota: 6
Percent visitors with bicycle: 12%

Unit Size: 31,428 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=61)
Day hikers (N=1)
Pooled total (N=62)
Total recorded days (n= 79)

Percent "visitor first choice" unit: **73% yes**, 27% no
Percent visitors on guided hike: 2%
Ability to camp out of sight/sound: 85% yes

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" The **pooled average was 3.88** (Standard Deviation 3.12); range: 0—15 people.

Backcountry Indicators in Unit 10: Day hikers and backpackers to unit 10 typically experienced Backcountry Management Plan (BMP) indicators during their hike days that **exceeded** BMP standards for visitor encounters, natural sound disturbance, landscape modification, and litter/sanitation encounters. Exceptions are encounters with large groups, modern equipment, and administrative presence in which the distribution of events are primarily below the BMP standard.

Backcountry indicators in Unit 10: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others (Figure 1).

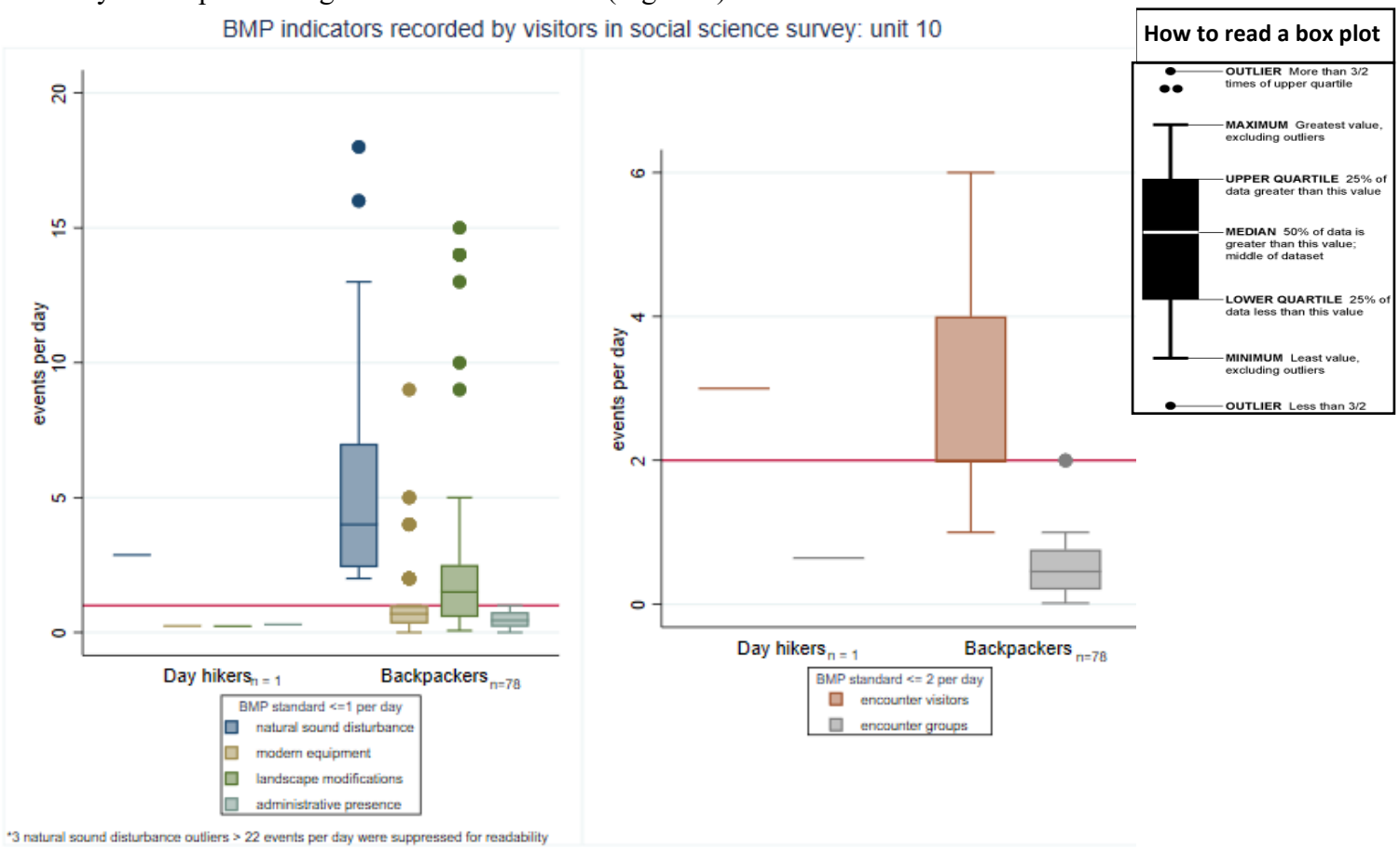


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, the top 50% of observations for backpackers was above 4.7 events per day and have a larger high-event extreme range than low-event range. The dots are outlier data points for BMP indicator events. Note three natural sound disturbance outliers greater than 20 events per day were suppressed for readability.

NPS sound monitoring program (2005-2018), the average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **1.4 events per hour** or 22.4 events per defined backcountry visitor day (16 hours). 22.4 is within the range visitors recorded, when including the three outliers of 22, 24, & 30 events per day. Median events recorded by visitors is lower than the sound station day average, but the corroboration of high daily events recorded by visitors and NPS tells us the 'true' average lies between 5 & 22 per day.

Camping Density: 85% of backpackers to unit 10 were able to camp away from others; 100% reported they wanted to camp out of sight/sound. This does not meet the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 233

Average Miles: 33 miles/year

Average Visitors Encountered: 3.33/year Average Litter/Sanitation Encountered: 3/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 10. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 45% of total days sampled in Unit 10 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	**BMP Standard**	**Mean daily events (2011) N = 57**	**Mean daily events (2018) N = 62**	**Percent change days in standard: 2010 - 2018**	**State of Change in Unit 10: 2011 to 2018**
Natural Sound Disturbance	≤ 1 / day	3.73	6.67	-25% in standard	
Encounter Visitors	≤ 2 / day	1.22	2.81	-17% in standard	
Encounter Groups	≤ 2 / day	0	1.11	-15% in standard	
Modern Equipment	≤ 1 / day	1.94	1.18	+23% in standard	
Landscape Modification	≤ 1 / day	1.18	2.87	-22% in standard	
Admin. Presence	≤ 1 / day	.06	.45	-2% in standard	
Litter	< 5%	.11	.09	+1% in standard	

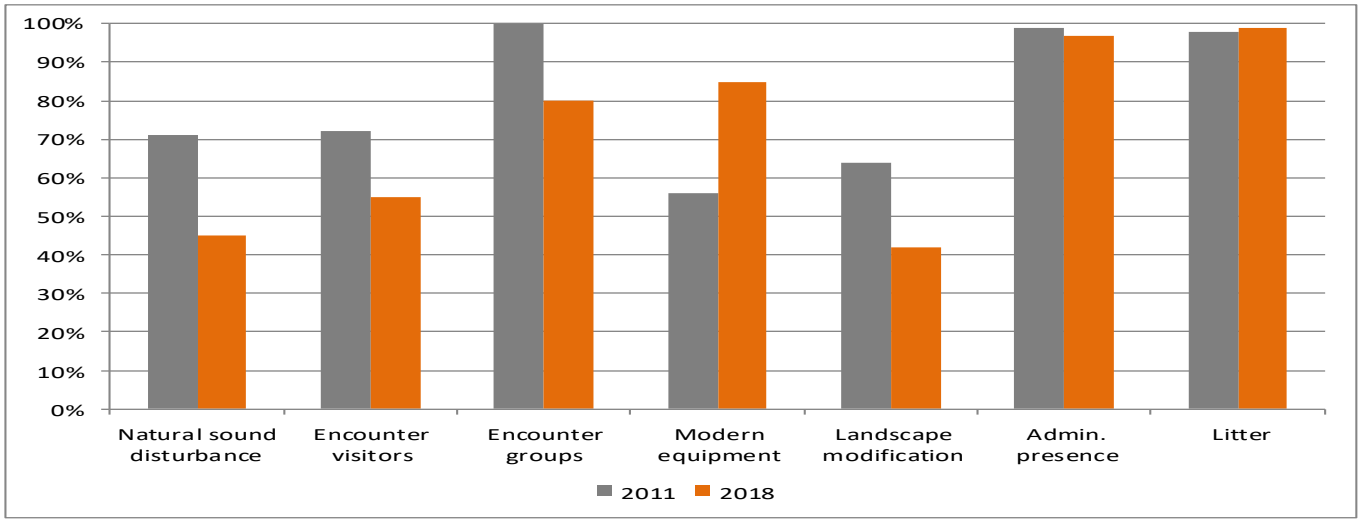


Figure 2. Percent sample days Unit 10 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 10 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

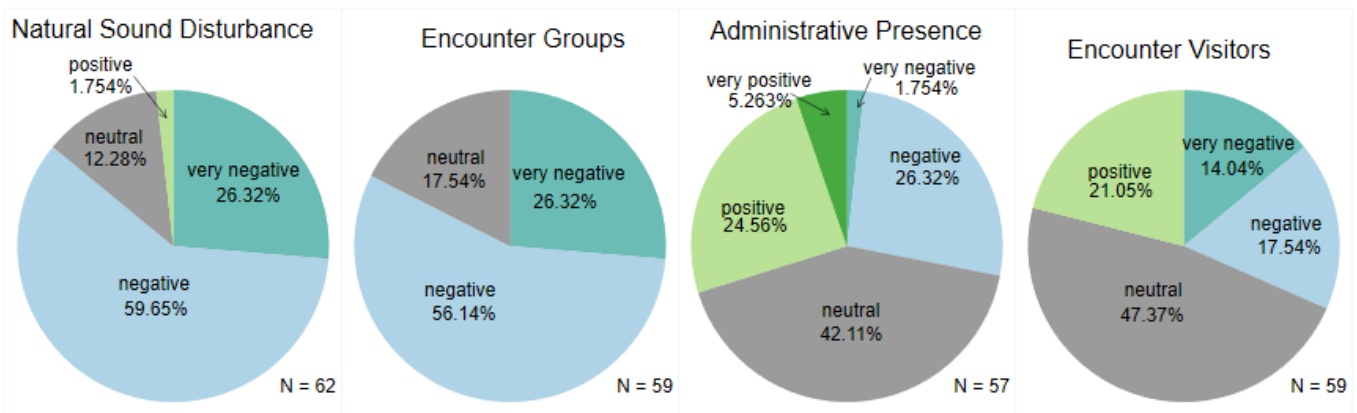


Figure 3. Positive or negative impact to visitor experience by BMP indicator

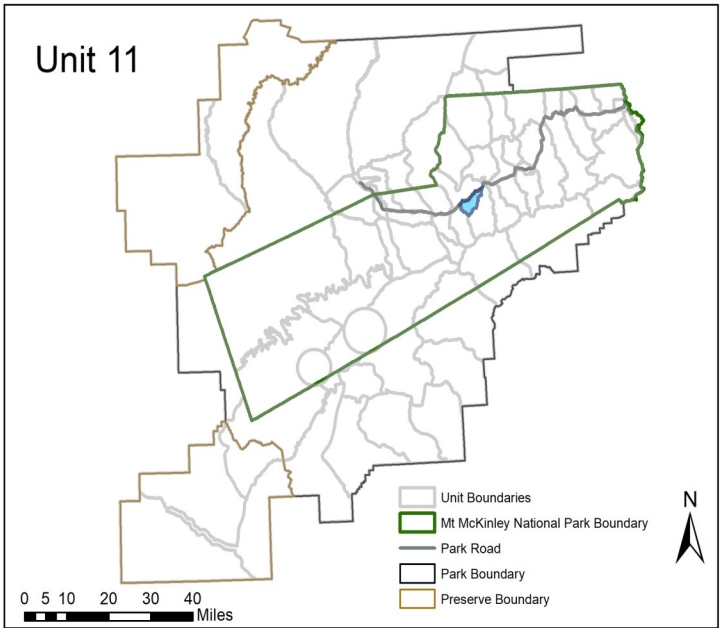
Backcountry Unit 11
"Stony Dome"
Management Area: Old Park 1 (OP1)

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



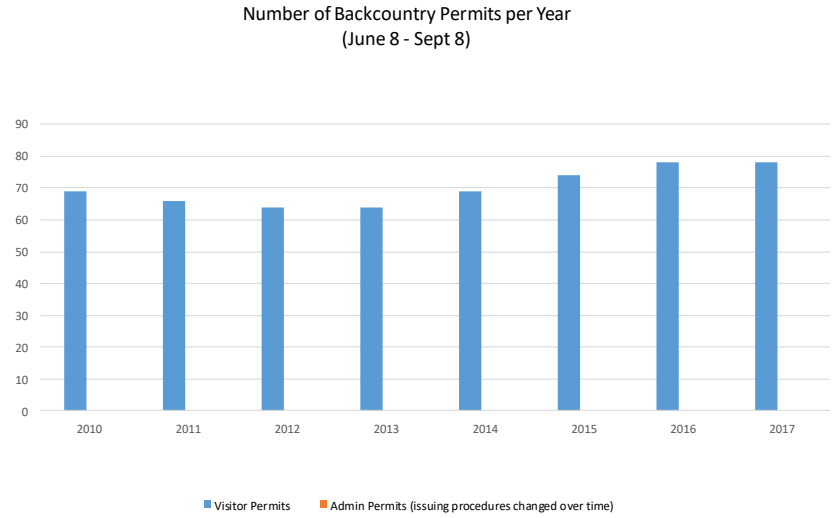
Stony Dome, looking south

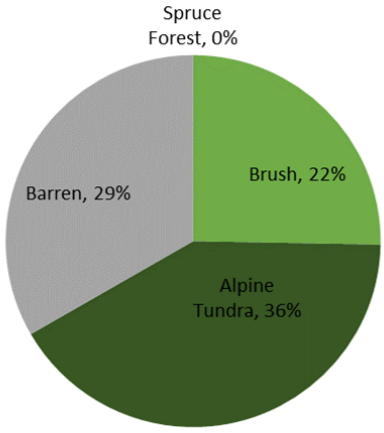


Park boundaries and Denali backcountry units: unit 11

Backcountry Permit Data:
Quota: 2
Percent visitors who traveled to unit with a bike: 10%

Unit Size: 8,693 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N = 37)
Day hikers (N = 25)
pooled total (N = 62)
Total recorded days (n = 80)

Percent visitors on guided hike: 9%
Ability to camp out of sight/sound: 95% yes
Percent "visitor first choice" unit: **82% yes**, 18% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 7.5** (Standard Deviation 9.05); range 0—45

Backcountry indicators in Unit 11: Day hikers and backpackers to unit 11 experienced Backcountry Management Plan (BMP) indicators that **exceeded** BMP standards. Exceptions were encounters with large groups and administrative presence; these were **below** standard.

Backcountry indicators in Unit 11: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence, litter/human waste, and ability to camp out of sight and sound of others (Figure 1).

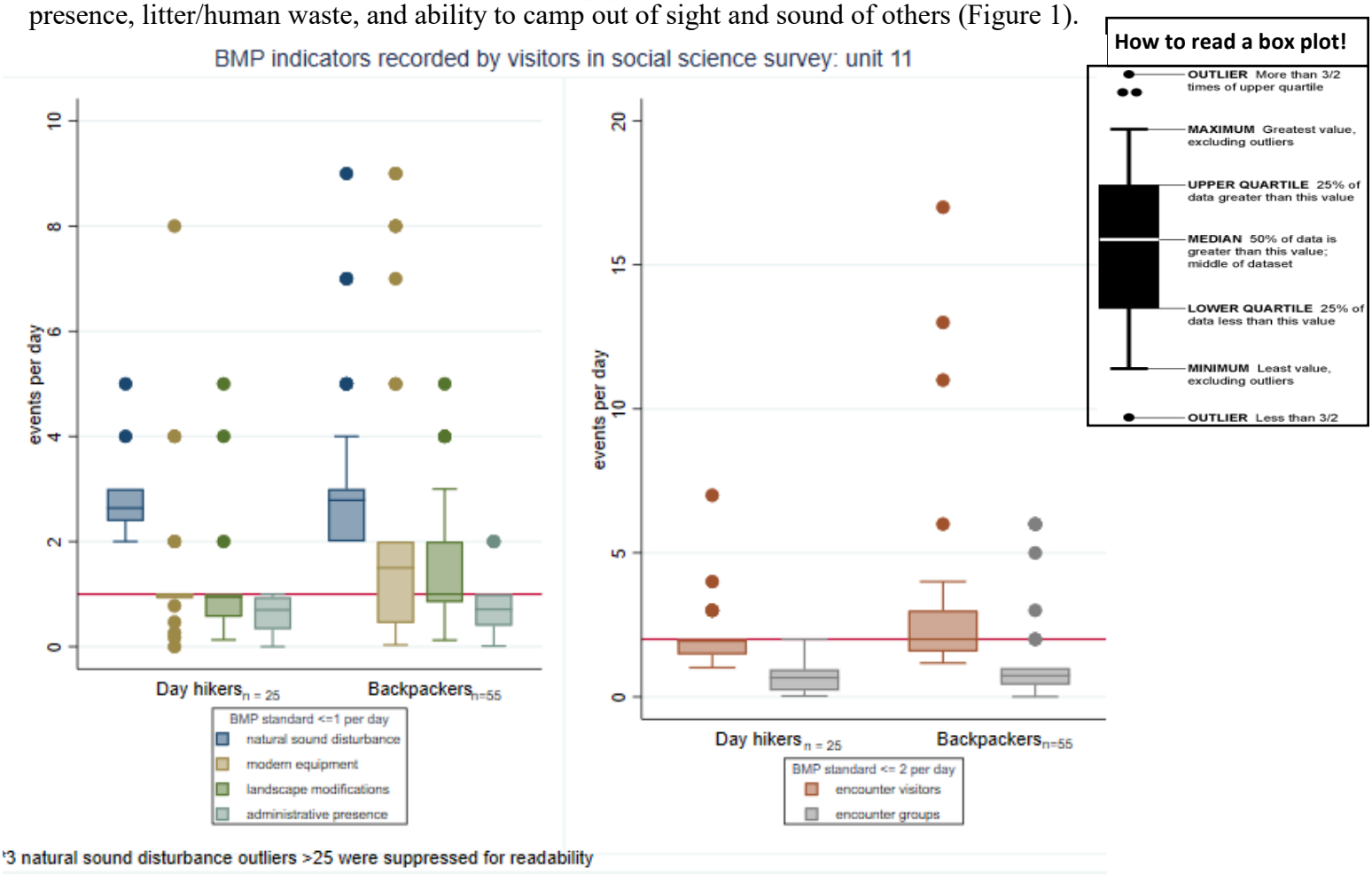


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, the top 50% of observations for backpackers was above 3 events per day and have a larger high-event extreme range than low-event range. The majority of day hiker observations were between 2 & 3 events per day, but the outlier data points (dots) show events up to 6 for day hikers and 24 for backpackers. For readability, three natural sound disturbance outlier events above 25 were suppressed.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.47 events per hour** or 7.52 events per defined backcountry visitor day (16 hours). 7.52 is within the maximum range visitors recorded (25% of observations, not including the 3 outliers), which corroborates the data collected by sound station and backcountry patrols.

Camping Density: 95% of backpackers to unit 11 were able to camp away from others, of which 15% (4 groups) reported they *wanted* to camp near others. This does not meet the standard of always being able to camp out of sight/sound of others, but some may have purposefully camped within sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 40

Average Miles: 6 miles/year

Average Visitors Encountered: 1/year Average Litter/Sanitation Encountered: 0.86/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 11. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 30% of total days sampled in Unit 11 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 49	Mean daily events (2018) n = 80	Percent change days in standard: 2010 - 2018	State of change in Unit 11: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	2.2	4.02	-17% in standard	
Encounter Visitors	≤ 2 / day	1.19	3	-30% in standard	
Encounter Groups	≤ 2 / day	.2	.755	-7% in standard	
Modern Equipment	≤ 1 / day	2.16	2.23	-5% in standard	
Landscape Modification	≤ 1 / day	.73	1.31	-33% in standard	
Admin. Presence	≤ 1 / day	0	.63	-11% in standard	
Litter	< 5%	0	.2	-20% in standard	

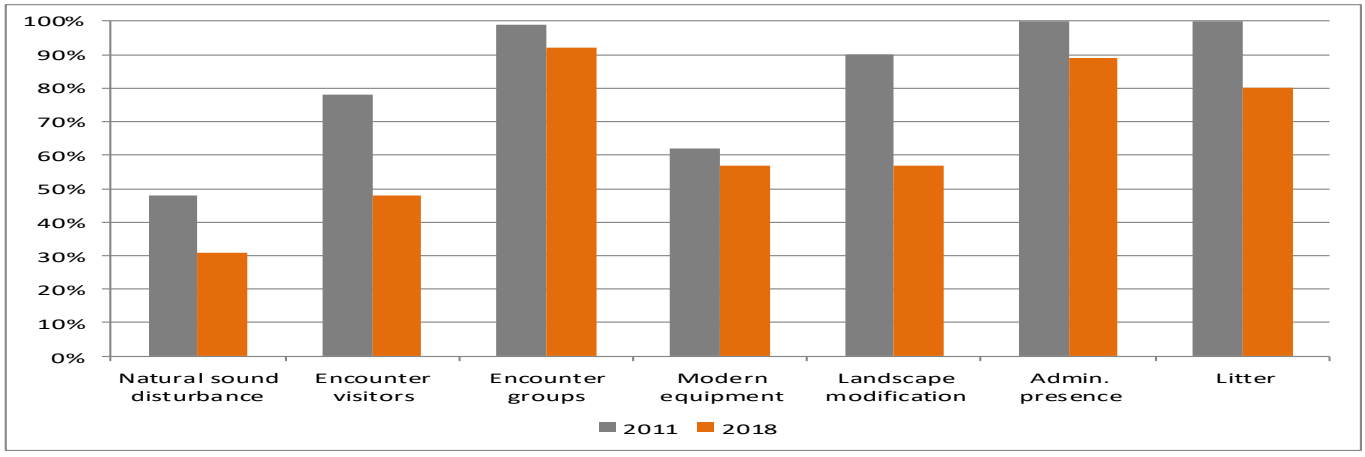


Figure 2. Percent sample days Unit 11 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 11 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

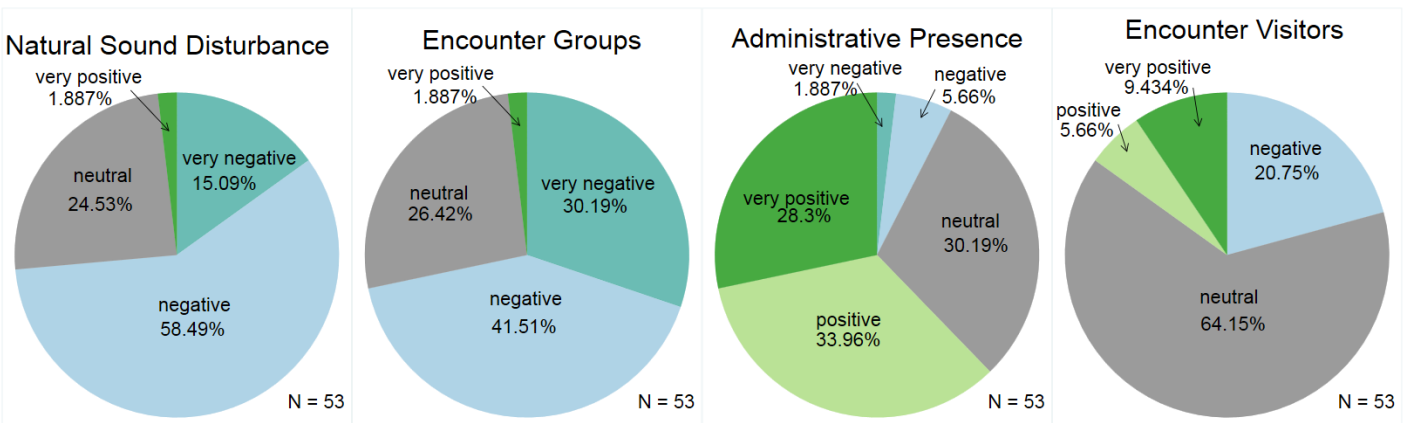


Figure 3. Positive or negative impact to visitor experience by BMP indicator

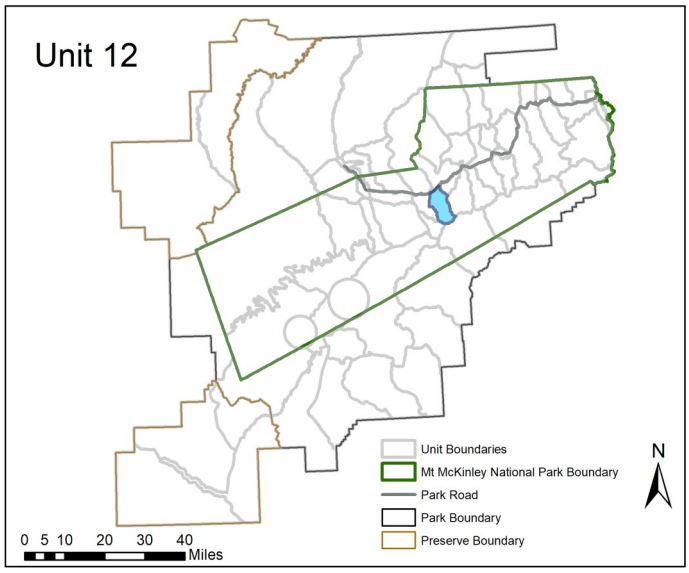
Backcountry Unit 12
"Sunset/Sunrise Glaciers"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



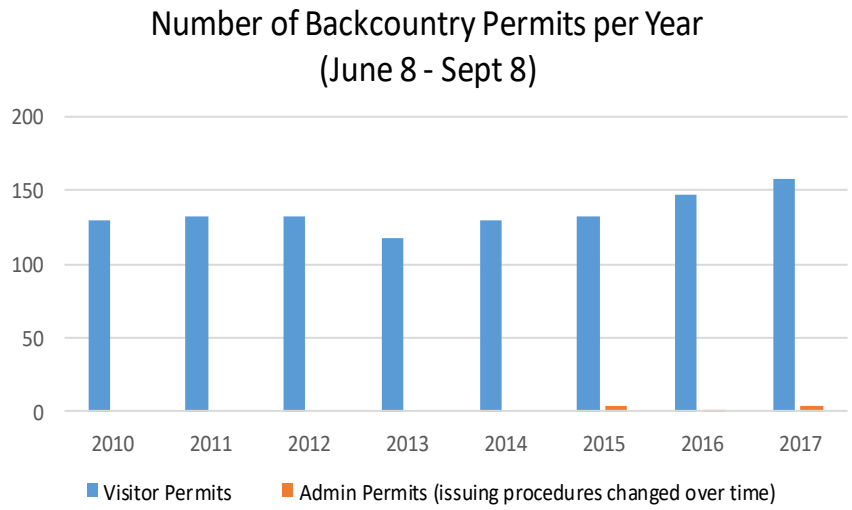
Gorge creek, looking west



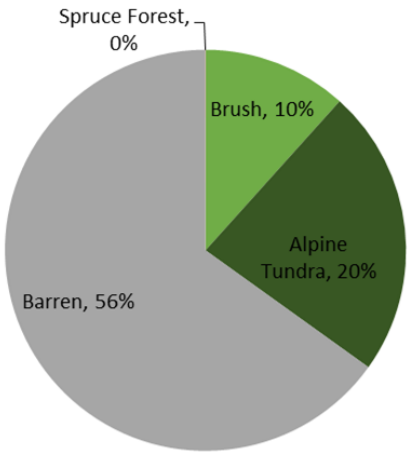
Park boundaries and Denali backcountry units: unit 12

Backcountry Permit Data:

Quota: 4
Percent visitors with bicycle: 10%



Unit Size: 21,081 acres



Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=46)
Day hikers (N=9)
Pooled total (N=55)
Total recorded days (n=69)

Percent visitors on guided hike: 5%
Ability to camp out of sight/sound: 91% yes
Percent "visitor first choice" unit: **68% yes**, 32% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 5 (**Standard deviation: 4.04); range 0—22 people.

Backcountry indicators in Unit 12: Day hikers and backpackers to unit 12 typically experienced Backcountry Management Plan (BMP) indicators during their hike days that were **within** standard. Exceptions are natural sound disturbance and encounters with modern equipment in which the distribution of events **exceeded** the BMP standard.

Backcountry Indicators in Unit 12: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

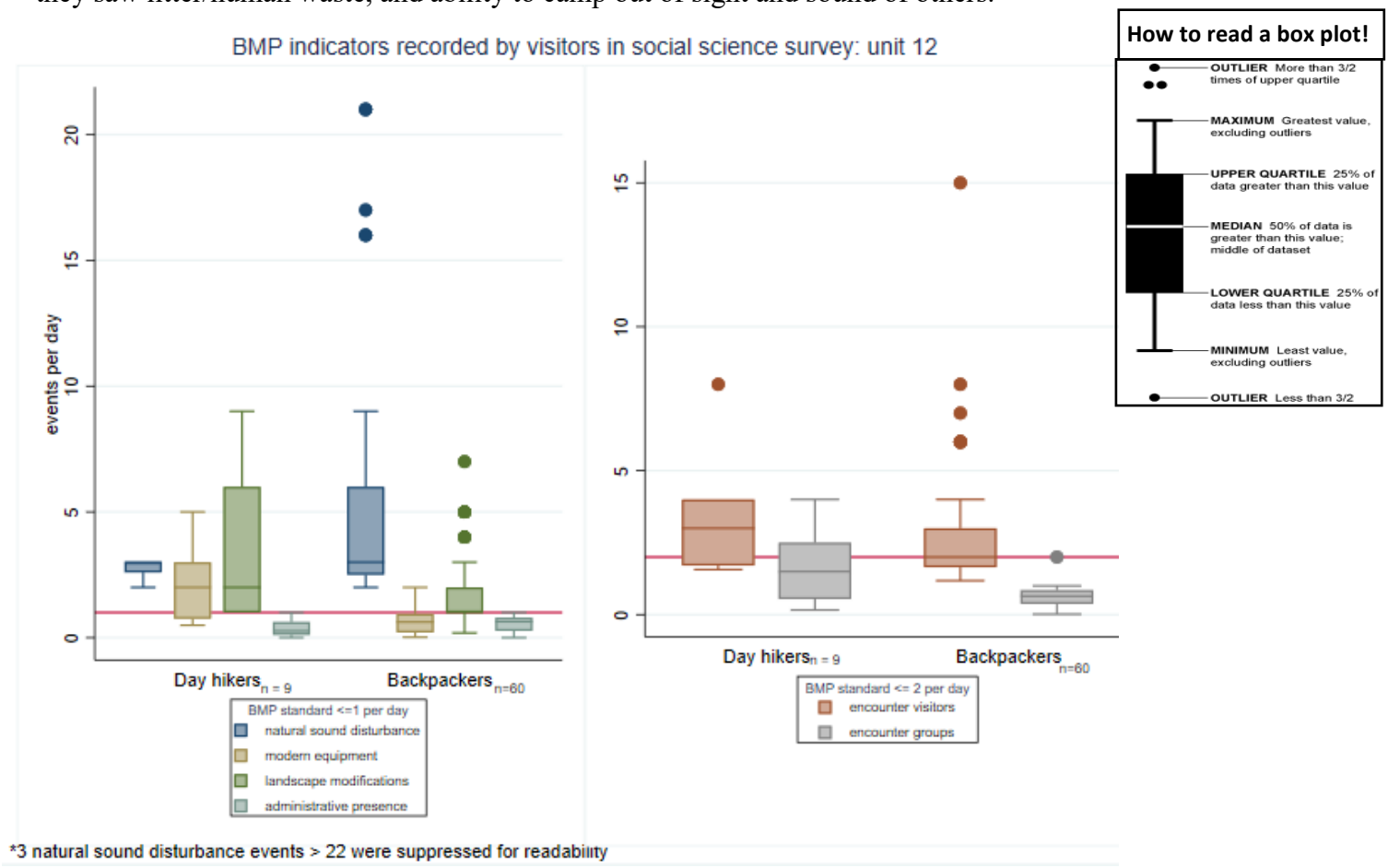


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations. Whereas for backpackers, the top 50% of observations have a range that is larger than the median observation (3 events per day). The dots are outlier data points for BMP indicator events. Note three natural sound disturbance event outliers greater than 21 per day were suppressed for readability.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.62 events per hour** or 9.92 events per defined backcountry visitor day (16 hours). 9.92 is within the maximum range visitors recorded, but the median is lower; visitors may not hearing as much natural sound disturbance as sound stations record. That the daily events recorded by NPS staff is within the range recorded by visitors corroborates both averages; the 'true' average is between 3 & 10 events per day.

Camping Density: 91% of backpackers to unit 12 were able to camp away from others; 100% of backpackers wanted to camp away from others. This does not meet the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 108

Average Miles: 15 miles/year

Average Visitors Encountered: 1.57/year Average Litter/Sanitation Encountered: 1.14/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 12. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 48% of total days sampled in Unit 12 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 63	Mean daily events (2018) n = 69	Percent change days in standard: 2010 - 2018	State of Unit 12: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	3.88	5.14	-17% in standard	
Encounter Visitors	≤ 2 / day	5.45	2.9	-14% in standard	
Encounter Groups	≤ 2 / day	1.2	.961	-13% in standard	
Modern Equipment	≤ 1 / day	1.2	.881	+13% in standard	
Landscape Modification	≤ 1 / day	1.09	2.1	-29% in standard	
Admin. Presence	≤ 1 / day	0	.53	-1% in standard	
Litter	< 5%	.105	.11	-6% in standard	

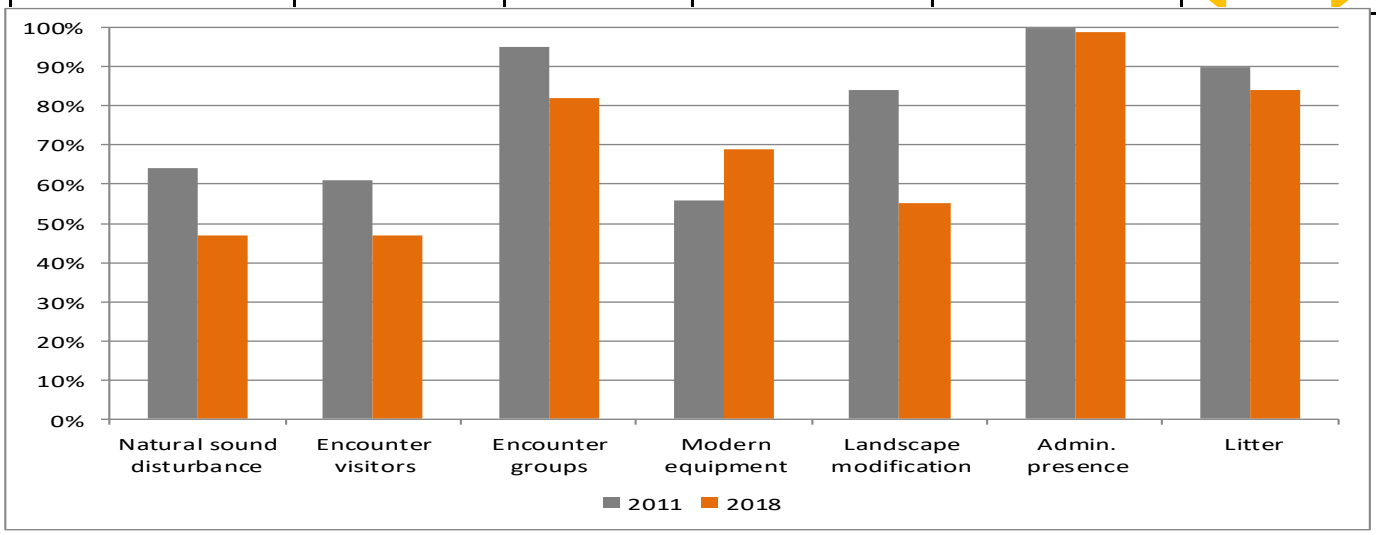


Figure 2. Percent sample days Unit 12 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 12 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

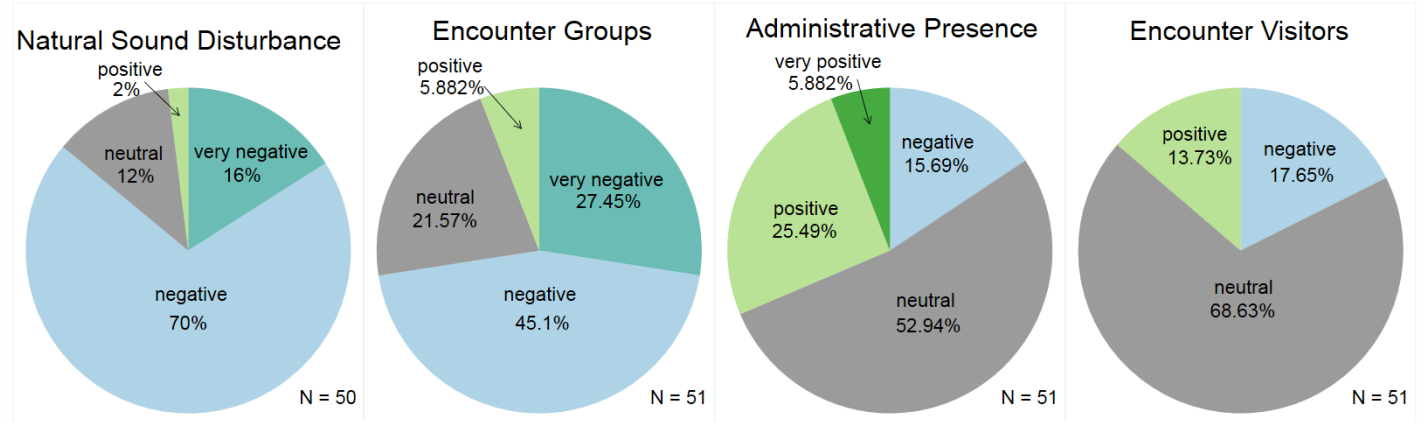


Figure 3. Positive or negative impact to visitor experience by BMP indicator

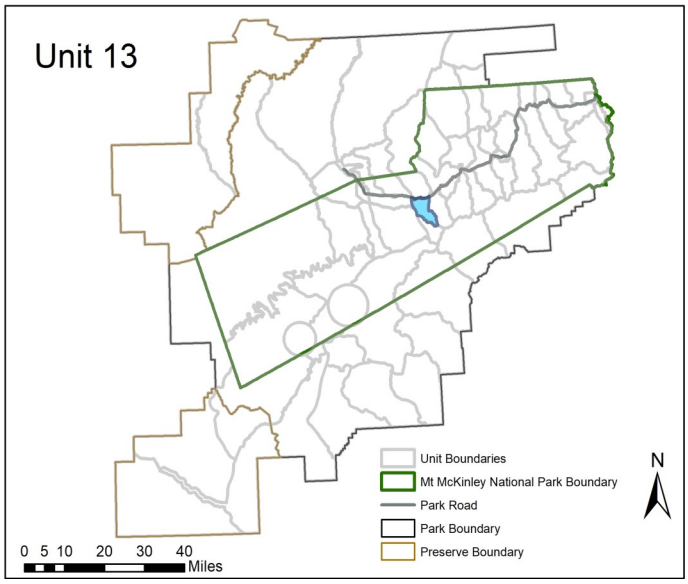
Backcountry Unit 13
"Mount Eielson"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Thoroughfare bar, looking west



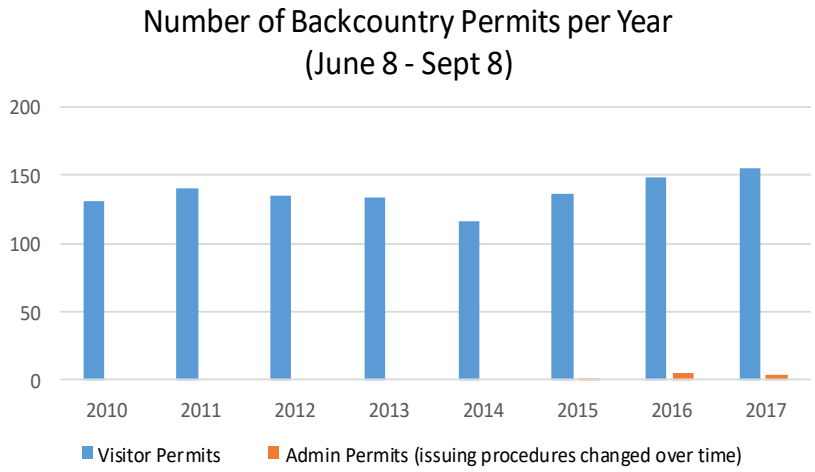
Park boundaries and Denali backcountry units: unit 13

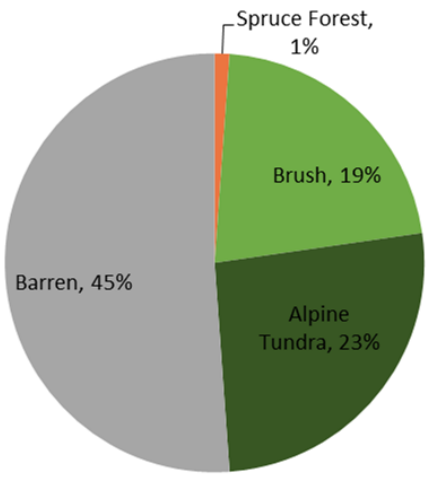
Unit Size: 14,849 acres

Backcountry Permit Data:

Quota: 4

Percent visitors with bicycle: 8%





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=63)
Day hikers (N=45),
pooled total (N=109)
Total recorded days (n=122)

Percent visitors on guided hike: 28%
Ability to camp out of sight/sound: 95% yes
Percent "visitor first choice" unit: **53% yes**, 47% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 13** (Standard deviation: 24.24); range 0—200 people.

Backcountry indicators in Unit 13: Day hikers and backpackers to unit 13 experienced events during their hike days that **exceeded** Backcountry Management Plan (BMP) standards. Exceptions were encounters with groups and administrative presence in which the distribution of events were **within** BMP standard.

Backcountry Indicators in Unit 13:Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

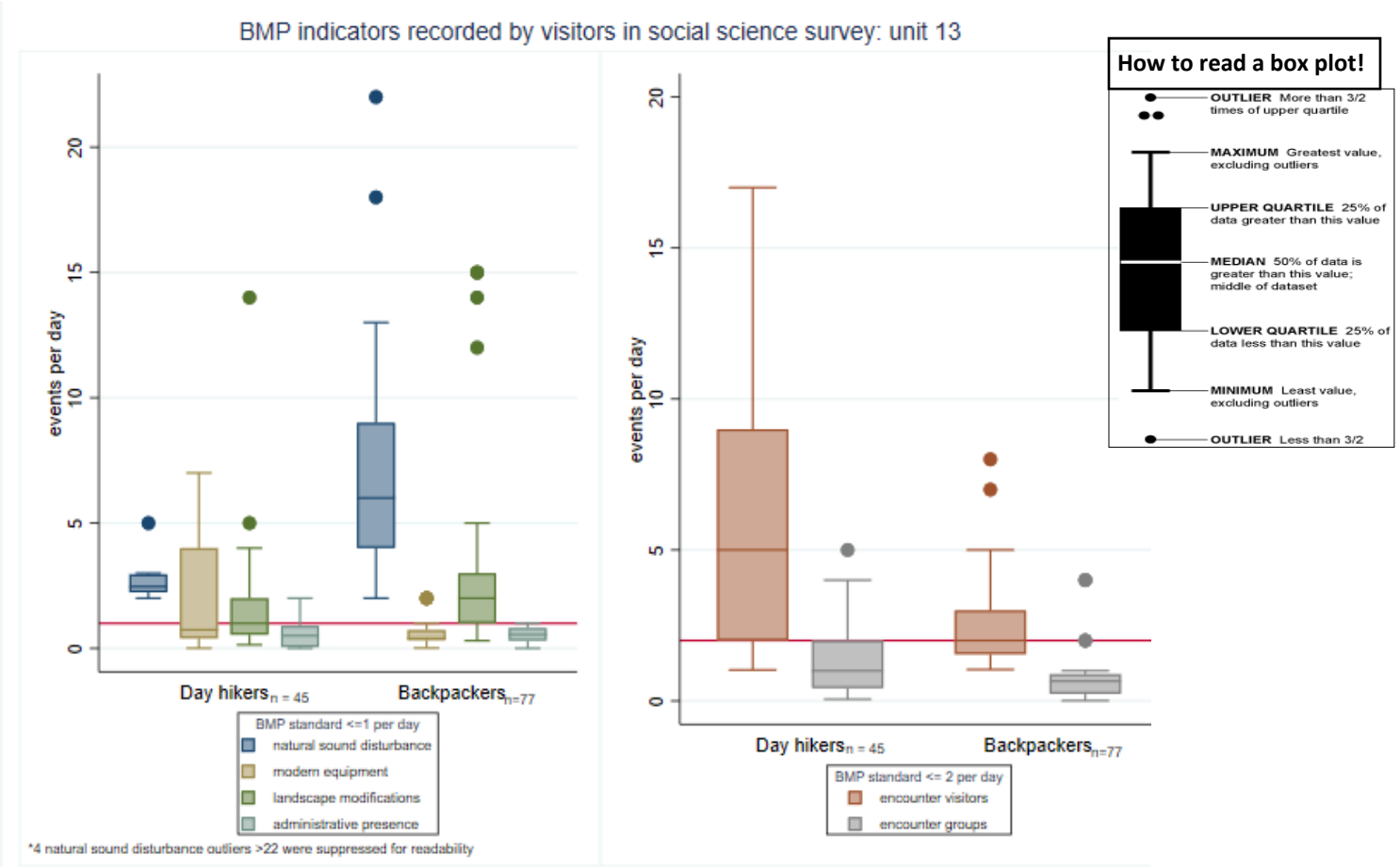


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations. Whereas for backpackers, the top 50% of observations have a range that is larger than the median observation (5.45 events/day). The dots are outlier data points for BMP indicator events. Four natural sound disturbance outliers of over 22 events per day were suppressed for readability (Figure 1).

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.74 events per hour** or 11.84 events per defined backcountry visitor day (16 hours). Median events recorded by visitors is lower than the sound station day average, but the corroboration of high daily events recorded by visitors and NPS tells us the 'true' average lies between 5 & 14 per day.

Camping Density: 95% of backpackers to unit 13 were able to camp away from others; 100% reported they wanted to camp away from others. This does not meet the standard of always being able to camp out of sight/ sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 239

Average Miles: 34 miles/year

Average Visitors Encountered: 4/year Average Litter/Sanitation Encountered: 3.57/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 13. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 39% of total days sampled in Unit 13 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP Standard	Mean daily events (2011) n = 88	Mean daily events (2018) n = 122	Percent change days in standard: 2010 - 2018	State of change in Unit 13: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	3.85	5.24	-30% in standard	
Encounter Visitors	≤ 2 / day	1.2	3.81	-48% in standard	
Encounter Groups	≤ 2 / day	.75	.632	-6% in standard	
Modern Equipment	≤ 1 / day	2.17	1.11	+6% in standard	
Landscape Modification	≤ 1 / day	1.2	2.28	-18% in standard	
Admin. Presence	≤ 1 / day	0	.54	-4% in standard	
Litter	< 5%	.16	.17	-11% in standard	

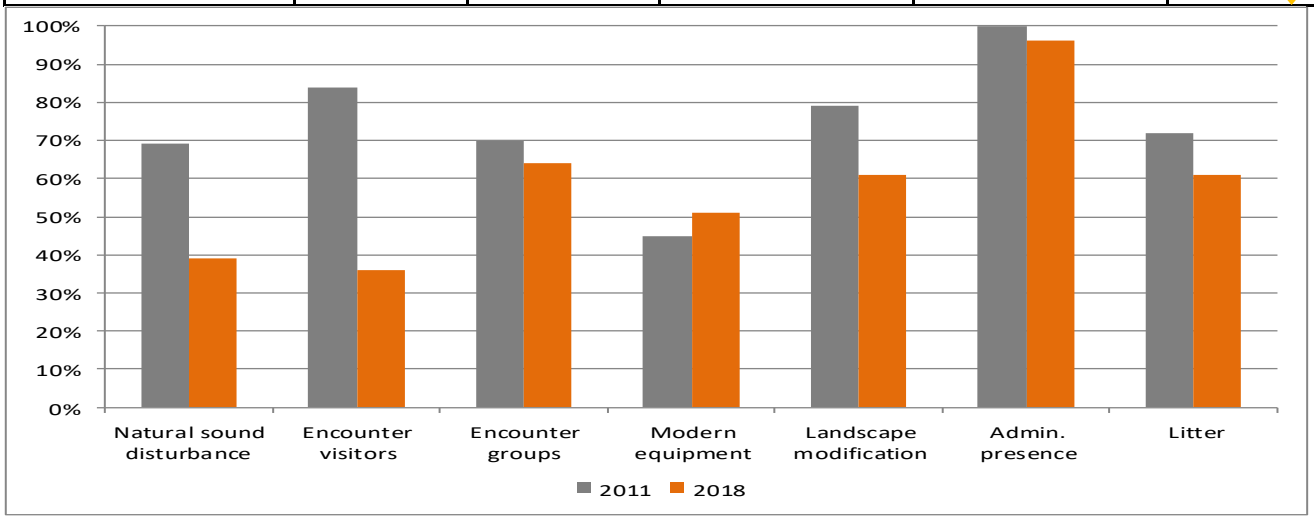


Figure 2. Percent sample days Unit 13 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 13 stated were the most impact-ful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

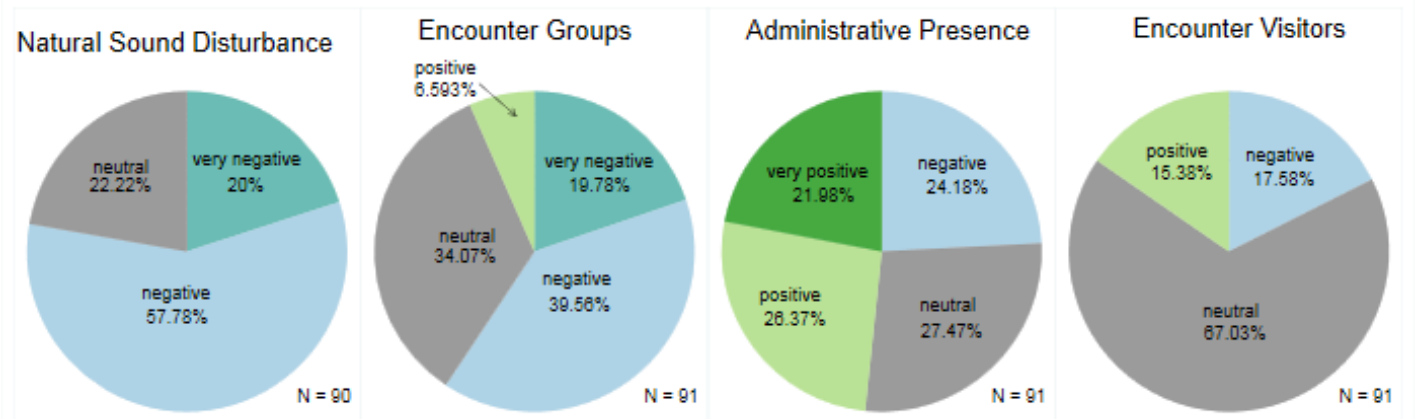


Figure 3. Positive or negative impact to visitor experience by BMP indicator

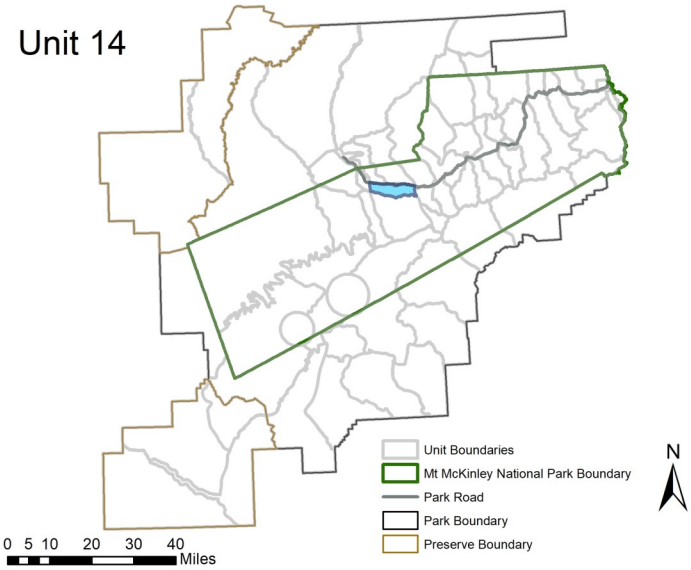
Backcountry Unit 14
"McKinley Bar East"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



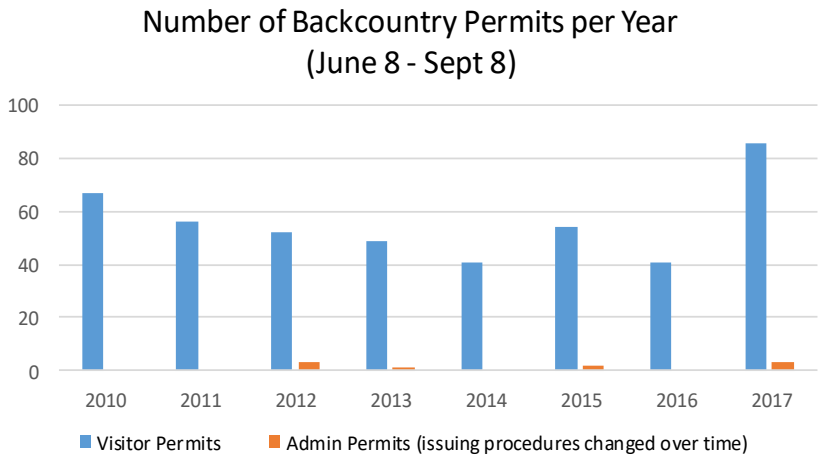
McKinley Bar, looking west

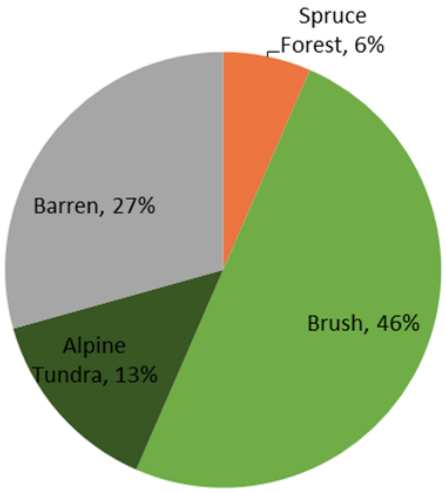


Park boundaries and Denali backcountry units: unit 14

Unit size: 17,435 acres

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 6%





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N=10)
Day hikers (N=6)
Pooled total (N=16)
Total recorded days (n=25)

Percent visitors on guided hike: 5%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **80% yes,** 20% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 4** (Standard Deviation 4.8); range: 0—15 people

Backcountry Indicators in Unit 14:Day hikers and backpackers to unit 14 typically experienced Backcountry Management Plan (BMP) indicators during their hike days that were **within** standard. The exceptions were natural sound disturbance and landscape modifications in which the distribution of events **exceeded** the BMP standard.

Backcountry Indicators in Unit 14: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

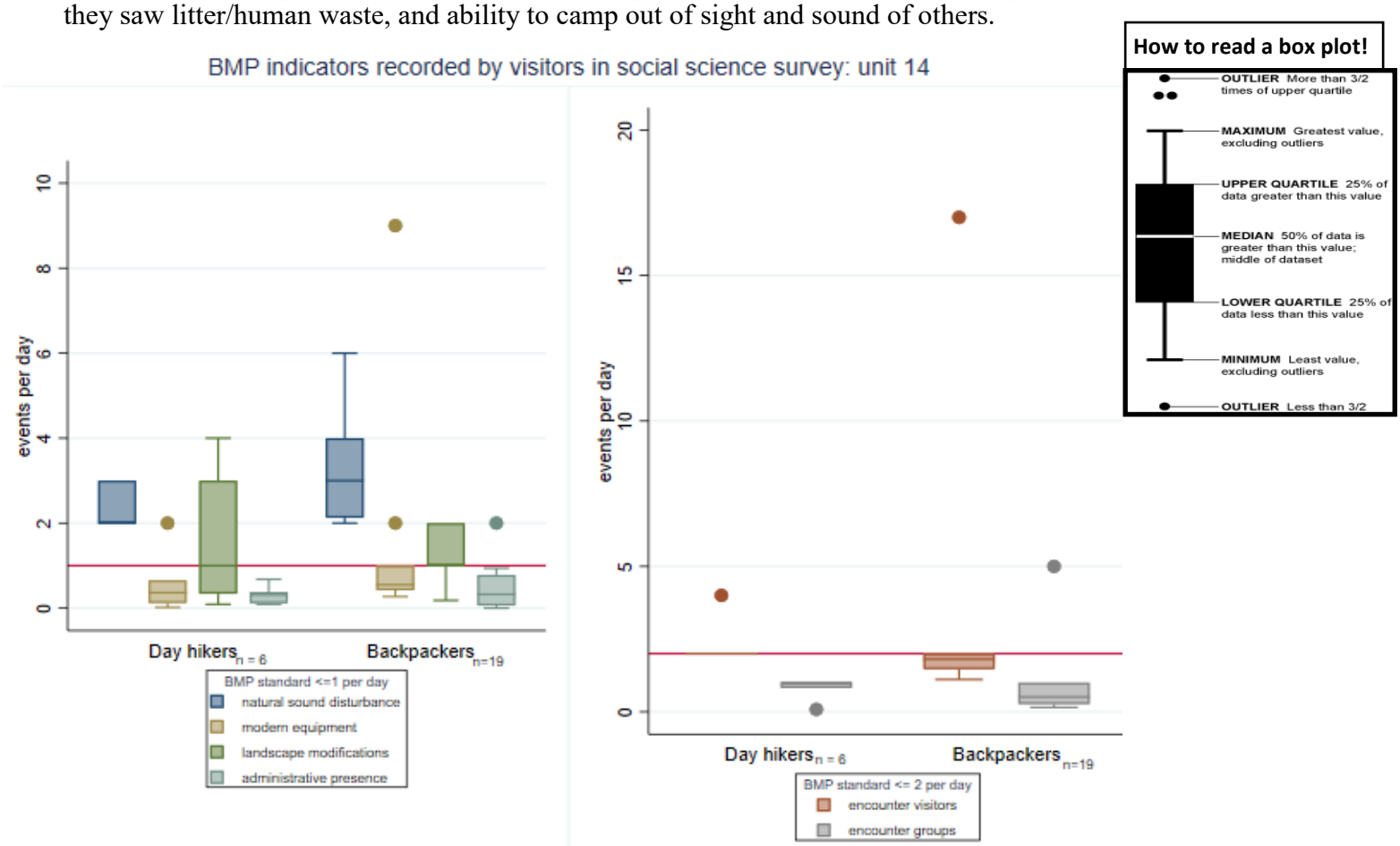


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, the top 50% of observations for backpackers was above 3 events per day and have a larger high-event extreme range than low-event range. The median for day hikers is 2 events: 50% of observations are 0 —1; 50% are 2—3. There were no outlier events for neither day hikers nor backpackers.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.19 events per hour** or 3 events per defined backcountry visitor day (16 hours). 3 is the median events per day recorded by visitors, meaning the top 50% of (backpacker) observations is above the extrapolated daily average from the sound station. The corroboration of 3 daily events recorded by visitors and NPS tells us the 'true' average lies between 3 & 6 per day.

Camping Density: 100% of backpackers to unit 8 were able to camp away from others; 100% of backpackers said they wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 6

Average Miles: 0.9 miles/year

Average Visitors Encountered: 0/year Average Litter/Sanitation Encountered: 0/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 14. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 73% of total days sampled in Unit 14 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: Unit 14

Indicator	BMP standard	Mean daily events (2011) N = 8	Mean daily events (2018) N = 16	Percent change days in standard: 2010 - 2018	State of Change in Unit 14
Natural Sound Disturbance	≤ 1 / day	0	3.51	-25% in standard	
Encounter Visitors	≤ 2 / day	2	2	0% in standard	
Encounter Groups	≤ 2 / day	.3	.317	-4% in standard	
Modern Equipment	≤ 1 / day	1.29	1.16	-2% in standard	
Landscape Modification	≤ 1 / day	0	1.31	-50% in standard	
Admin. Presence	≤ 1 / day	0	.35	-1% in standard	
Litter	< 5%	.13	.06	+14% in standard	

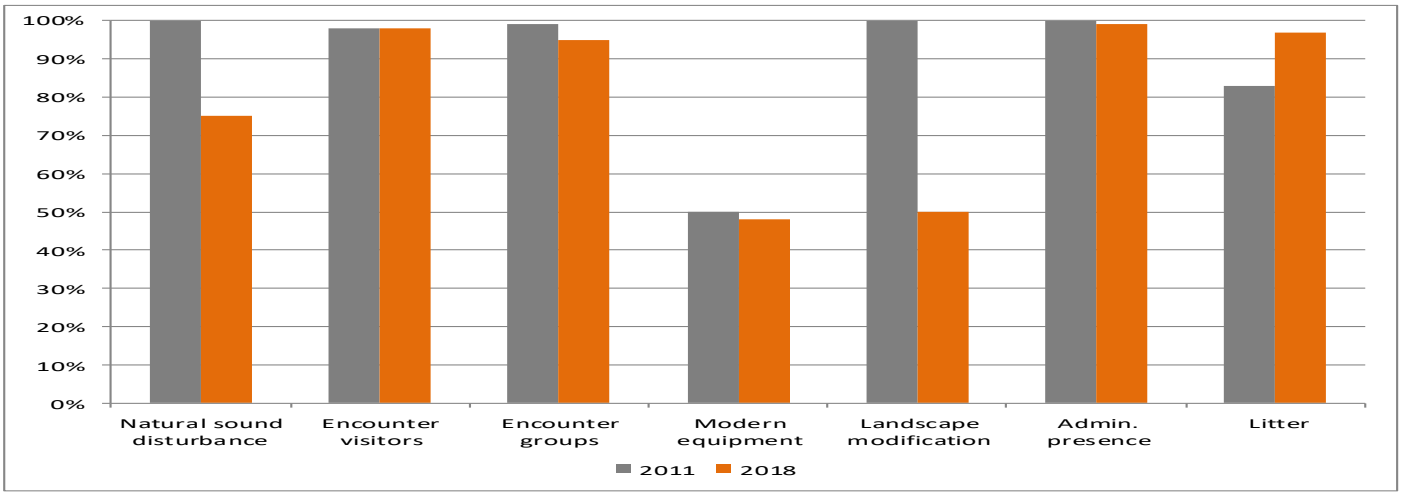


Figure 2. Percent sample days Unit 14 was within BMP standards: 2011 vs. 2018

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 14 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

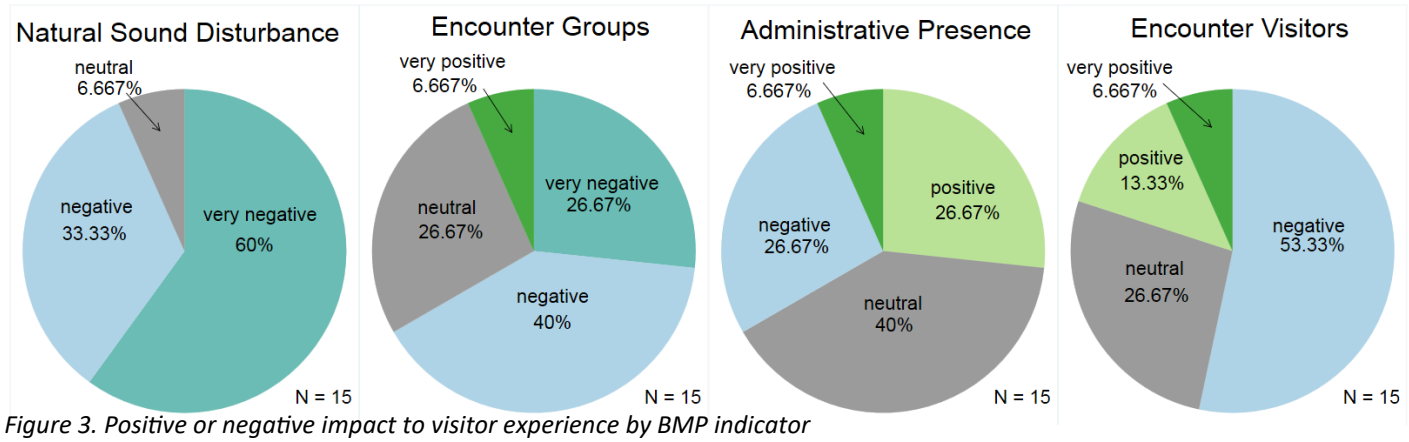


Figure 3. Positive or negative impact to visitor experience by BMP indicator

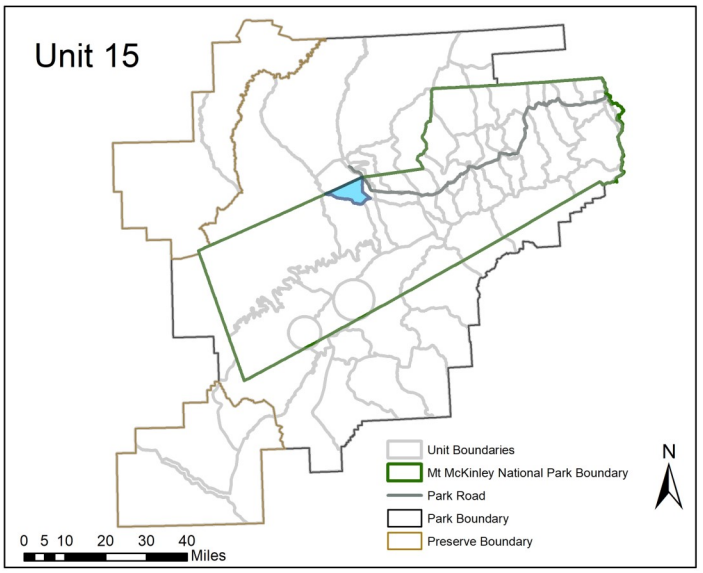
Backcountry Unit 15
"McKinley Bar West"
Management Area: Old Park 1 (OP1)

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



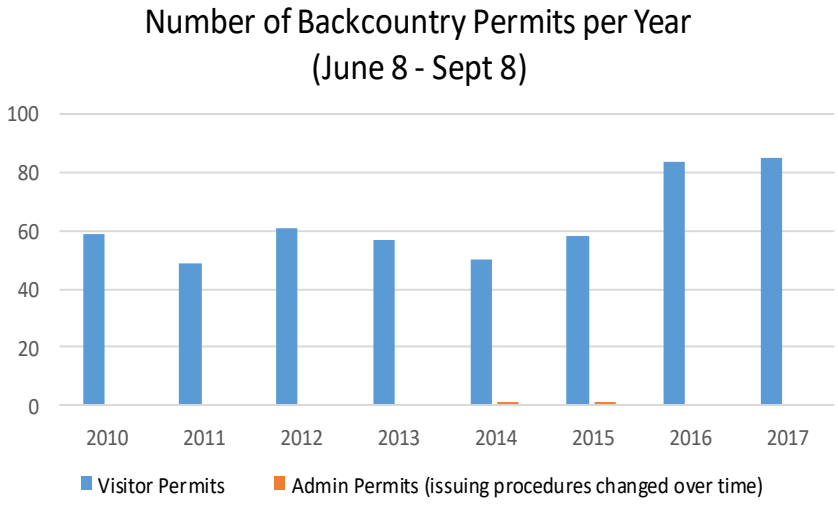
Mckinley bar trail, looking west

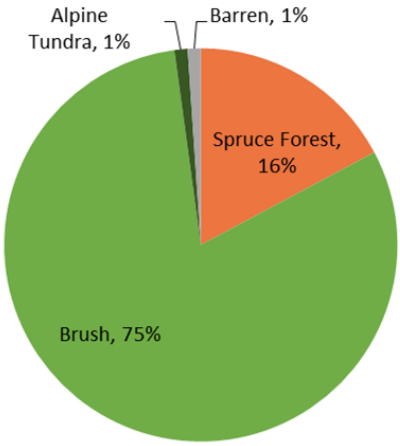


Park boundaries and Denali backcountry units: unit 15

Unit Size: 20,926 acres

Backcountry Permit Data:
Quota: 4
Percent visitors who traveled to unit with a bike: 13%





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N = 12)
Day hikers (N = 44),
pooled total (N = 56)
Total recorded days (n = 79)

Percent visitors on a guided hike: 17%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **69% yes,** 23% no, (6% missing)

Solitude threshold:
Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 16** (Standard Deviation: 13.5); range: 0 – 50 (three outliers of 250 were removed).

Backcountry indicators in Unit 15: Day hikers and backpackers to unit 15 typically experienced Backcountry Management Plan (BMP) indicators that **exceeded** the BMP standard. Exceptions were encounters with groups and administrative presence in which the distribution of observations were primarily **within** the BMP standard.

Backcountry Indicators in Unit 15: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

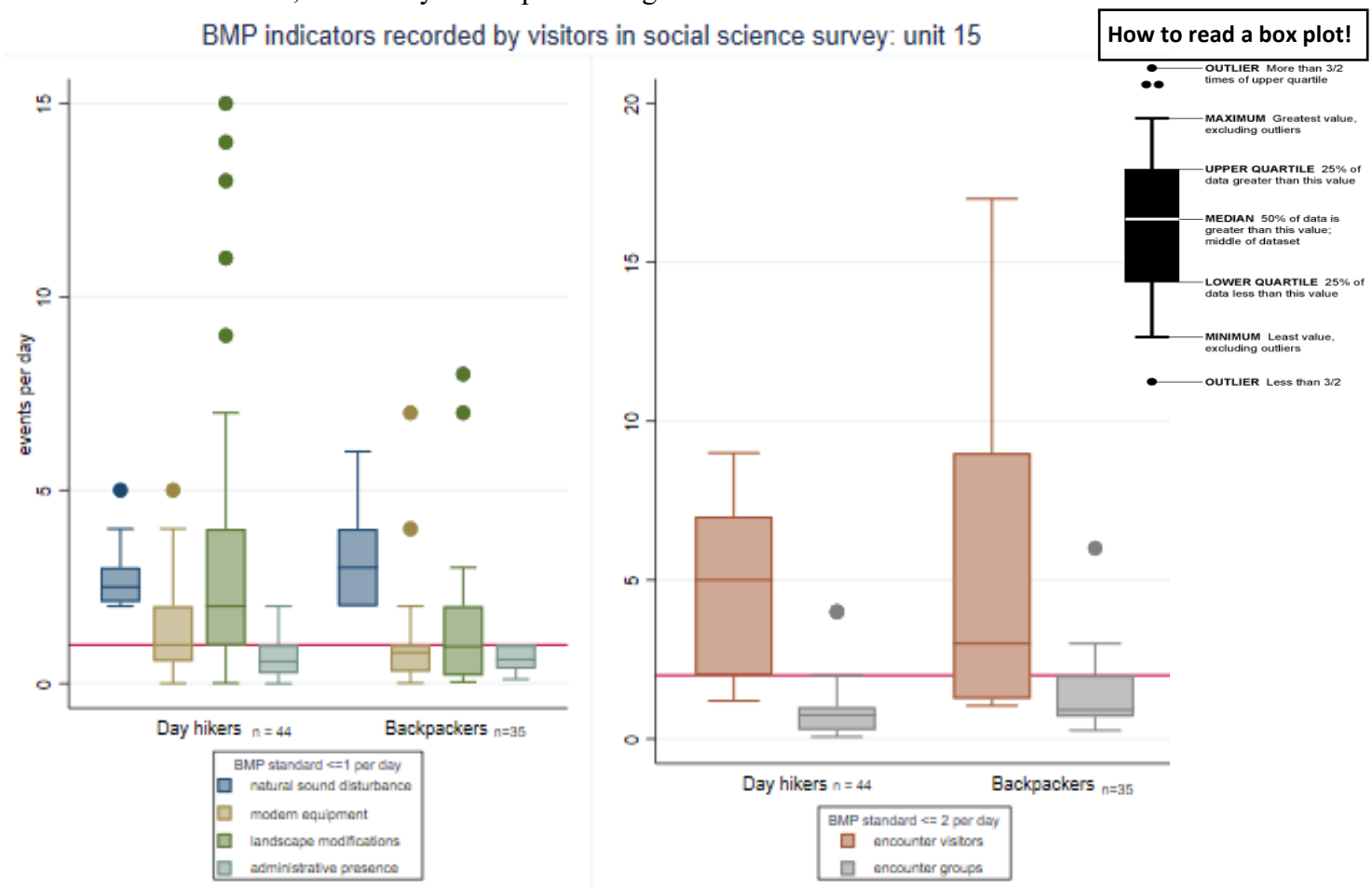


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, the top 50% of observations for backpackers was above 3.5 events per day and above 3 events per day for day hikers. 100% of visitor observations exceeded the standard. The dots are outlier data points for BMP indicator events.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.18 events per hour** or 2.88 events per defined backcountry visitor day (16 hours). 2.88 is within the range visitors recorded, but the median for backpackers is higher. This corroboration of NPS and visitor recorded data suggests the true average is between 2 & 8 events per day.

Camping Density: 100% of backpackers to unit 15 were able to camp away from others; 100% wanted to camp out of sight/sound. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 21

Average Miles: 3 miles/year

Average Visitors Encountered: 0.29/ year Average Litter/Sanitation Encountered: 0.29/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 15. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 61% of total days sampled in Unit 15 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 16	Mean daily events (2018) n = 79	Percent change days in standard: 2011 - 2018	State of Change in Unit 15
Natural Sound Disturbance	≤ 1/day	1.33	2.75	-14% in standard	
Encounter Visitors	≤ 2/day	1.14	4.82	-52% in standard	
Encounter Groups	≤ 2/day	1.33	1.06	+ 1% in standard	
Modern Equipment	≤ 1/day	1.43	1.55	-5% in standard	
Landscape Modification	≤ 1 / day	1.57	2.023.47	-25% in standard	
Admin. Presence	≤1 /day	0.14	0.62	-1% in standard	
Litter	< 5% yes	0.0 (0% yes)	0.14 (14% yes)	-2% in standard	

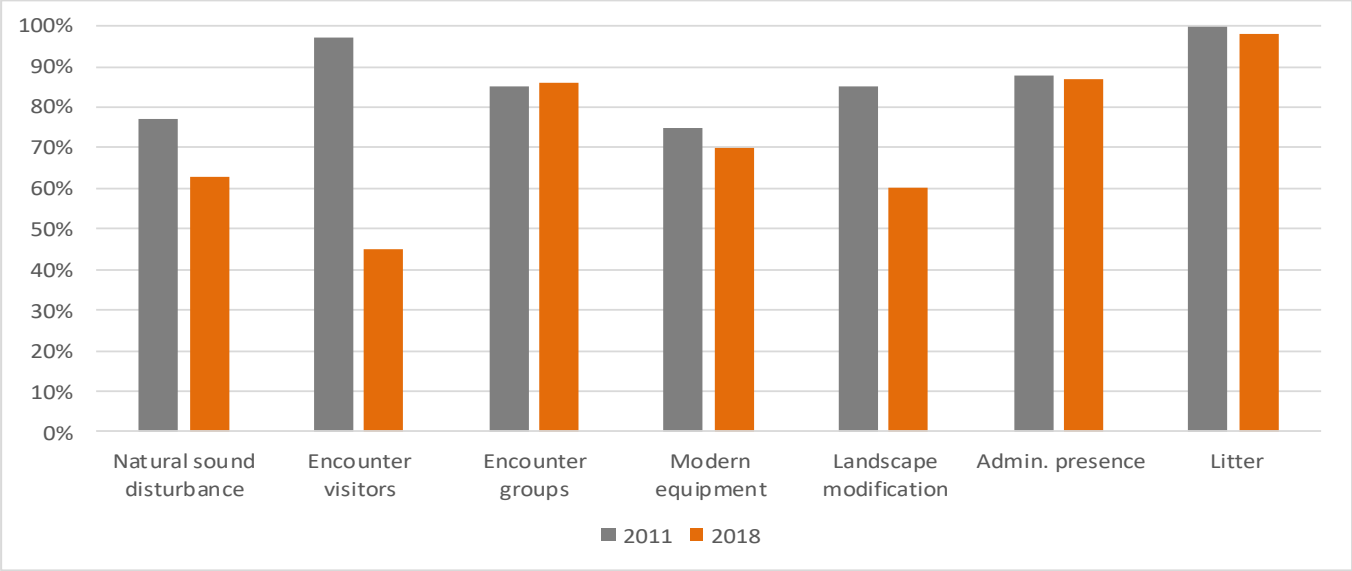


Figure 2. Percent sample days Unit 15 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 15 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

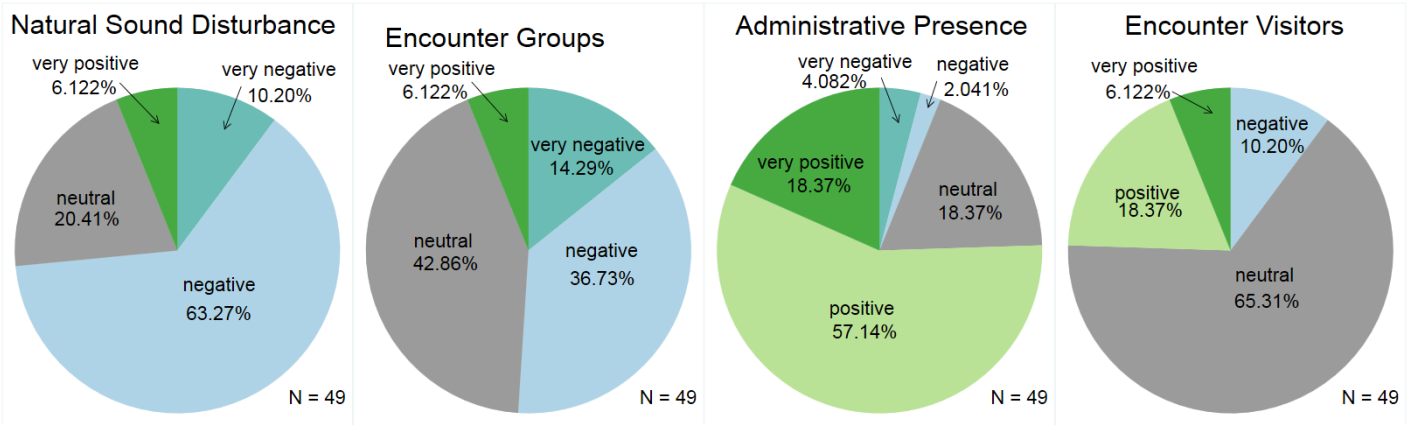


Figure 3. Positive or negative impact to visitor experience by BMP indicator

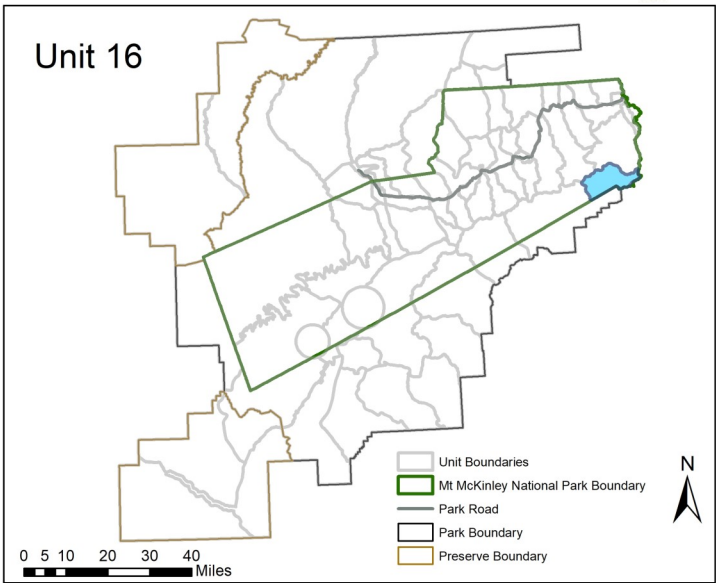
Backcountry Unit 16
"Windy Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Windy Creek, looking west

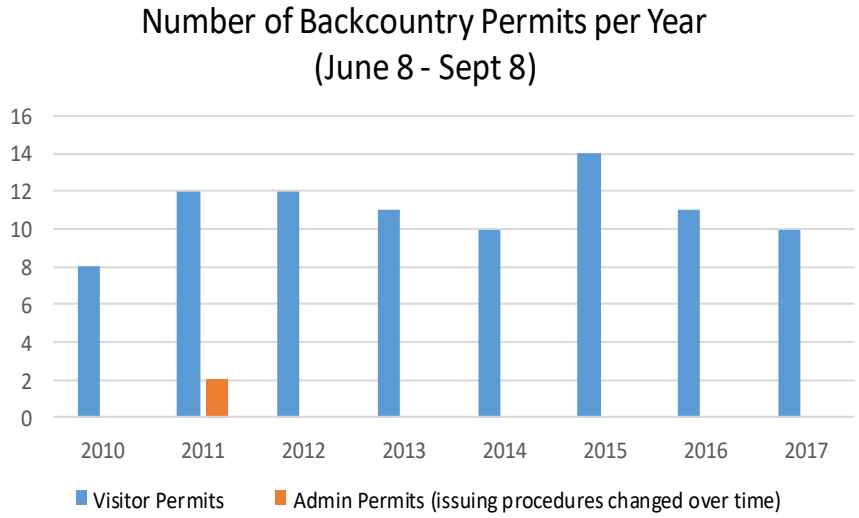


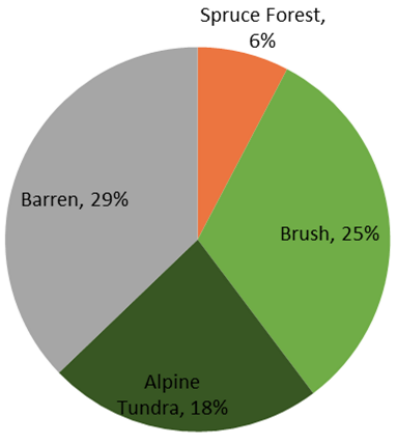
Park boundaries and Denali backcountry units: unit 16

Backcountry Permit Data:

Quota: 8
Percent visitors with bicycle: 0%

Unit Size: 38,714 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=9)
Day hikers (N=0)
Pooled total (N=9)
Total recorded days (n=14)

Percent visitors on guided hike: 0%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **100% yes**

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 5** (Standard Deviation 0.33); range 4—6

Backcountry indicators in Unit 16: Day hikers and backpackers to unit 16 experienced Backcountry Management Plan (BMP) indicators **within** standard. Exceptions were natural sound disturbance and landscape modifications; these **exceeded** BMP standards.

Backcountry indicators in Unit 16: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate over 50% of observations of landscape modifications were above the standard of 1 encounter per day.

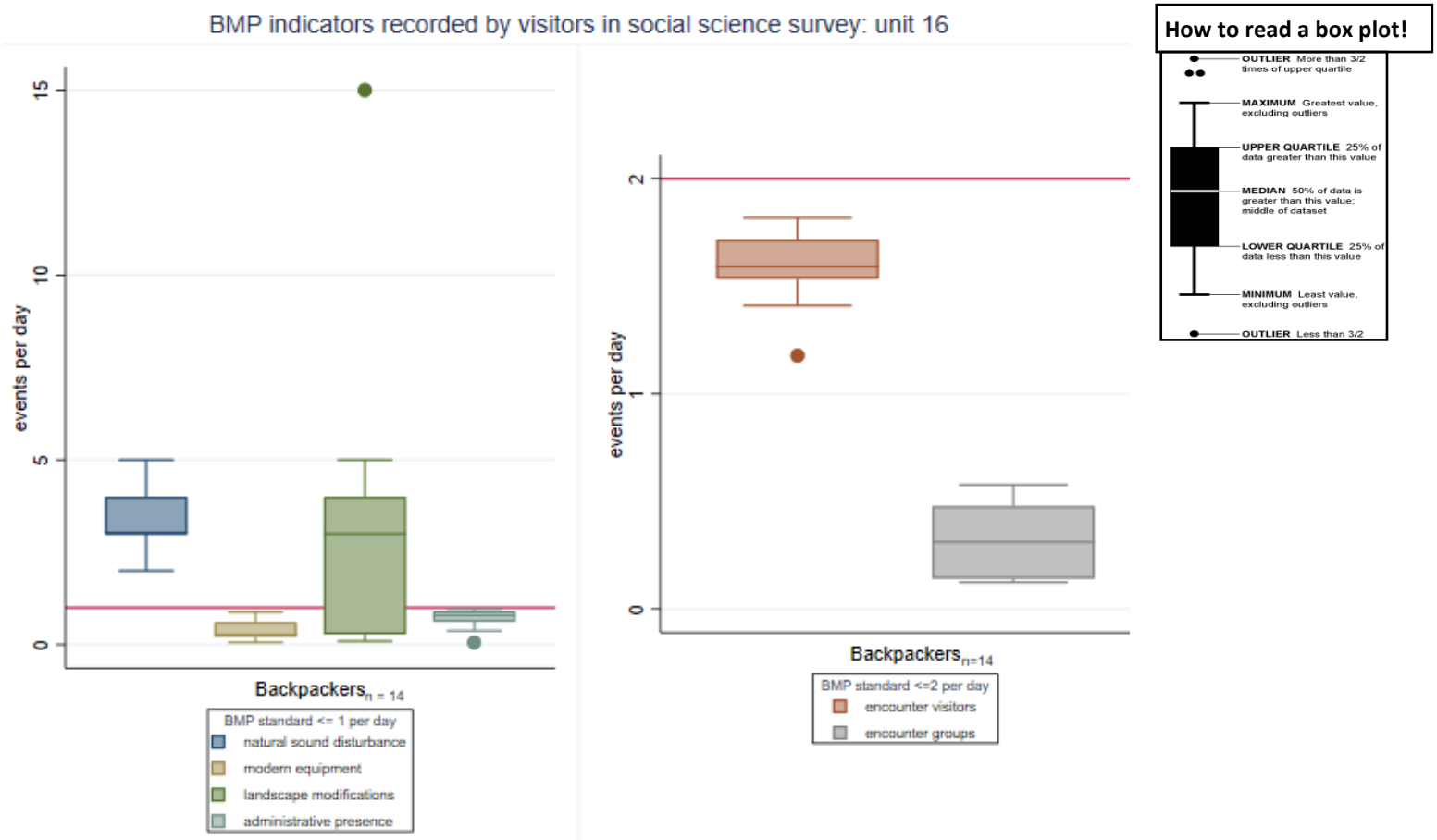


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, 100% of natural sound disturbance observations were above BMP standard of 2 events per day, and the top 50% of observations have a range that is larger than the median observation of 3 events/day (Figure 1).

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and patrols is **1.01 events per hour** or 16.16 events per day (16 hours= backcountry visitor day). 16 is not within the maximum range visitors recorded, and the median of 3 events per day is lower than the NPS recorded events. The lack of corroboration between visitor recorded and sound station/backcountry patrol recorded events means the 'true' daily average is unknown. However, both the visitor survey and NPS records demonstrate that natural sound disturbance occurs at a higher frequency than the OP1 BMP standard.

Camping Density: 100% of backpackers to unit 16 were able to camp away from others; 100% reported they wanted to camp away from others. This meets the standard of always being able to camp out of sight/ sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 126

Average Miles: 18 miles/year

Average Visitors Encountered: 0.14/year Average Litter/Sanitation Encountered: 0.14/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 16. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 66% of total days sampled in Unit 16 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n= 3	Mean daily events (2018) n = 14	Percent change days in standard: 2011 - 2018	State of change in Unit 16: 2011 to 2018
Natural Sound Disturbance	≤ 1/ day	1	3.67	-34% in standard	
Encounter Visitors	≤ 2 / day	4	1.6	-23% in standard	
Encounter Groups	≤ 2 / day	0	.584	-1% in standard	
Modern Equipment	≤ 1 / day	0	.412	-10% in standard	
Landscape Modification	≤ 1 / day	0	3.62	-50% in standard	
Admin. Presence	≤ 1 / day	0	.692	-4% in standard	
Litter	< 5%	0	.11	-20% in standard	

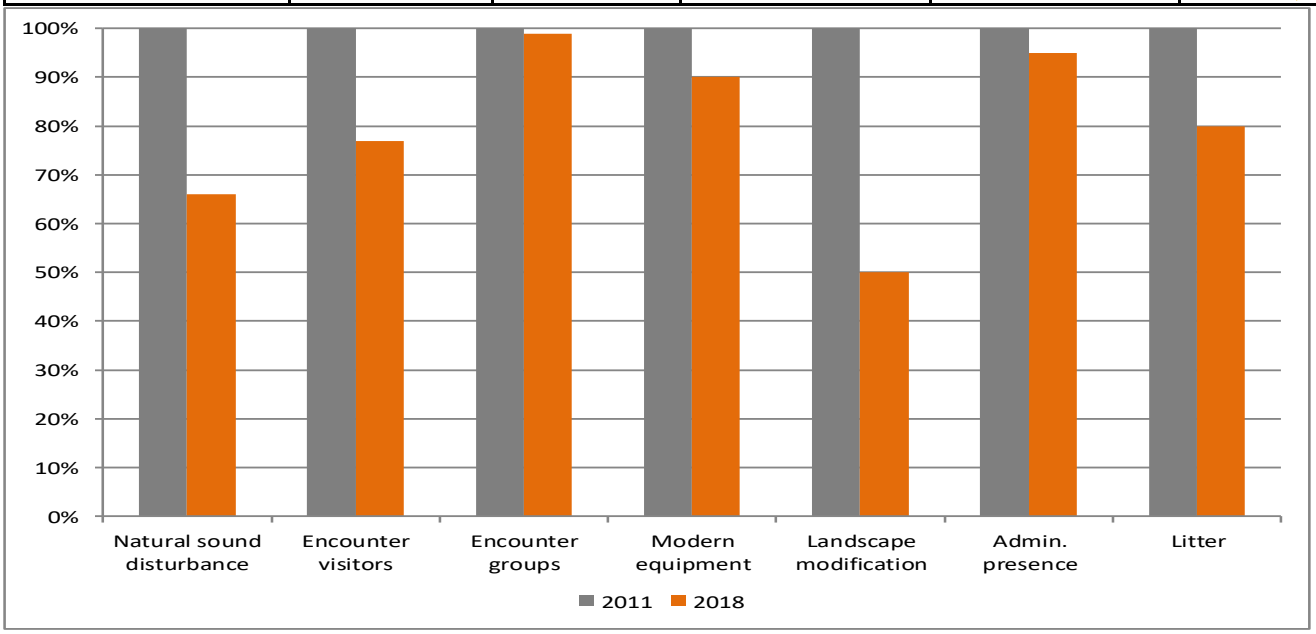


Figure 3. Percent sample days Unit 16 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 16 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

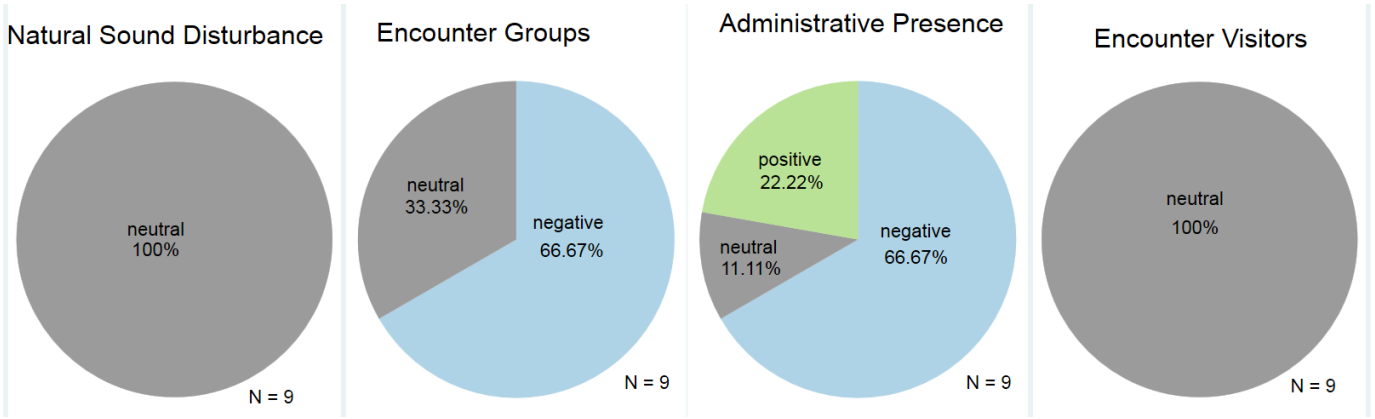


Figure 3. Positive or negative impact to visitor experience by BMP indicator

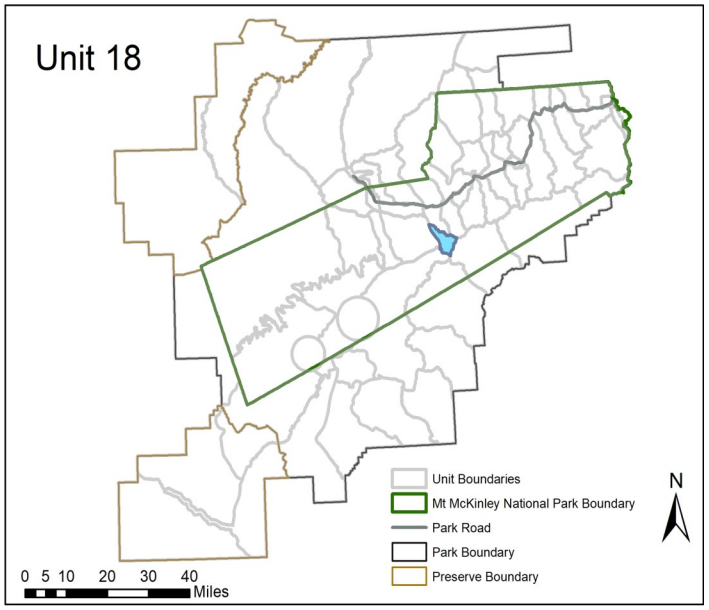
Backcountry Unit 18
"Upper Glacier Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Glacier Creek, looking south

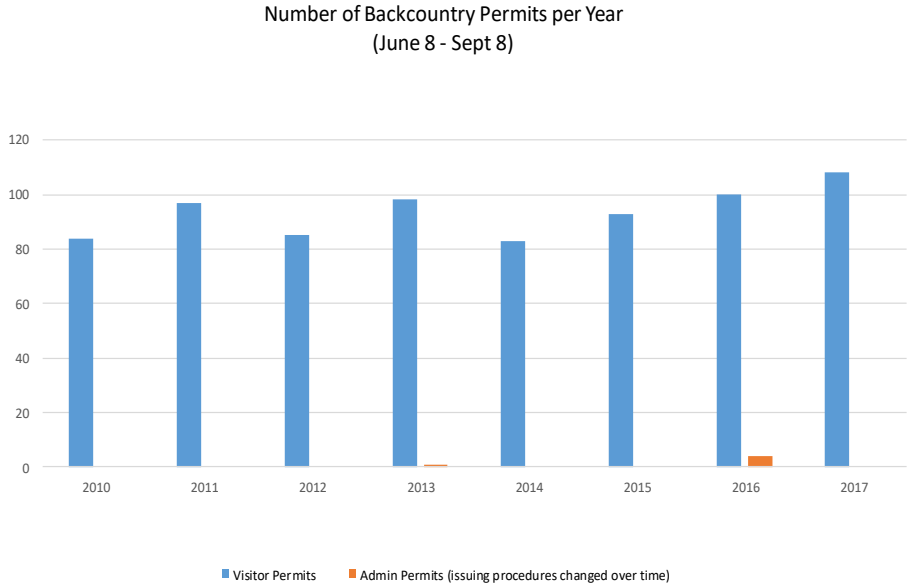


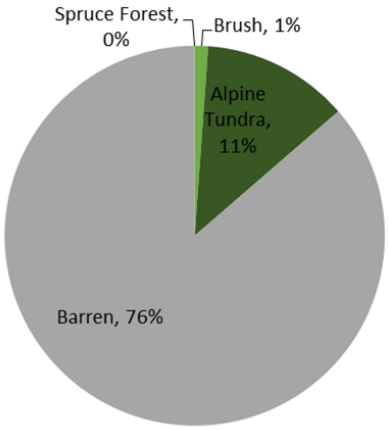
Park boundaries and Denali backcountry units: unit 18

Backcountry Permit Data:

Quota: 4
Percent visitors with bicycle: 0%

Unit Size: 12,470 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=24)
Day hikers (N=0)
Pooled total (N=24)
Total recorded days (n=39)

Percent visitors on guided hike: 1%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **50% yes**, 50% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 3** (Standard Deviation 1.97); range 0—6

Backcountry indicators in Unit 18: Backpackers recorded Backcountry Management Plan (BMP) indicators that **exceeded** BMP standards for OP1. Exceptions were encounter groups and administrative presence; these were **within** OP1 BMP standards.

Backcountry indicators in Unit 18: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate 50% of recorded visitor encounters were above the standard of 2 events per day, and the maximum range of observations of landscape modifications were above the standard of 1 encounter per day.

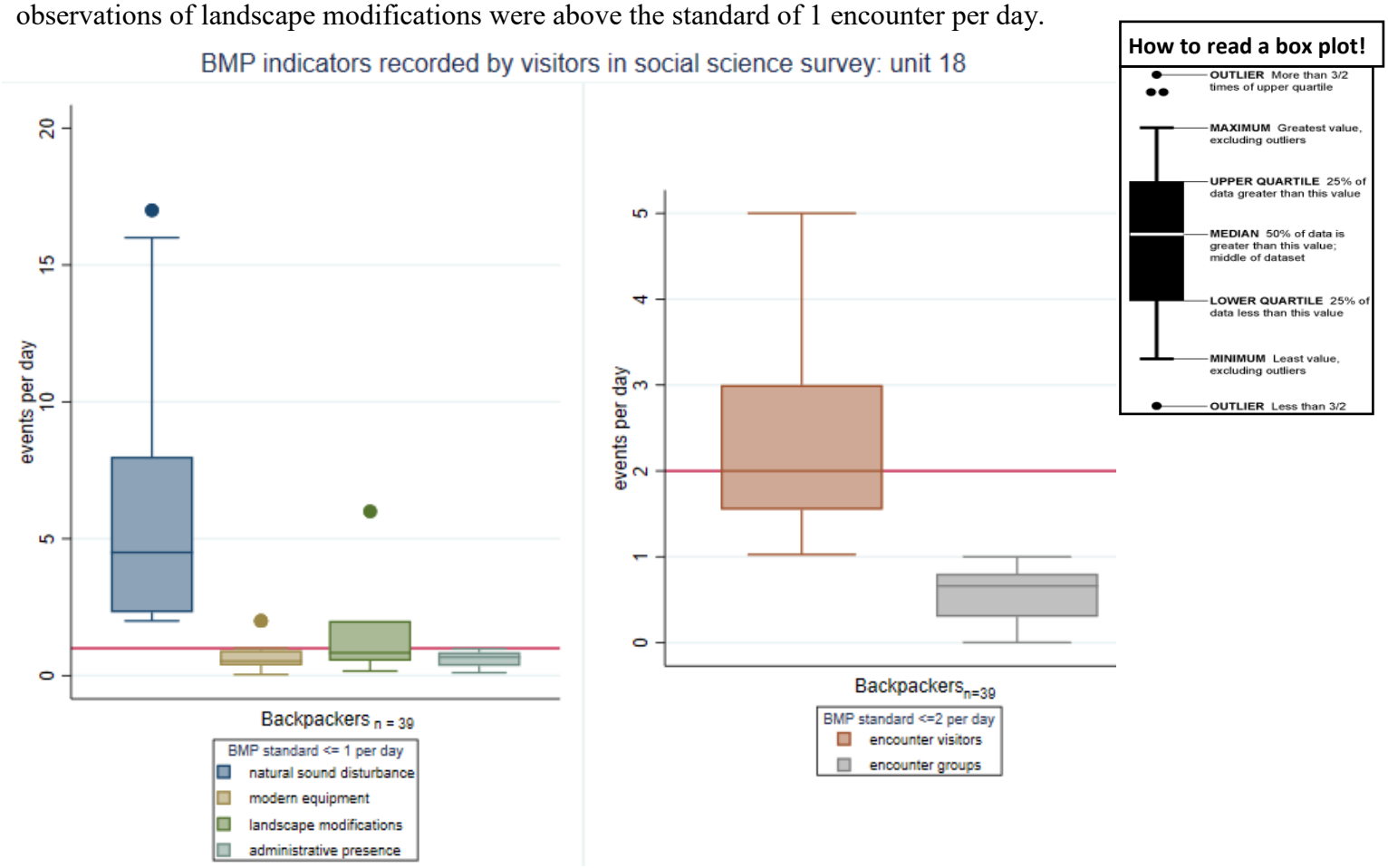


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, all recorded natural sound disturbance events exceeded the BMP standard for OP1. The top 50% of observations have a range that is larger than the median observation: from 4.7 to 16 events per day. The dots are outlier data points for BMP indicator events.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.73 events per hour** or 12 events per defined backcountry visitor day (16 hours). 12 is within the maximum range visitors recorded. Even though the visitor median of 4.7 events per day is lower than the NPS recorded daily events, the corroboration means the 'true' daily average is between 4 & 12 events. The visitor survey and NPS records demonstrate that natural sound disturbance occurs at a higher frequency than backcountry standards allow.

Camping Density: 100% of backpackers to unit 18 were able to camp away from others; 100% reported they wanted to camp away from others. This meets the standard of always being able to camp out of sight/ sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 167

Average Miles: 24 miles/year

Average Visitors Encountered: 1.57/ year Average Litter/Sanitation Encountered: 1/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 18. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 38% of total days sampled in Unit 18 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP Standard	Mean daily events (2011) n = 22	Mean daily events (2018) n = 24	Percent change days in standard: 2011 - 2018	State of change in Unit 18: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	2.96	6.18	-49% in standard	
Encounter Visitors	≤ 2 / day	.43	2.28	-30% in standard	
Encounter Groups	≤ 2 / day	0	.81	-2% in standard	
Modern Equipment	≤ 1 / day	.29	.7	-6% in standard	
Landscape Modification	≤ 1 / day	.79	1.21	-10% in standard	
Admin. Presence	≤ 1 / day	.2	.6	-4% in standard	
Litter	< 5%	.16	.08	+13% in standard	

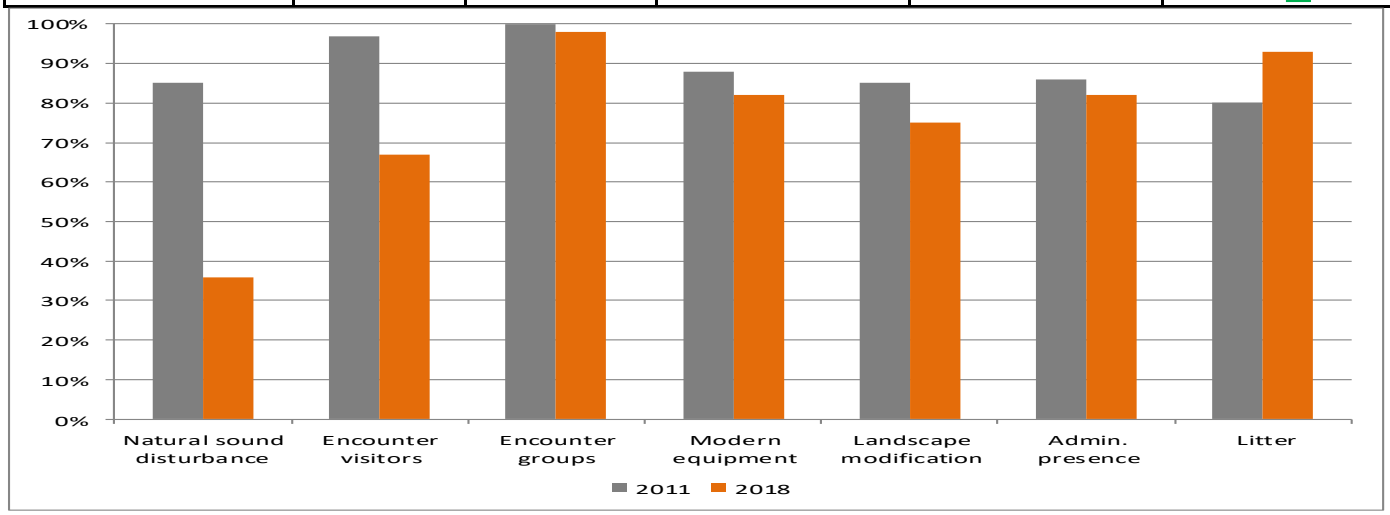


Figure 3. Percent sample days Unit 18 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 18 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

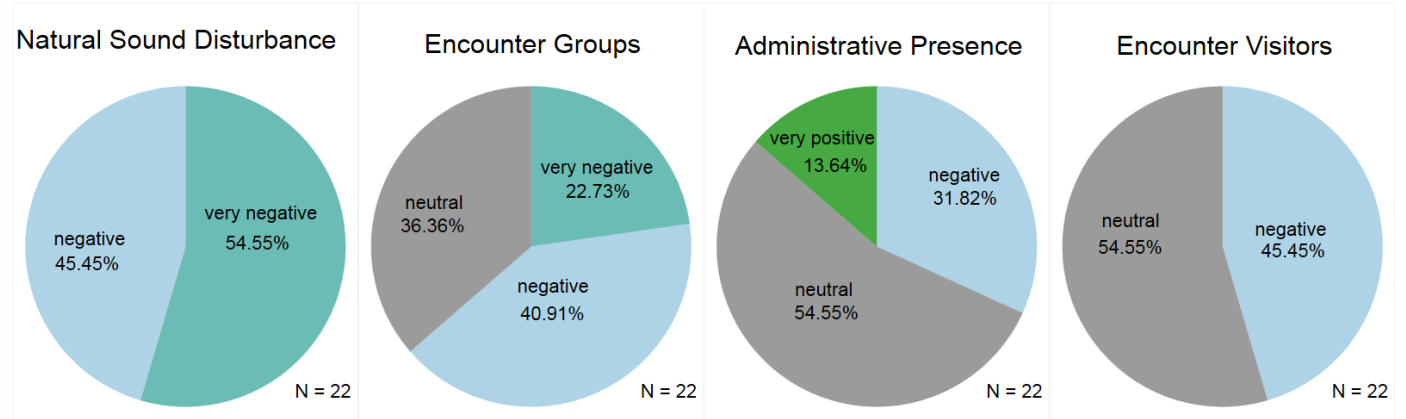


Figure 3. Positive or negative impact to visitor experience by BMP indicator

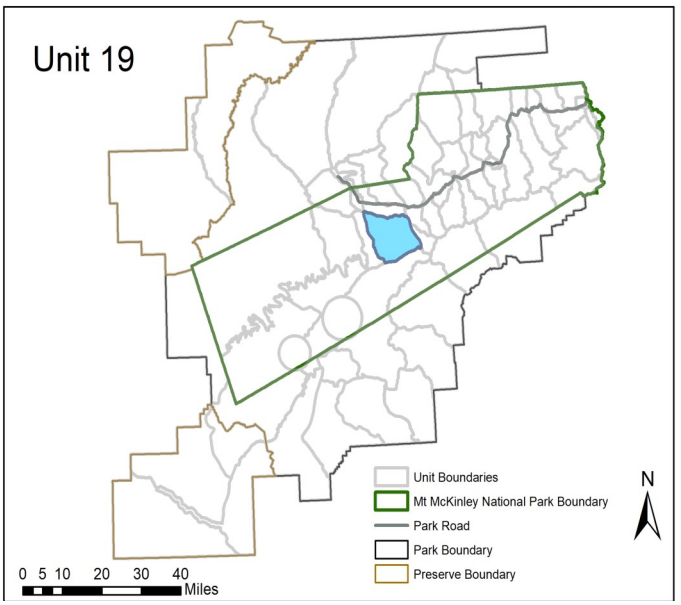
Backcountry Unit 19
"Pirate Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



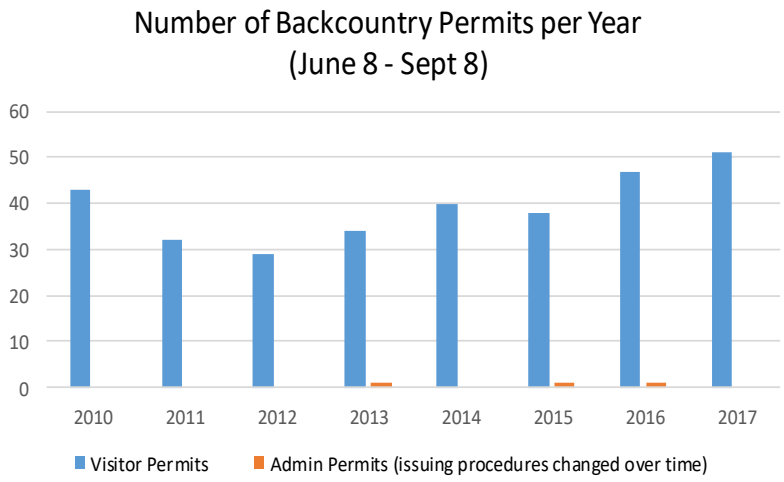
Muldrow glacier, looking west

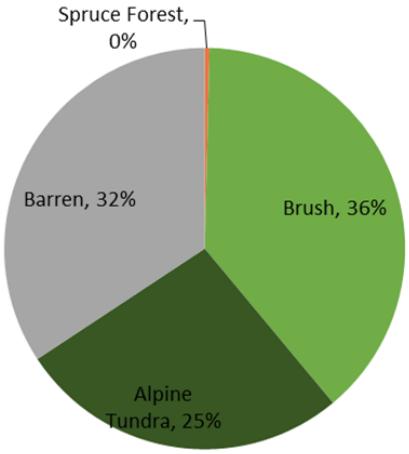


Park boundaries and Denali backcountry units: unit 19

Unit Size: 69,235 acres

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 0%





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=12)
Day hikers (N=3)
Pooled total (N=15)
Total recorded days (n=23)

Percent visitors on guided hike: 1%
Ability to camp out of sight/sound: 90% yes
Percent "visitor first choice" unit: **83% yes**, 17% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 8 (**Standard deviation: 2.0); range 2—10 people.

Backcountry indicators in Unit 19: Day hikers and backpackers typically recorded Backcountry Management Plan (BMP) indicators during their hike days that were **within** standard. The exception was natural sound disturbance in which the distribution of events entirely **exceeded** the BMP standard.

Backcountry Indicators in Unit 19: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

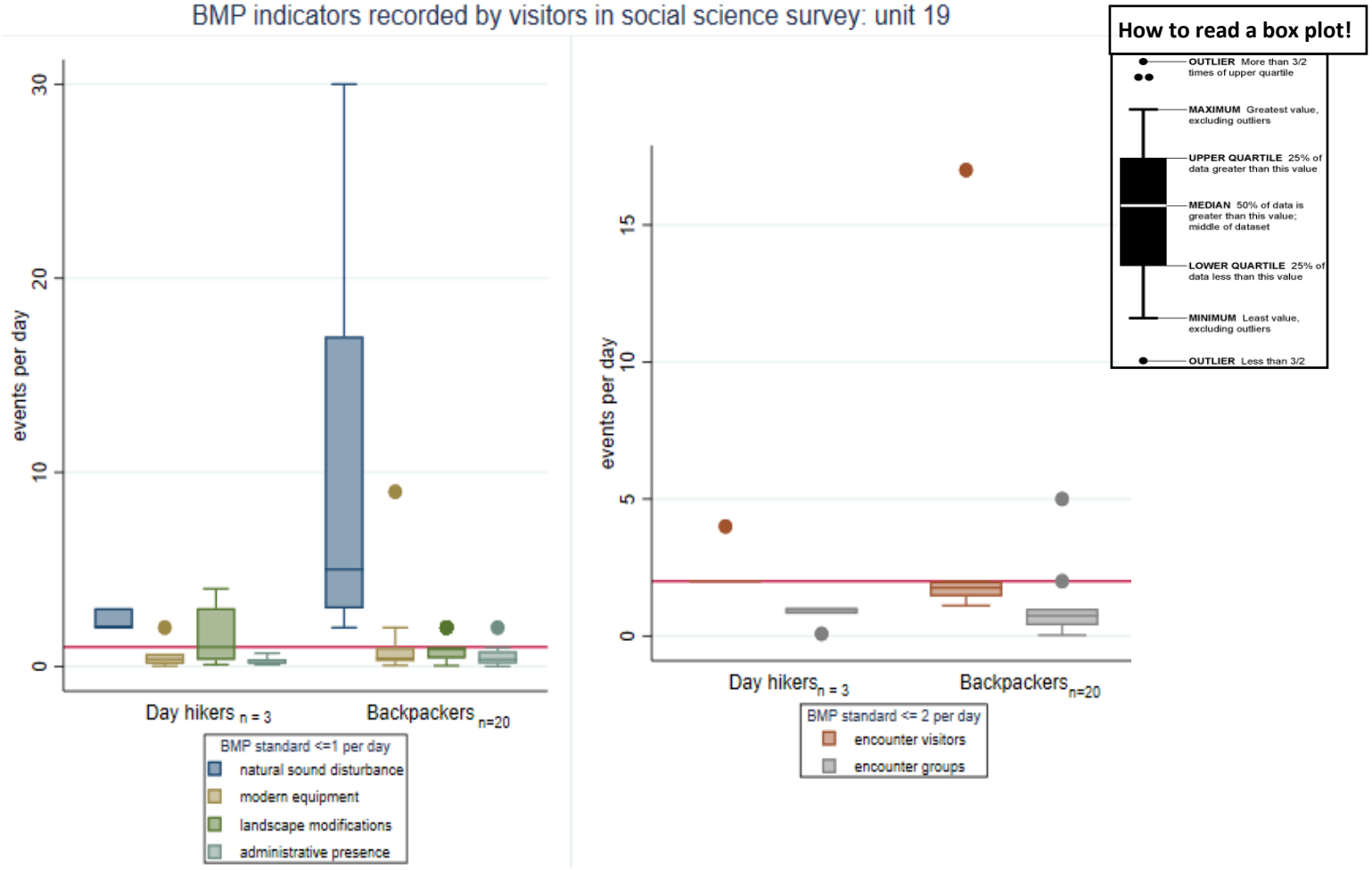


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations. Whereas for backpackers, the top 50% of observations have a range that is larger than 12 (the median) events per day.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.87 events per hour** or 14 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 12, and 14 daily events is well within the maximum range. NPS and visitor collected data are similar for natural sound disturbance; the corroboration means the 'true' average is between 2 & 14 events per day.

Camping Density: 90% of backpackers to unit 19 were able to camp away from others, of these 5% (2 groups) reported they *wanted* to camp near others. This does not meet the standard of always being able to camp out of sight/sound of others, but some may have purposefully camped within sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 127

Average Miles: 18 miles/year

Average Visitors Encountered: 0/year Average Litter/Sanitation Encountered: 0/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 19. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 73% of total days sampled in unit 19 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 10	Mean daily events (2018) n = 23	Percent change days in standard: 2011 - 2018	State of change in Unit 19: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	1.8	14.25	-20% in standard	
Encounter Visitors	≤ 2 / day	1.67	1.65	-8% in standard	
Encounter Groups	≤ 2 / day	0	.801	-8% in standard	
Modern Equipment	≤ 1 / day	3	.46	+9% in standard	
Landscape Modification	≤ 1 / day	.17	.566	-10% in standard	
Admin. Presence	≤ 1 / day	0	.49	-1% in standard	
Litter	< 5%	0	0	-0% in standard	

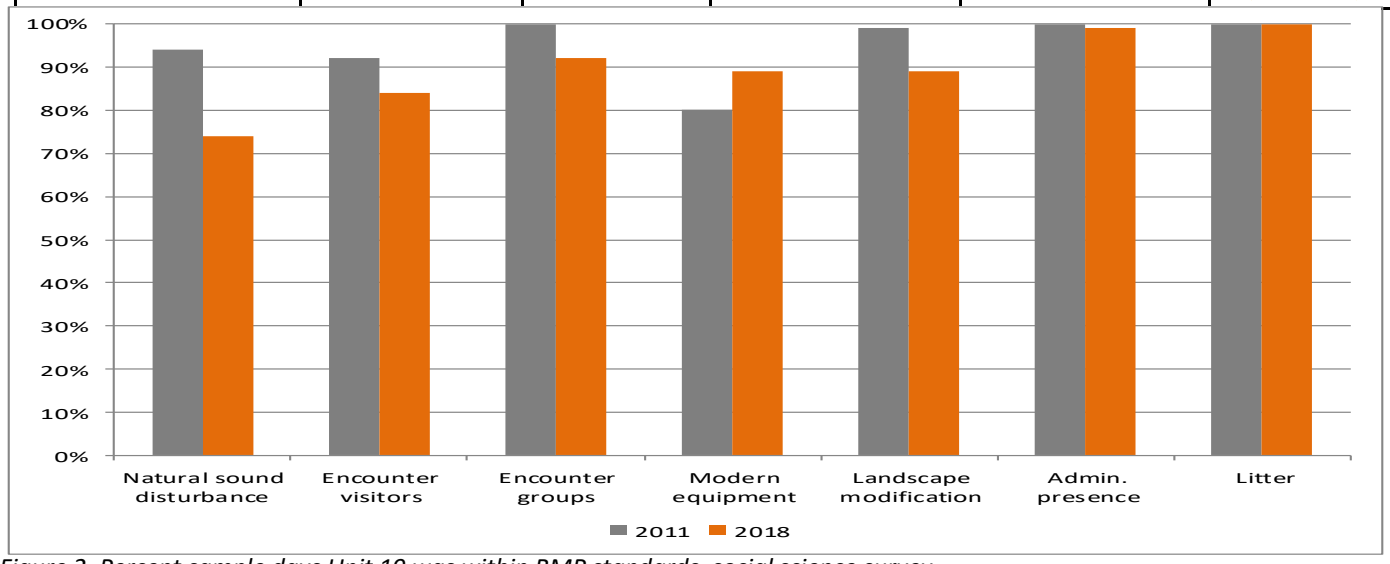


Figure 2. Percent sample days Unit 19 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 19 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

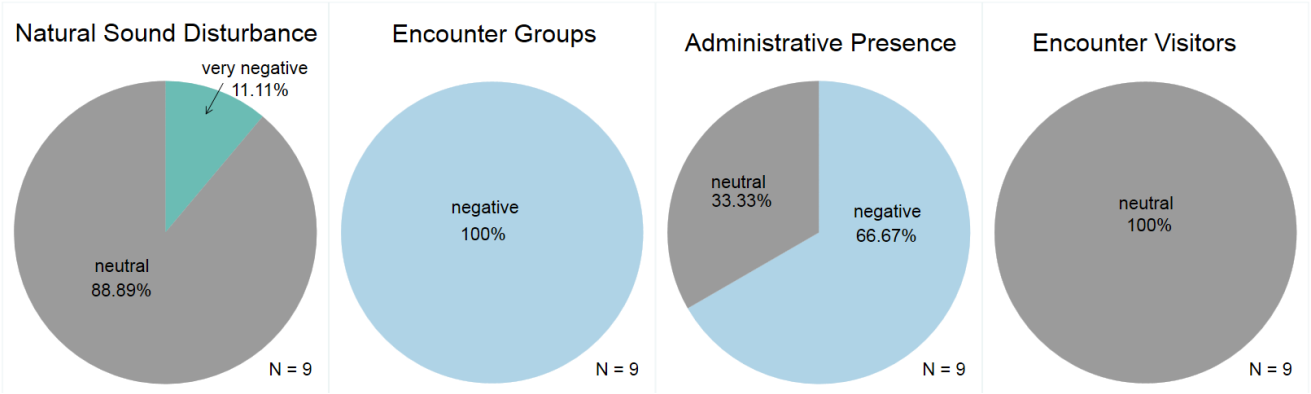
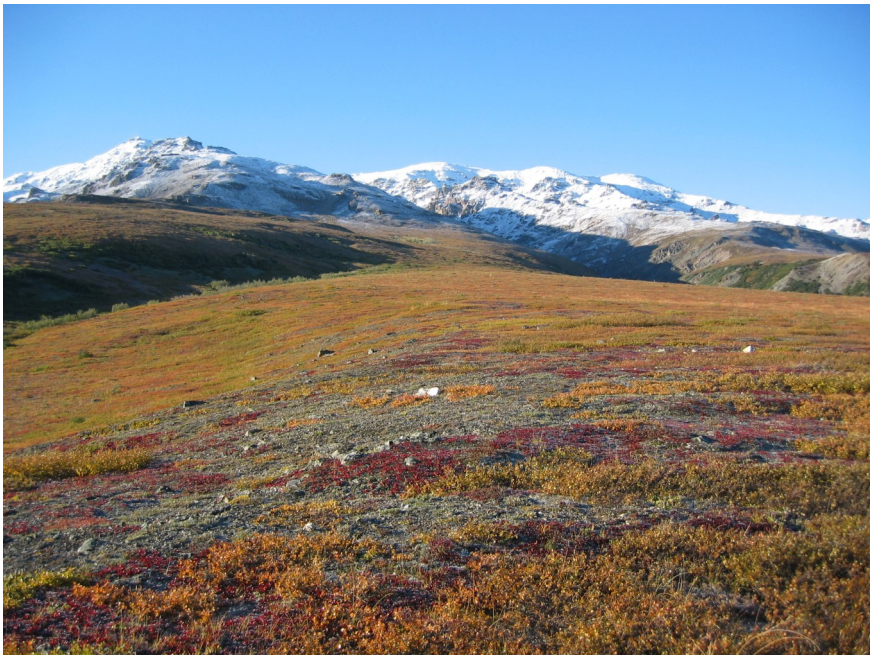


Figure 3. Positive or negative impact to visitor experience by BMP indicator

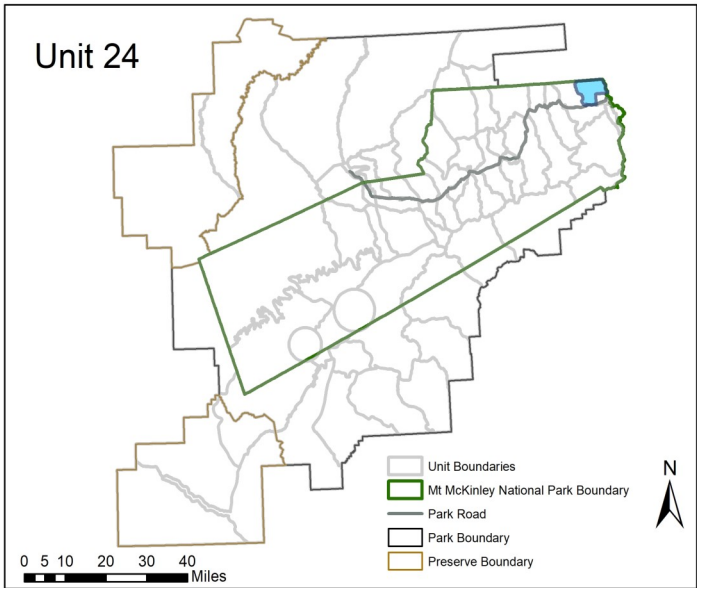
Backcountry Unit 24
"Mount Healy"
Management Area: Old Park 1 (OP1)

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska

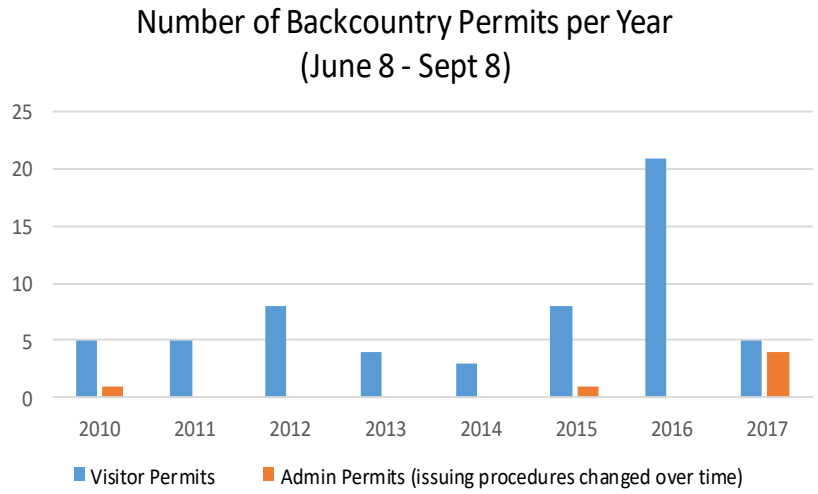


Mount Healy, looking west

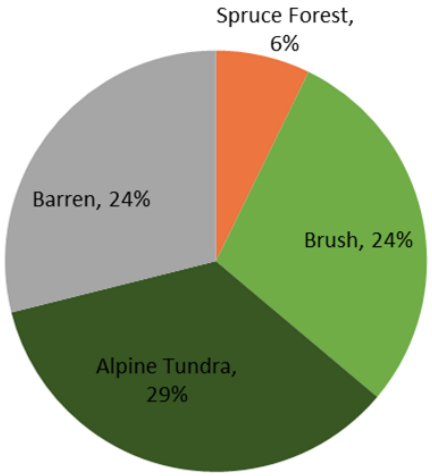


Park boundaries and Denali backcountry units: unit 24

Backcountry Permit Data:
Quota: 4
Percent visitors who traveled to unit with a bike: 2%



Unit Size: 19,978 acres



Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N = 2)
Day hikers (N = 3),
pooled total (N = 5)
Total recorded days (n = 7)

Percent visitors who reported they were on a guided hike: 21%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: no data

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 15 (**Standard deviation: 7.0); range 10—20 people.

Backcountry indicators in Unit 24: Day hikers and backpackers to unit 24 typically experienced Backcountry Management Plan (BMP) indicators during their hike days that were **within** standard. The exceptions were natural sound disturbance and visitor encounters; these **exceeded** BMP standards.

Backcountry Indicators in Unit 24: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/ human waste, and ability to camp out of sight and sound of others. Backpackers' observations were exactly the same, for each day, therefore there is no dispersion of the data.* The plots show day hikers' median of encounters with modern equipment and landscape modifications higher than the two backpackers.

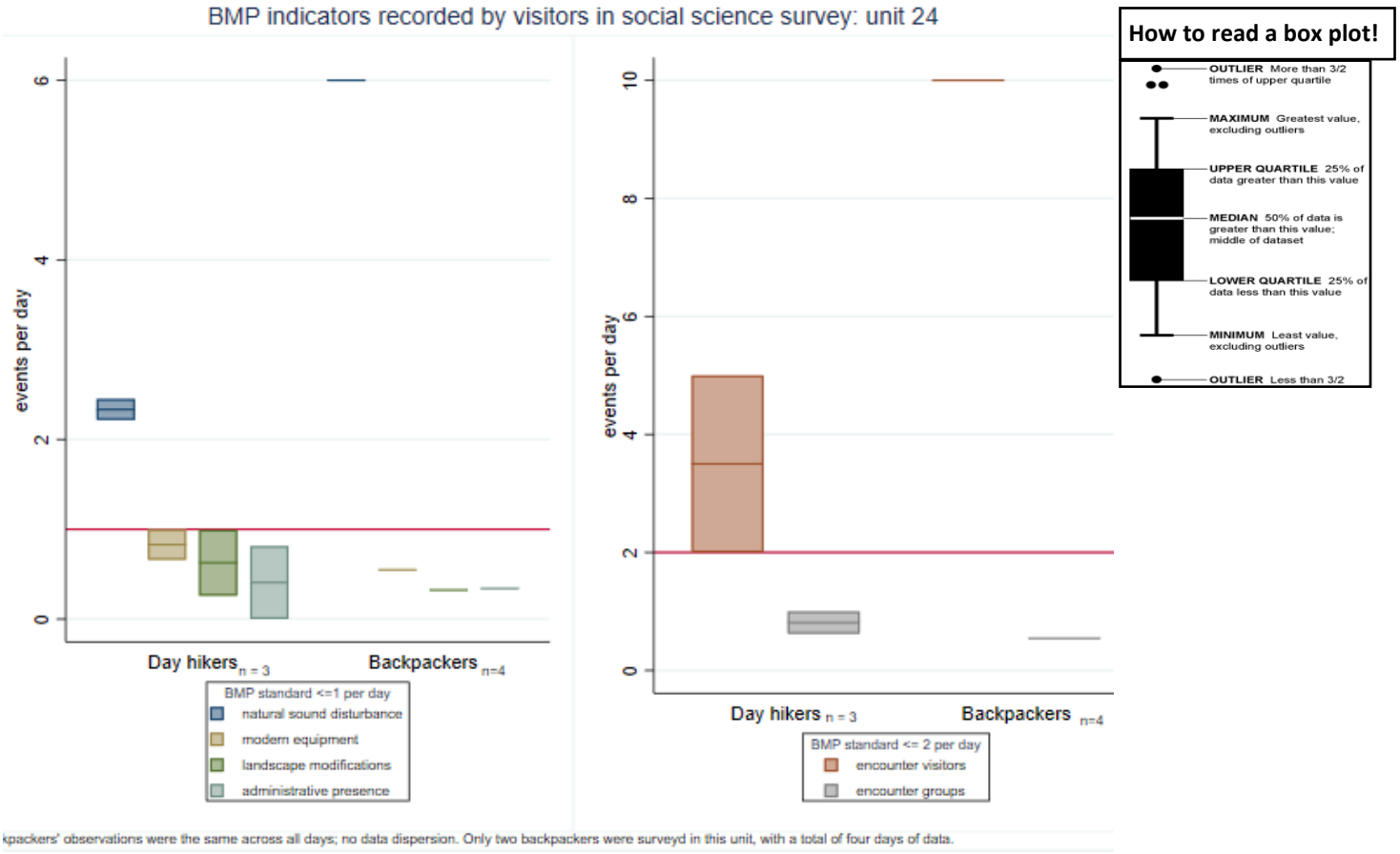


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, Natural sound disturbance recorded by day hikers and backpackers did not have a large range of observations (n=7). However, 100% reported noise events above 2 per day.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.43 events per hour** or 7 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 2.5 (day hikers) or 6 (backpackers) daily events, but this is based on 7 total observations. NPS and visitor collected data are similar for natural sound disturbance. Given 100% of visitor observations are above BMP standard for OP1, the corroboration among NPS, day hiker and backpacker data means the 'true' average is above 2 events per day.

Camping Density: 100% of backpackers to unit 24 were able to camp away from others; 100% reported they wanted to camp away from others. This meets the standard of always being able to camp out of sight/ sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 24

Average Miles: 3 miles/year

Average Visitors Encountered: 0/year Average Litter/Sanitation Encountered: 0.14/year

*Unknown why there is no data dispersion. Accurate: backpackers truly experienced the exact levels reported. Recall bias: if backpackers returned from trip but didn't fill out in the field and recalled 'high' or 'low' events but not exact numbers. Disinterest: took survey but did not want to actually participate.

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 24. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 80% of total days sampled in unit 24 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 16	Mean daily events (2018) n = 9	Percent change days in standard: 2011 - 2018	State of change in Unit 24: 2011 to 2018
Natural sound disturbance	≤ 1 / day	2	2.78	-14% in standard	
Encounter visitors	≤ 2 / day	9.5	4.69	+19% in standard	
Encounter groups	≤ 2 / day	1	.659	-5% in standard	
Modern equipment	≤ 1 / day	3.4	.66	+29% in standard	
Landscape modification	≤ 1 / day	4.6	.582	+58% in standard	
Admin. presence	≤ 1 / day	0	.52	-10% in standard	
Litter	< 5%	.33	0	+18% in standard	

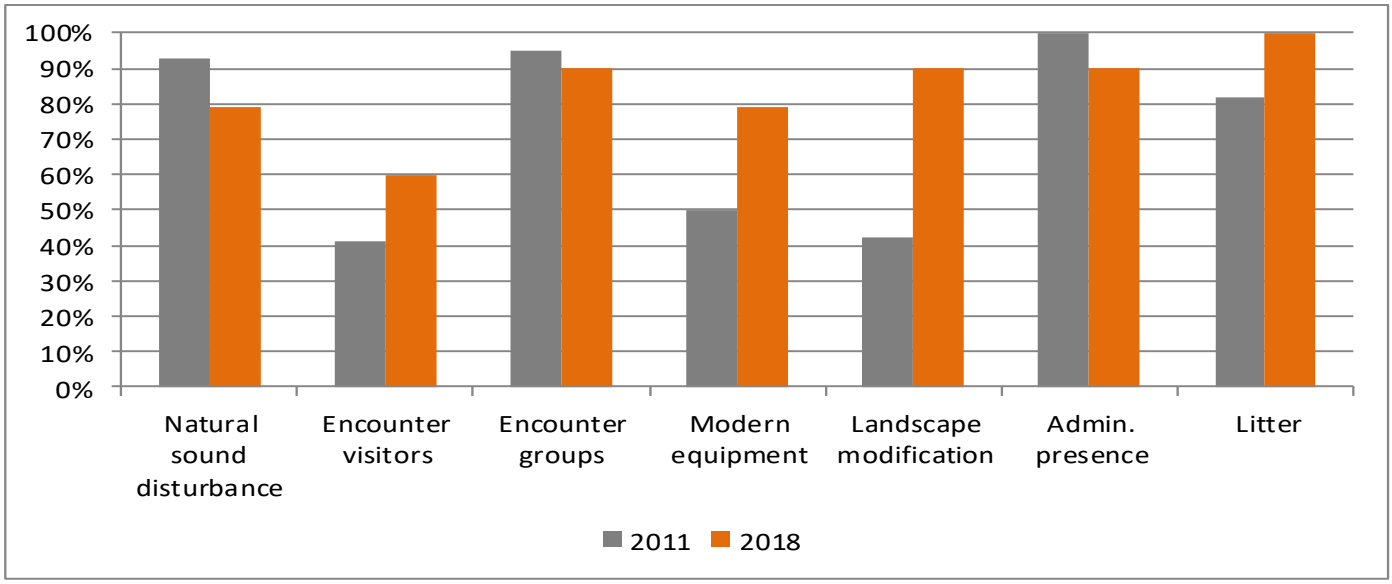


Figure 2. Percent sample days Unit 24 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 24 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

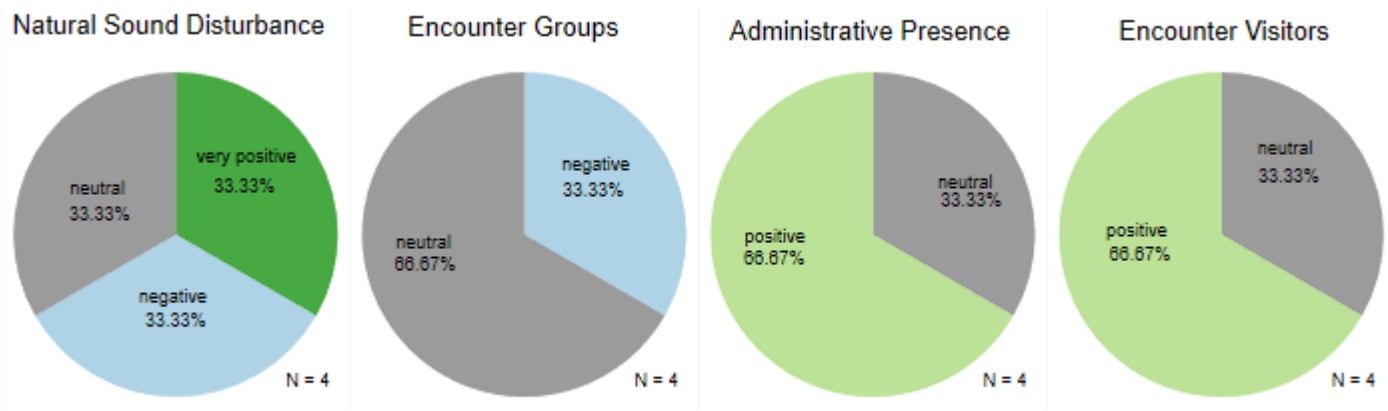


Figure 3. Positive or negative impact to visitor experience by BMP indicator

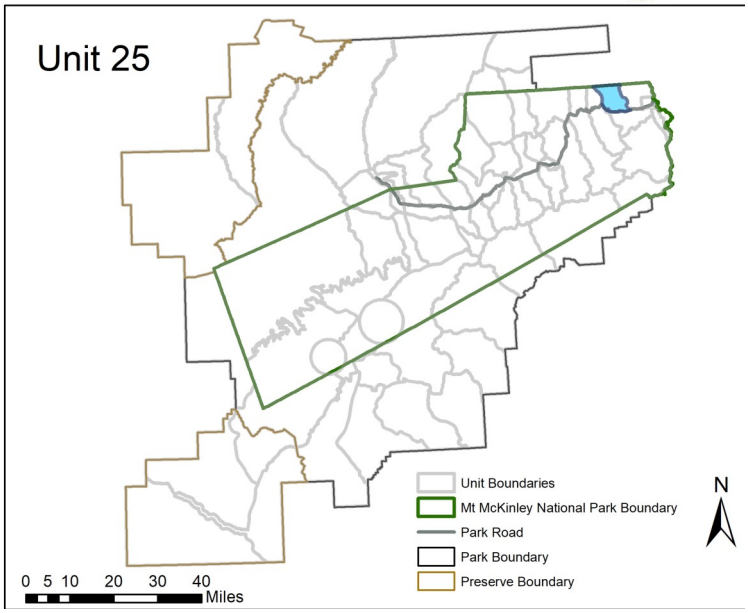
Backcountry Unit 25
"Healy Ridge"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



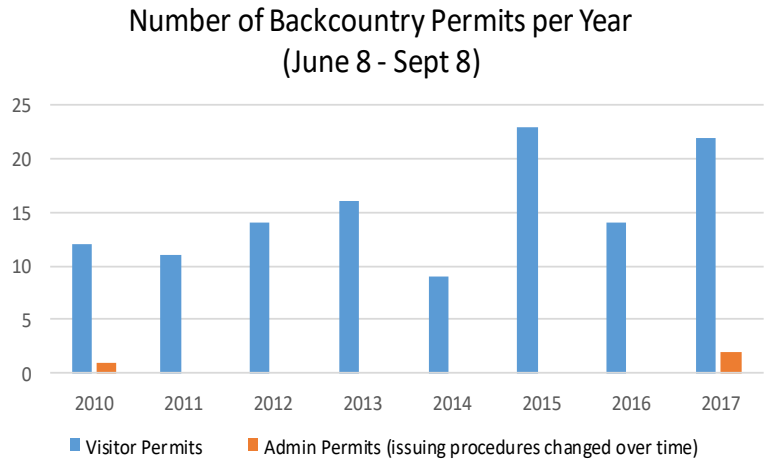
Healy Range, looking northeast

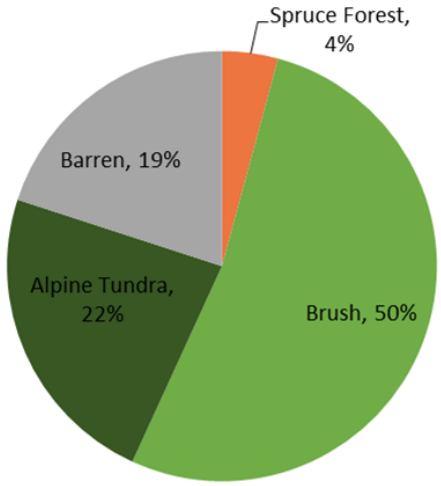


Park boundaries and Denali backcountry units: unit 25

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 6%

Unit Size: 19,997 acres





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=9)
Day hikers (N=22)
Pooled total (N=31)
Total recorded days (n=39)

Percent visitors on guided hike: 10%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **90% yes**, 10% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 14 (**Standard deviation: 9.0); range 5—50 people.

Backcountry indicators in Unit 25: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators during their hike days that **exceeded** BMP standards for OP1. The exceptions were encounters with groups and administrative presence, in which the distribution of events were **within** standards.

Backcountry Indicators in Unit 25: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that day hikers recorded higher encounters with visitors, modern equipment and landscape modifications. Visitor encounters had a median of 7, meaning 50% of encounters were over 7 per day.

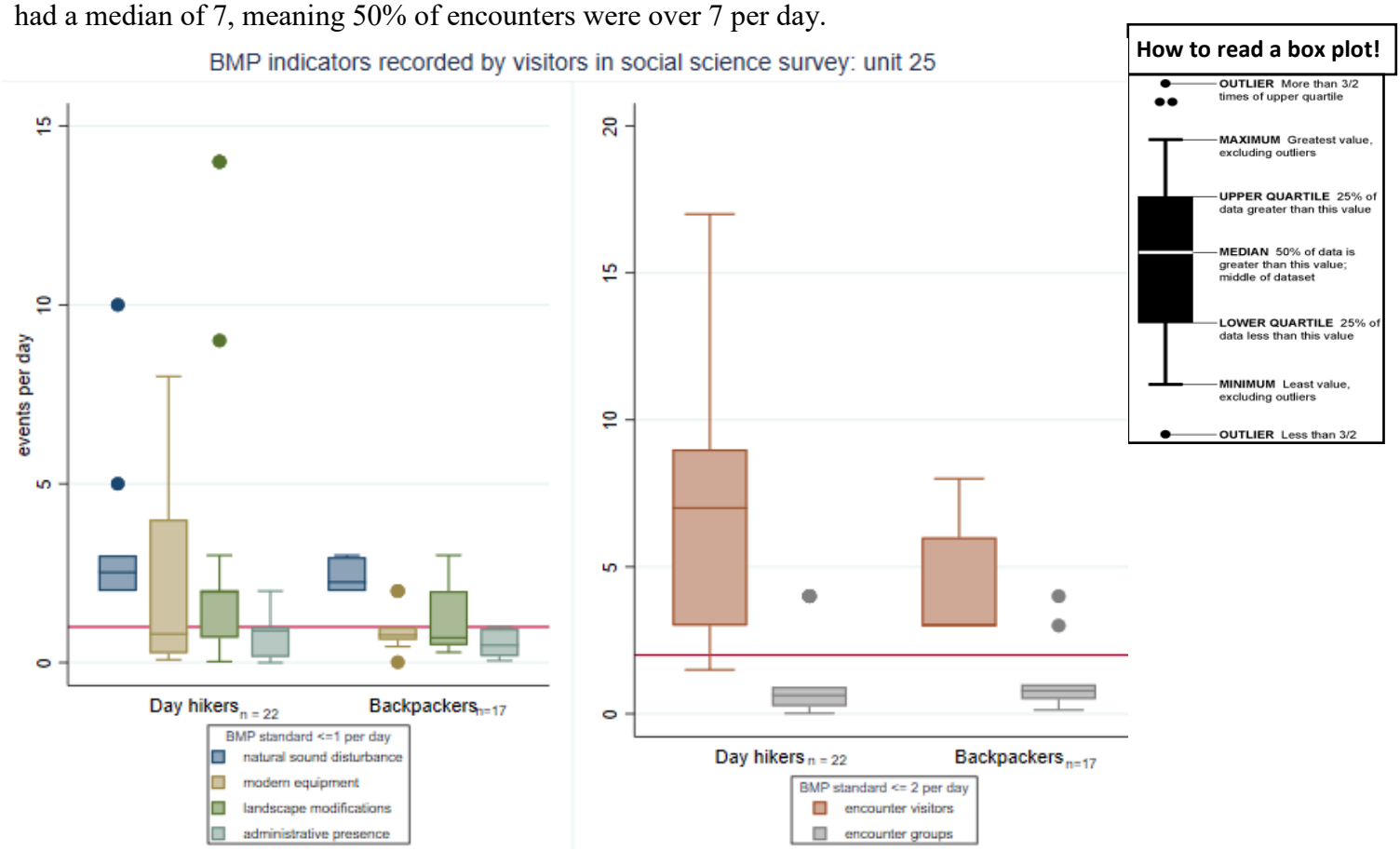


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers had a larger range of observations than backpackers, but all recorded over 2 events daily. Day hikers' median was slightly higher than backpackers (3 vs. 2.2 events daily). The dots are outlier data points for BMP indicator events (Figure 1).

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by NPS was **0.79 events per hour** or 12.6 events per defined backcountry visitor day (16 hours). The sound station estimate of 12.6 is outside the maximum range recorded by visitors. However, 100% of visitor observations are above BMP standard for OP1. Corroboration between visitor and NPS data result in a daily average at least above 2 events per day.

Camping Density: 100% of backpackers to unit 25 were able to camp away from others; 100% reported they wanted to camp away from others. This meets the standard of always being able to camp out of sight/ sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 114

Average Miles: 16 miles/year

Average Visitors Encountered: 2.71/year Average Litter/Sanitation Encountered: 1.71/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 25. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 71% of total days sampled in unit 25 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 32	Mean daily events (2018) n = 39	Percent change days in standard: 2011 - 2018	State of change in Unit 25
Natural Sound Disturbance	≤ 1 / day	0	2.81	-29% in standard	
Encounter Visitors	≤ 2 / day	1.7	5.53	-22% in standard	
Encounter Groups	≤ 2 / day	.11	1.16	-9% in standard	
Modern Equipment	≤ 1 / day	.71	1.5	-10% in standard	
Landscape Modification	≤ 1 / day	4	2.15	+24% in standard	
Admin. Presence	≤ 1 / day	.9	.65	+3% in standard	
Litter	< 5%	0	.16	-28% in standard	

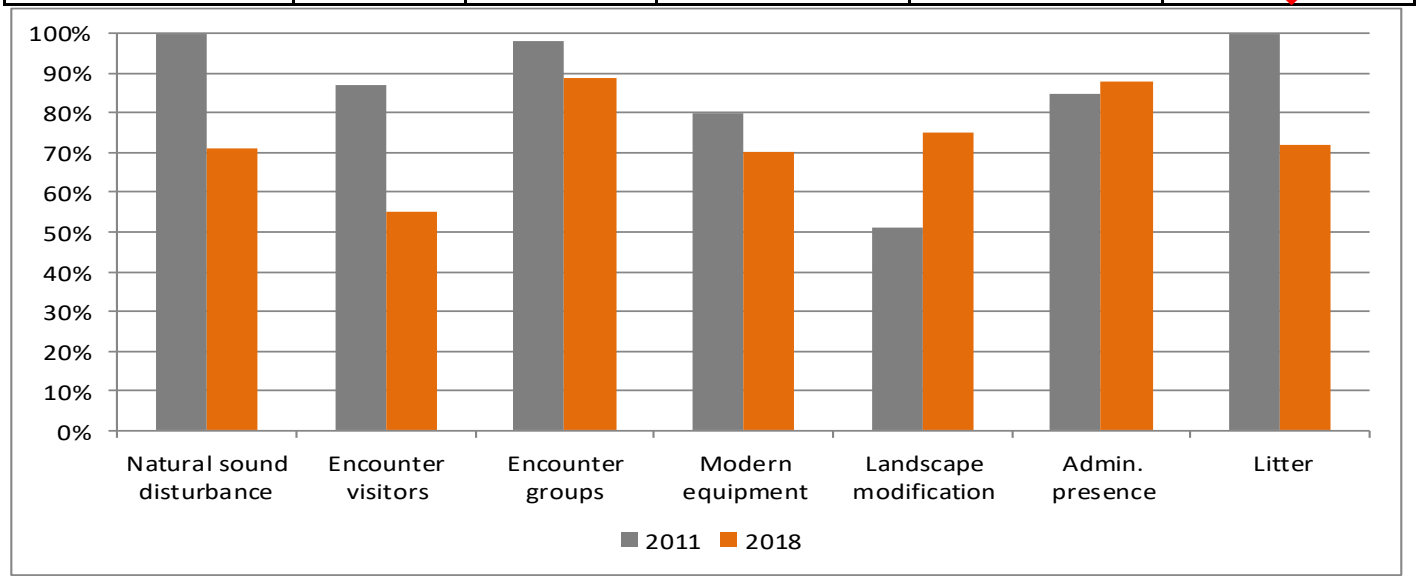


Figure 2. Percent sample days Unit 25 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 25 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

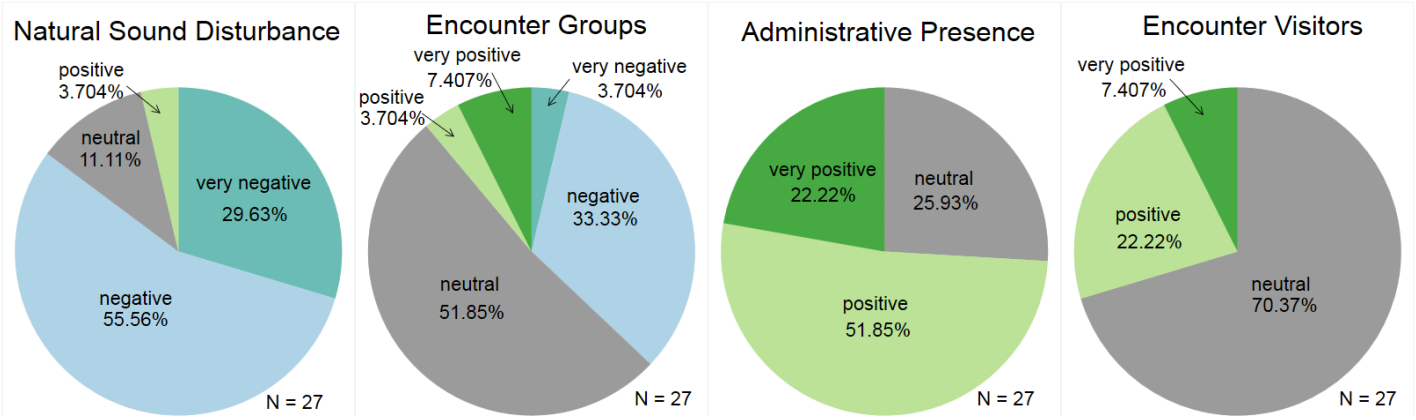
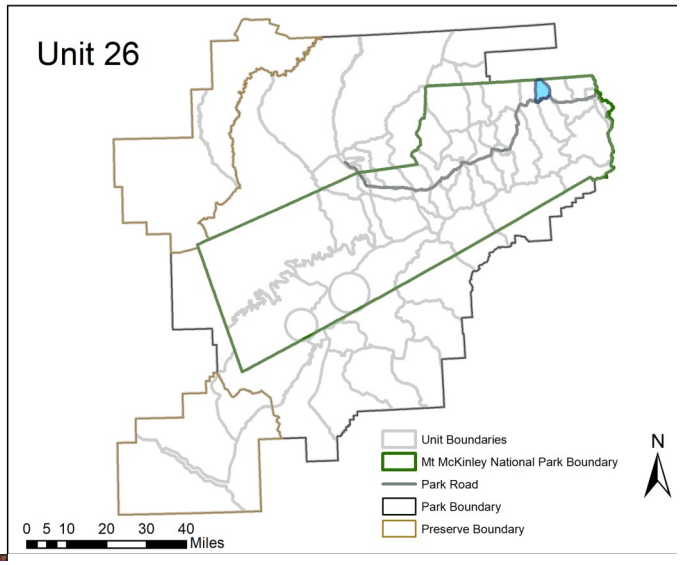


Figure 3. Positive or negative impact to visitor experience by BMP indicator



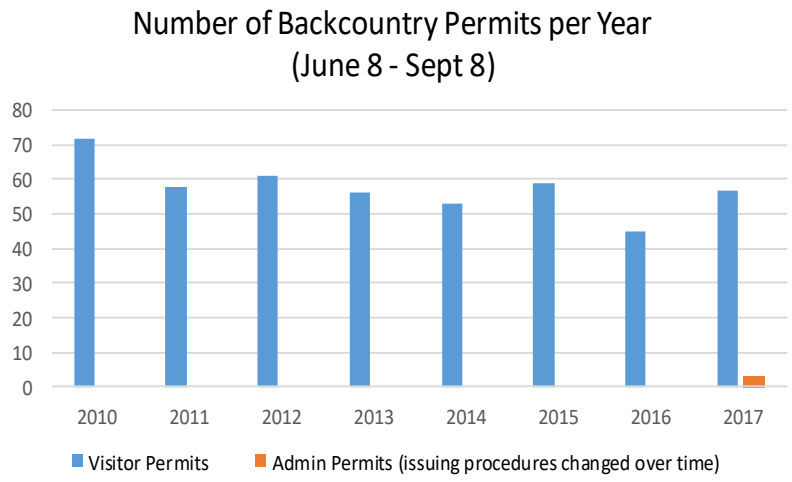
Primrose ridge, looking north

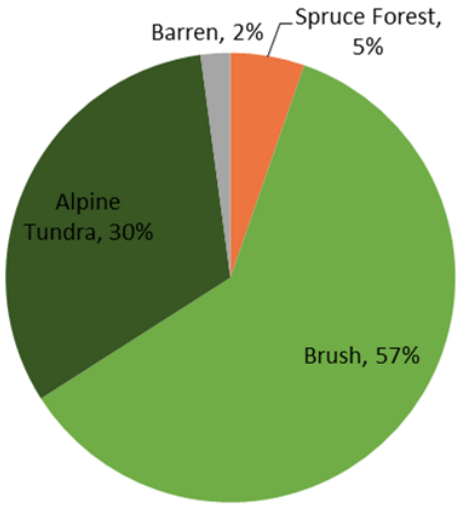


Park boundaries and Denali backcountry units: unit 26

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 10%

Unit Size: 9,604 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N=9)
Day hikers (N=20)
Pooled total (n=29)
Total recorded days (n=36)

Percent visitors on guided hike: n=16%
Ability to camp out of sight/sound: 83% yes
Percent "visitor first choice" unit: **62% yes**, 38% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 3 (**Standard deviation: 4.2); range 0—15 people.

Backcountry indicators in Unit 26: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators during their hike days that were **within** BMP standards for OP1. The exceptions were natural sound disturbance and encounters with visitors; these indicators entirely **exceeded** BMP standards.

Backcountry Indicators in Unit 26: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that day hikers recorded higher encounters with modern equipment and landscape modifications.

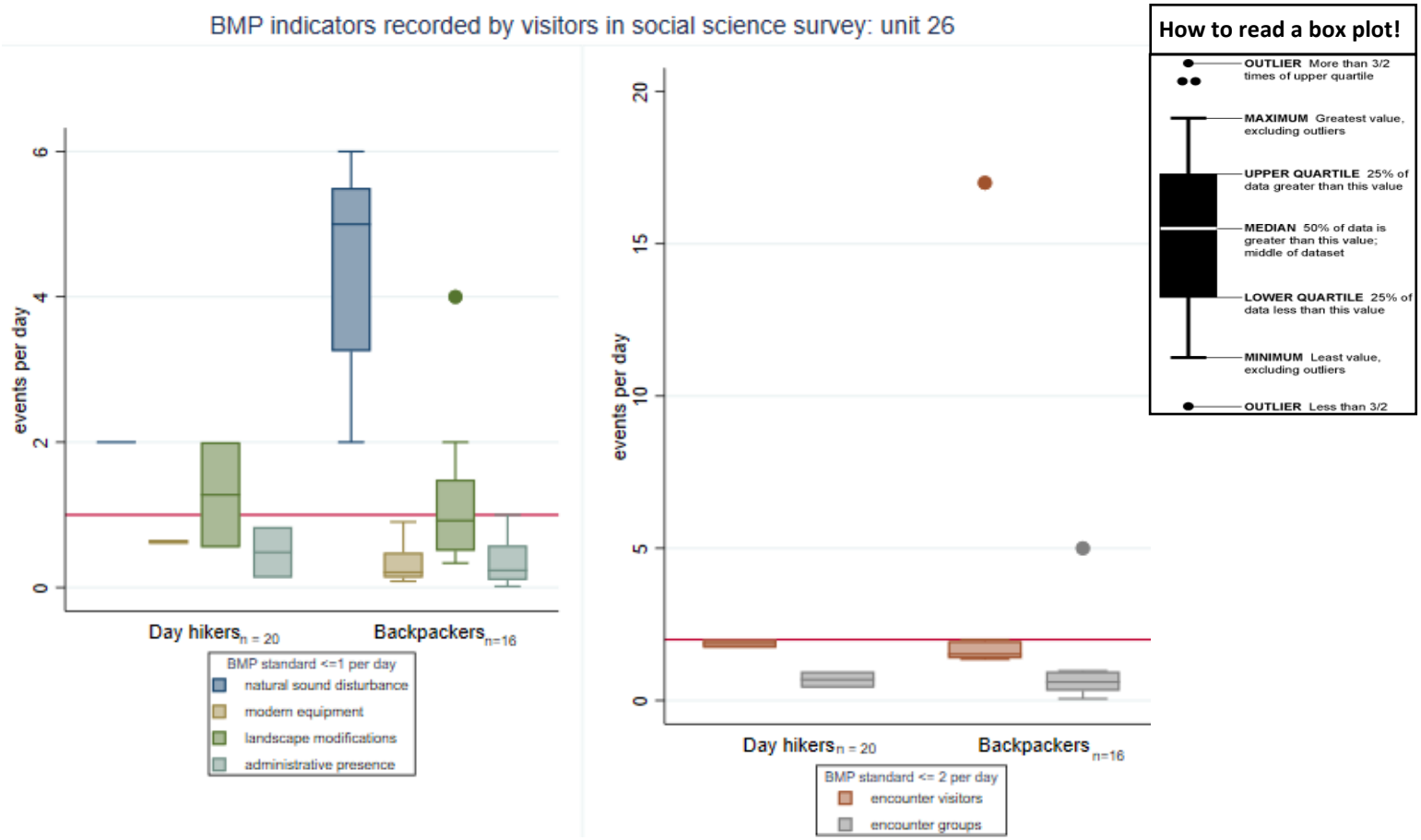


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations, but one outlier event surpassed the maximum range of backpacker observations. Day hikers' and backpackers' median observations were 2 & 5 events per day, and 100% of observations are above the BMP standard.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.49 events per hour** or 7.8 events per defined backcountry visitor day (16 hours). The median backpackers recorded for natural sound disturbance was 5 daily events, and the sound station estimate of 7.8 is close to the maximum range recorded by backpackers. 100% of visitor observations are above BMP standard for OP1. The NPS collected data is corroborated by the visitor collected data, meaning the natural sound disturbance average is between 2 & 8 daily events.

Camping Density: 83% of backpackers to unit 26 were able to camp away from others; of which 5% (2 groups) reported they *wanted* to camp near others. This does not meet the standard of always being able to camp out of sight/sound of others, but some may have purposefully camped within sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 157

Average Miles: 22 miles/year

Average Visitors Encountered: 1.43/year Average Litter/Sanitation Encountered: 1/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 26. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 44% of total days sampled in unit 26 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP Standard	Mean daily events (2011) n = 25	Mean daily events (2018) n = 29	Percent change days in standard: 2011 - 2018	State of change in Unit 26: 2011 to 2018
Natural Sound Disturbance	≤ 2 / day	3	3.63	-7% in standard	
Encounter Visitors	≤ 2 / day	7.13	3.87	+47% in standard	
Encounter Groups	≤ 2 / day	0	.561	-10% in standard	
Modern Equipment	≤ 1 / day	1.14	.478	+21% in standard	
Landscape Modification	≤ 1 / day	1.56	1.3	+14% in standard	
Admin. Presence	≤ 1 / day	.9	.33	+19% in standard	
Litter	< 5%	.056	.03	+4% in standard	

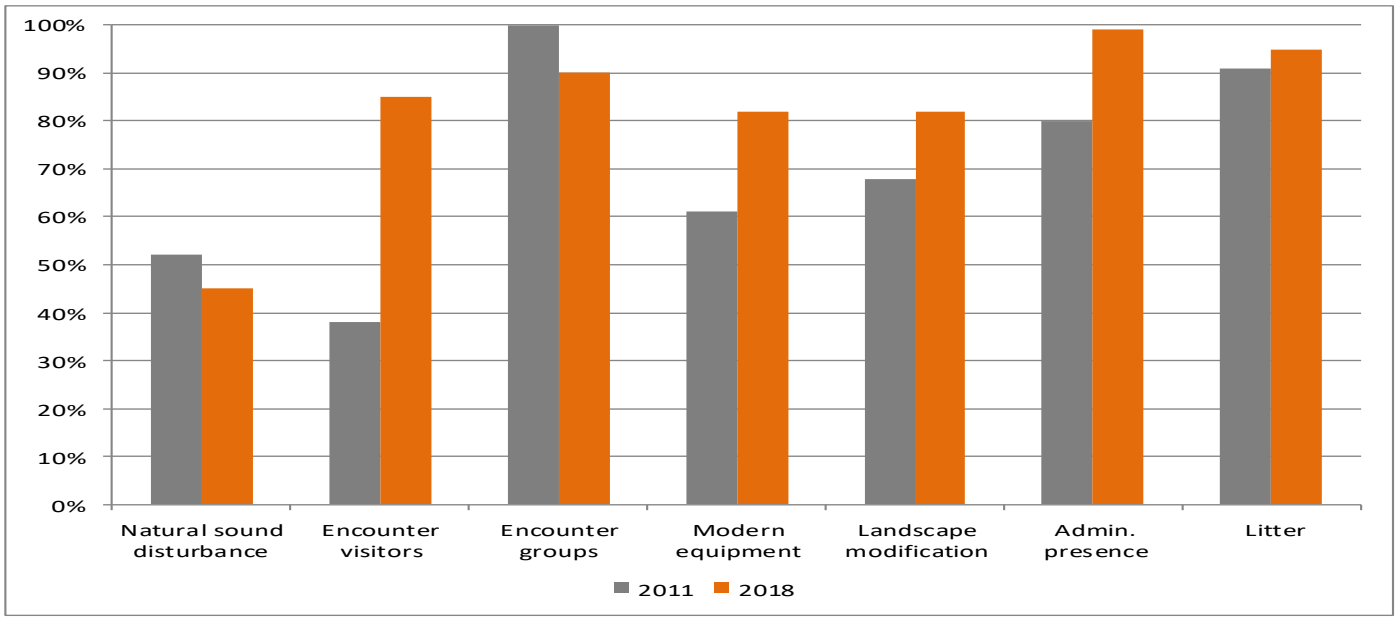


Figure 2. Percent sample days Unit 26 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 26 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

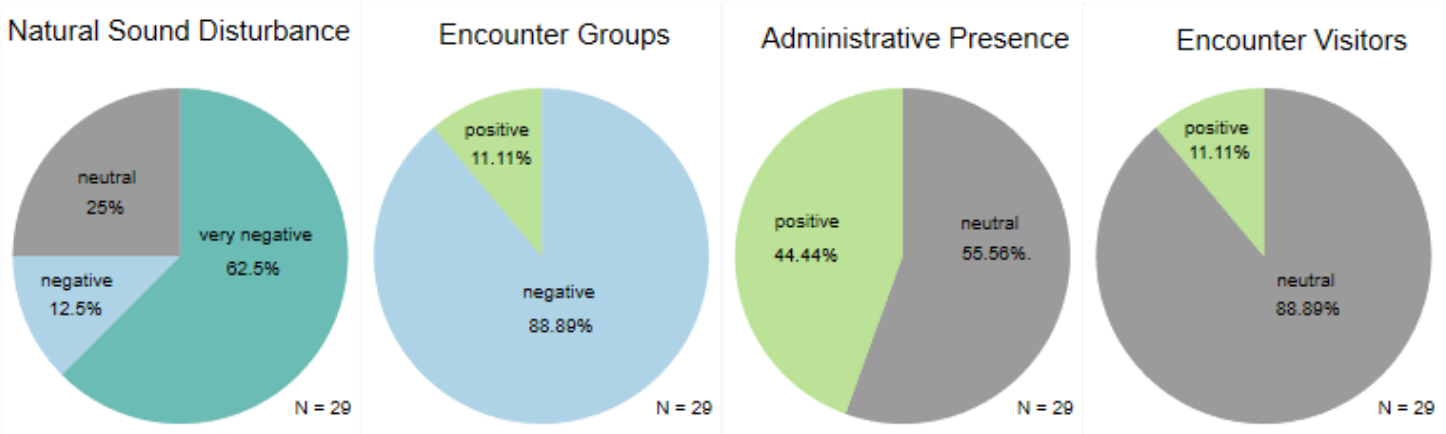


Figure 3. Positive or negative impact to visitor experience by BMP indicator

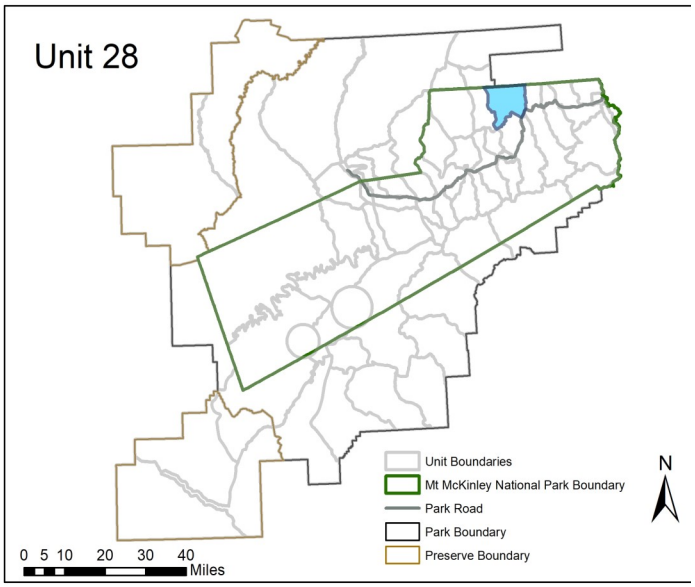
Backcountry Unit 28
"Sushana River"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



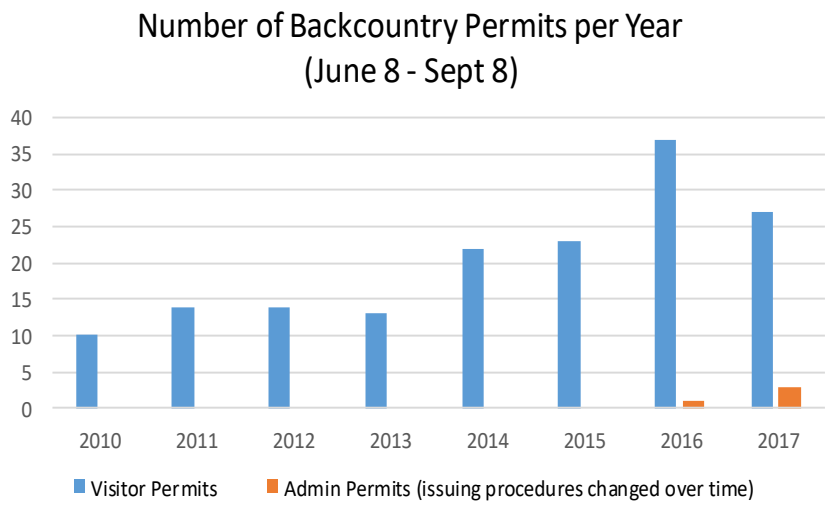
Sushana, looking south

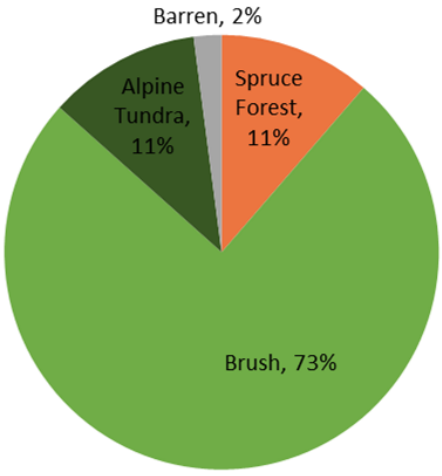


Park boundaries and Denali backcountry units: unit 28

Backcountry Permit Data:
Quota: 8
Percent visitors with bicycle: 5%

Unit Size: 44,818 acres





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=9)
Day hikers (N=3)
Pooled total (N=12)
Total recorded days (n=19)

Percent visitors on guided hike: 0%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **30% yes,** 70% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 3 (**Standard deviation: 3.9); range 0—10 people.

Backcountry indicators in Unit 28: Backpackers typically recorded Backcountry Management Plan (BMP) indicators during their hike days that were **within** BMP standards for OP1, whereas day hikers recorded indicators that **exceeded** standards. The exception was natural sound disturbance; this indicator **exceeded** the OP1 BMP standard for both backpackers and day hikers.

Backcountry Indicators in Unit 28: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that day hikers recorded higher encounters with visitors, modern equipment and landscape modifications.

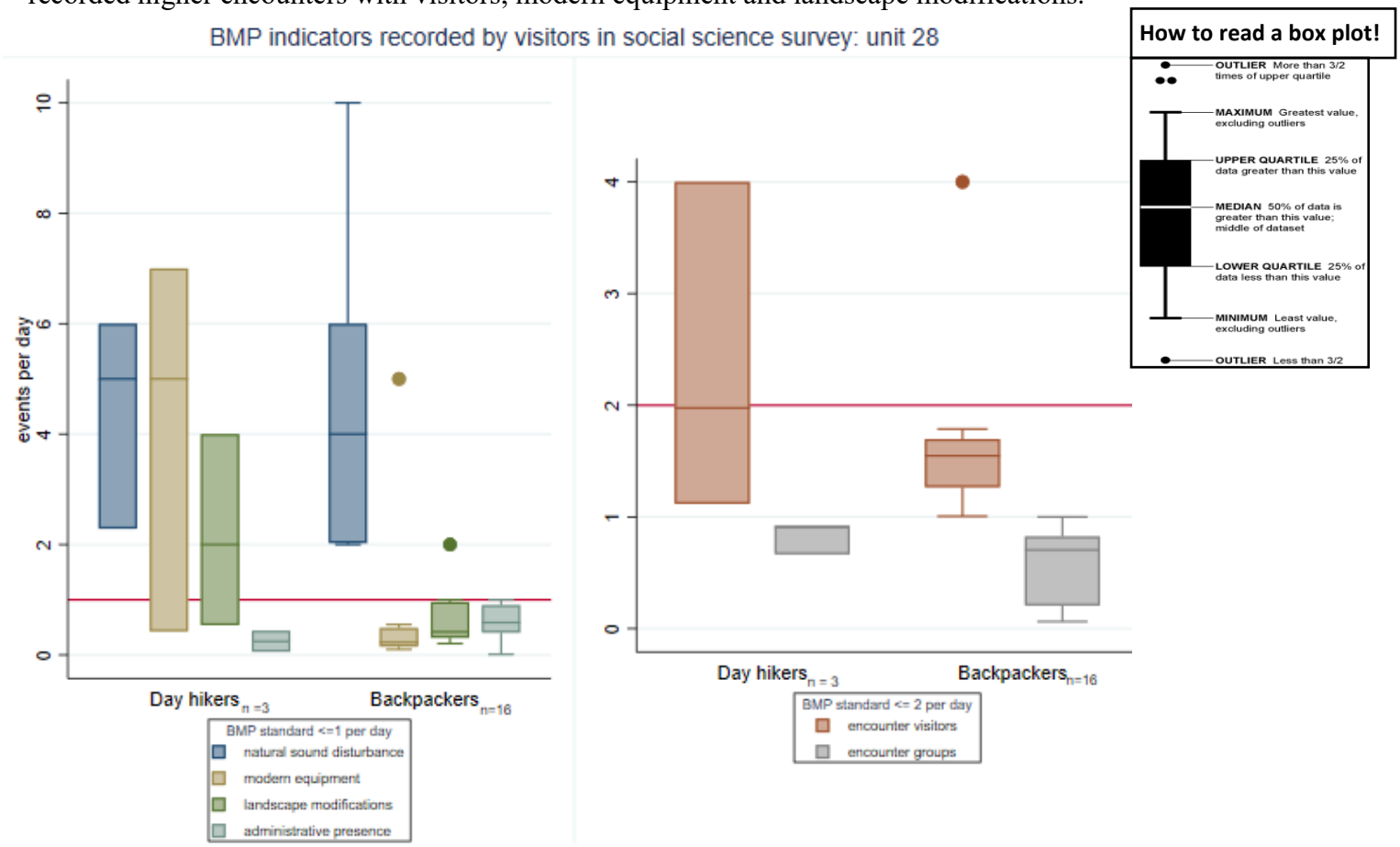


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers had a smaller interquartile range than backpackers, but all visitors to this unit recorded over 2 events per day. For backpackers, the top 50% of observations have a range that is larger than the median observation (4 events/day) with a max range of 10. Day hikers' median observation was higher (5) but note here n=3.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **1 event per hour** or 16 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 5 (day hikers) or 4 (backpackers) daily events, and the sound station estimate larger than the maximum range recorded by visitors. Despite a lack of corroboration between NPS and visitor collected natural sound disturbance events, 100% of visitor observations are above BMP standard for OP1. The true average of natural sound disturbance events is at least greater than 2 per day.

Camping Density: 100% of backpackers to unit 28 were able to camp away from others; 100% reported they wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 115

Average Miles: 16 miles/year

Average Visitors Encountered: 0/year Average Litter/Sanitation Encountered: 0.29/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 28. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 43% of total days sampled in unit 28 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP Standard	Mean daily events (2011) n = 10	Mean daily events (2018) n = 19	Change in percent of days in standard: 2011- 2018	State of change in Unit 28: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	5	4.42	+10% in standard	
Encounter Visitors	≤ 2 / day	2	1.78	-3% in standard	
Encounter Groups	≤ 2 / day	0	.616	-5% in standard	
Modern Equipment	≤ 1 / day	3.3	1.23	+27% in standard	
Landscape Modification	≤ 1 / day	2	.951	-5% in standard	
Admin. Presence	≤ 1 / day	0	.44	-1% in standard	
Litter	< 5%	.2	.08	+5% in standard	

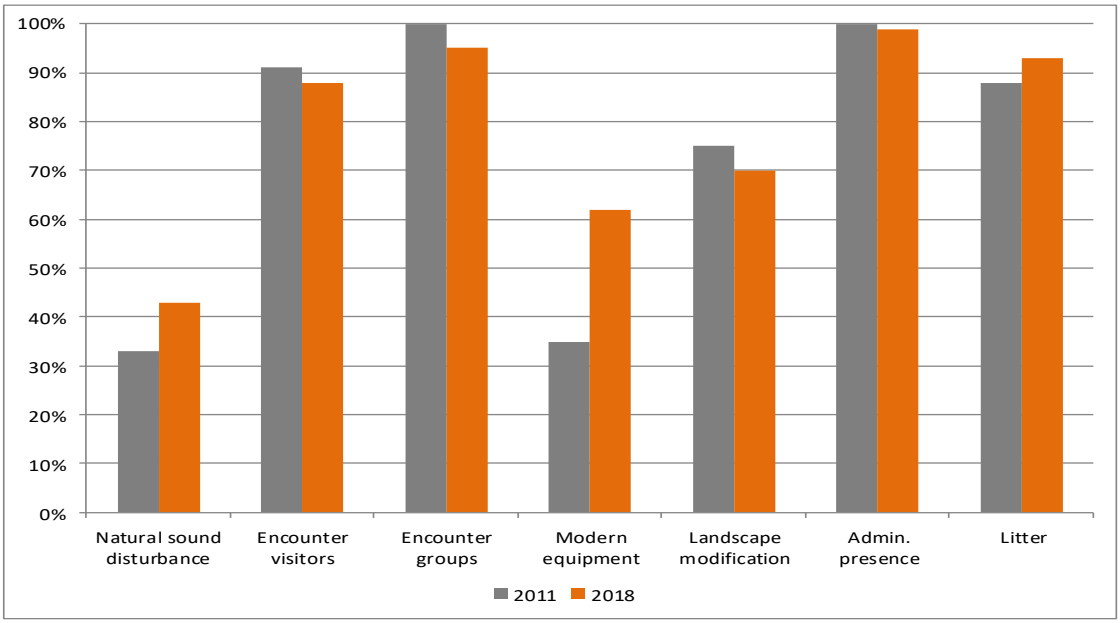


Figure 2. Percent sample days Unit 28 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 28 stated were the most impact-ful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

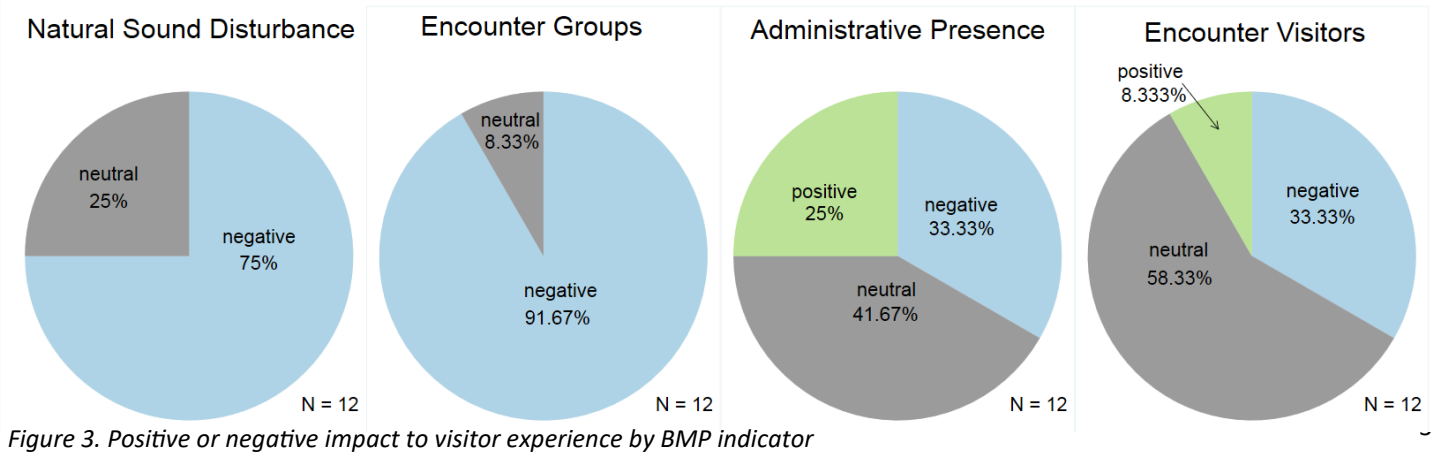


Figure 3. Positive or negative impact to visitor experience by BMP indicator

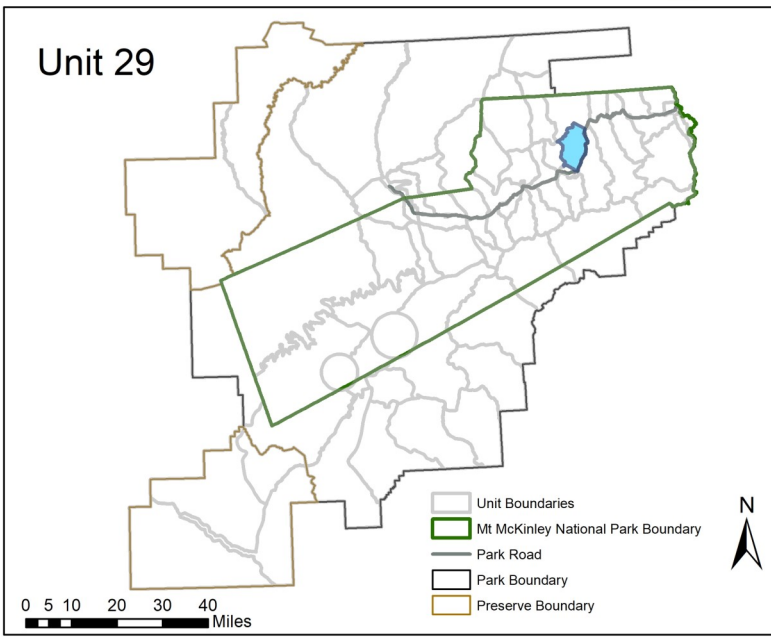
Backcountry Unit 29
"Igloo Mountain"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Igloo mt., looking west

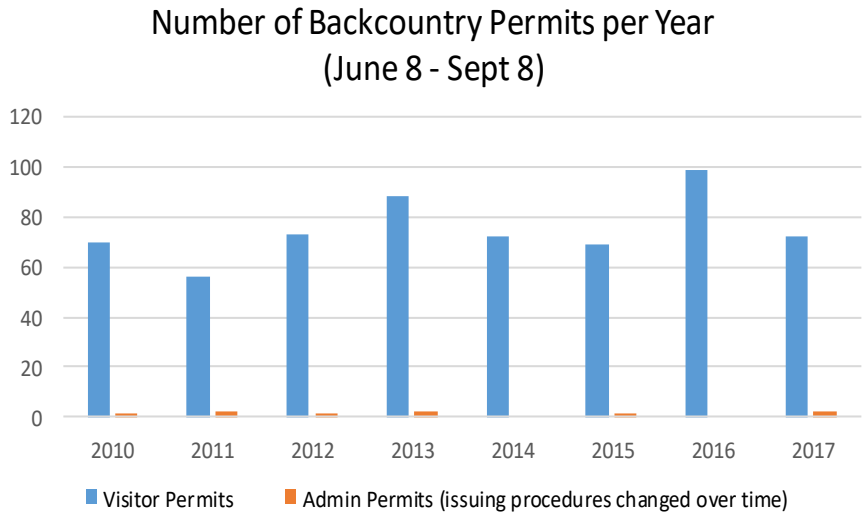


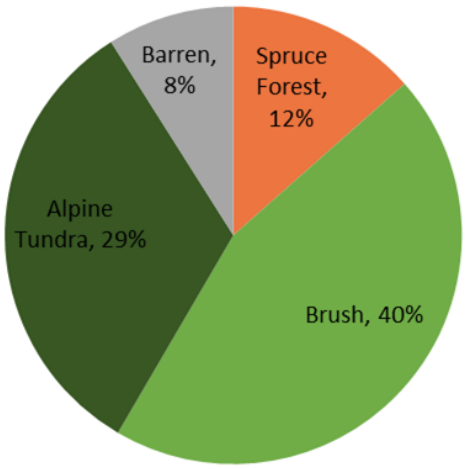
Park boundaries and Denali backcountry units: unit 29

Backcountry Permit Data:

Quota: 4
Percent visitors traveled to unit with bicycle: 6%

Unit Size: 26,797 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=31)
Day hikers (N=28)
Pooled total (N=59)
Total recorded days (n=68)

Percent visitors on guided hike: 2%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **48% yes**, 52% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 7.5 (**Standard deviation: 9.6); range 0—50 people.

Backcountry indicators in Unit 29: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators during their hike days that were similar in distribution. Natural sound disturbance, encounters with visitors, modern equipment and landscape modifications had distributions that **exceeded** BMP standards, whereas encounters with groups and administrative presence were **within** BMP standards.

Backcountry Indicators in Unit 29: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots show that day hikers recorded higher encounters with visitors, but only the upper quartile and outliers exceed the BMP standard.

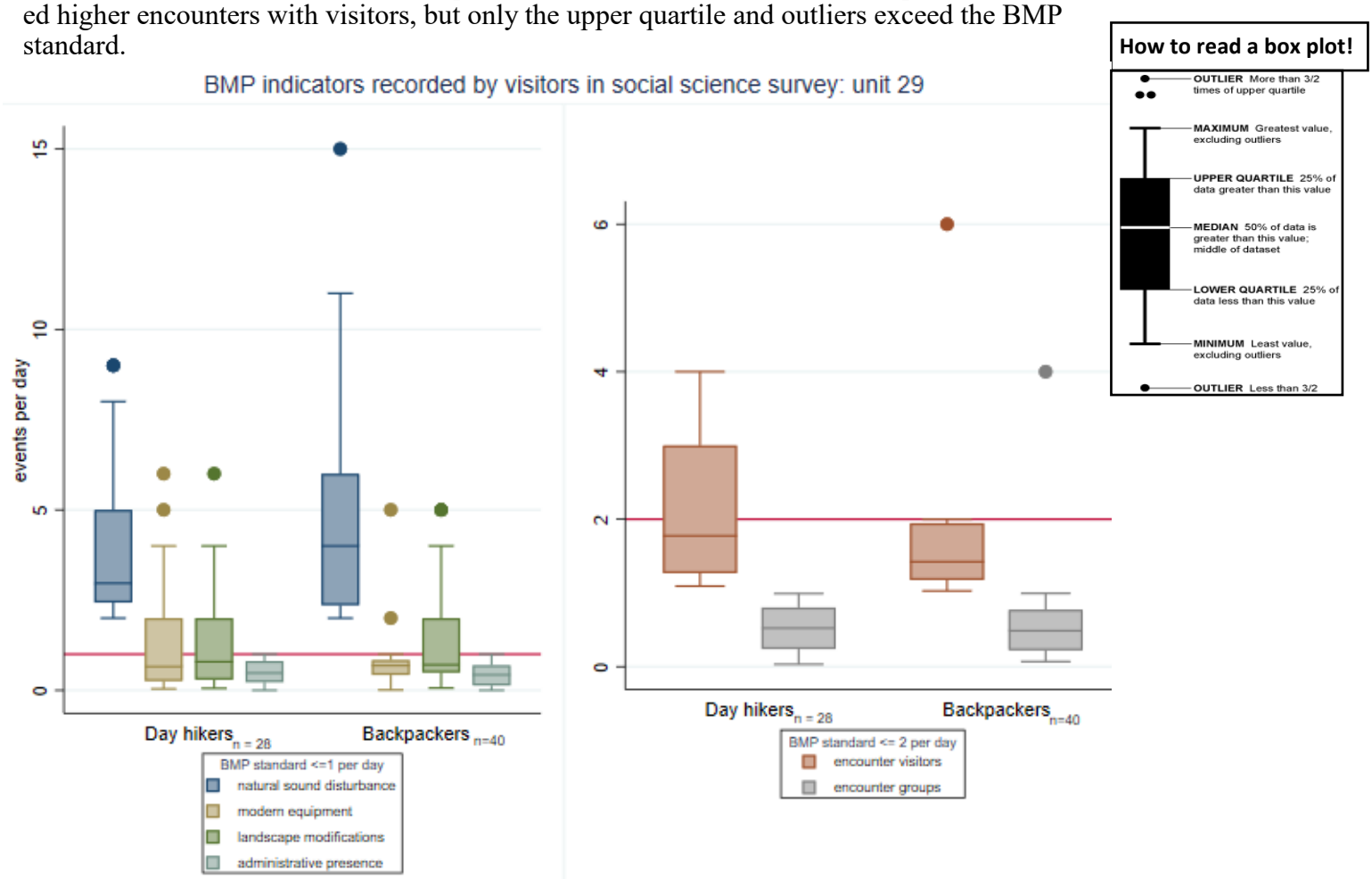


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not had a smaller range of observations than backpackers. Whereas for backpackers, the top 50% of observations have a range that is larger than the median observation (4.5 events/day), the top 50% of day hiker observations are larger than the median of 3 events per day. The dots are outlier data points for BMP indicator events.

Sound station recorded events(2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.31 events per hour** or 5 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 3 (day hikers) or 4 (backpackers) daily events, and the sound station estimate of 5 is well within the maximum ranges recorded by visitors. 100% of visitor observations are above BMP standard for OP1. High natural sound disturbance events is corroborated by NPS collected data, suggesting the true natural sound disturbance events average is between 2 & 12 per day.

Camping Density: 100% of backpackers to unit 29 were able to camp away from others; 100% reported they wanted to camp away from others. This meets the standard of always being able to camp out of sight/ sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 62

Average Miles: 9 miles/year

Average Visitors Encountered: 0.43/year Average Litter/Sanitation Encountered: 0.57/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 29. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 66% of total days sampled in unit 29 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2018) n = 68	Mean daily events (2011) n = 25	Change in percent days in standard: 2011 - 2018	State of change in Unit 29: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	5.71	5.73	+15% in standard	
Encounter Visitors	≤ 2 / day	2.17	1.5	-49% in standard	
Encounter Groups	≤ 2 / day	.661	.33	-4% in standard	
Modern Equipment	≤ 1 / day	1.1	.8	-37% in standard	
Landscape Modification	≤ 1 / day	1.41	2	+7% in standard	
Admin. Presence	≤ 1 / day	.52	.6	+1% in standard	
Litter	< 5%	.12	.17	-1% in standard	

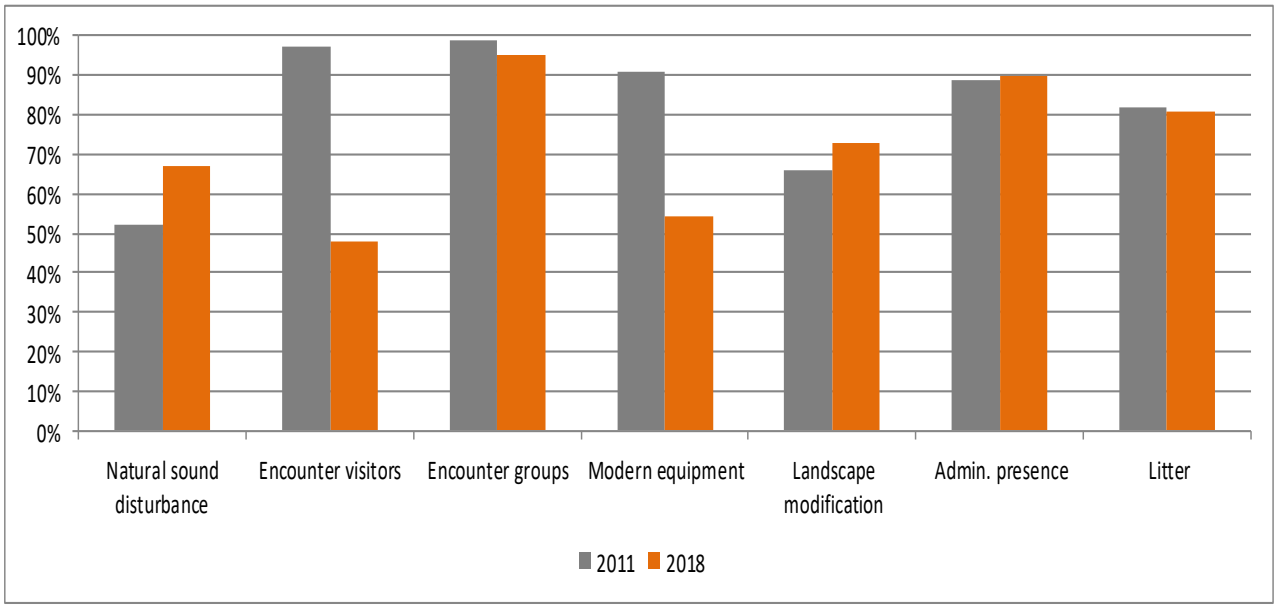


Figure 2. Percent sample days Unit 28 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 29 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

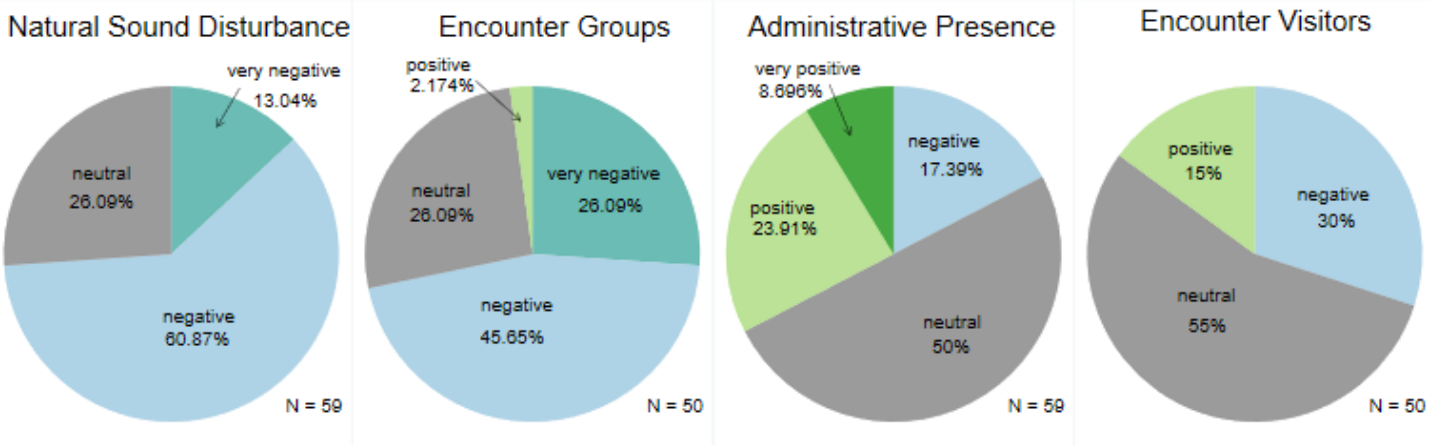


Figure 3. Positive or negative impact to visitor experience by BMP indicator

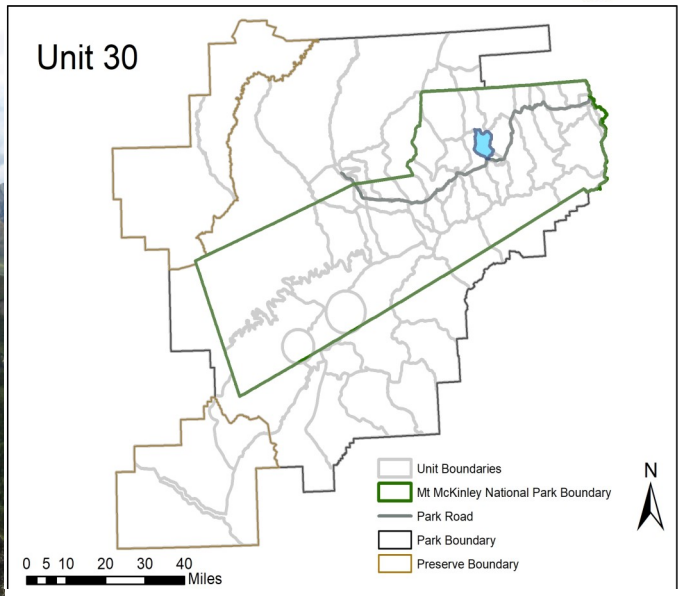
Backcountry Unit 30
"Tributary Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Tributary Creek., looking east



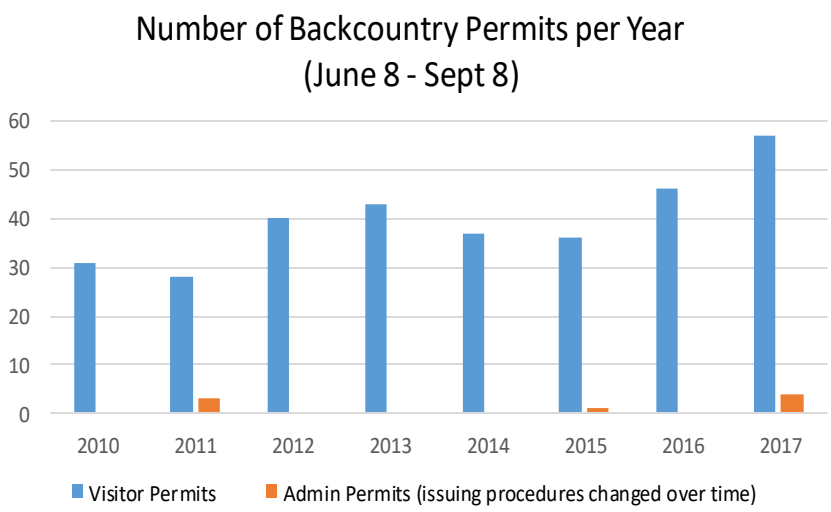
Park boundaries and Denali backcountry units: unit 30

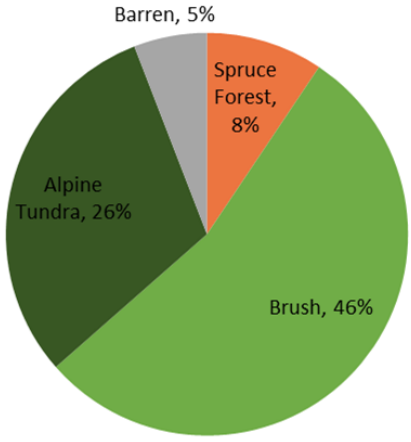
Backcountry Permit Data:

Quota: 4

Percent visitors traveled to unit with bicycle: 2%

Unit Size: 14,615 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=24)

Day hikers (N=0)

Pooled total (n=24)

Total recorded days (n=33)

Percent visitors on guided hike: 0%

Ability to camp out of sight/sound: 100% yes

Percent "visitor first choice" unit: **68% yes**, 32% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 4 (**Standard deviation: 4.3); range 0—20 people.

Backcountry indicators in Unit 30: Backpackers to unit 30 typically recorded Backcountry Management Plan (BMP) indicators during their hike days that were **within** BMP standards for OP1. The exception was natural sound disturbance which entirely **exceeded** the BMP standard for OP1.

Backcountry Indicators in Unit 30: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

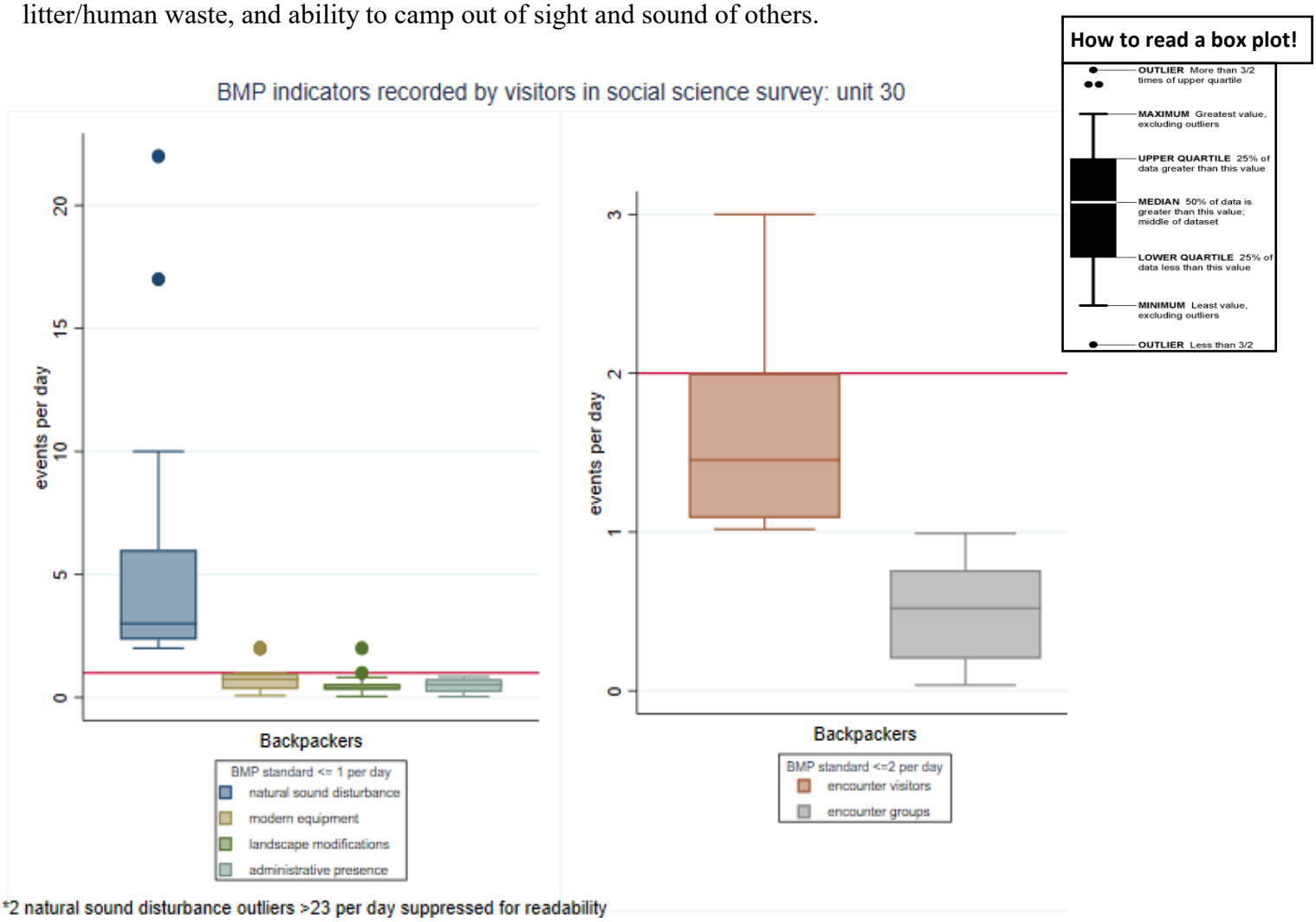


Figure 1. BMP indicators recorded by visitors in a social science survey

Natural Sound disturbance: In the visitor survey, 50% of natural sound disturbance recorded by backpackers were between 3 & 10 events per day. Two outliers above 23 events per day were suppressed for readability.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.45 events per hour** or 7 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 3 daily events, and the sound station estimate of 7 is well within the maximum ranges recorded by visitors. The corroboration of NPS and visitor collected data points to the true average daily natural sound disturbance is between 2 & 10 events.

Camping Density: 100% of backpackers to unit 30 were able to camp away from others; 100% reported they wanted to camp away from others. This meets the standard of always being able to camp out of sight/ sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 29

Average Miles: 4 miles/year

Average Visitors Encountered: 0/year Average Litter/Sanitation Encountered: 0/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 30. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 41% of total days sampled in unit 30 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 14	Mean daily events (2018) n = 33	Change in percent of days in standard: 2011 - 2018	State of change in Unit 30: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	1	5.95	-58% in standard	
Encounter Visitors	≤ 2 / day	.4	1.65	-10% in standard	
Encounter Groups	≤ 2 / day	0	.51	-11% in standard	
Modern Equipment	≤ 1 / day	.97	.761	-9% in standard	
Landscape Modification	≤ 1 / day	2.33	.581	+1% in standard	
Admin. Presence	≤ 1 / day	.3	.51	+9% in standard	
Litter	< 5%	0	.04	-10% in standard	

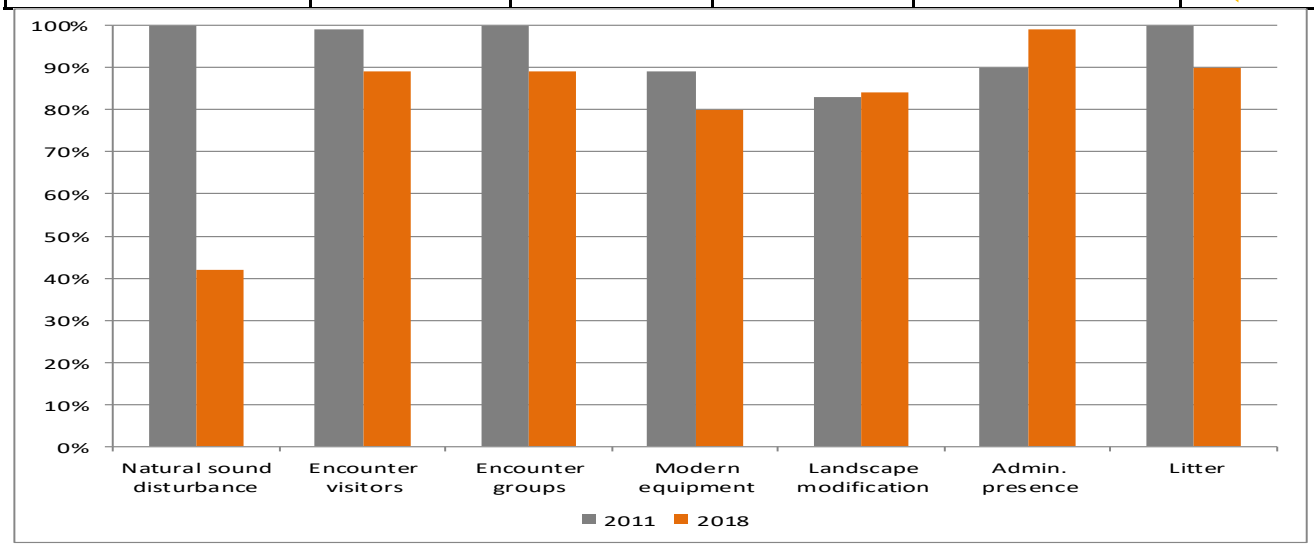


Figure 2. Percent sample days Unit 28 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 30 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

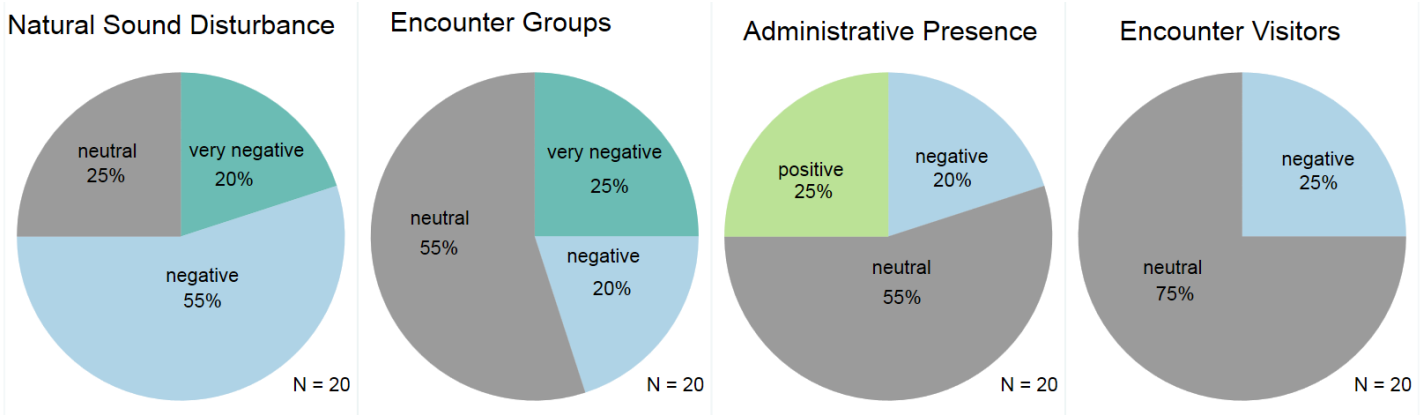


Figure 3. Positive or negative impact to visitor experience by BMP indicator

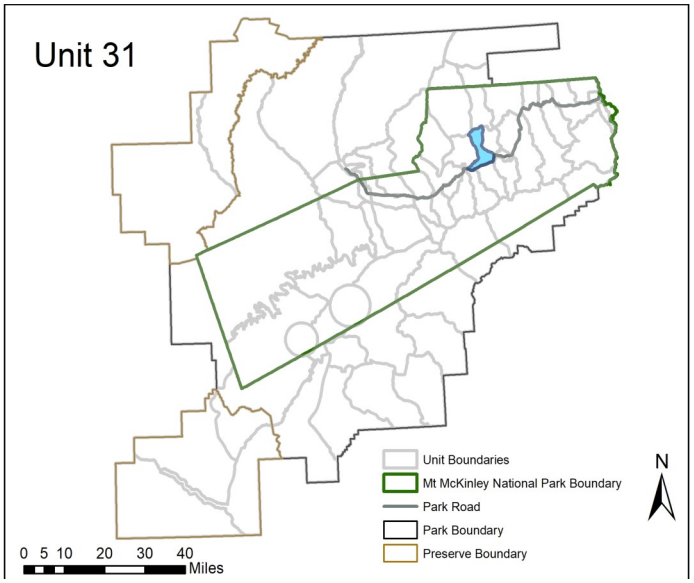
Backcountry Unit 31
"Polychrome Mountain"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



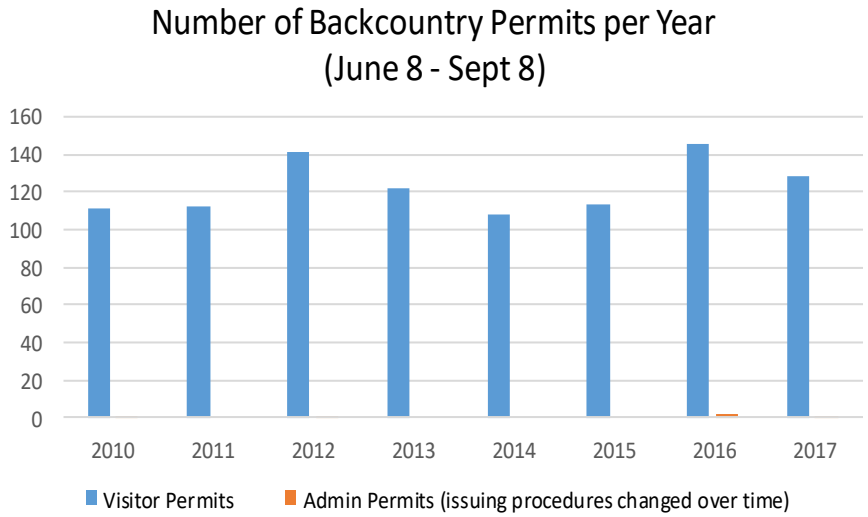
Tributary Creek., looking east

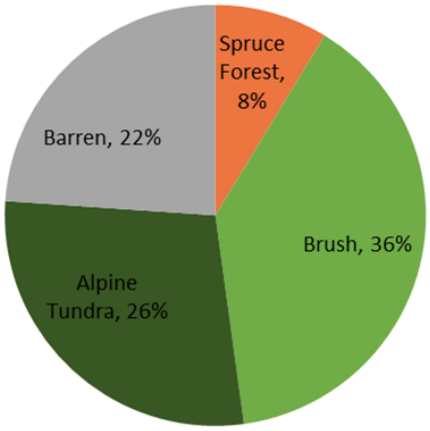


Park boundaries and Denali backcountry units: unit 31

Backcountry Permit Data:
Quota: 6
Percent visitors with bicycle: 6%

Unit Size: 18,788 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N=52)
Day hikers (N=21)
Pooled total (n=73)
Total recorded days (n=85)

Percent visitors on guided hike: 13%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **69% yes**, 31% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 6.5 (**Standard deviation: 6.7); range 0—42 people.

Backcountry indicators in Unit 31: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators during their hike days that were similar in distribution. Natural sound disturbance, encounters with visitors, modern equipment and landscape modifications had distributions that **exceeded** BMP standards, whereas encounters with groups and administrative presence were **within** BMP standards.

Backcountry Indicators in Unit 31: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots show that day hikers recorded higher encounters with visitors, but only the upper quartile and outliers exceed BMP standard.

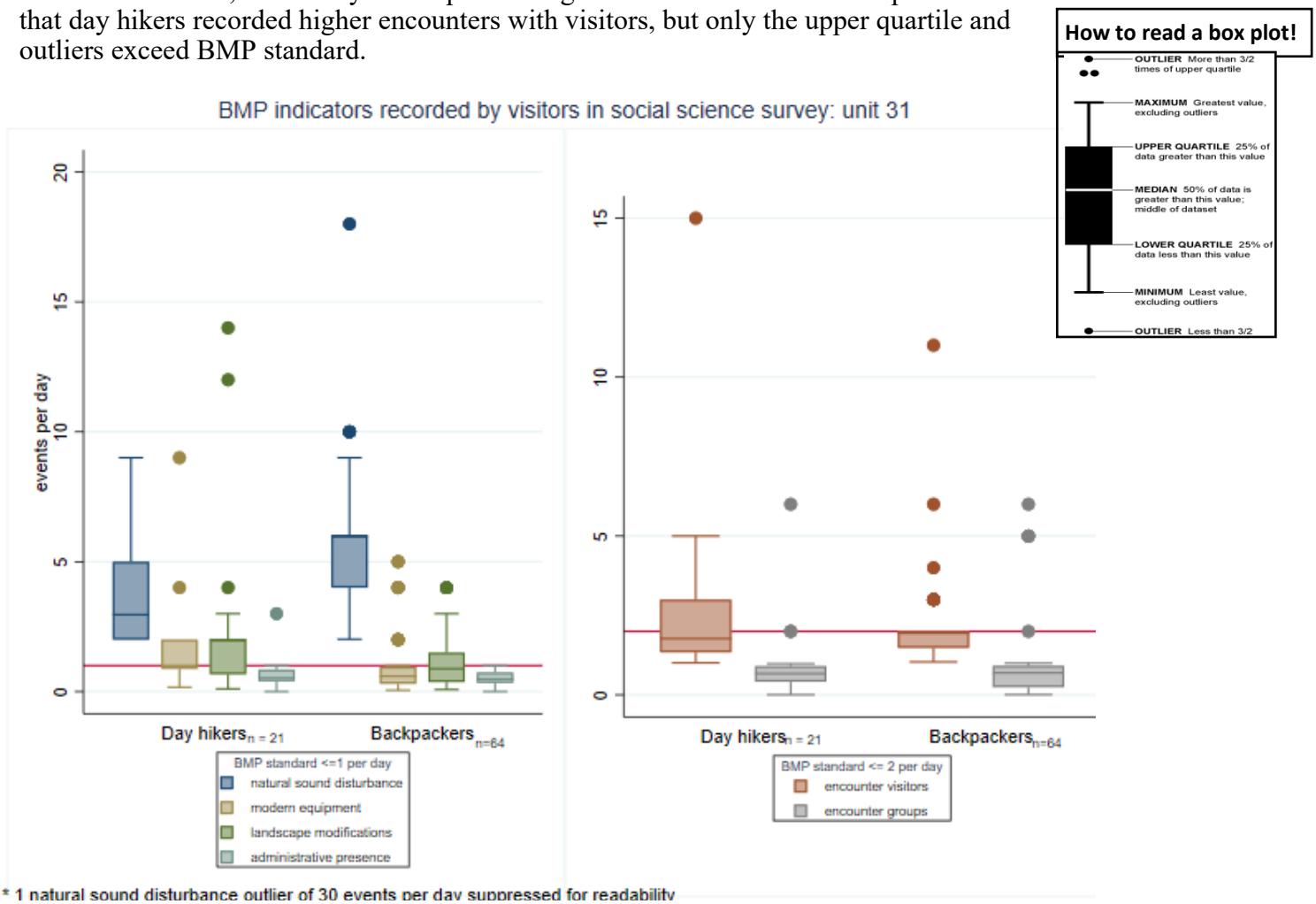


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers and backpackers had similar observation ranges. Day hikers' median of 3 events per day is lower than backpackers (median 6.5), but 100% of observations are above the BMP standard. The dots are outlier data points for BMP indicator events. One outlier of 30 events per day was suppressed in the plots.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.35 events per hour** or 5.6 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 3 (day hikers) or 7 (backpackers) daily events; the sound station estimate of 5.6 is between these two medians and well within the maximum ranges recorded by visitors. The upper quartile range of both day hikers and backpackers is 9, therefore the corroboration of NPS and visitor collected data points results in a daily average natural sound disturbance between 2 & 9 events.

Camping Density: 100% of backpackers to unit 31 were able to camp away from others; of which 7% (3groups) reported they *wanted* to camp near others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 93

Average Miles: 13 miles/year

Average Visitors Encountered: 1.57/year Average Litter/Sanitation Encountered: 1.57/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 31. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 50% of total days sampled in unit 31 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP Standard	Mean daily events (2011) n = 41	Mean daily events (2018) n = 85	Percent change days in standard: 2011- 2018	State of change in Unit 31: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	1.8	5.11	-38% in standard	
Encounter Visitors	≤ 2 / day	1.1	2.29	-23% in standard	
Encounter Groups	≤ 2 / day	0	.935	-25% in standard	
Modern Equipment	≤ 1 / day	1.38	1.16	+13% in standard	
Landscape Modification	≤ 1 / day	.88	1.58	-28% in standard	
Admin. Presence	≤ 1 / day	.3	.52	-0% in standard	
Litter	< 5%	.11	.16	-7% in standard	

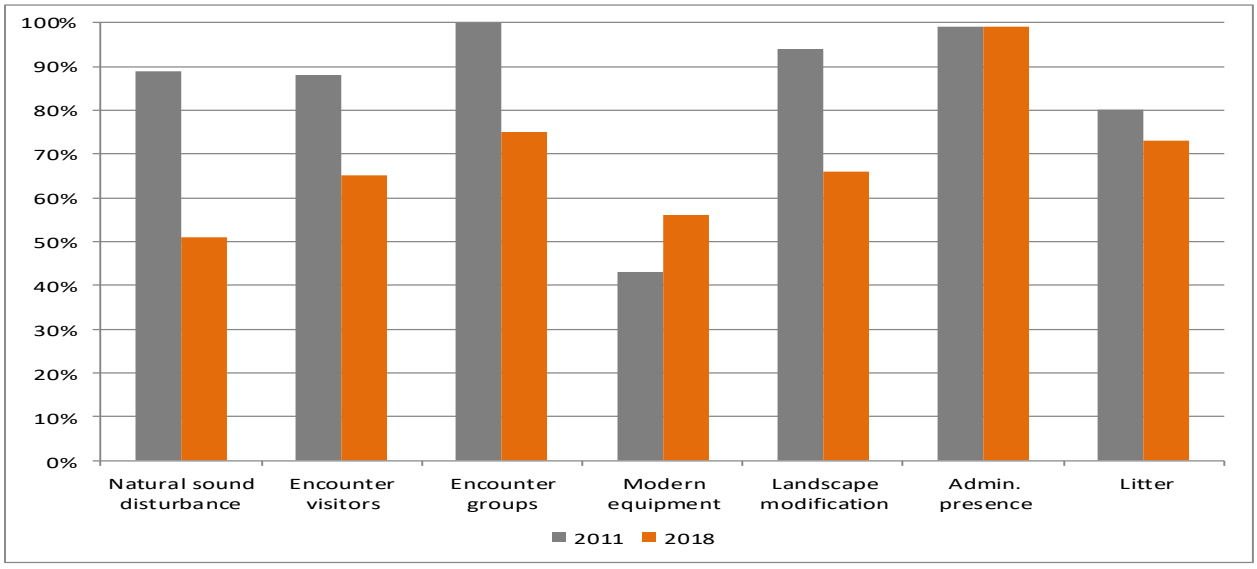


Figure 2. Percent sample days Unit 31 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 31 stated were the most impact-ful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

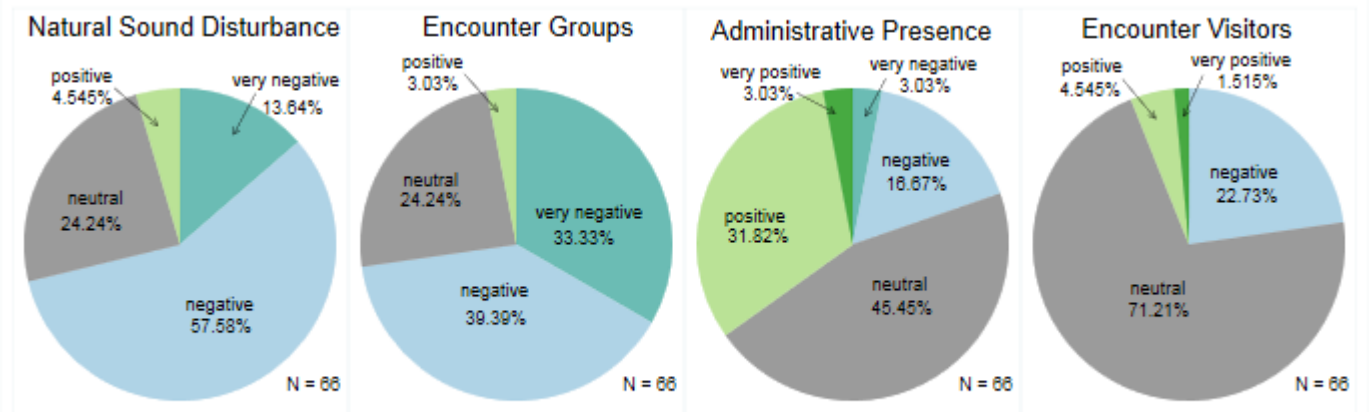


Figure 3. Positive or negative impact to visitor experience by BMP indicator

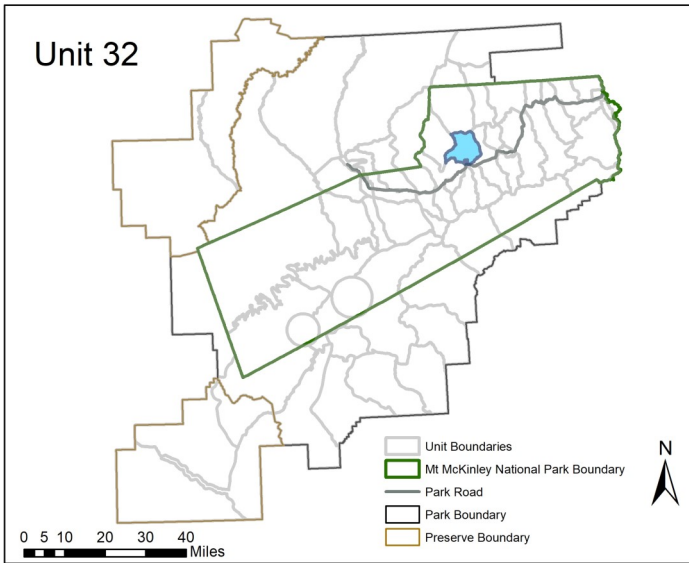
Backcountry Unit 32
"Middle Toklat"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



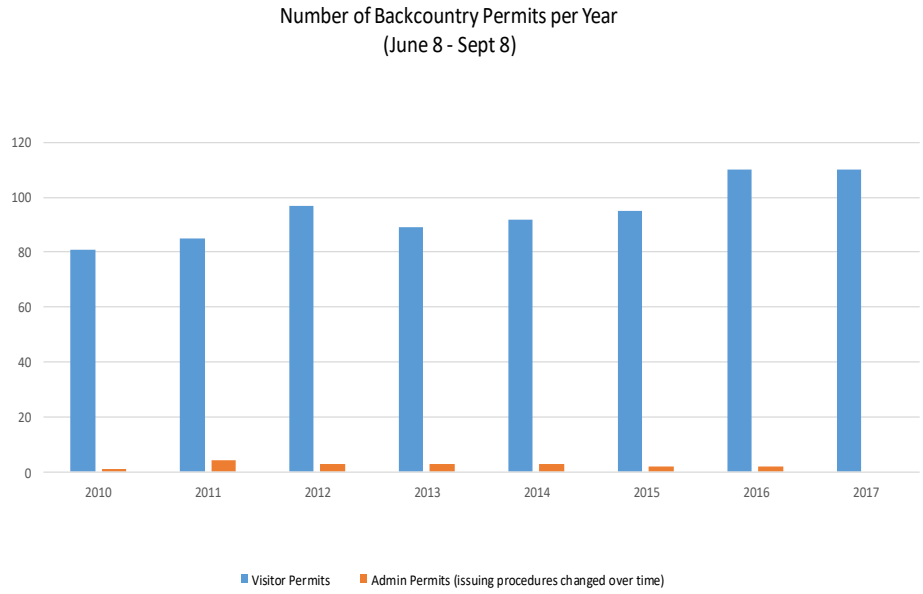
Cabin peak, looking south

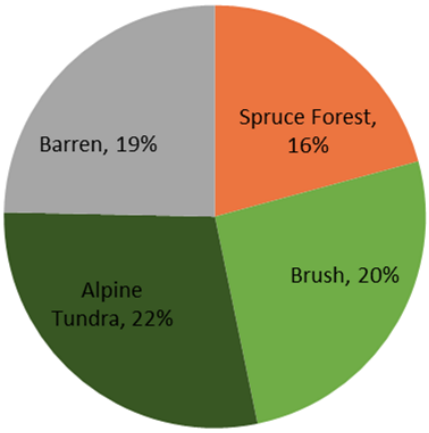


Park boundaries and Denali backcountry units: unit 32

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 9%

Unit Size:29,600 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N=36)
Day hikers (N=13)
Pooled total (N=49)
Total recorded days (n=59)

Percent visitors on guided hike : 5%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **69% yes**, 31% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 4.5 (**Standard deviation: 4.0); range 0—20 people.

Backcountry indicators in Unit 32: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators during their hike days that **exceeded** BMP standards for OP1. Exceptions were encounters with groups and administrative presence ; these indicators were **within** BMP standards.

Backcountry Indicators in Unit 32: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that day hikers recorded higher encounters with visitors on average than backpackers resulting in a wider distribution.

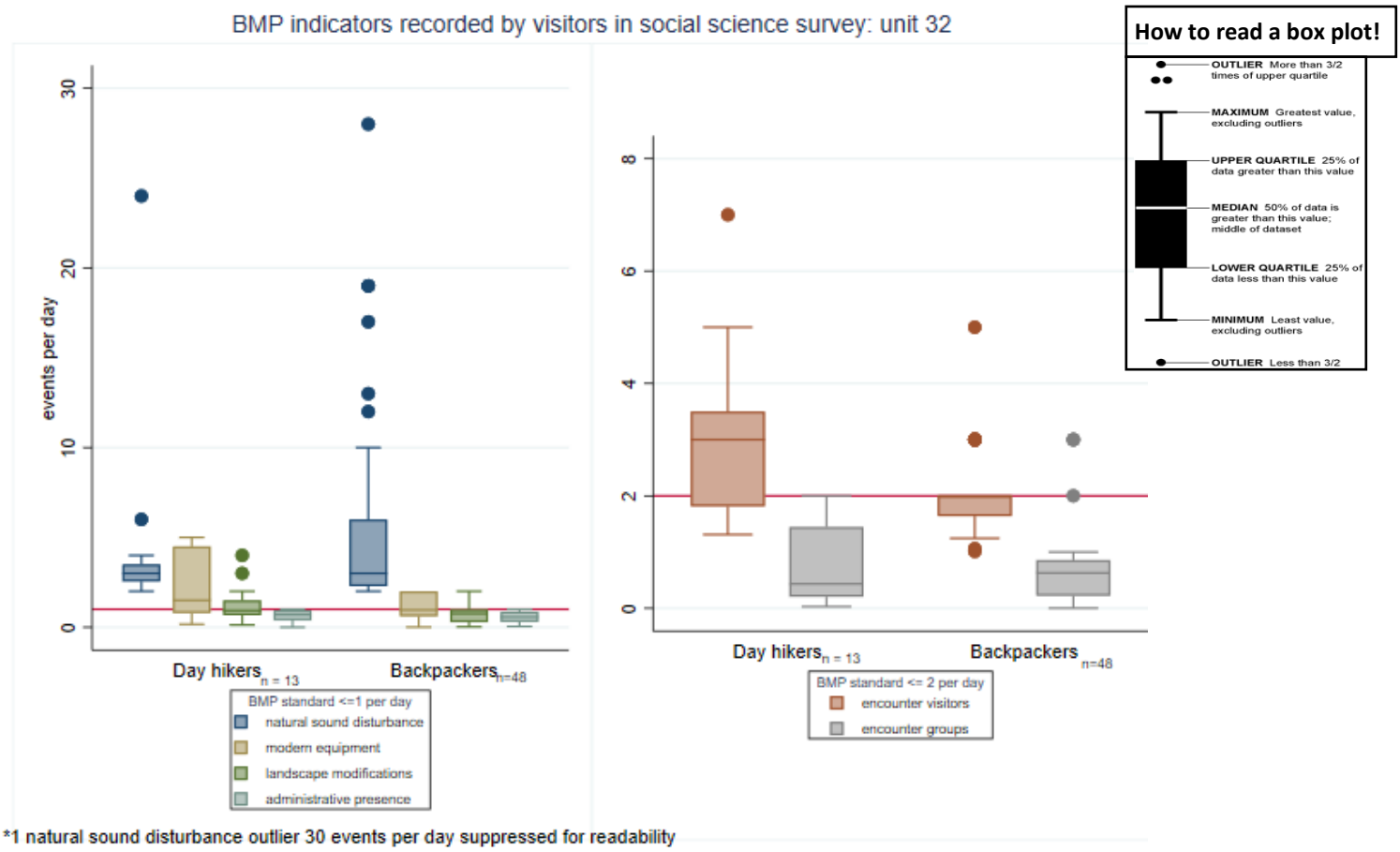


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, the median value for natural sound disturbance was 3 for both day hikers and backpackers, meaning 50% of observations were greater than 3 events per day. 100% of observations exceeded the BMP standard. The dots are outlier data points for BMP indicator events. Note one natural sound disturbance event outlier of 30 events per day was suppressed for readability.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.78 events per hour** or 12.5 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 3.3 daily events; the sound station estimate of 12.5 is within the outliers recorded by visitors. The corroboration of NPS and visitor collected data points results in a daily average natural sound disturbance estimate between 2 & 12 events.

Camping Density: 100% of backpackers to unit 32 were able to camp away from others; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others/

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 159

Average Miles: 23 miles/year

Average Visitors Encountered: 0.86/year Average Litter/Sanitation Encountered: 0.86/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 32. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 43% of total days sampled in unit 32 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 44	Mean daily events (2018) n = 59	Change in percent days in standard: 2011 - 2018	State of change in Unit 32: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	2.03	6.41	-43% in standard	
Encounter Visitors	≤ 2 / day	1.3	2.33	-20% in standard	
Encounter Groups	≤ 2 / day	.07	.702	-14% in standard	
Modern Equipment	≤ 1 / day	1.32	1.34	+10% in standard	
Landscape Modification	≤ 1 / day	1.19	.952	-1% in standard	
Admin. Presence	≤ 1 / day	.3	.59	-7% in standard	
Litter	< 5%	.18	.22	-4% in standard	

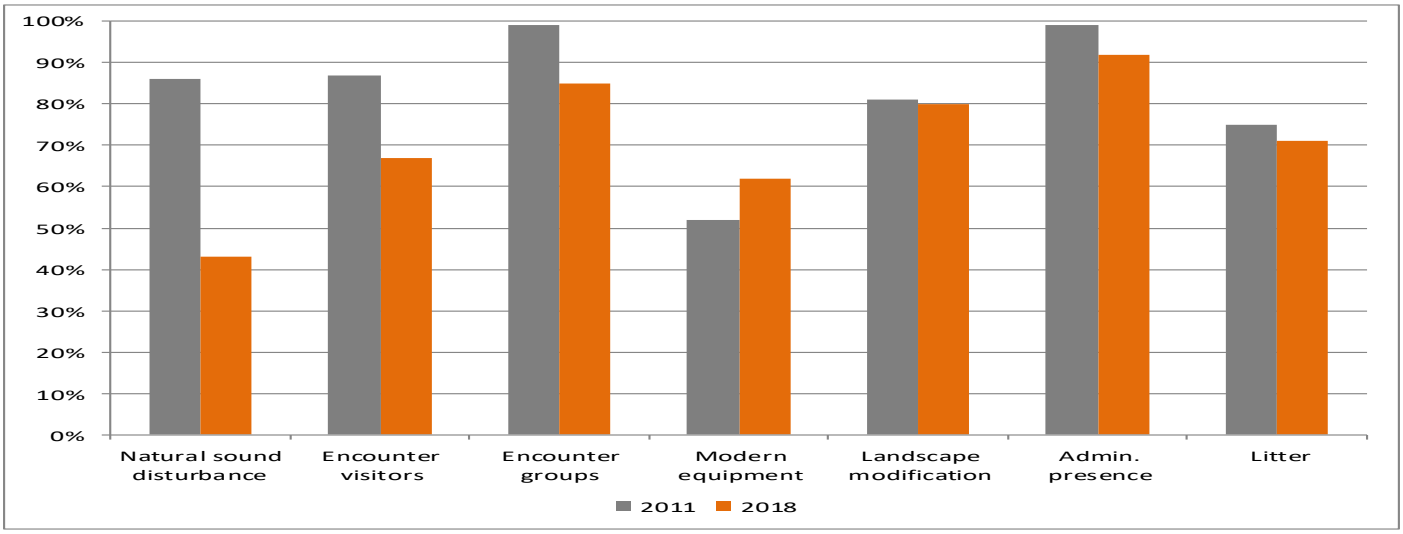


Figure 2. Percent sample days Unit 32 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 32 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 6% visitors to unit 32 find natural sound disturbance to be a positive impact.

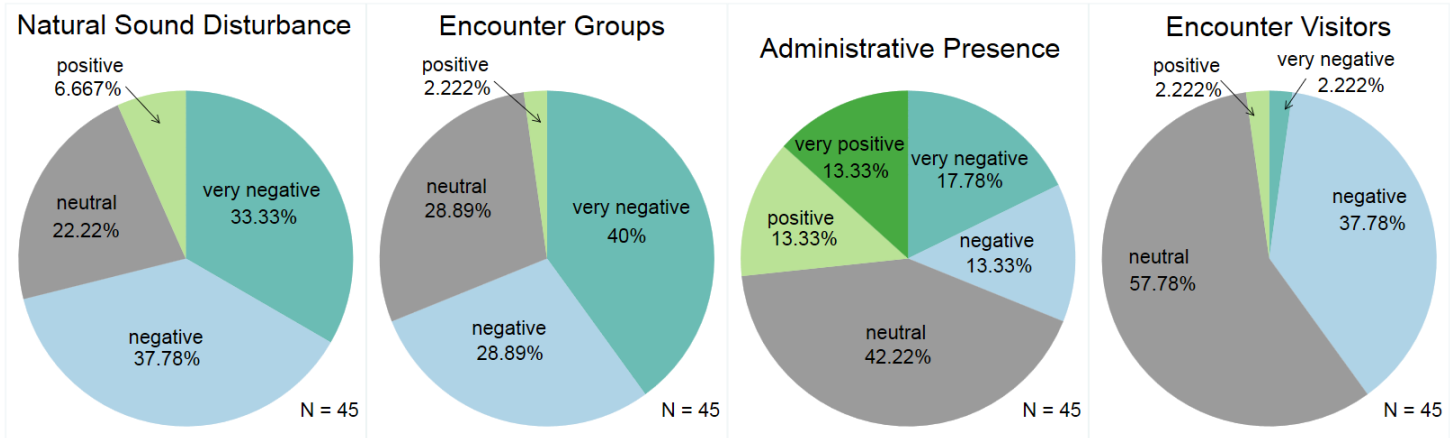


Figure 3. Positive or negative impact to visitor experience by BMP indicator

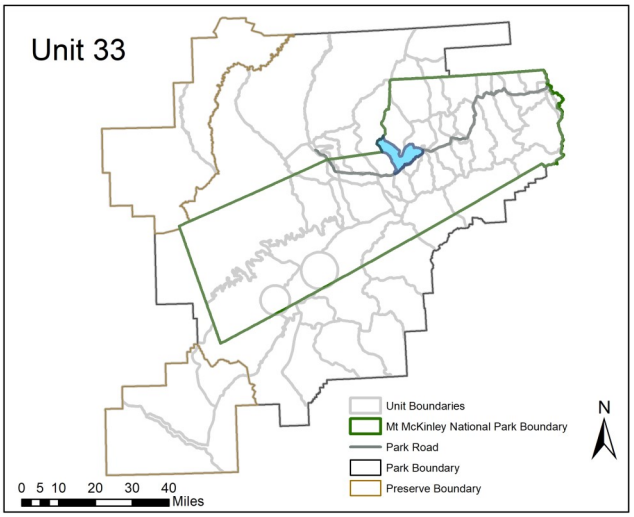
Backcountry Unit 33
"Stony Hill"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



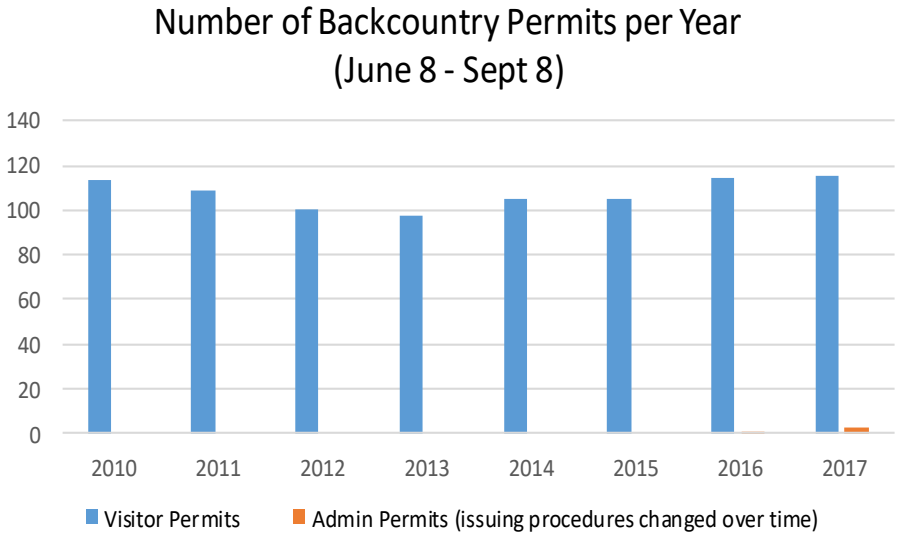
Stony Hill , looking east

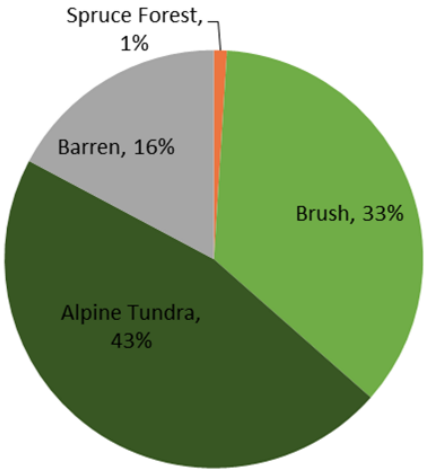


Park boundaries and Denali backcountry units: unit 33

Backcountry Permit data:
Quota: 4
Percent visitors who traveled to unit with a bike: 10%

Unit Size: 30,119 acres





Broad vegetation class composition

Visitor Survey Data (2017-2018):
Backpackers (N = 52)
Day hikers (N = 20)
pooled total (N = 72)
Total recorded days (n = 82)

Percent visitors on guided hike: 14%
Ability to camp out of sight/sound: 90% yes
Percent visitor "first choice" unit: **49% yes**, 51% no

Solitude threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 7 people** (Standard Deviation: 9.8);range: 0 – 60 people.

Backcountry indicators in Unit 33: Day hikers and backpackers to unit 33 typically recorded Backcountry Management Plan (BMP) indicators during their hike days that were **within** standard. Exceptions were natural sound disturbance and encounters with visitors in which the distribution of events **exceeded** BMP standards.

Backcountry indicators in Unit 33: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

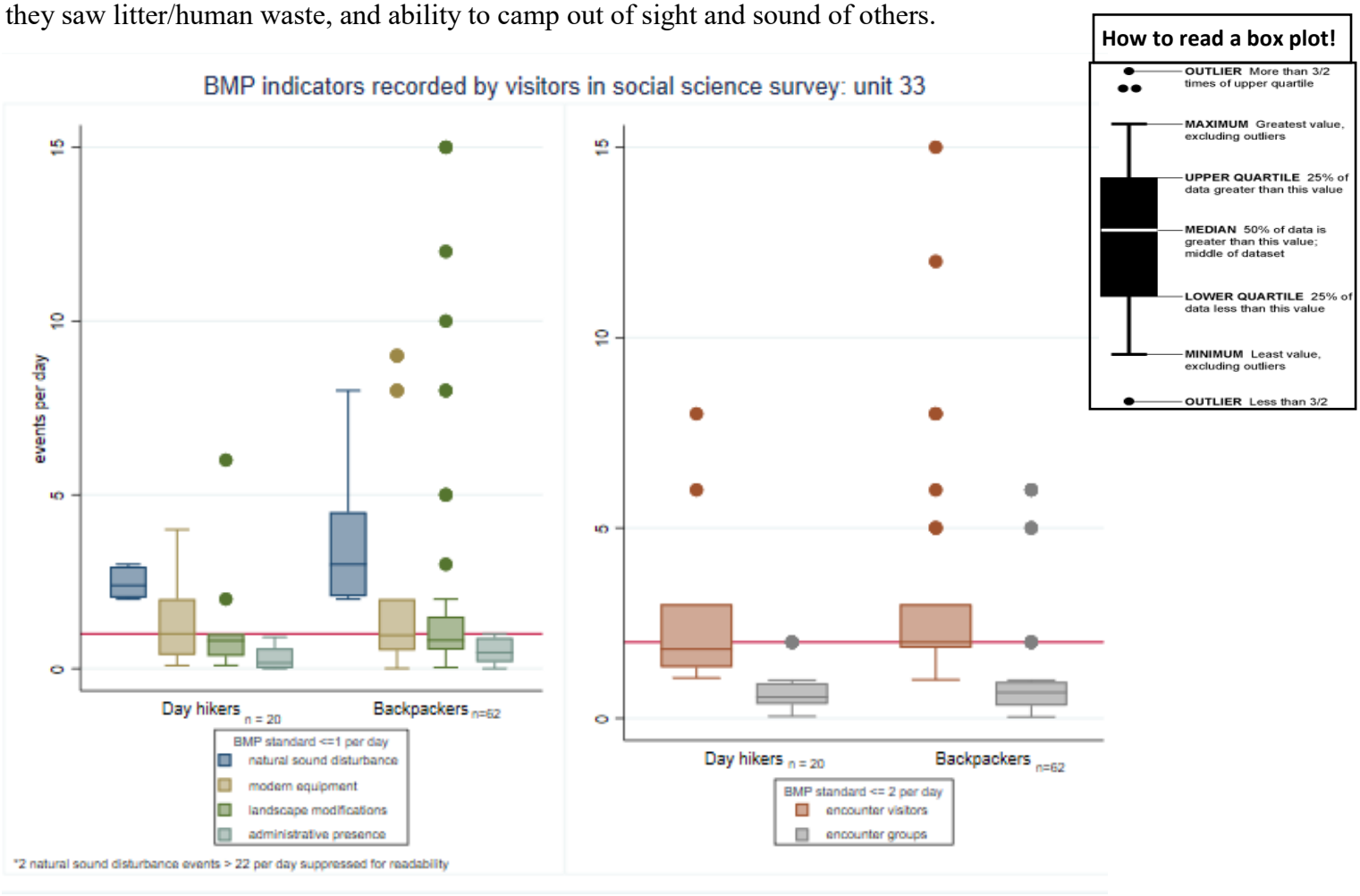


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations, but one outlier event surpassed the maximum range of backpacker observations. Day hikers' and backpackers' median observations align close to 3 events per day, and 100% of observations are above the BMP standard. The dots are outlier data points for BMP indicator events. Note two outliers greater than 22 events per day were suppressed for readability.

NPS sound monitoring program (2005—2018): No data: sound station was not deployed in this unit, and the backcountry patrol was less than 30 listening hours.

Camping Density: 90% of backpackers to unit 33 were able to camp away from others; of which 3% (2 groups) reported they *wanted* to camp near others. This does not meet the standard of always being able to camp out of sight/sound of others, but some may have purposefully camped within sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 52

Average Miles: 7 miles/year

Average Visitors Encountered: 0.86/year Average Litter/Sanitation Encountered: 0.57/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 33. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 32% of total days sampled in Unit 33 were within the BMP standard (Table 1, Figure 2).

Table 1. Pooled BMP indicator means and percent survey days that were within standard: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 40	Mean daily events (2018) n = 82	Percent change days in standard: 2011 - 2018	State of Change in Unit 33: 2011 to 2018
Natural sound disturbance	≤ 1/day	1.56	4.05	-51% in standard	
Encounter visitors	≤ 2/day	3.62	2.88	+13% in standard	
Encounter groups	≤ 2/day	0.07	.989	-10% in standard	
Modern equipment	≤ 1/day	0.08	1.62	-1% in standard	
Landscape modification	≤ 1/day	0.21	2.02	-21% in standard	
Admin. presence	≤1 /day	0.0	.71	-1% in standard	
Litter	< 5% yes	0.097 (9% yes)	.18 (18% yes)	+13% in standard	

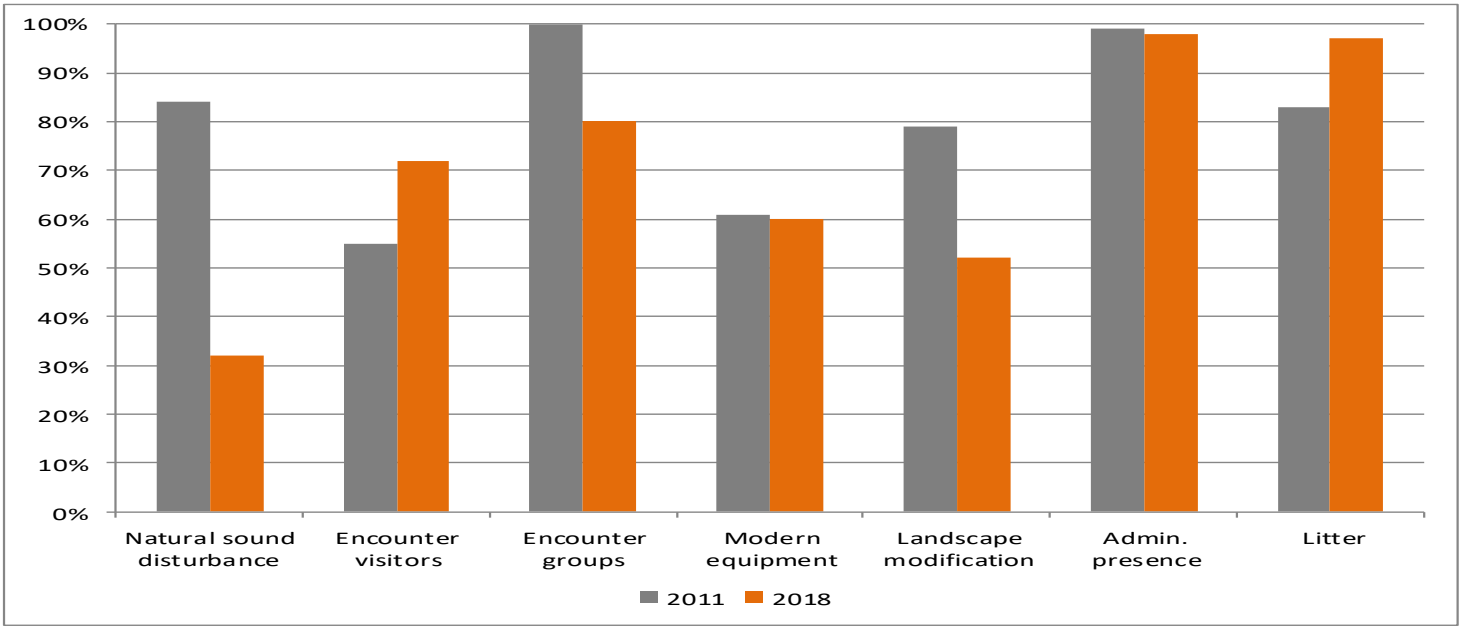


Figure 2. Percent of sample days that measured BMP indicators were within standard for Unit 33: 2018 vs. 2011, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 33 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

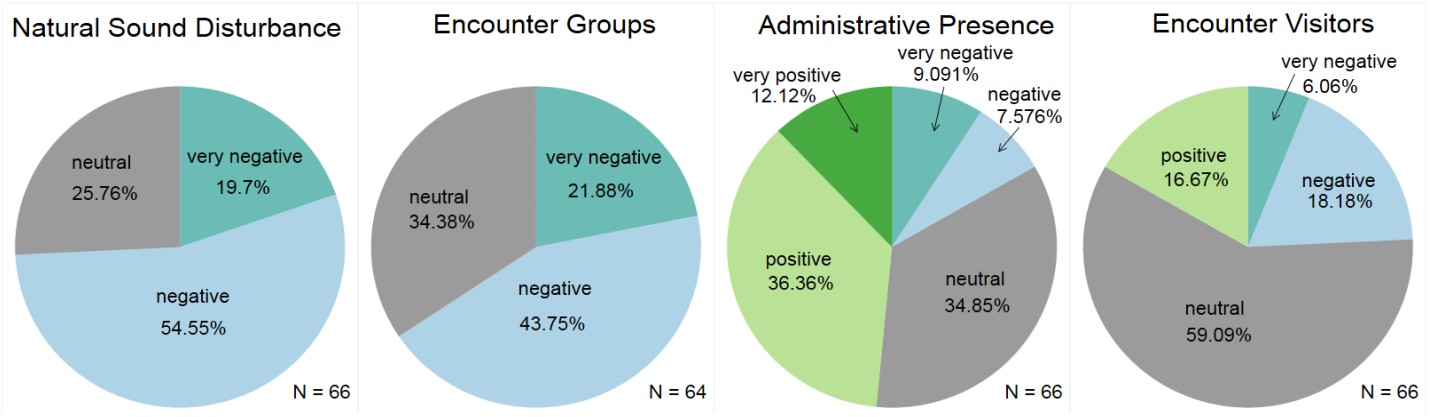
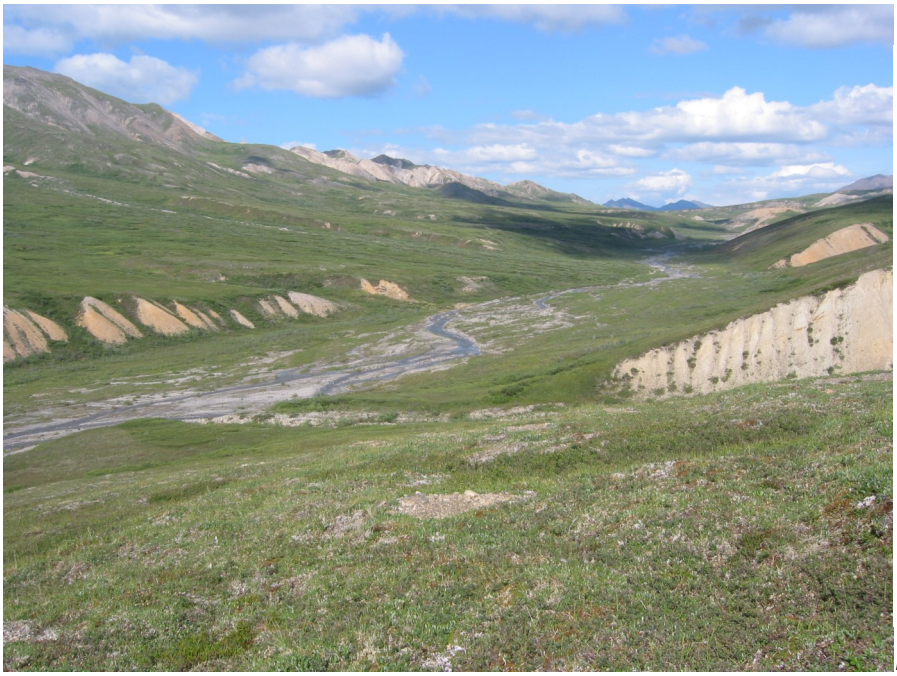


Figure 3. Main BMP indicators that affect visitor experience: Unit 33

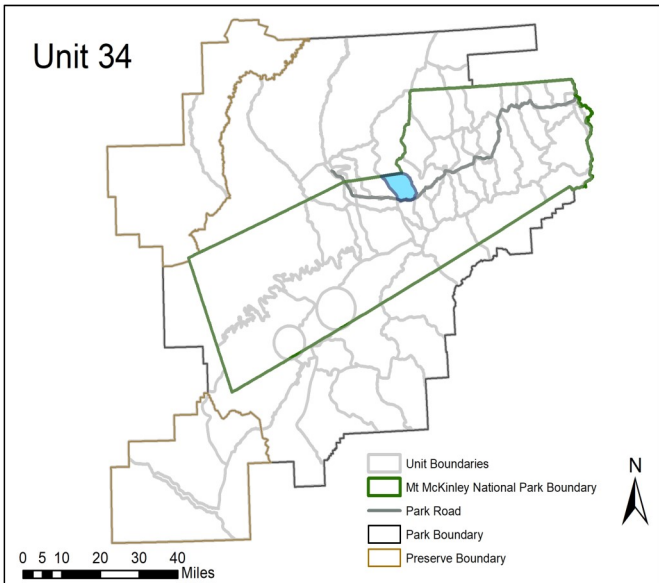
Backcountry Unit 34
"Mount Galen"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



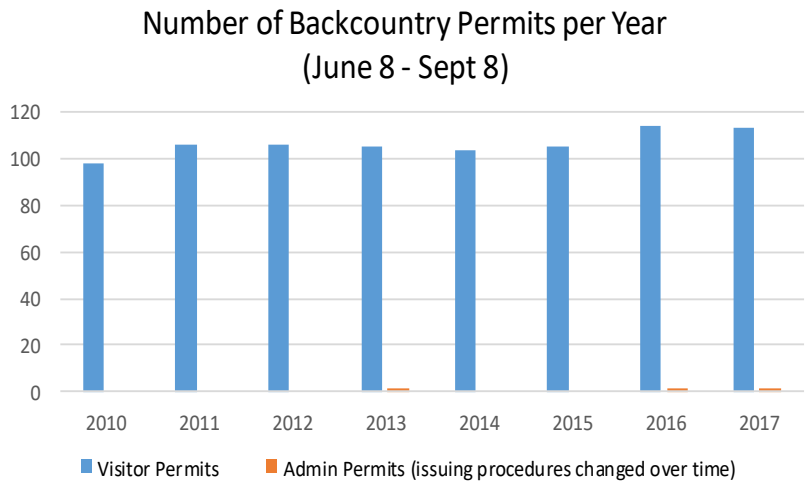
Moose creek, looking west

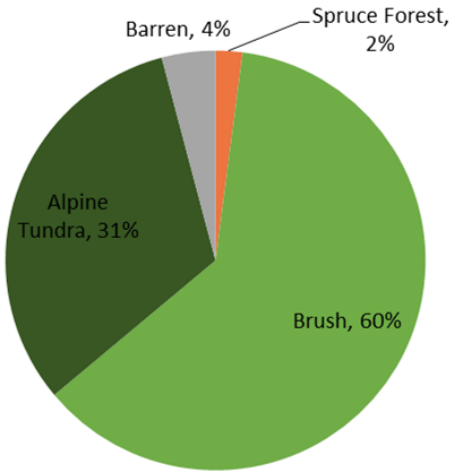


Park boundaries and Denali backcountry units: unit 34

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 3%

Unit Size: 23,030 acres





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=45)
Day hikers (N=40)
Pooled total (N=85)
Total recorded days (n=105)

Percent visitors on guided hike: 32%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **72% yes**, 28% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 10 (**Standard deviation: 13.0); range 0—75 people (two outliers > 250 people per day was removed from analysis).

Backcountry indicators in Unit 34: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators during their hike days that **exceeded** BMP standards for OP1. Exceptions were encounters with groups and administrative presence; these indicators were **within** BMP standards.

Backcountry Indicators in Unit 34: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that natural sound disturbance and encounters with visitors had distributions primarily above BMP standards, whereas encounters with modern equipment and landscape modifications had 1/2 to 1/4 of observations above standards. Day hikers recorded higher encounters with visitors on average: 50% of observations were greater than 7 encounters per day.

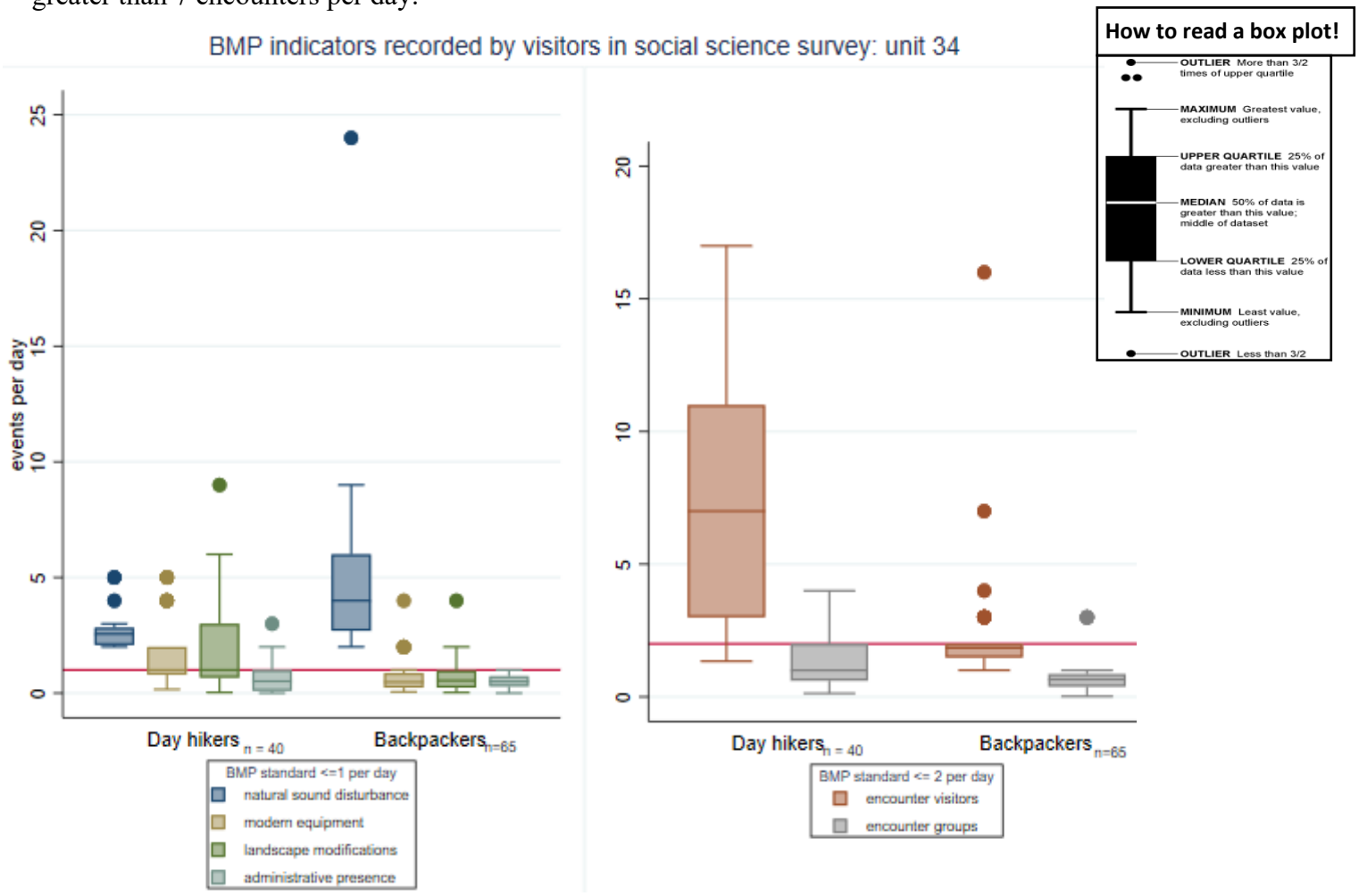


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations, outlier events align with the range of backpacker observations. 100% of observations are above the BMP standard. 50% of observations for backpackers was above 4.4 events per day. The dots are outlier data points for BMP indicator events.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.65 events per hour** or 10 events per backcountry day (16 hours). The sound station estimate of 10 is near the maximum range recorded by backpackers, but substantially lower than the three outliers of 24, 26, & 30 events daily. The corroboration of NPS and visitor collected data points results in a daily average natural sound disturbance estimate between 2 & 10 events.

Camping Density: 100% of backpackers to unit 34 were able to camp away from others; of which 4% (2 groups) reported they *wanted* to camp near others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 52

Average Miles: 8 miles/year

Average Visitors Encountered: 0.57/year Average Litter/Sanitation Encountered: 0.29/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 34. The mean of natural sound disturbance is above the BMP standard of 2 events per day, only 41% of total days sampled in unit 34 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 33	Mean daily events (2018) n = 105	Change in percent *days* in standard: 2011- 2018	State of change in Unit 34: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	1.25	3.97	-46% in standard	
Encounter Visitors	≤ 2 / day	5.2	4.79	-6% in standard	
Encounter Groups	≤ 2 / day	0	1	-25% in standard	
Modern Equipment	≤ 1 / day	2.45	1.28	+20% in standard	
Landscape Modification	≤ 1 / day	3.91	1.53	+6% in standard	
Admin. Presence	≤ 1 / day	1.19	.56	+17% in standard	
Litter	< 5%	.087 (8.7%)	.14 (14%)	-0% in standard	

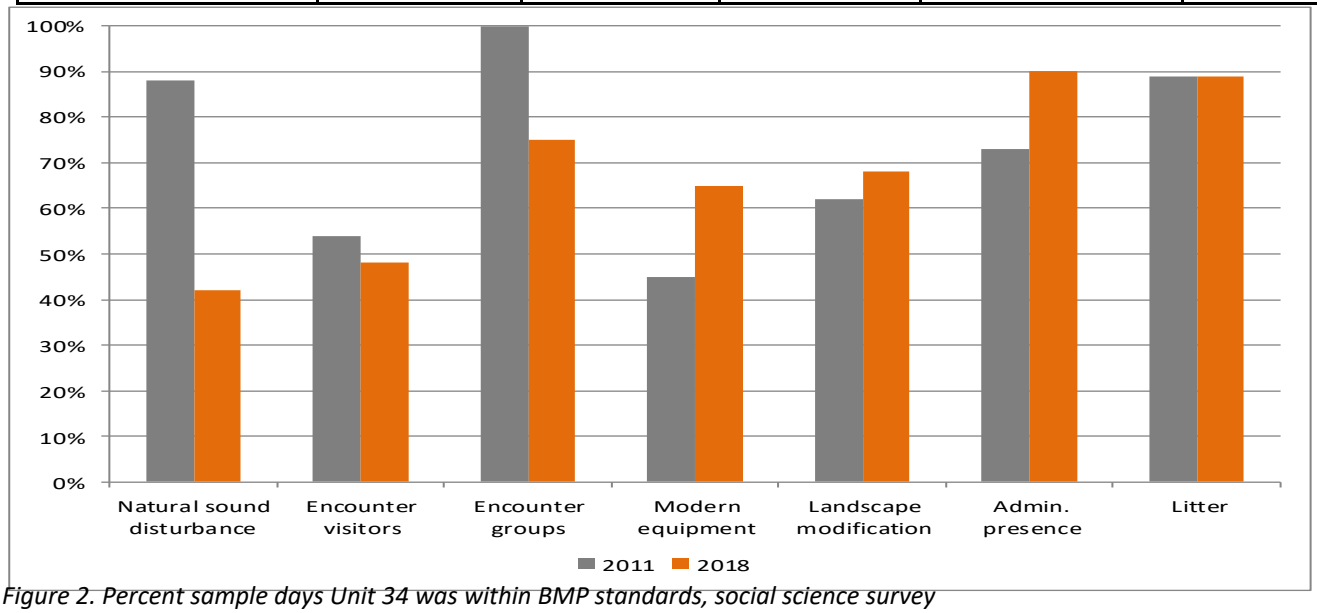


Figure 2. Percent sample days Unit 34 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 34 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 14% visitors to unit 34 found encounters with visitors to be a positive impact.

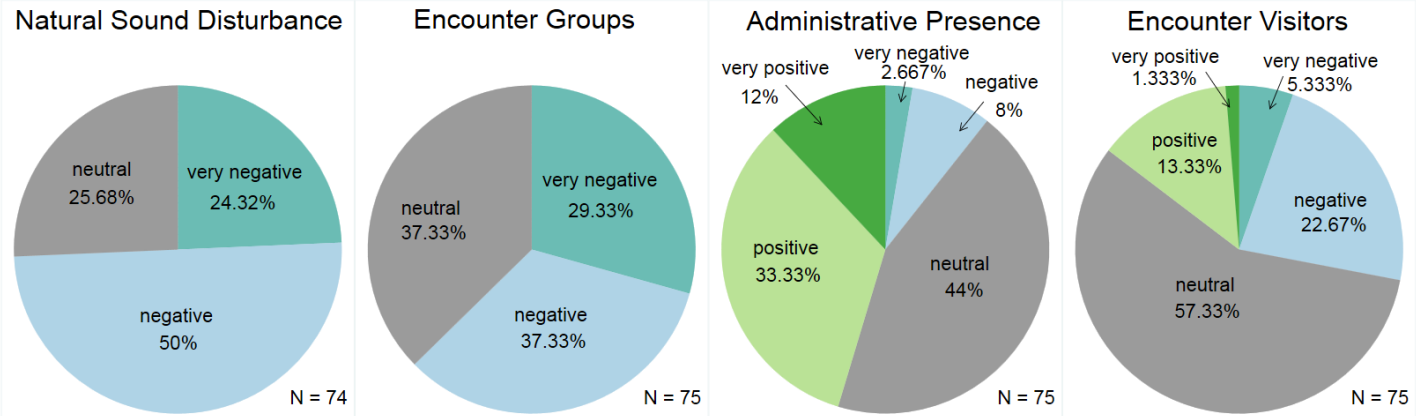


Figure 3. Positive or negative impact to visitor experience by BMP indicator

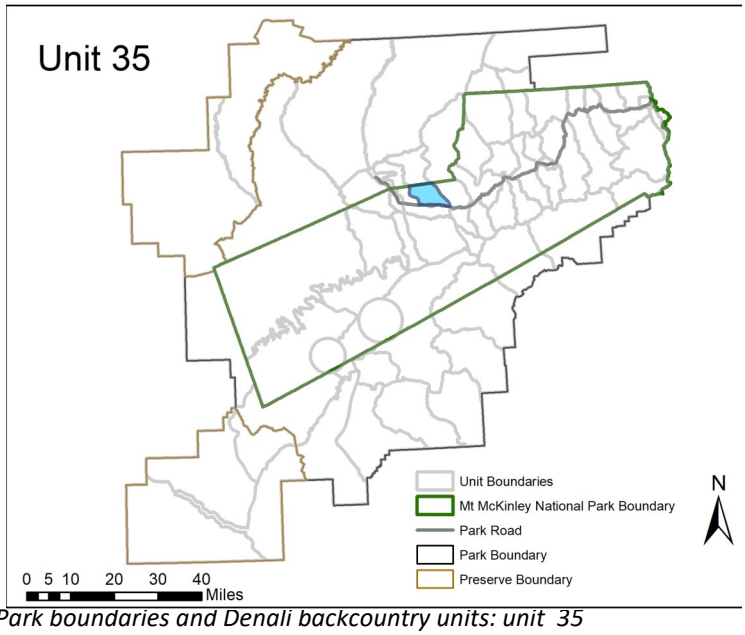
Backcountry Unit 35
"Moose Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



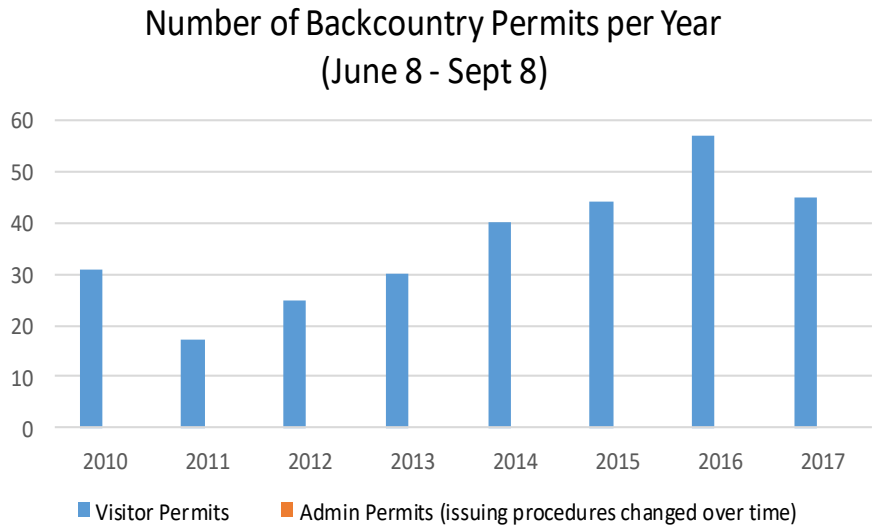
Moose creek, looking west

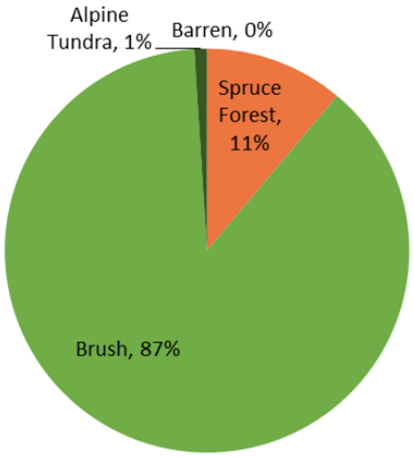


Park boundaries and Denali backcountry units: unit 35

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 3%

Unit Size: 20,005 acres





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=12)
Day hikers (N=3)
Pooled total (N=15)
Total recorded days (n=22)

Percent visitors on guided hike: 3%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **100% yes**

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 7 (**Standard deviation: 8); range 0—20 people.

Backcountry indicators in Unit 35: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators during their hike days that **exceeded** BMP standards for OP1. Exceptions were encounters with groups and administrative presence; these indicators were **within** BMP standards.

Backcountry Indicators in Unit 35: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that natural sound disturbance and modern equipment had distributions primarily above BMP standards, whereas encounters with visitors and landscape modifications had 50% observations above standards (backpackers).

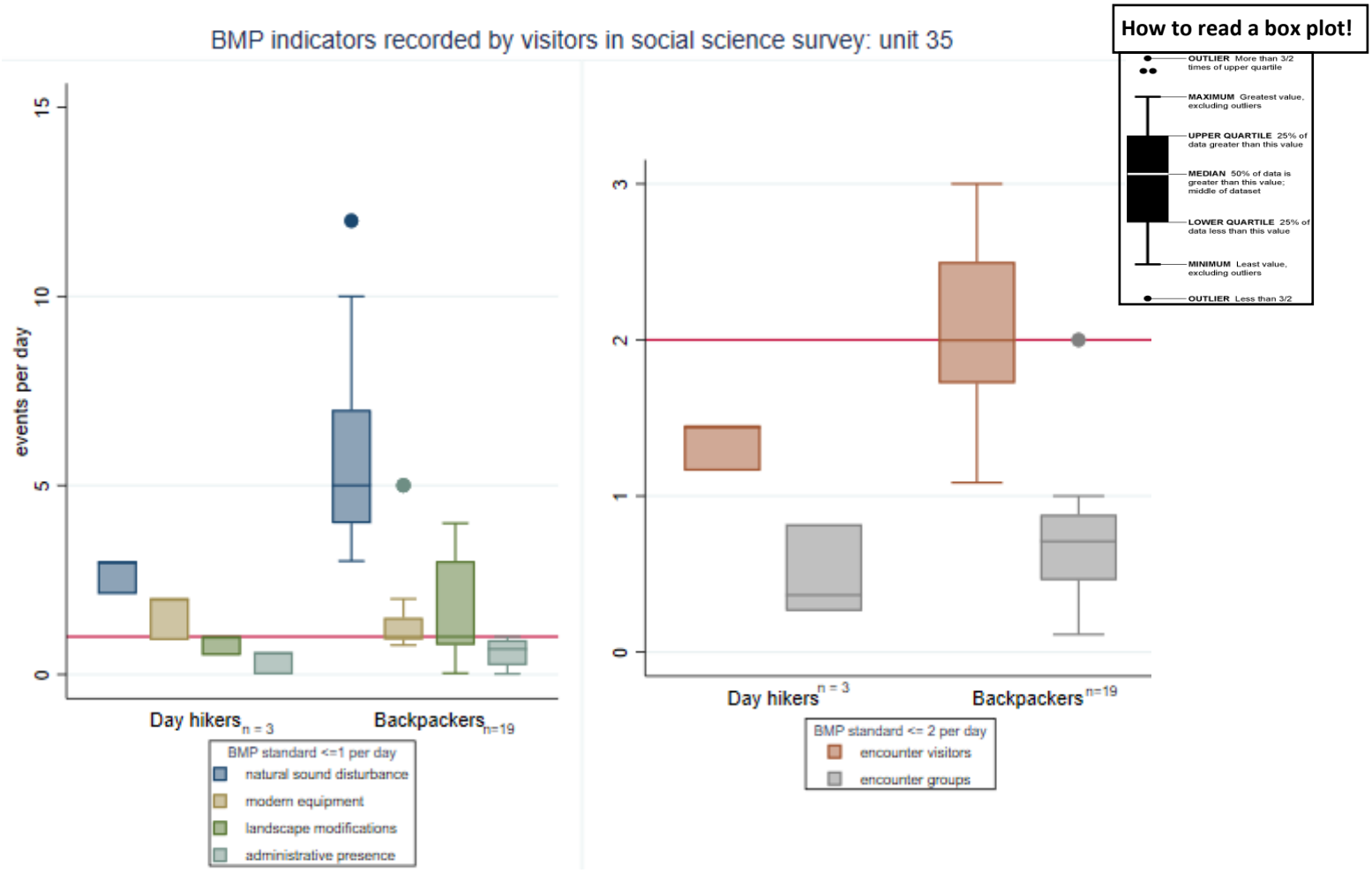


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations (n=3). Backpackers recorded higher natural sound disturbance events on average: 50% of observations were greater than 5 events per day. 100% of visitor observations for natural sound disturbance were greater than 2 events per day.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.09 events per hour** or 1.4 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 3 (day hikers) or 5 (backpackers) daily events; the sound station estimate of 1.4 is below the entire distribution of recorded events by visitors. Despite a lack of corroboration of NPS and visitor collected data points, the similarity between day hiker and backpacker recorded events suggests a daily average natural sound disturbance estimate between 2 & 5 events.

Camping Density: 100% of backpackers to unit 35 were able to camp away from others; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 31

Average Miles: 4 miles/year

Average Visitors Encountered: 0.14/year Average Litter/Sanitation Encountered: 0.14/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 35. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 59% of total days sampled in unit 35 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP Standard	Mean daily events (2011) n = 9	Mean daily events (2018) n = 22	Change in percent *days* in standard: 2011 - 2018	State of change in Unit 35: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	1	5.33	-34% in standard	
Encounter Visitors	≤ 2 / day	0	1.93	-3% in standard	
Encounter Groups	≤ 2 / day	0	.689	-2% in standard	
Modern Equipment	≤ 1 / day	5.13	1.68	+29% in standard	
Landscape Modification	≤ 1 / day	.33	1.49	-16% in standard	
Admin. Presence	≤ 1 / day	.6	.53	+2% in standard	
Litter	< 5%	.12 (12%)	0 (0%)	+26% in standard	

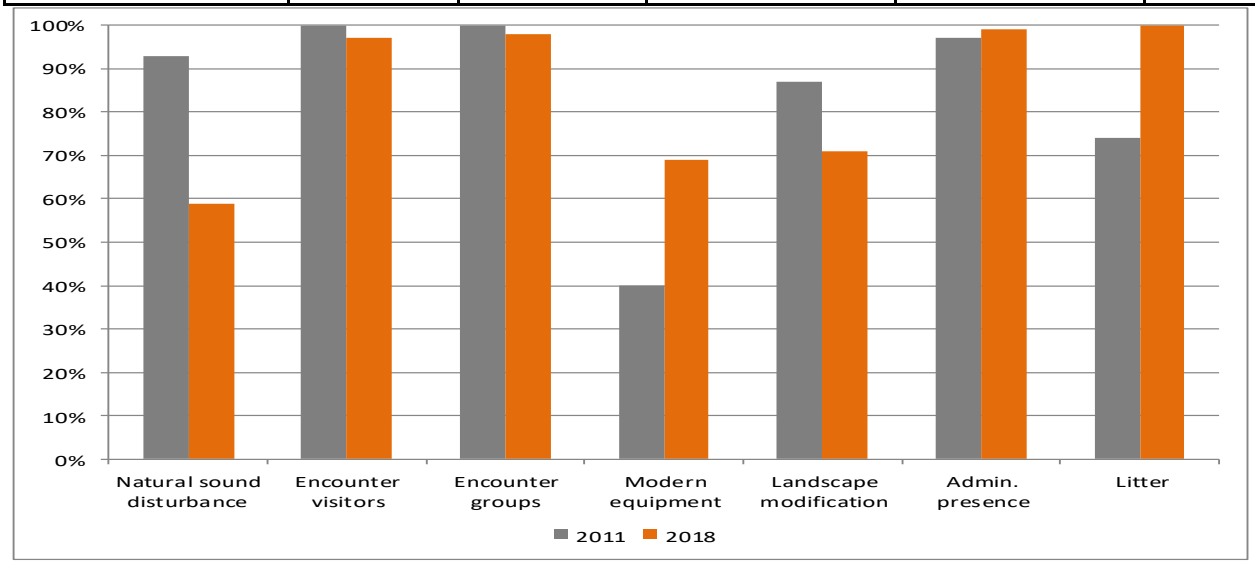


Figure 2. Percent sample days Unit 35 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 35 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. A little over 6% visitors to unit 35 found encounters with groups to be a positive impact.

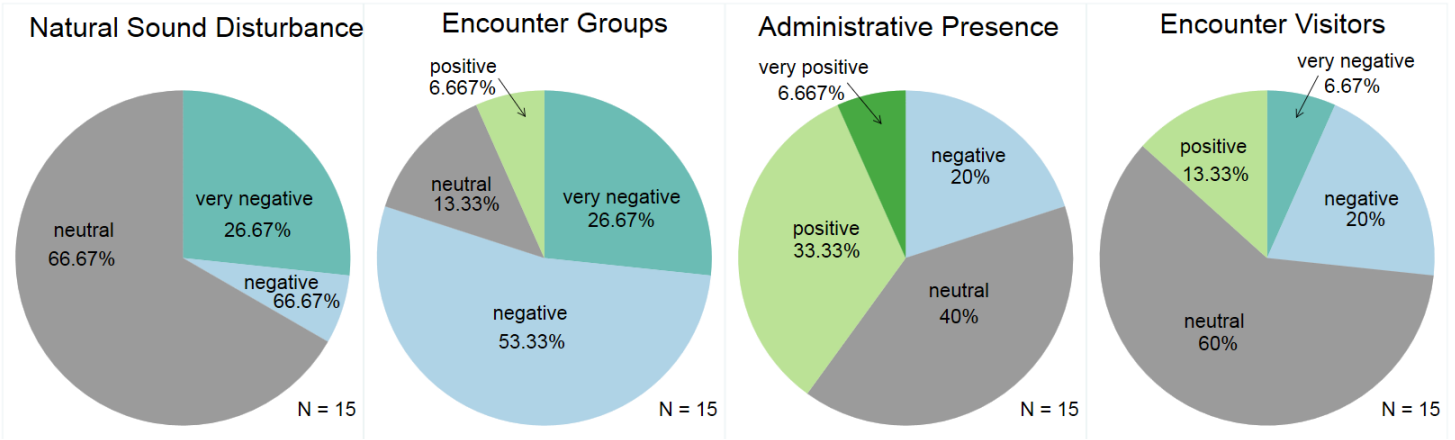


Figure 3. Positive or negative impact to visitor experience by BMP indicator

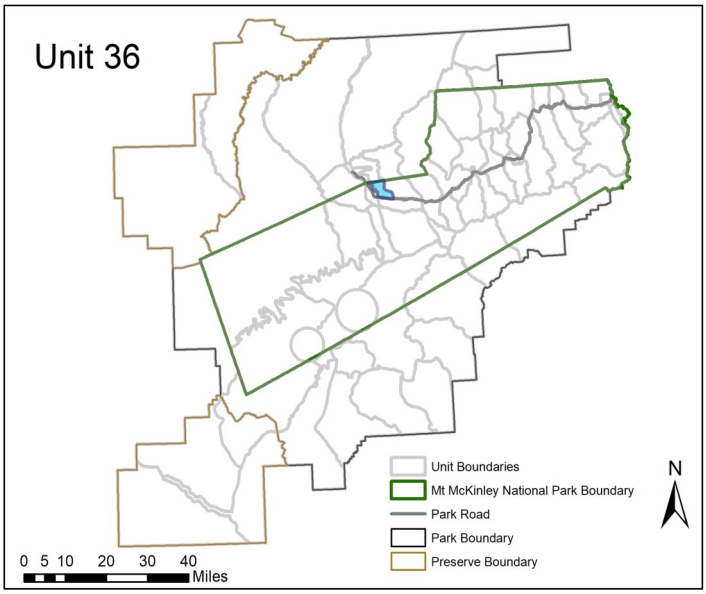
Backcountry Unit 36
"Jumbo Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



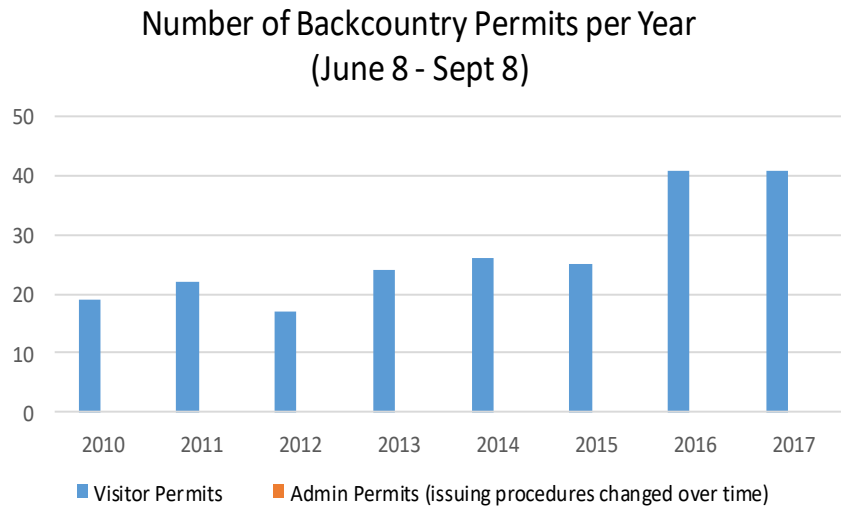
Jumbo creek looking west



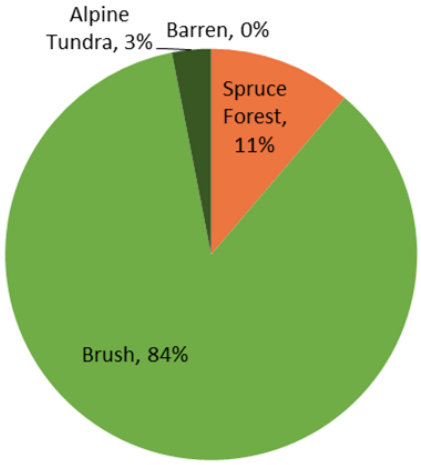
Park boundaries and Denali backcountry units: unit 36

Backcountry Permit Data:

Quota: 2
Percent visitors with bicycle: 2%



Unit Size: 8,230 acres



Broad vegetation class composition

Visitor Survey Data (2017-2018):

Backpackers (N=14)
Day hikers (N=4)
pooled total (N=18)
Total recorded days (n= 24)

Percent visitors on guided hike: 6%
Ability to camp out of sight/sound: 89% yes
Percent "visitor first choice" unit: **85% yes**, 15% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 8 (**Standard deviation: 12.8); range 0—50 people.

Backcountry indicators in Unit 36: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators during their hike days that were **within** BMP standards. Exceptions were natural sound disturbance and encounters with modern equipment in which the distribution of events **exceeded** BMP standards.

Backcountry indicators in Unit 36: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

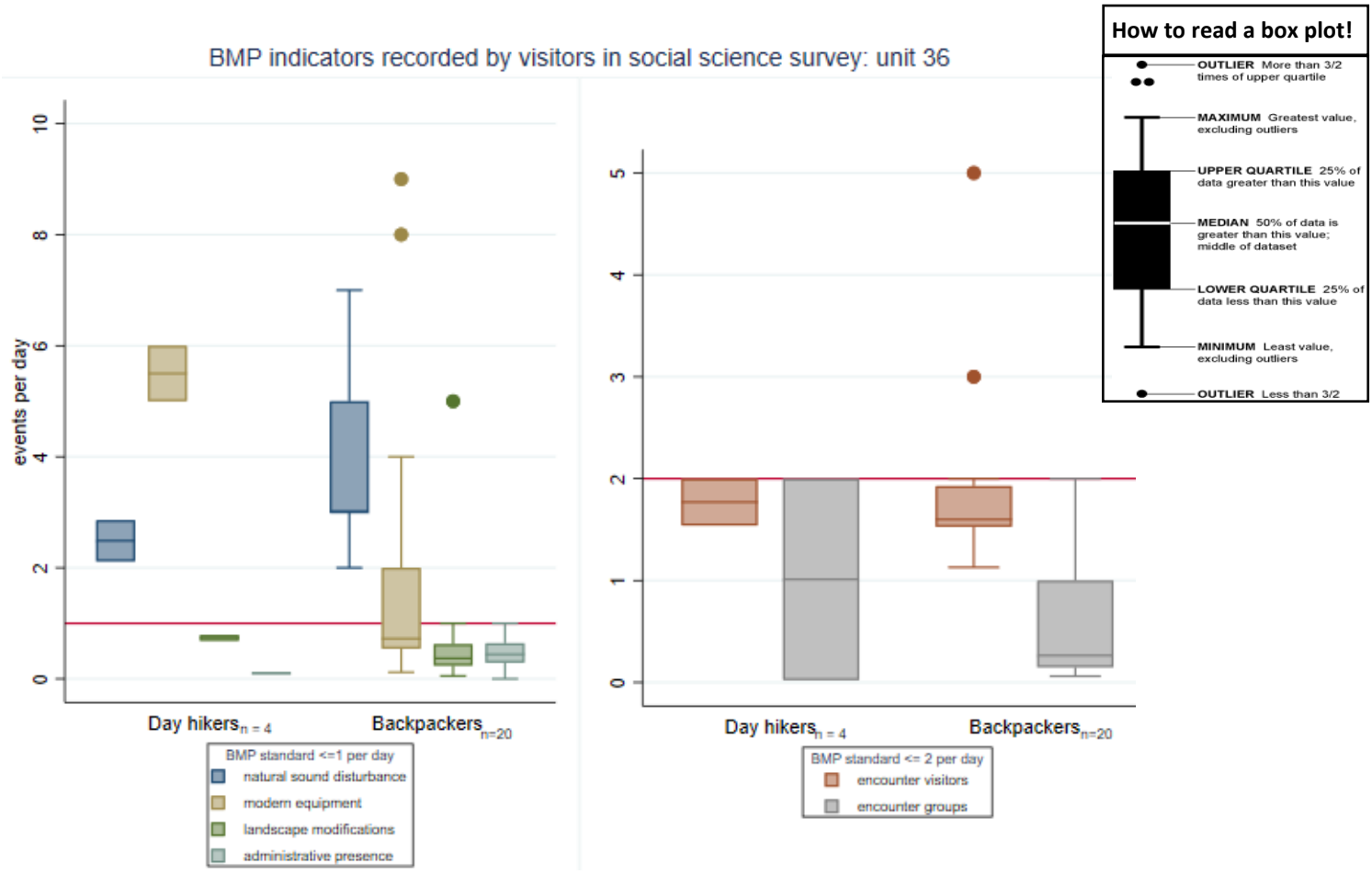


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations (n=4). For backpackers, the top 50% of observations were between 3 & 7 events per day. No extreme events were recorded beyond 7 events per day.

NPS sound monitoring program (2005-2018): No data: sound station was not deployed in this unit, and the backcountry patrol was less than 30 listening hours.

Camping Density: 89% of backpackers to unit 36 were able to camp away from others; 100% wanted to camp away from others. This does not meet the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 0

Average Miles: 0 miles/year

Average Visitors Encountered: n/a Average Litter/Sanitation Encountered: n/a

The BMP indicator mean levels show the average daily event a visitor experiences hiking in Unit 36. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 68% of total days sampled in Unit 36 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP Standard	Mean daily events (2011) n = 3	Mean daily events (2018) n = 24	Change in percent *days* in standard: 2011 - 2018	State of change in Unit 36: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	3.87	3.04	+25% in standard	
Encounter Visitors	≤ 2 / day	3.1	2.18	-16% in standard	
Encounter Groups	≤ 2 / day	0	.633	-5% in standard	
Modern Equipment	≤ 1 / day	3	2.56	-13% in standard	
Landscape Modification	≤ 1 / day	1.3	.688	+1% in standard	
Admin. Presence	≤ 1 / day	1	.465	-2% in standard	
Litter	< 5%	0	.05	-2% in standard	

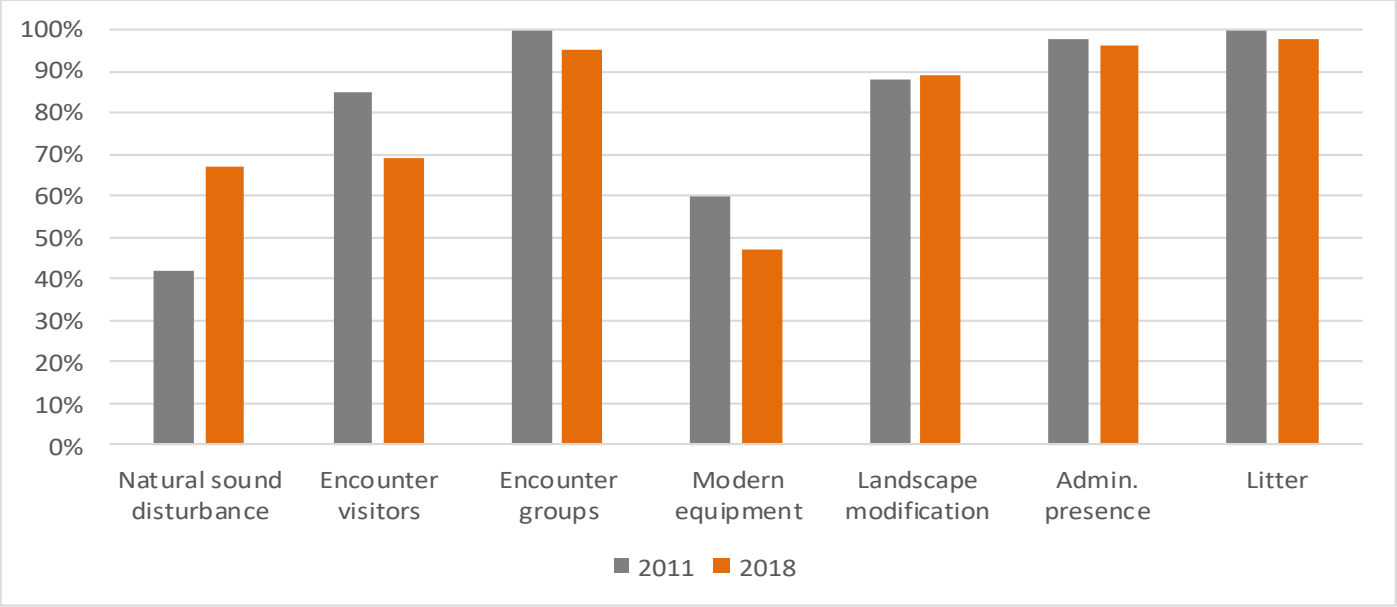


Figure 2. Percent sample days Unit 36 was within BMP standards: 2011 vs. 2018, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 36 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence.

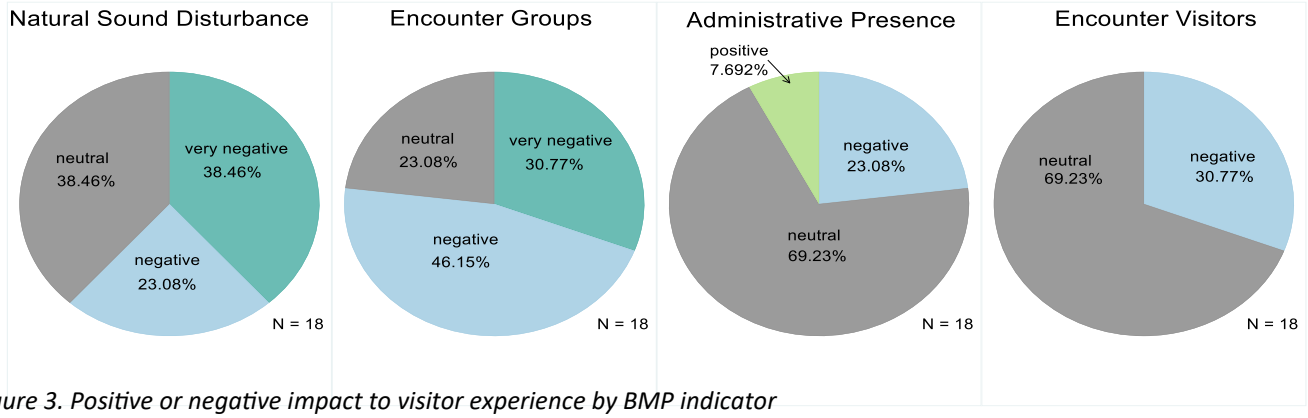


Figure 3. Positive or negative impact to visitor experience by BMP indicator

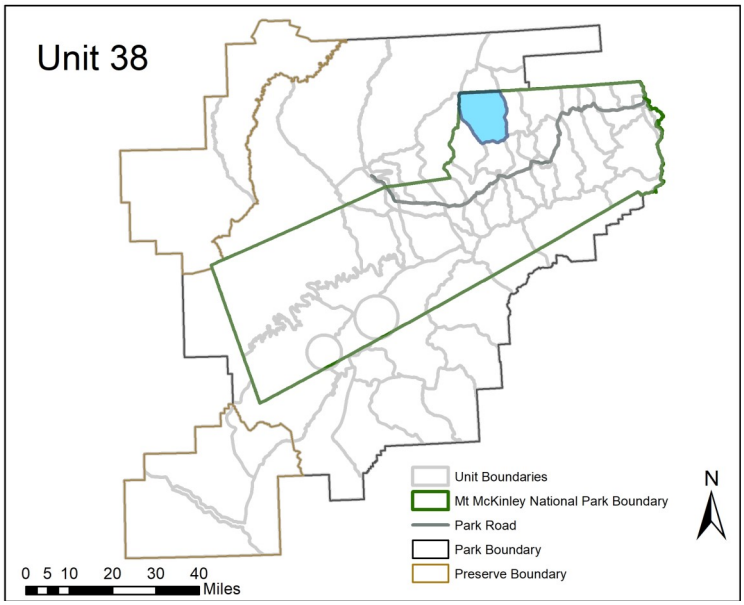
Backcountry Unit 38
"Lower Toklat"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



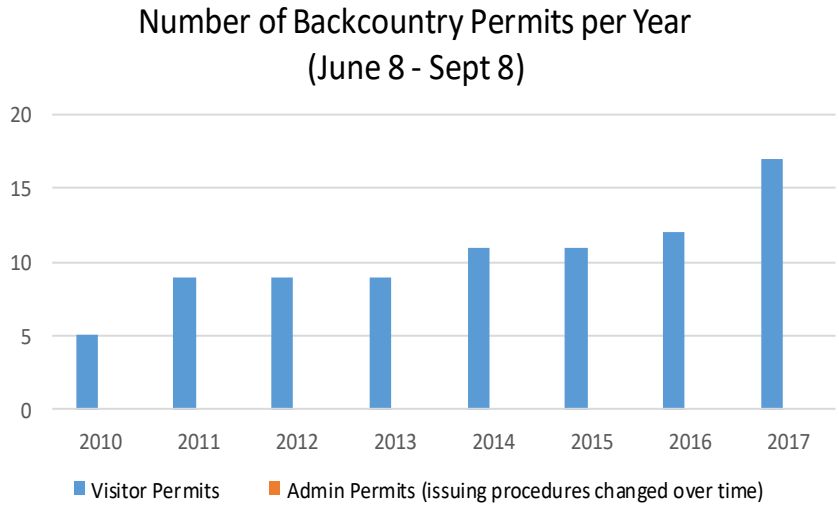
Wyoming Hills, looking southwest towards Denali

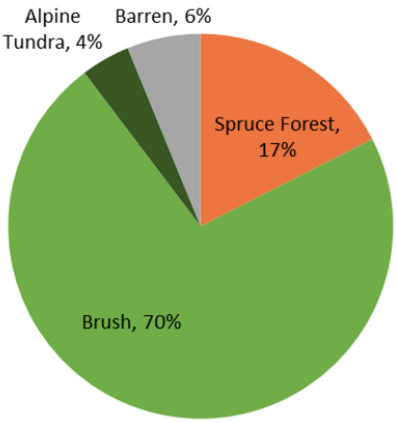


Park boundaries and Denali backcountry units: unit 38

Backcountry Permit Data:
Quota: 6
Percent visitors with bicycle: 7%

Unit Size: 68,455 acres





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=7)
Day hikers (N=1)*
Pooled total (N=8)
Total recorded days (n=13)

Percent visitors on guided hike: 0%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **100% yes**

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 7 (**Standard deviation: 15.1); range 0—45 people.

Backcountry indicators in Unit 38: Backpackers recorded Backcountry Management Plan (BMP) indicators that were **within** BMPS standards for OP1. The exceptions were natural sound disturbance and landscape modifications, in which distributions **exceeded** BMP standards.

*the day hiker to unit 38 did not record any indicator data

Backcountry Indicators in Unit 38: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others.

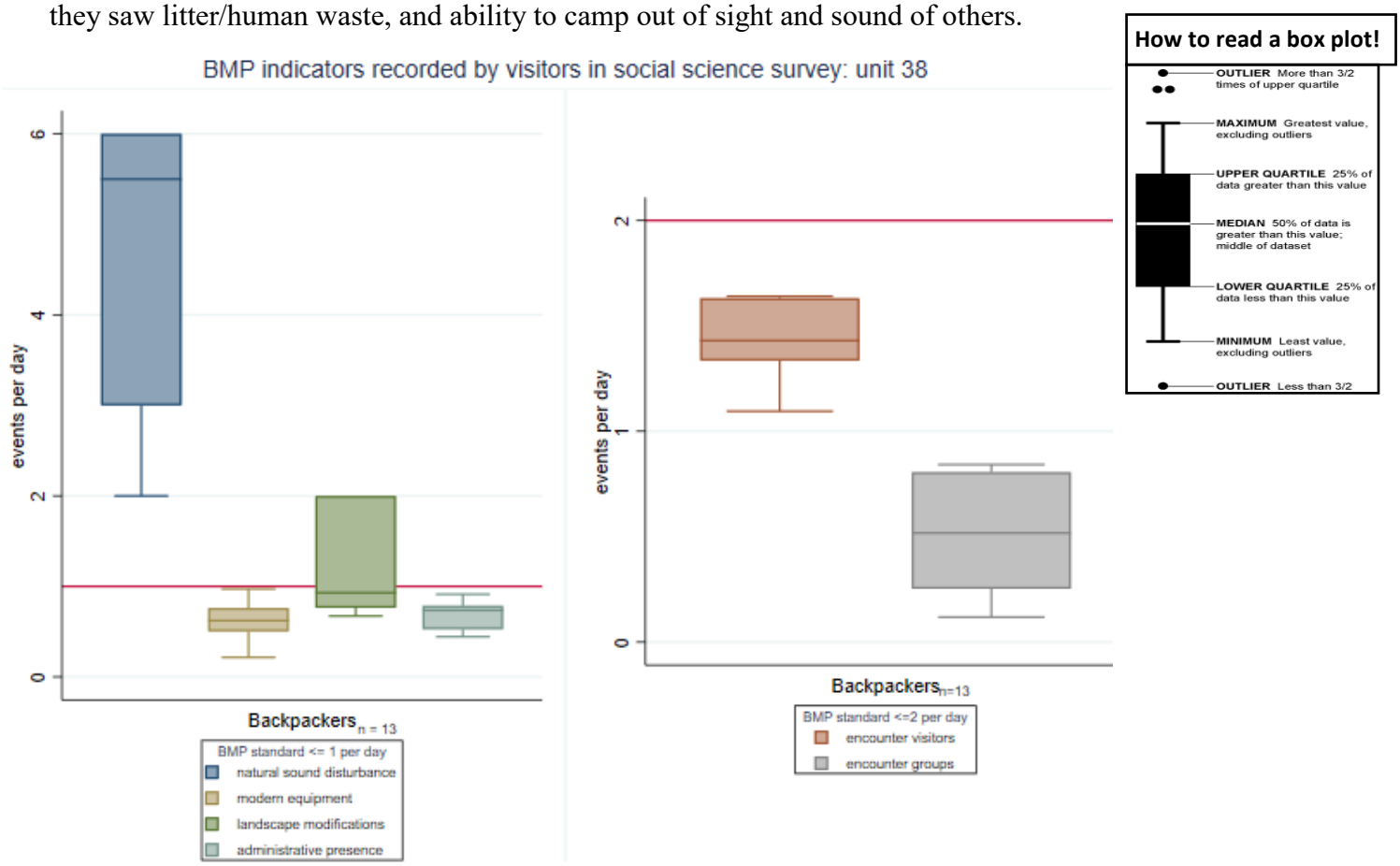


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, 100% of observations exceeded the BMP standard of 2 events per day. The plots (Figure 1) demonstrate that backpackers recorded high natural sound disturbance events, with a median of 5.6 per day. 50% of observations were between 5.6 and 6 per day, meaning 1/2 of backpackers' total trip days were high event days (note: n = 13 days of observation).

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **0.33 events per hour** or 5 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 5.6 daily events; the sound station estimate of 5 is within the interquartile range recorded events by visitors. The corroboration of NPS and visitor collected data results in a daily average natural sound disturbance estimate between 2 & 6 events.

Camping Density: 100% of backpackers to unit 38 were able to camp away from others; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 33

Average Miles: 5 miles/year

Average Visitors Encountered: 0.14/year Average Litter/Sanitation Encountered: 0/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 38. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 72% of total days sampled in unit 38 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	**BMP standard**	**Mean daily events (2011) n = 11**	**Mean daily events (2018) n = 13**	**Change in percent *days* in standard: 2011 - 2018**	**State of change in Unit 38: 2011 to 2018**
Natural Sound	≤ 1 / day	1	3.5	-27% in standard	
Encounter Visitors	≤ 2 / day	0	1.57	-11% in standard	
Encounter Groups	≤ 2 / day	0	.917	-25% in standard	
Modern Equipment	≤ 1 / day	0	.84	-6% in standard	
Landscape Modification	≤ 1 / day	0	1.41	-31% in standard	
Admin. Presence	≤ 1 / day	0	.092	-0% in standard	
Litter	< 5%	0.06	0.0	+19% in standard	

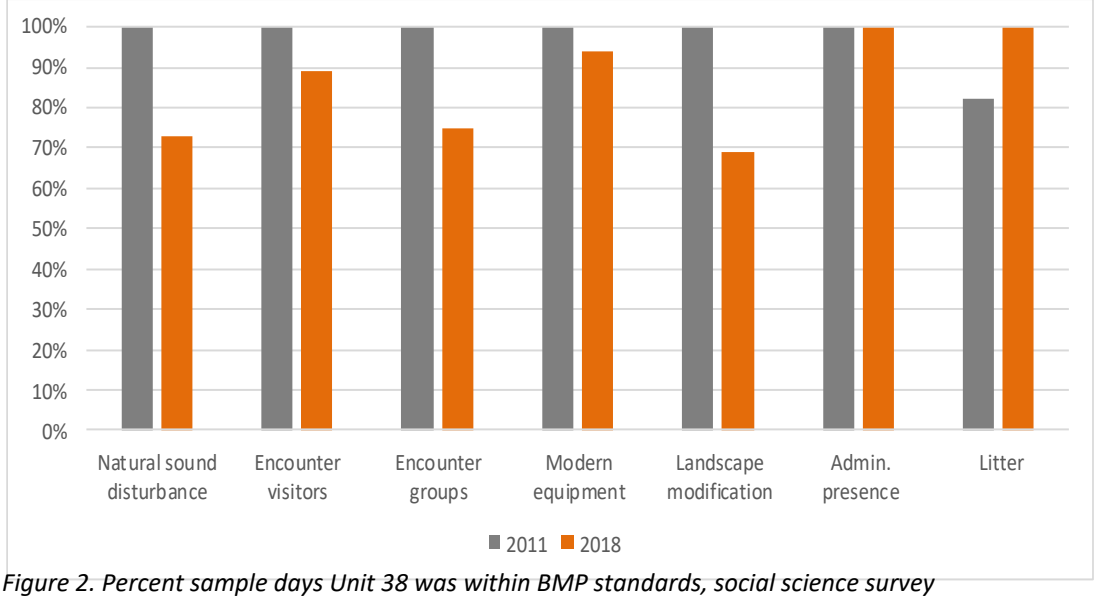


Figure 2. Percent sample days Unit 38 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 38 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. Visitors to unit 38 found any encounters to be negative or neutral.

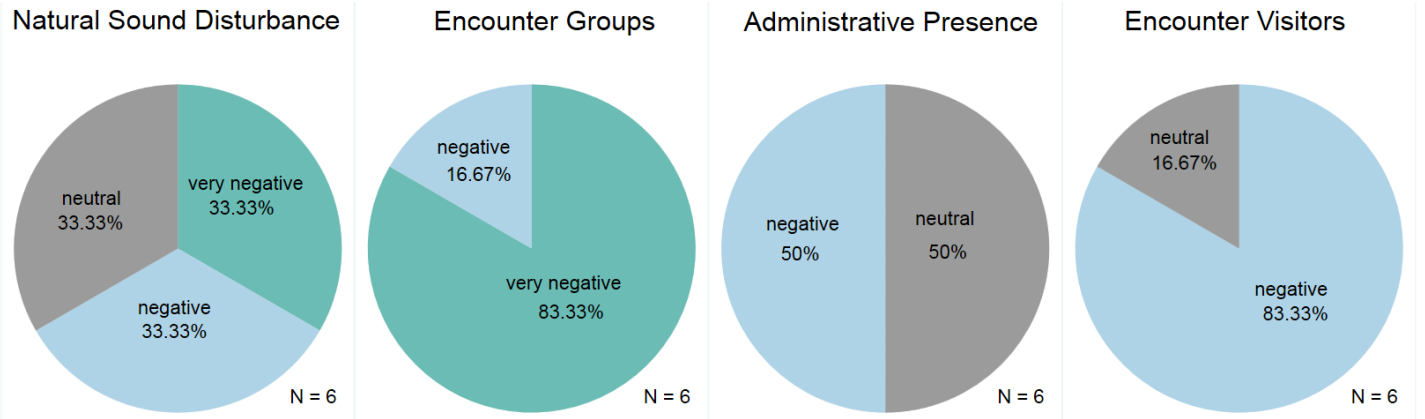
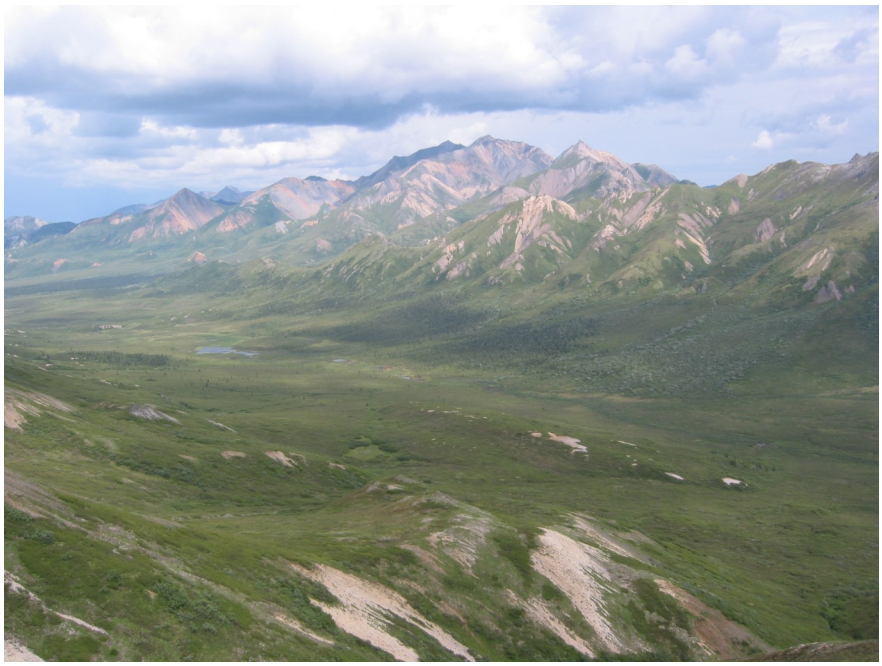


Figure 3. Positive or negative impact to visitor experience by BMP indicator

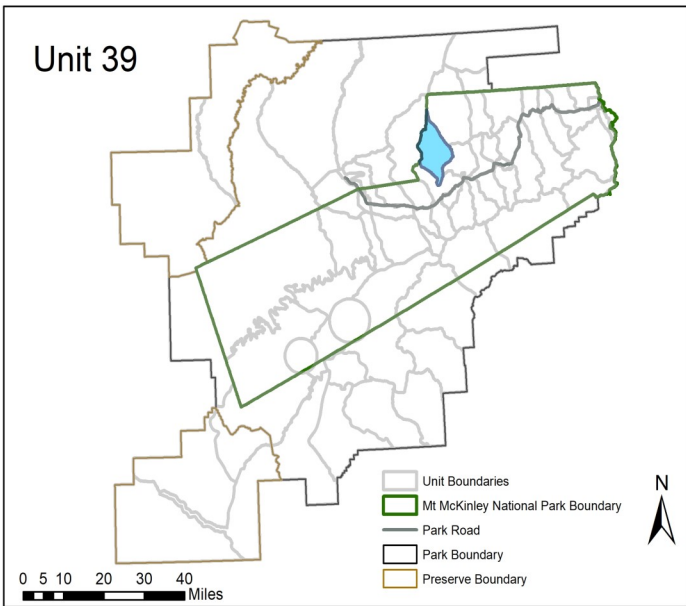
Backcountry Unit 39
"Stony Creek"
Management Area OP1: Old Park 1

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



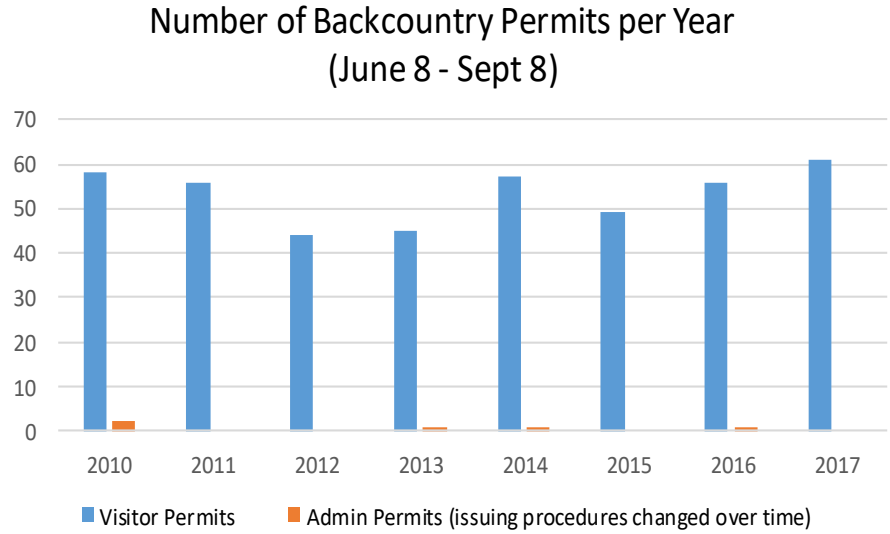
Stony creek, looking east

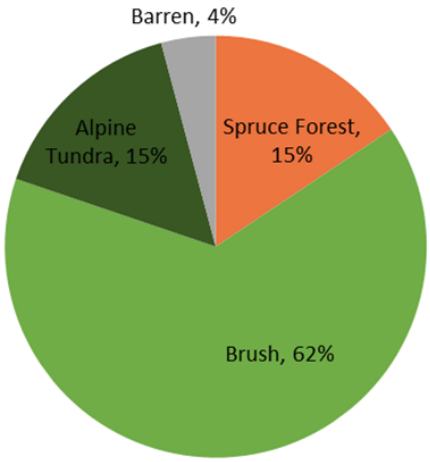


Park boundaries and Denali backcountry units: unit 39

Backcountry Permit Data:
Quota: 4
Percent visitors with bicycle: 0%

Unit Size: 44,808 acres





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=24)
Day hikers (N=2)
Pooled total (N=26)
Total recorded days (n=34)

Percent visitors on guided hike: 6%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **43% yes,** 57% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 2.5 (**Standard deviation: 1); range 0—4 people.

Backcountry indicators in Unit 39: Day hikers and backpackers typically recorded Backcountry Management Plan (BMP) indicators that were **within** standards for OP1. The exception was natural sound disturbance; this indicator **exceeded** the BMP standard for OP1.

Backcountry Indicators in Unit 39: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots show natural sound disturbance and encounters with visitors had distributions that exceeded BMP standards, whereas landscape modifications had two outlier encounters (for backpackers).

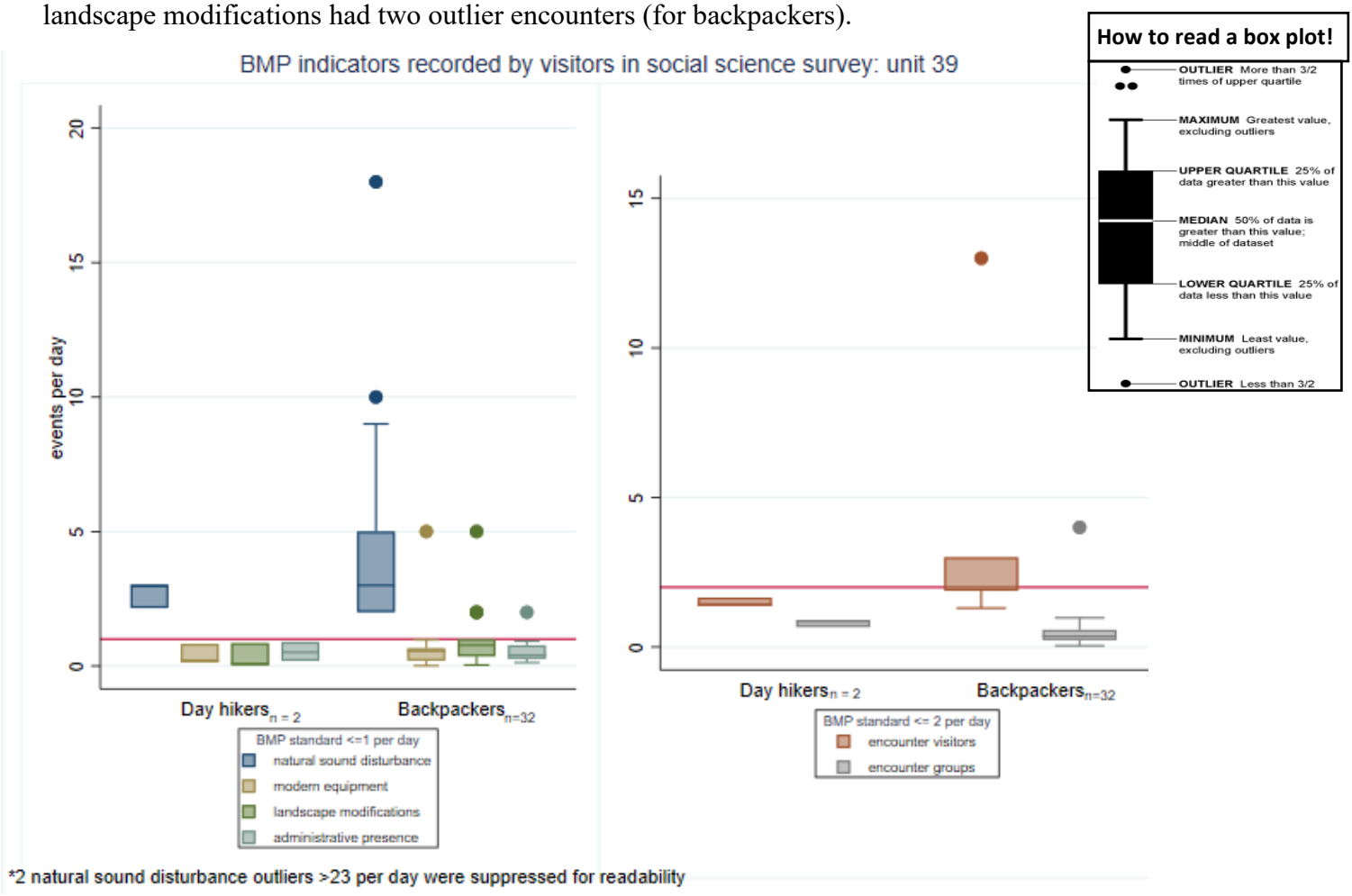


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations (n=2). 50% of backpackers' observations were greater than 3 events per day. 100% of visitor observations for natural sound disturbance were greater than 2 events per day. The dots are BMP indicator outlier data points. Note two natural sound disturbance event outliers greater than 23 per day were suppressed for readability.

NPS sound monitoring program (2005-2018): No data: sound station was not deployed in this unit, and the backcountry patrol was less than 30 listening hours.

Camping Density: 100% of backpackers to unit 39 were able to camp away from others; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 65

Average Miles: 9 miles/year

Average Visitors Encountered: 0.14/year Average Litter/Sanitation Encountered: 0.29/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 39. The mean of natural sound disturbance is above the BMP standard of 2 events per day, but 70% of total days sampled in unit 39 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	BMP standard	Mean daily events (2011) n = 16	Mean daily events (2018) n = 34	Percent change *days* in standard: 2011 - 2018	State of change in Unit 39: 2011 to 2018
Natural Sound Disturbance	≤ 1 / day	1.25	4.86	-28% in standard	
Encounter Visitors	≤ 2 / day	.33	2.07	-22% in standard	
Encounter Groups	≤ 2 / day	0	.565	-13% in standard	
Modern Equipment	≤ 1 / day	0	.489	-7% in standard	
Landscape Modification	≤ 1 / day	.13	.991	-9% in standard	
Admin. Presence	≤ 1 / day	0	.54	-1% in standard	
Litter	< 5%	.12	.07	-0% in standard	

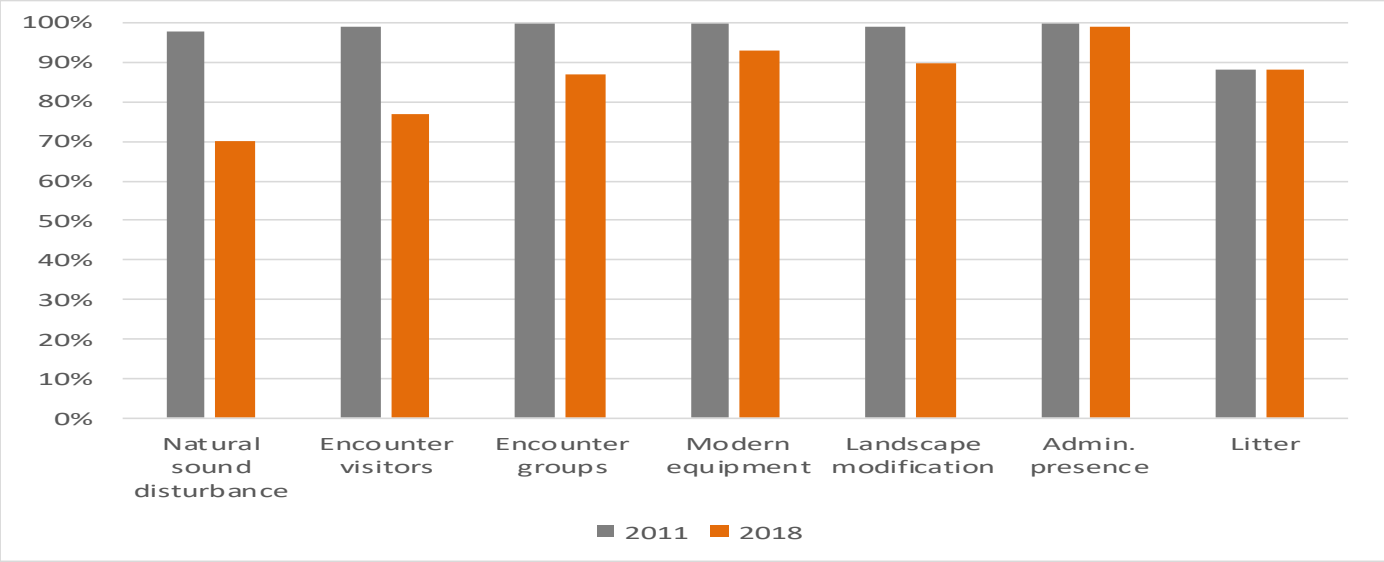


Figure 2. Percent sample days Unit 39 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for daily events above OP1 BMP standards, except for encounters with visitors and groups (rated at OP1 BMP standards). The indicators that visitors to unit 39 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. A little over 4% visitors to unit 39 found encounters with visitors to be a positive impact.

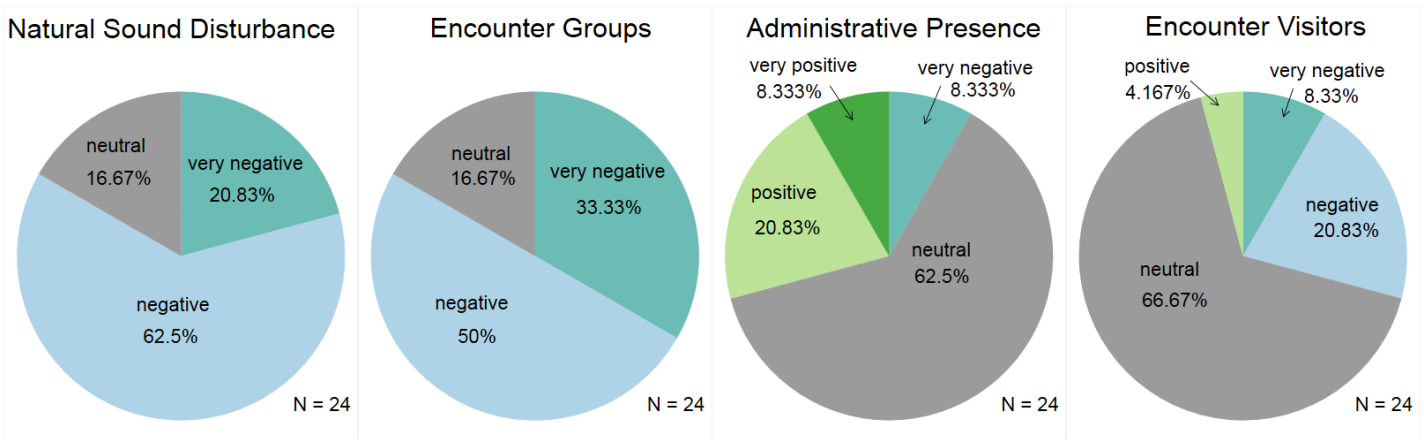


Figure 3. Positive or negative impact to visitor experience by BMP indicator

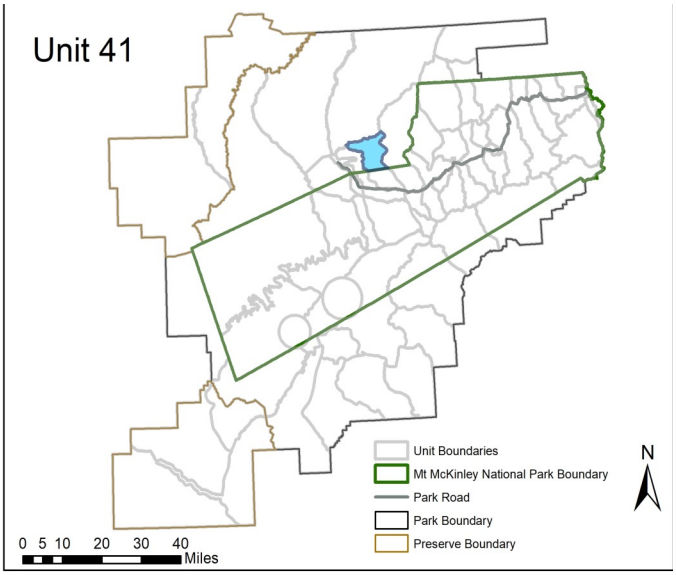
Backcountry Unit 41
"Spruce Peak"
Management Area B: Kantishna

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



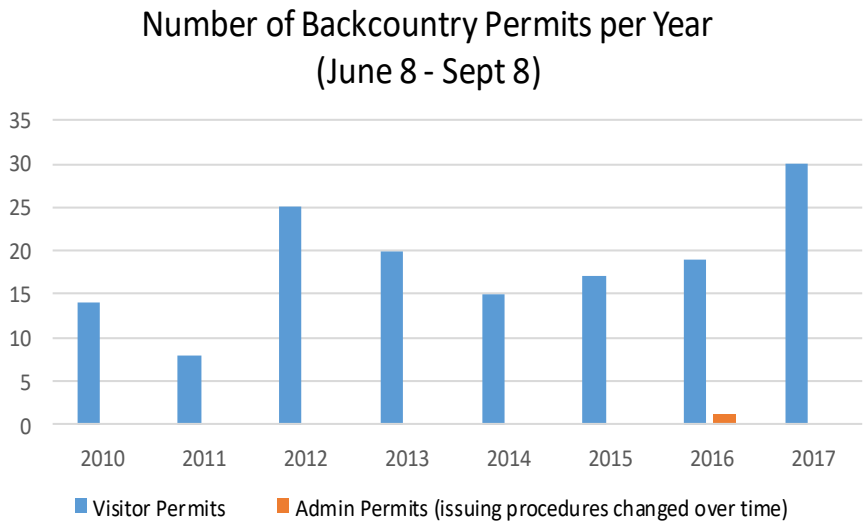
Spruce peak, looking south

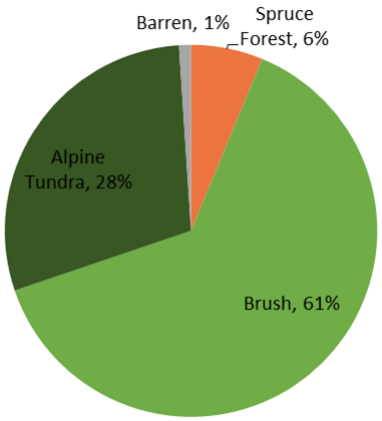


Park boundaries and Denali backcountry units: unit 41

Unit Size: 32,184 acres

Backcountry Permit Data:
Quota: 12
Percent visitors with bicycle: 1%





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=12)
Day hikers (N=15)
Pooled total (N=27)
Total recorded days (n=31)

Percent visitors on guided hike: 60%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **65% yes,** 30% no, 5% don't know

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 14 (**Standard deviation: 7); range 2-20 people.

Backcountry indicators in Unit 41: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators that were **within** BMP standards for Mgmt area B. Natural sound disturbance had a distribution entirely within BMP standard. Exceptions were encounters with visitors and landscape modifications; these indicators had distributions that **exceeded** BMP standards.

Backcountry Indicators in Unit 41: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that backpackers recorded more varied encounters with visitors, but day hikers recorded higher encounters with visitors on average (the median for day hikers is 5 per day whereas backpackers is 3 per day). The median for encounters with landscape modifications was 1 (backpackers) or 2 (day hikers) per day, with observation outliers approaching 10 per day.

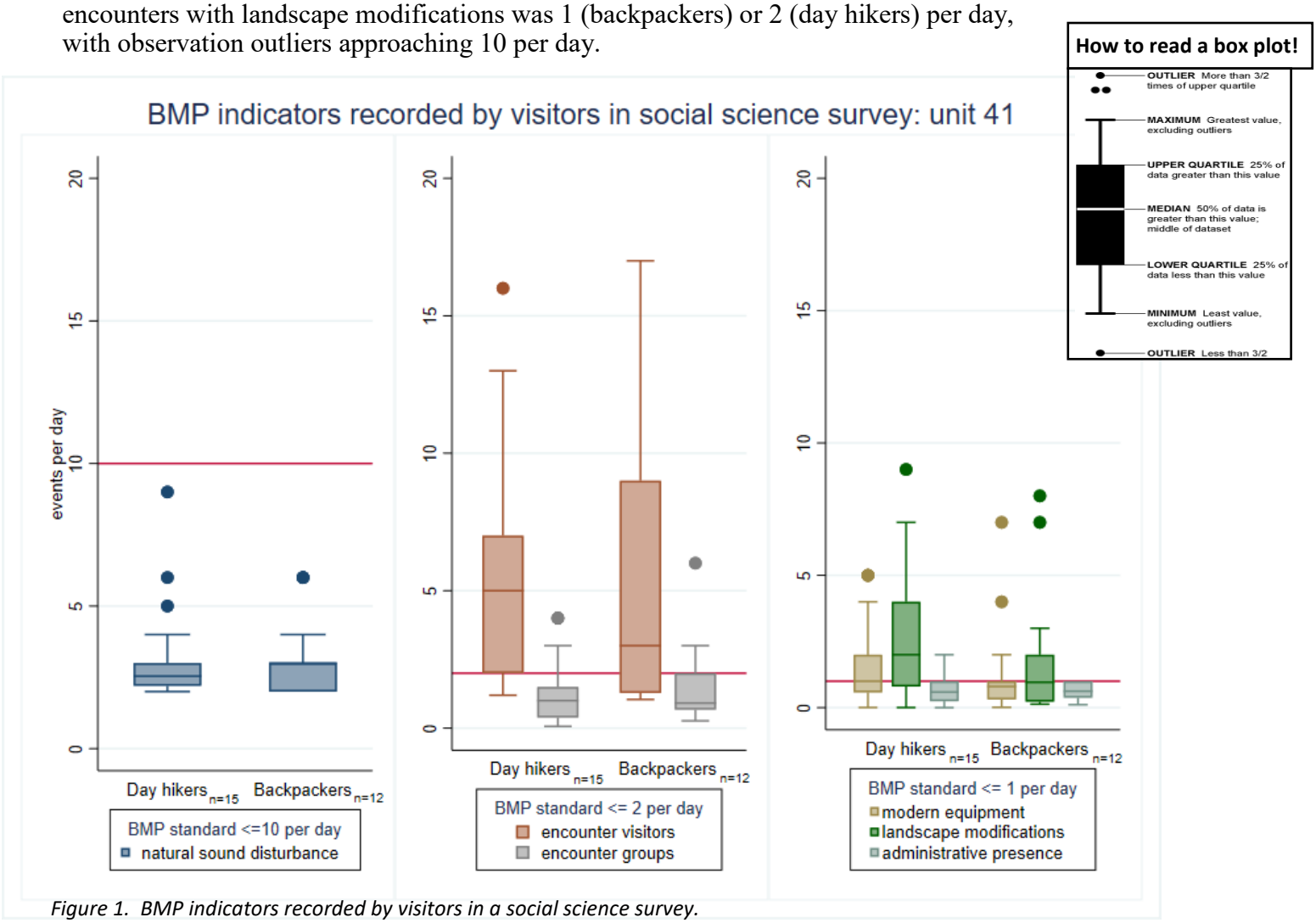


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers and backpackers did not exceed BMP standard for Mgmt. Area B. The median observations for daily natural sound disturbance events mirrored one another: 3 for day hikers and 4 for backpackers.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by the NPS is **0.6 events per hour** or 9.6 events per backcountry day (16 hours). The sound station estimate of 9.6 is captured in the outliers recorded by day hikers, but lower than the BMP standard for mgmt. area B. The corroboration of NPS and visitor collected data points results in a daily average natural sound disturbance estimate between 2 & 9 events.

Camping Density: 100% of backpackers to unit 41 were able to camp away from others; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 86

Average Miles: 12 miles/year

Average Visitors Encountered: 0.14/year Average Litter/Sanitation Encountered: 0.57/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 41. The mean of encounters with visitors is above the BMP standard of 2 events per day, but 71% of total days sampled in unit 41 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	**Mean daily events (2011) n = 3**	**Mean daily events (2018) n = 27**	**Change in percent *days* in standard: 2011 - 2018**	**State of change in Unit 41: 2011 to 2018**
Natural Sound Disturbance	0	4.16	-0% in standard	
Encounter Visitors	.5	2.81	-17% in standard	
Encounter Groups	0	.936	-6% in standard	
Modern Equipment	0	.981	-8% in standard	
Landscape Modification	1.33	1.42	-9% in standard	
Admin. Presence	0	.381	-1% in standard	
Litter	0	0	-0% in standard	

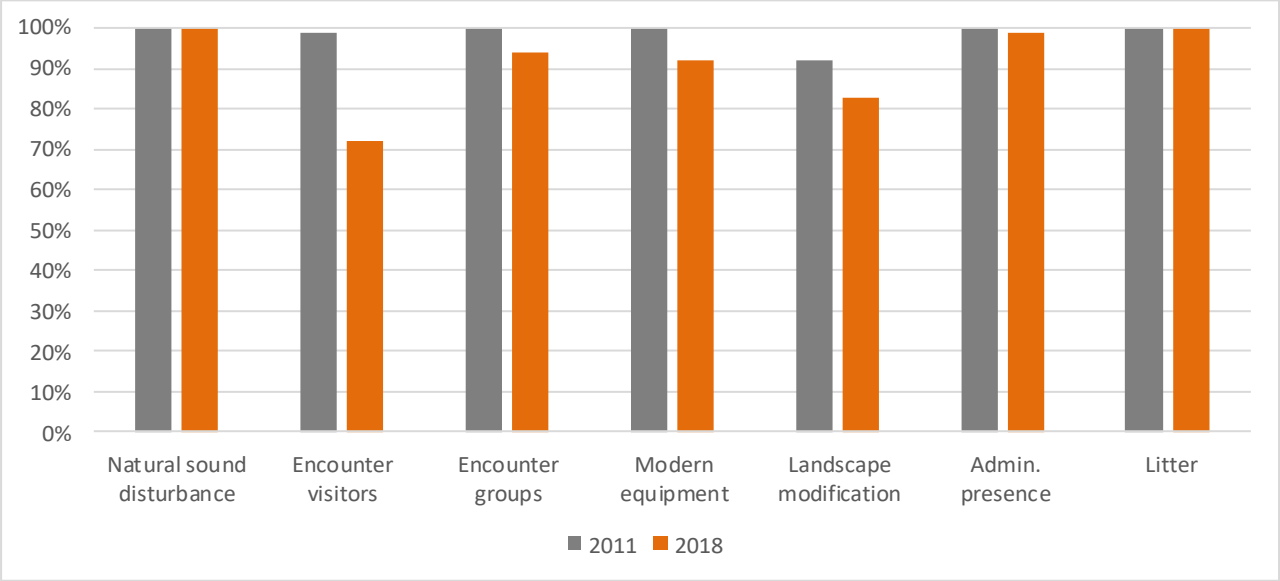


Figure 2. Percent sample days Unit 41 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for natural sound disturbance daily events above 5 per day; encounters with visitors, groups, and administrative presence above 2 per day. The indicators that visitors to unit 41 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 75% visitors to unit 41 found natural sound disturbance to have no impact.

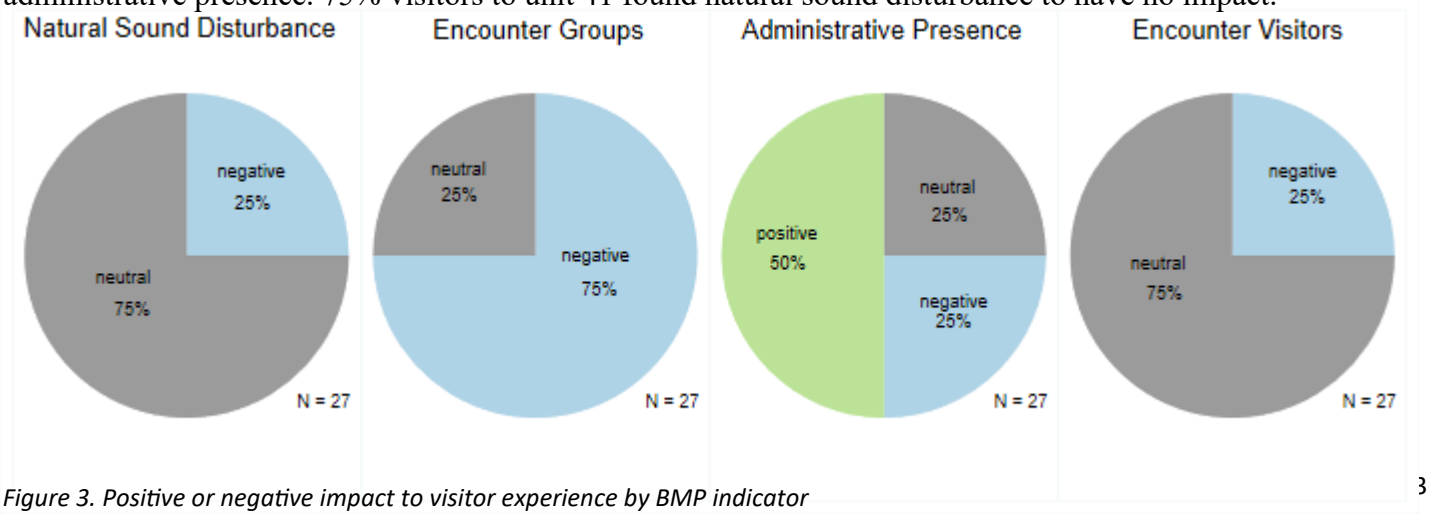


Figure 3. Positive or negative impact to visitor experience by BMP indicator

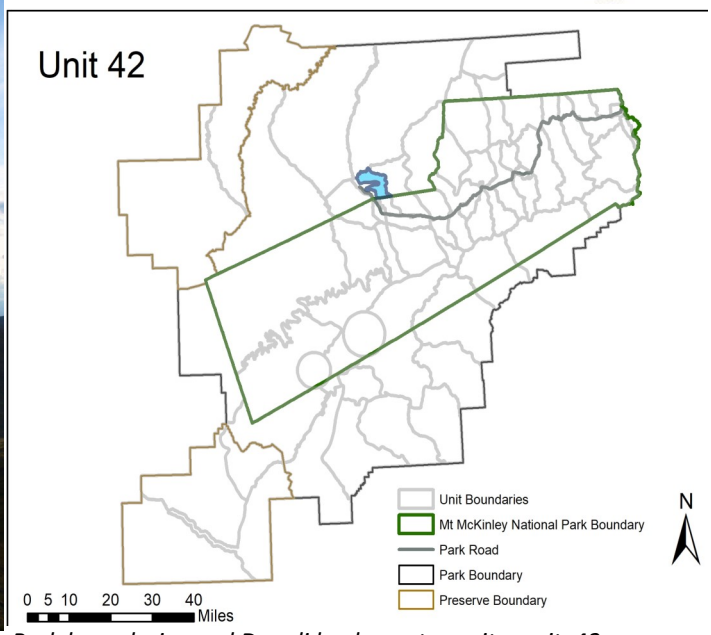
Backcountry Unit 42
"Eureka Creek"
Management Area B: Kantishna

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



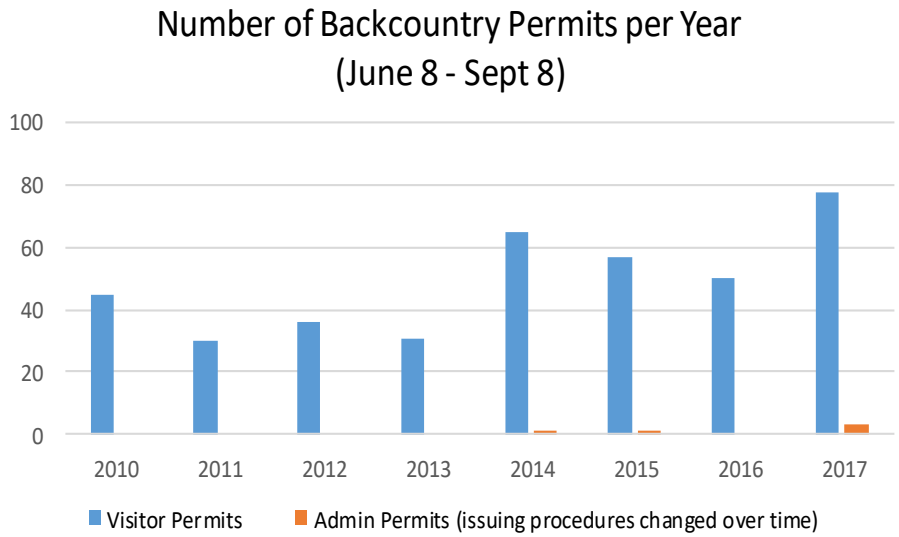
Eureka creek, looking south

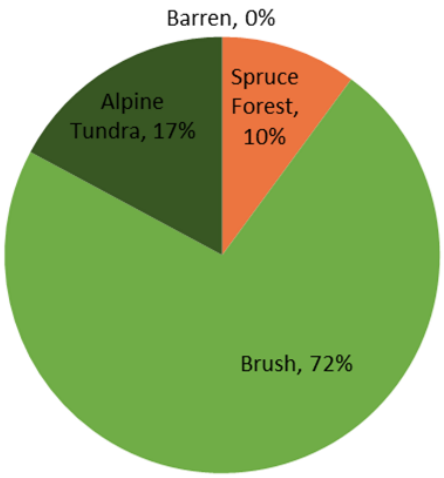


Park boundaries and Denali backcountry units: unit 42

Backcountry Permit Data:
Quota: 12
Percent visitors with bicycle: 3%

Unit Size: 16,113 acres





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=18)
Day hikers (N=55)
Pooled total (N=73)
Total recorded days (n=85)

Percent visitors on guided hike: 58%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **66% yes,** 34% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 14 (**Standard deviation: 9.5); range 2-50 people.

Backcountry indicators in Unit 42: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators that were **within** BMP standards for Mgmt area B. Exceptions were encounters with visitors, modern equipment and landscape modifications; these indicators had distributions that **exceeded** BMP standards.

Backcountry Indicators in Unit 42: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that day hikers recorded higher daily encounters with visitors (a larger range of distribution and 6 outliers) but shared a visitor encounter median with backpackers that is at the standard (2—2.4). The median for encounters with landscape modifications was 3 (day hikers) or 4.5 (backpackers) per day, meaning 50% of visitor recorded encounters were above 3—4.5 per day, and extended to 10 encounters per day.

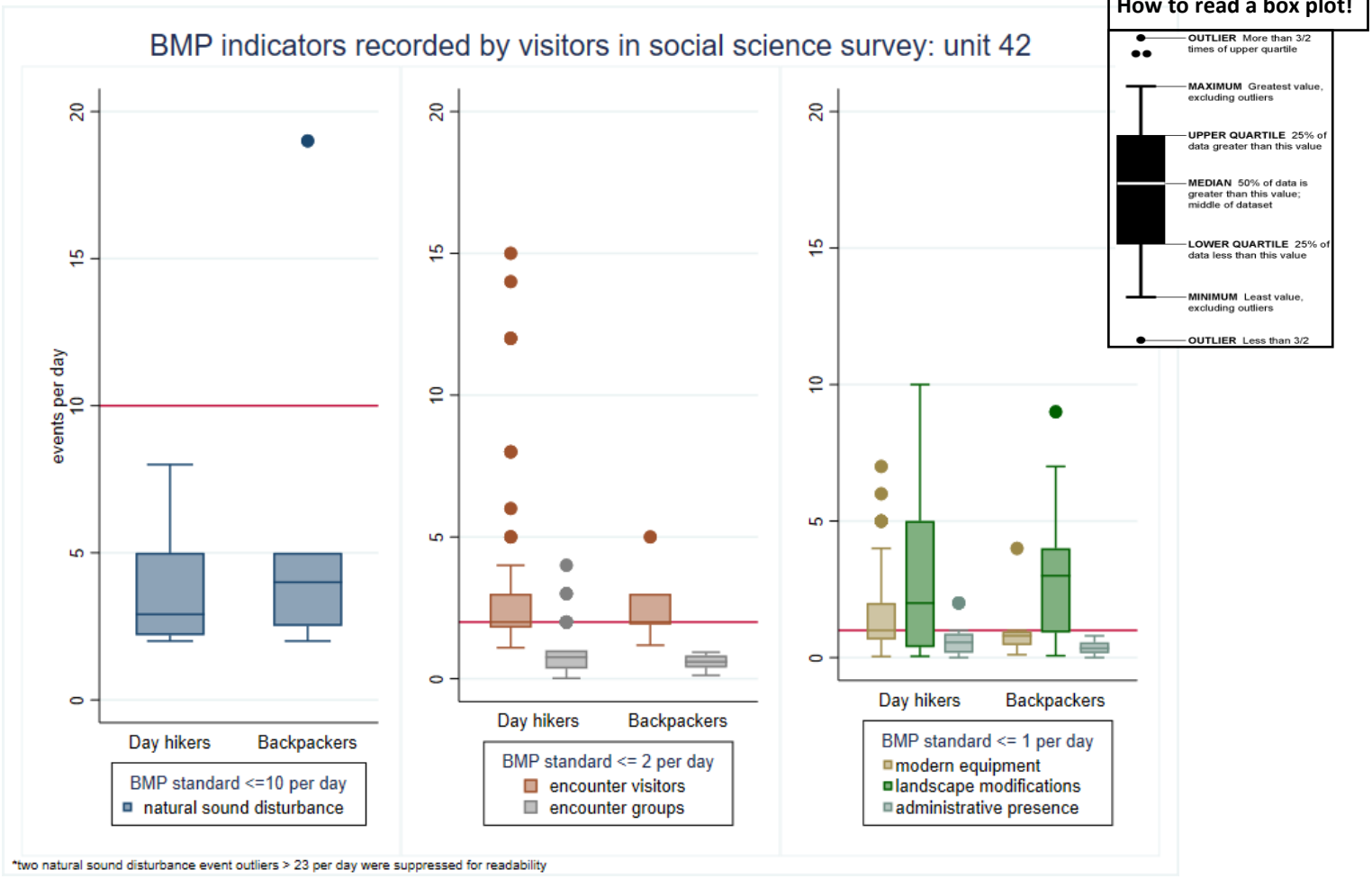


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by visitors had a range between 3 & 8, but one outlier event = 18 events per day surpassed the maximum range of observations. Day hikers' and backpackers' median observations are 3 & 4, respectively, but the maximum ranges are within BMP standards for Mgmt. Area B.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by the NPS is **1.0 events per hour** or 16 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 3.4 (day hikers) or 4.7 (backpackers) daily events; the sound station estimate of 16 is smaller the max outlier recorded by backpackers, but lower than the BMP standard for mgmt. area B. The lack of corroboration of NPS and visitor maximum range events (not including outliers) suggests a

Camping Density: 100% of backpackers to unit 42 were able to camp away from others; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 59

Average Miles: 8 miles/year

Average Visitors Encountered: 0.14/year Average Litter/Sanitation Encountered: 1/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 42. The mean of encounters with visitors is above the BMP standard of 2 events per day, but 62% of total days sampled in unit 42 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2011 vs. 2018: social science survey data

Indicator	**Mean daily events (2011) n = 9**	**Mean daily events (2018) n = 85**	**Change in percent *days* in standard: 2011- 2018**	**State of change in Unit 42: 2011 to 2018**
Natural Sound Disturbance	7.8	5.98	+10% in standard	
Encounter Visitors	2.56	2.65	-19% in standard	
Encounter Groups	.22	.839	-23% in standard	
Modern Equipment	1.2	1.81	-40% in standard	
Landscape Modification	1.44	2.44	-30% in standard	
Admin. Presence	0	.551	-1% in standard	
Litter	.34	.22	+4% in standard	

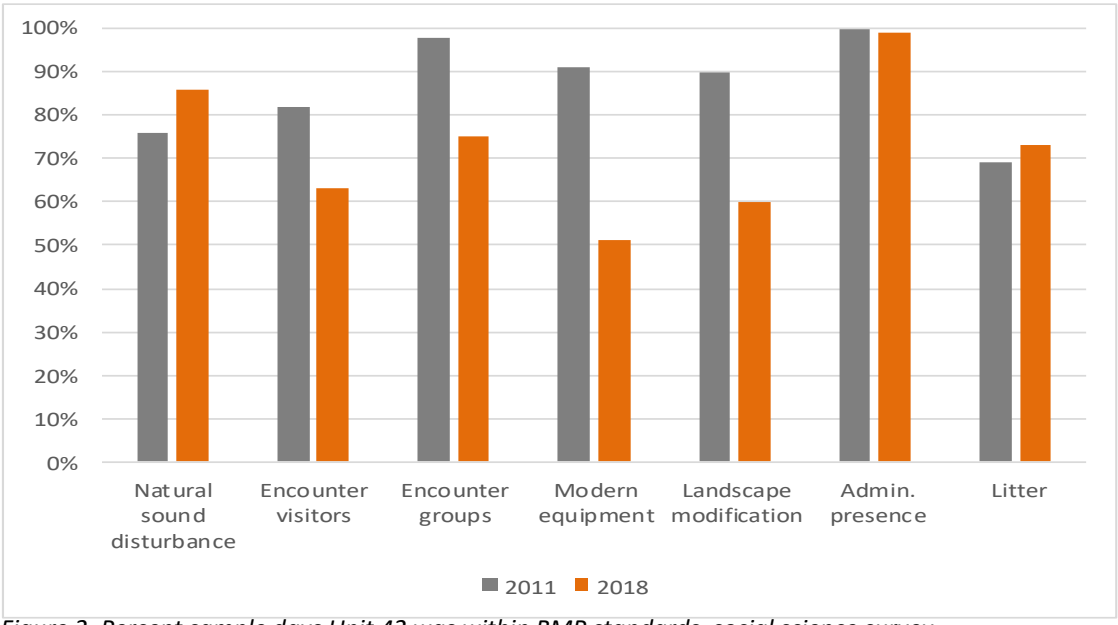


Figure 2. Percent sample days Unit 42 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for natural sound disturbance daily events above 5 per day; encounters with visitors, groups, and administrative presence above 2 per day. The indicators that visitors to unit 42 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 21% visitors to unit 42 found encounters with visitors to have a positive impact.

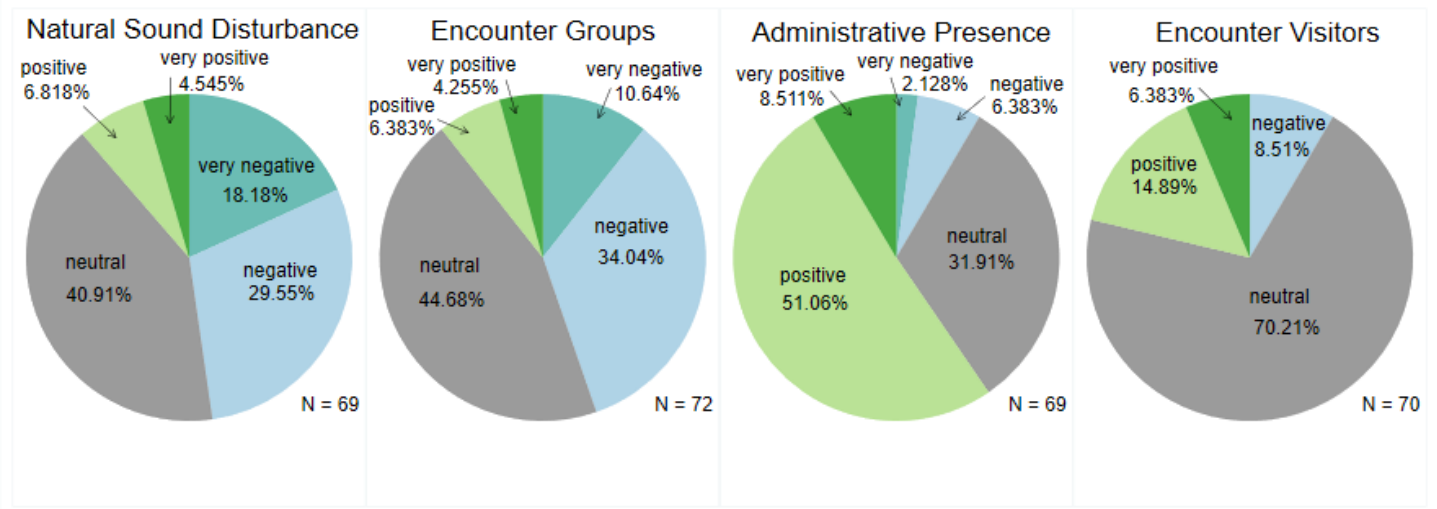


Figure 3. Positive or negative impact to visitor experience by BMP indicator

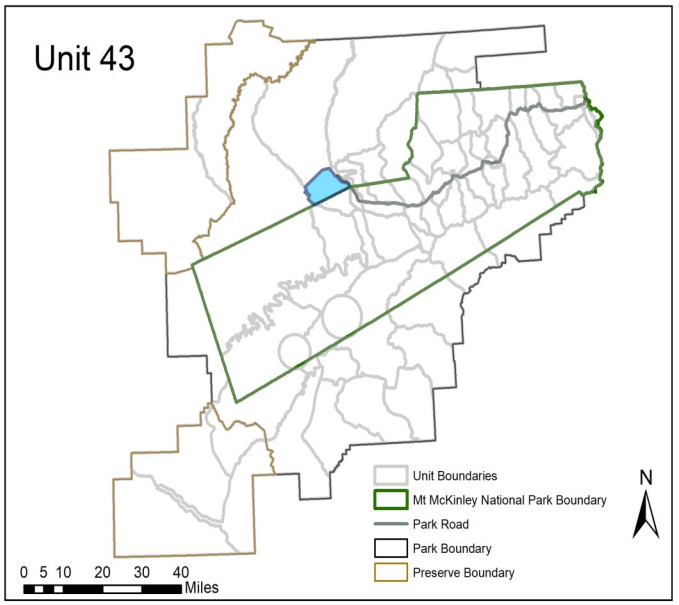
Backcountry Unit 43
"Eldorado Creek"
Management Area B: Kantishna

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



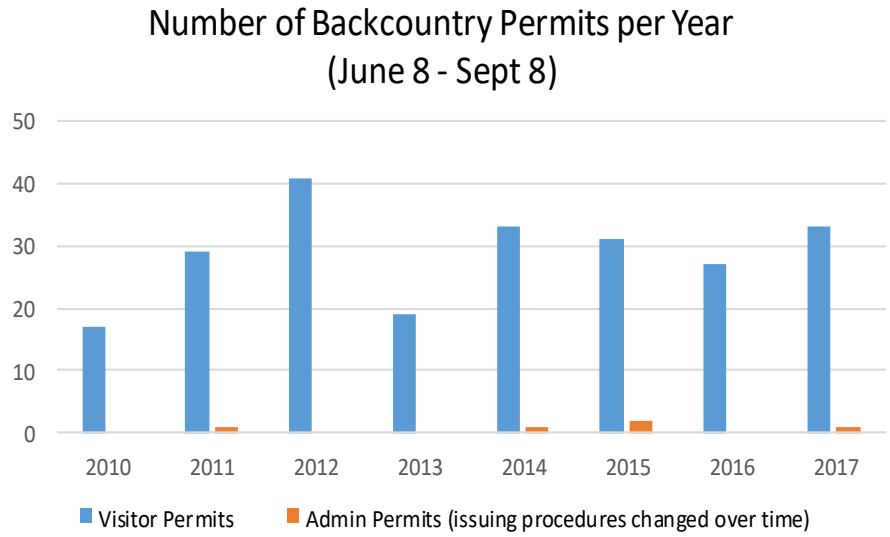
Eldorado Creek, looking south

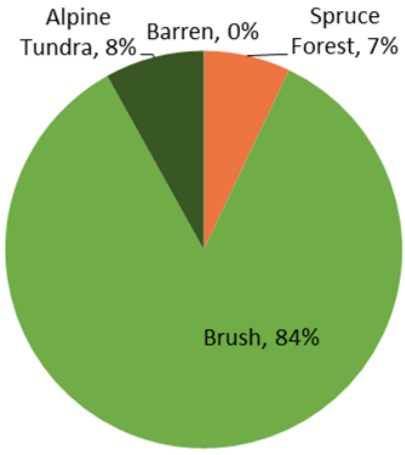


Park boundaries and Denali backcountry units: unit 43

Backcountry Permit Data:
Quota: 12
Percent visitors with bicycle: 3%

Unit Size: 32,687 acres





Broad vegetation class composition

Visitor Survey Data(2017-2018):
Backpackers (N=20)
Day hikers (N=35)
Pooled total (N=55)
Total recorded days (n=62)

Percent visitors on guided hike: 75%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **50% yes,** 50% no

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 18 (**Standard deviation: 17.8); range 2-100 people.

Backcountry indicators in Unit 43: Day hikers and backpackers recorded Backcountry Management Plan (BMP) indicators that were **within** standards for Mgmt. Area B. The exceptions were encounters with visitors, modern equipment and landscape modifications; these indicators **exceeded** BMP standards.

Backcountry Indicators in Unit 43: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/ human waste, and ability to camp out of sight and sound of others. The plots demonstrate that day hikers recorded higher daily encounters with visitors (as well as group encounters) with a median of 4 per day. 50% of day hiker total recorded encounters were above 4 per day. The median for encounters with landscape modifications was 1 (day hikers) or 3 (backpackers) per day, meaning 50% of visitor recorded encounters were above 1 or 3 per day, with outliers extending to 10 encounters per day.

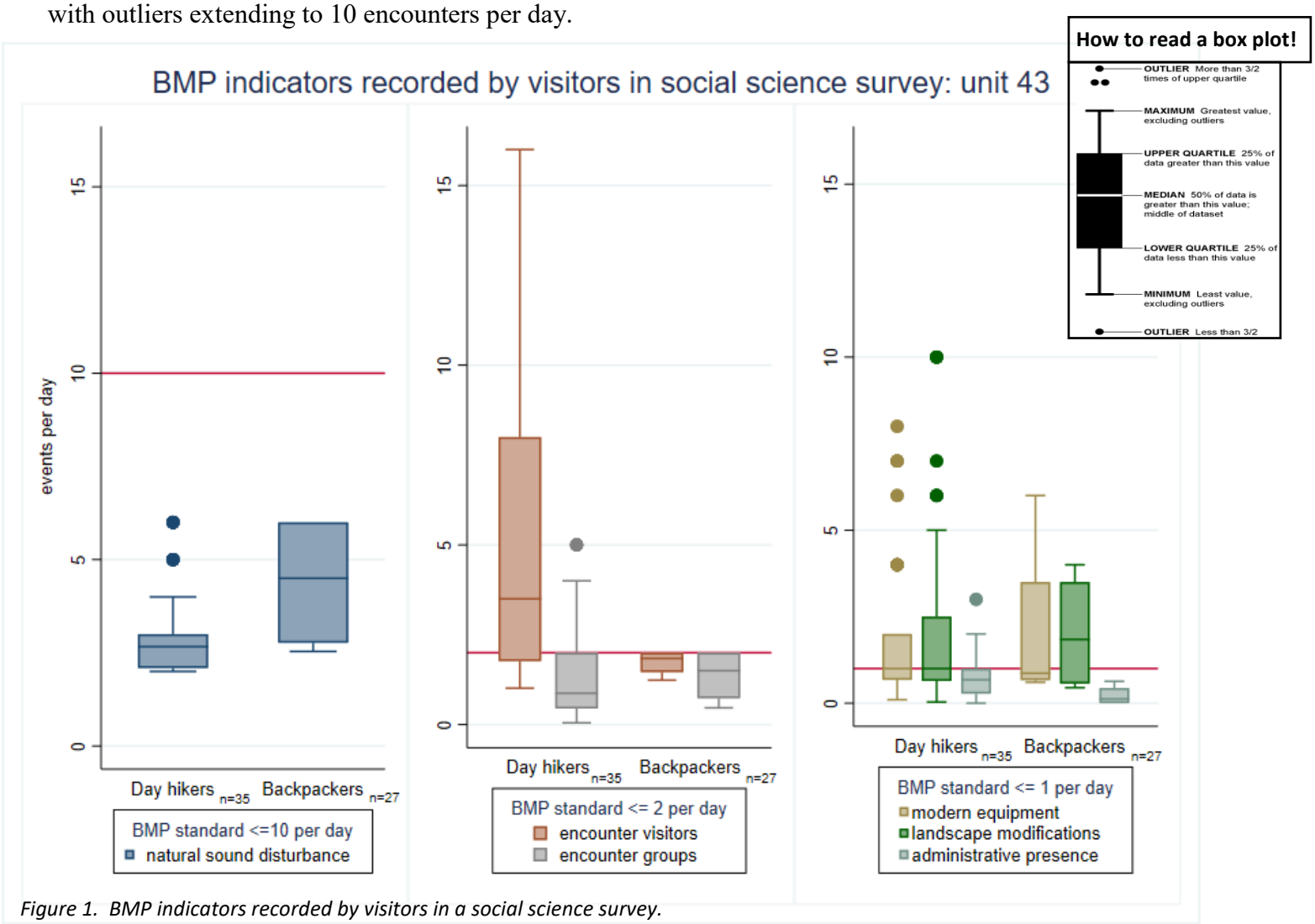


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers and backpackers had a similar range of observations. 50% of day hikers' observations are above 3.5 events per day, and 50% of backpackers' observations are above 4.5 events per day. The dots are outlier data points for BMP indicator events. 0% of observations exceeded BMP standard for Mgmt. Area B.

NPS sound monitoring program (2005-2018): No data: sound station was not deployed in this unit, and the backcountry patrol was less than 30 listening hours.

Camping Density: 100% of backpackers to unit 43 were able to camp away from others; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017) :

Total miles patrolled: 27

Average Miles: 4 miles/year

Average Visitors Encountered: 0/year Average Litter/Sanitation Encountered: 0/year

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 43. The mean of encounters with visitors is above the BMP standard of 2 events per day, but 60% of total days sampled in unit 43 were within the BMP standard (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2018: social science survey data

Indicator	**Mean daily events (2018) n = 62**	**Percent *days* in standard: 2018**	**State of Unit 43 in 2018**
Natural Sound Disturbance	6.82	79% in standard	
Encounter Visitors	3.81	60% in standard	
Encounter Groups	1.2	57% in standard	
Modern Equipment	1.79	45% in standard	
Landscape Modification	2.31	59% in standard	
Admin. Presence	.621	92% in standard	
Litter	0	100% in standard	

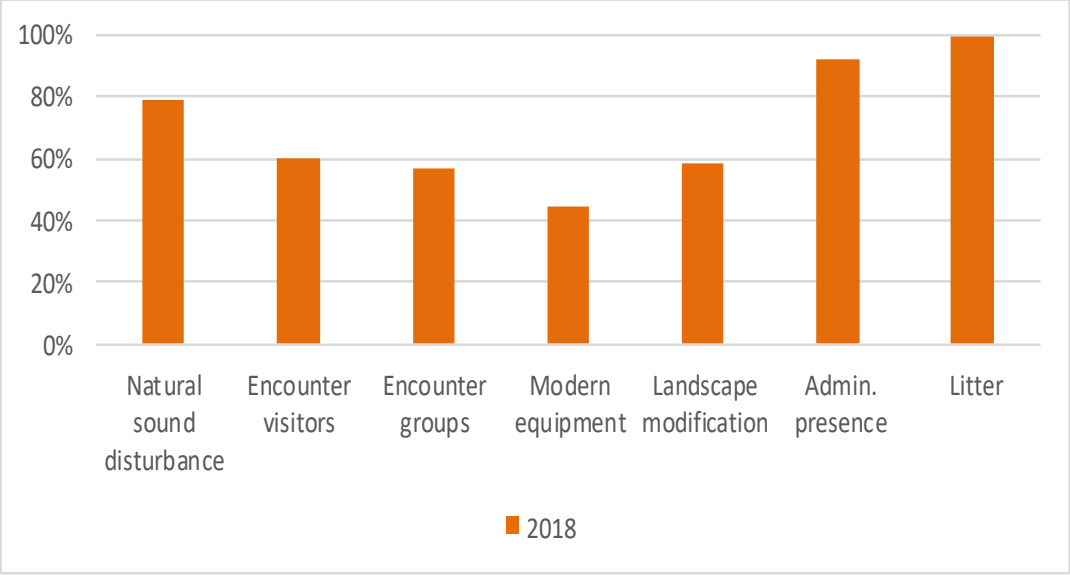


Figure 2. Percent sample days Unit 43 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for natural sound disturbance daily events above 5 per day; encounters with visitors, groups, and administrative presence above 2 per day. The indicators that visitors to unit 43 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 25% visitors to unit 43 found encounters with visitors to have a positive impact.

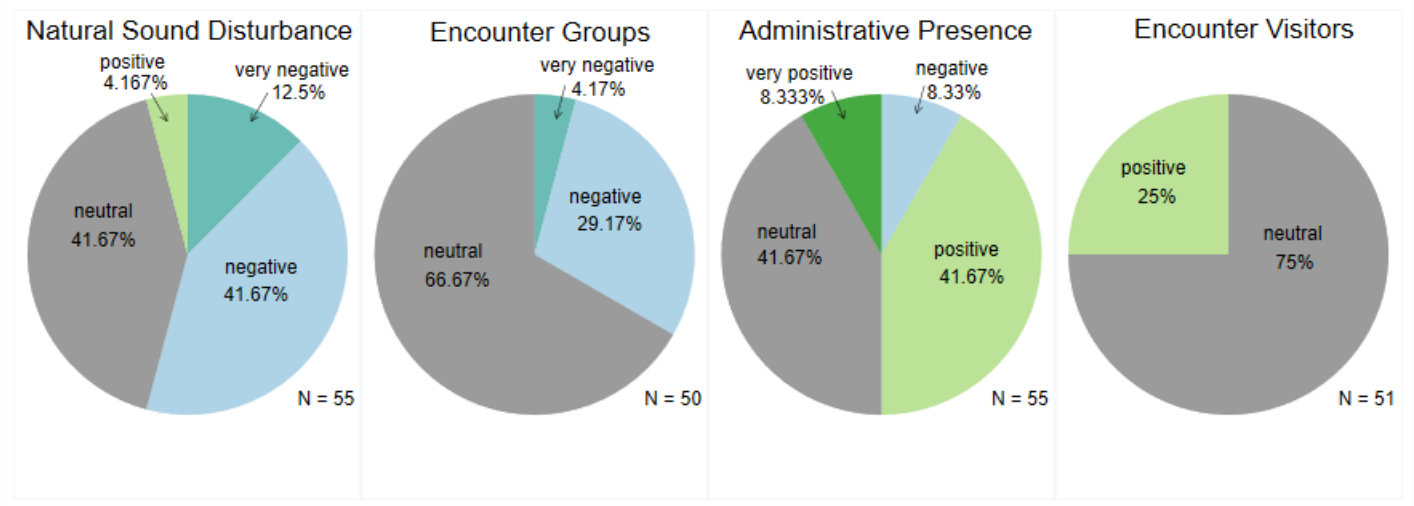


Figure 3. Positive or negative impact to visitor experience by BMP indicator

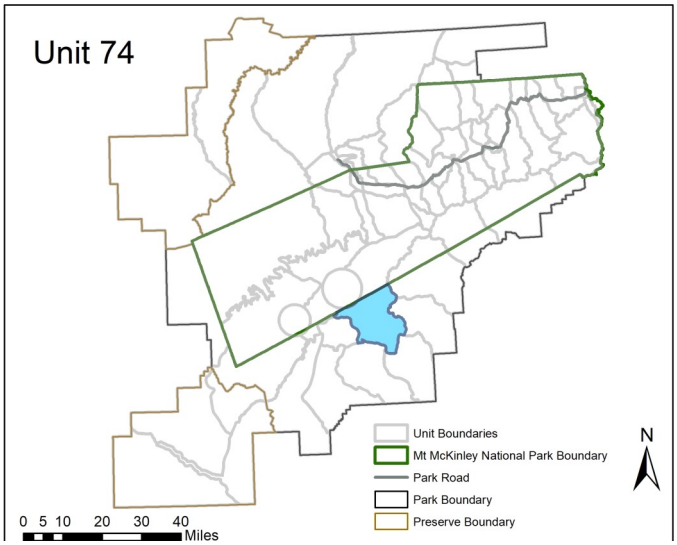
Backcountry Unit 74
"Upper Ruth"
Management Area A: Ruth/Backside Lake

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Backside Lake



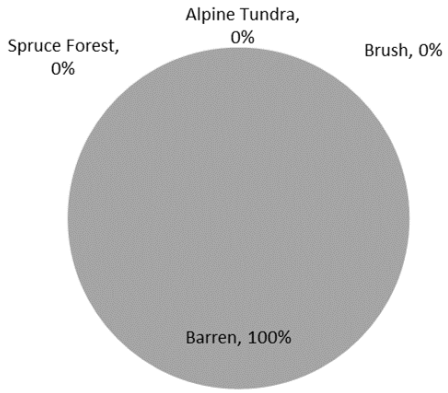
Park boundaries and Denali backcountry units: unit 74

Backcountry Permit Data:
Quota: unlimited—no permit required
Percent visitors with bicycle: 0%

Unit Size: 101,319 acres

Visitor Survey Data(2017-2018):
Backpackers (N=9)
Day hikers (N=4)
Pooled total (N=13)
Total recorded days (n=21)

Percent visitors on guided hike: 100%
Ability to camp out of sight/sound: 100% yes
Percent "visitor first choice" unit: **100% yes**



Broad vegetation class composition

Solitude Threshold: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" The pooled average was **18.6 (**Standard deviation: 7.8); range 8-31 people*.

Backcountry indicators in Unit 74: Day hikers and backpackers to unit 74 recorded Backcountry Management Plan (BMP) indicators that were **within** BMP standards for Mgmt. Area A. The exceptions were encounters with visitors, and modern equipment; these indicators **exceeded** BMP standards.

*two outliers of 250 people were removed for analysis

Backcountry Indicators in Unit 74: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/human waste, and ability to camp out of sight and sound of others. The plots demonstrate that backpackers recorded higher outlier visitor encounters, despite having a lower median than day hikers. Day hikers' recorded encounters were based on only four surveys, whereas backpackers had 15 observation days. Day hikers did record slightly higher encounters with modern equipment than backpackers.

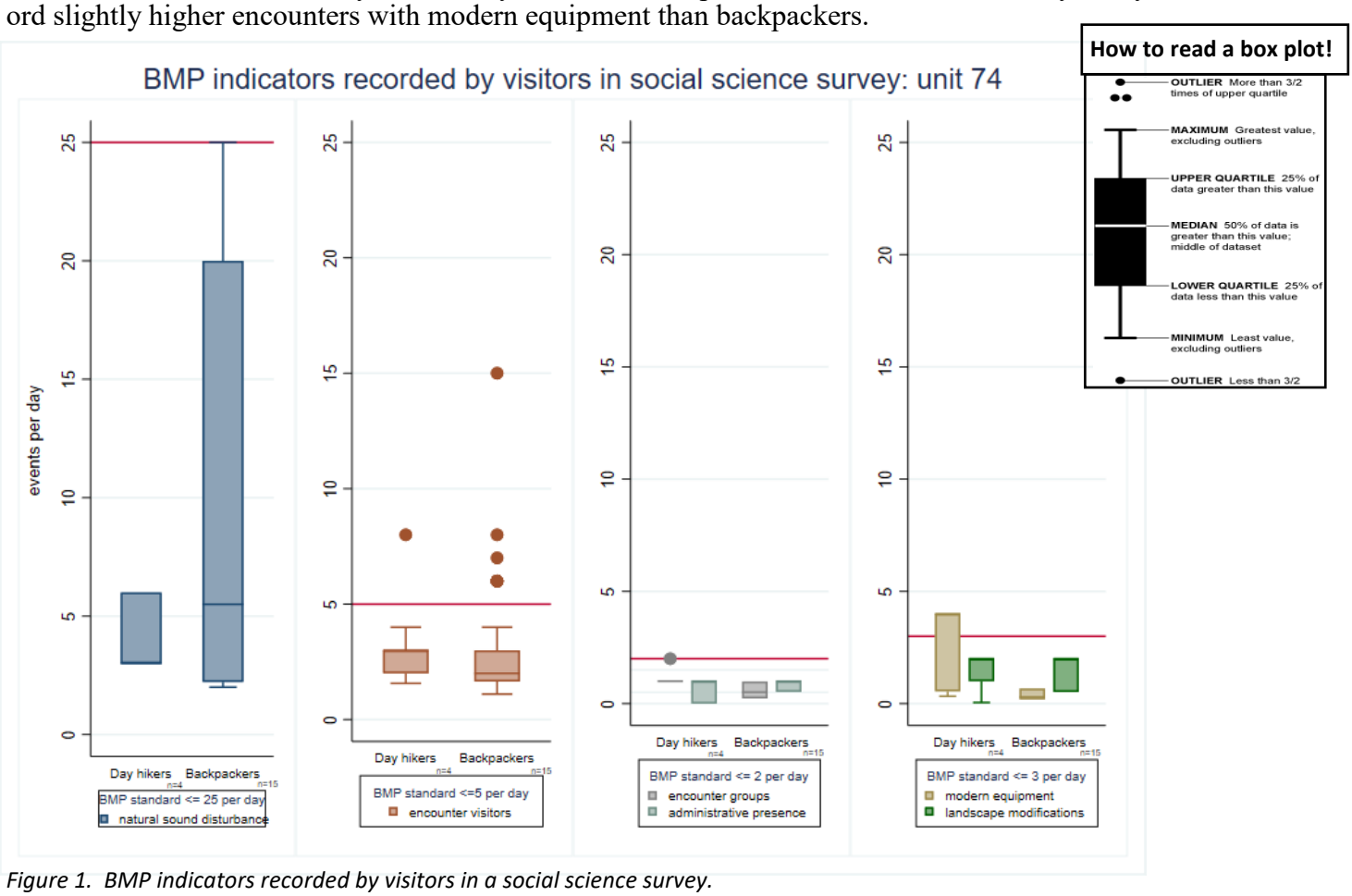


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, natural sound disturbance recorded by day hikers did not have a significant range of observations (n=4). The top 50% of backpackers' observations were above 5 events per day (the median), and had a much larger extreme event range compared to low event range. 0% of observations exceeded the BMP standard for Mgmt. Area A.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **1.9 events per hour** or 30 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 5.2 daily events (day hikers' observations were 100% between 4 & 5.5 per day). The sound station estimate of 30 is slightly higher than the max range recorded by backpackers. The lack of corroboration of NPS and visitor maximum range events suggests a daily average estimate of natural sound disturbance at least above 3 (min range) & below 25 (within visitor maximum range).

Camping Density: 100% of backpackers to unit 74 were able to camp away from others who were not part of their guided group; 100% wanted to camp away from others. This meets the standard of always being able to camp out of sight/sound of others.

NPS Data Collection and Administrative Presence (2011-2017):

Total miles patrolled: 58 (all in 2014 for monitoring)

Visitors Encountered in 2014: 54 Litter/Sanitation Encountered in 2014: 7

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 74. The mean of encounters with visitors is below the BMP standard of 5 events per day, but 20% of total days sampled in unit 74 had visitors recording more than 5 encounters per day (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2018: social science survey data

Indicator	**Mean daily events (2018) n = 21**	**Percent *days* in standard: 2018**	**State of Unit 74 in 2018**
Natural Sound Disturbance	7.91	98% in standard	
Encounter Visitors	2.51	80% in standard	
Encounter Groups	1.28	89% in standard	
Modern Equipment	2	80% in standard	
Landscape Modification	1.6	72% in standard	
Admin. Presence	.655	99% in standard	
Litter	.152	75% in standard	

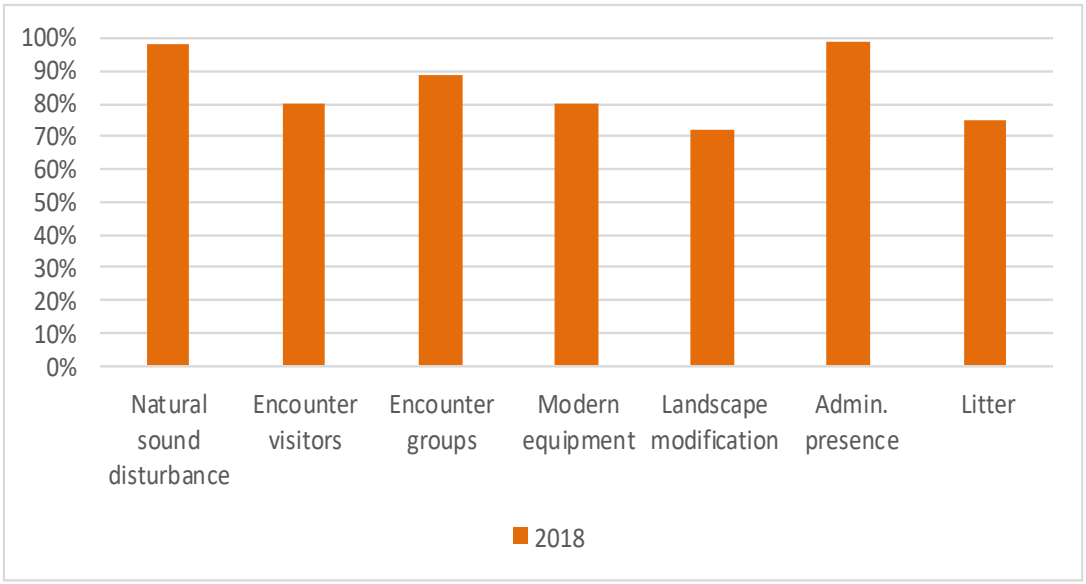


Figure 2. Percent sample days Unit 74 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for natural sound disturbance daily events above 5 per day; encounters with visitors, groups, and administrative presence above 2 per day. The indicators that visitors to unit 74 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 89% visitors to unit 74 found administrative presence was a positive impact.

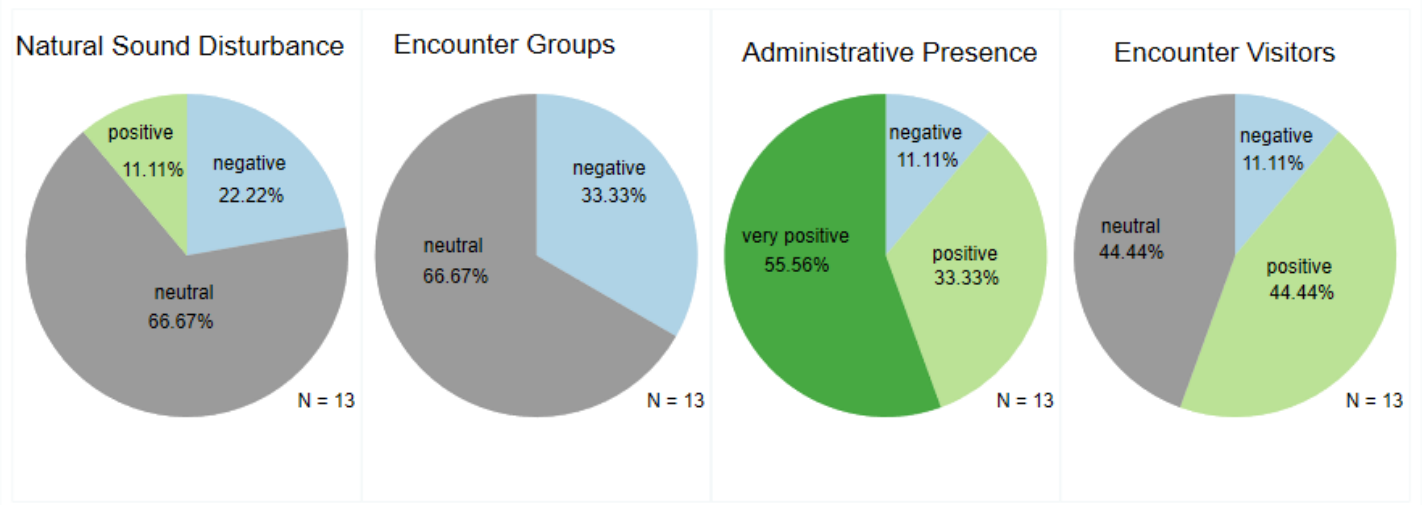


Figure 3. Positive or negative impact to visitor experience by BMP indicator

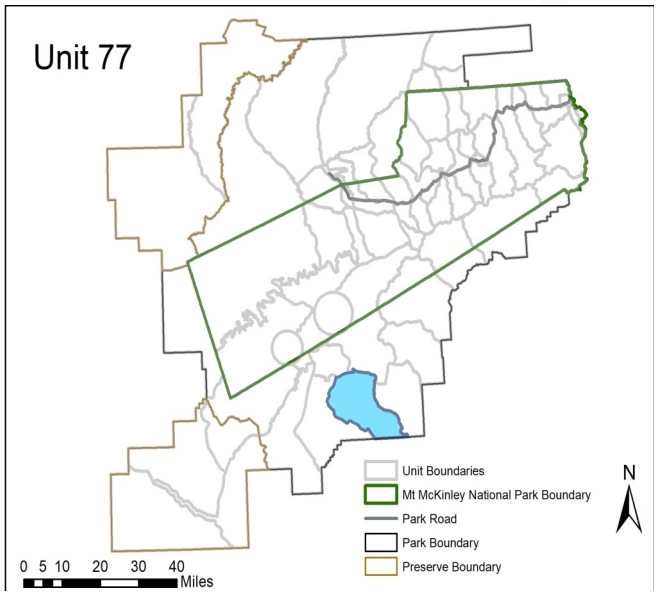
Backcountry Unit 77
"Tokositna Glacier"
Management Area A: Ruth/Backside Lake

National Park Service
U.S. Department of the Interior

Denali National Park and Preserve, Alaska



Tundra near Backside Lake



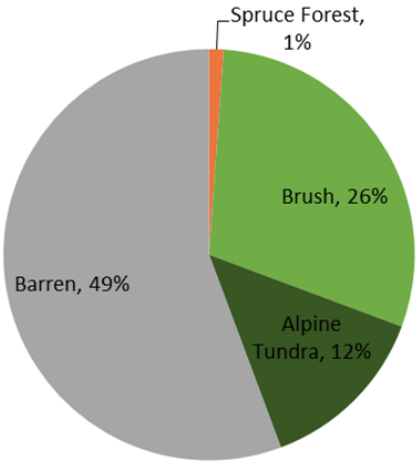
Park boundaries and Denali backcountry units: unit 77

<u>Backcountry Permit Data:</u>
Quota: unlimited—no permit required
Percent visitors with bicycle: 0%

<u>Visitor Survey Data (2017-2018):</u>
Backpackers (N=7)
Day hikers (N=3)
Pooled total (N=10)
Total recorded days (n=19)

Percent visitors on guided hike: 100%
Ability to camp out of sight/sound: no data
Percent "visitor first choice" unit: **100% yes**

<u>Unit Size</u>: 114,846 acres



Broad vegetation class composition

<u>Solitude Threshold</u>: Visitors were asked, "how many people could you meet a day and still feel that you attained solitude during your hike?" **The pooled average was 7.5 (**Standard deviation: 3.2); range 0-10 people.

<u>Backcountry indicators in Unit 74:</u> Backpackers to unit 77 recorded Backcountry Management Plan (BMP) indicators that were **within** standards for Mgmt. Area A. The only exceptions where distributions slightly **exceeded** BMP standards were encounters with modern equipment and landscape modifications.

Backcountry Indicators in Unit 77: Visitors recorded BMP indicators by tracking daily events. For each day of their backcountry trip, visitors reported: the number of natural sound disturbance events, encounters with visitors, large groups, modern equipment, landscape modifications, administrative presence (Figure 1), if they saw litter/ human waste, and ability to camp out of sight and sound of others. The plots demonstrate that all BMP indicator medians were below BMP standards. Day hikers did not provide any BMP indicator responses in the survey.

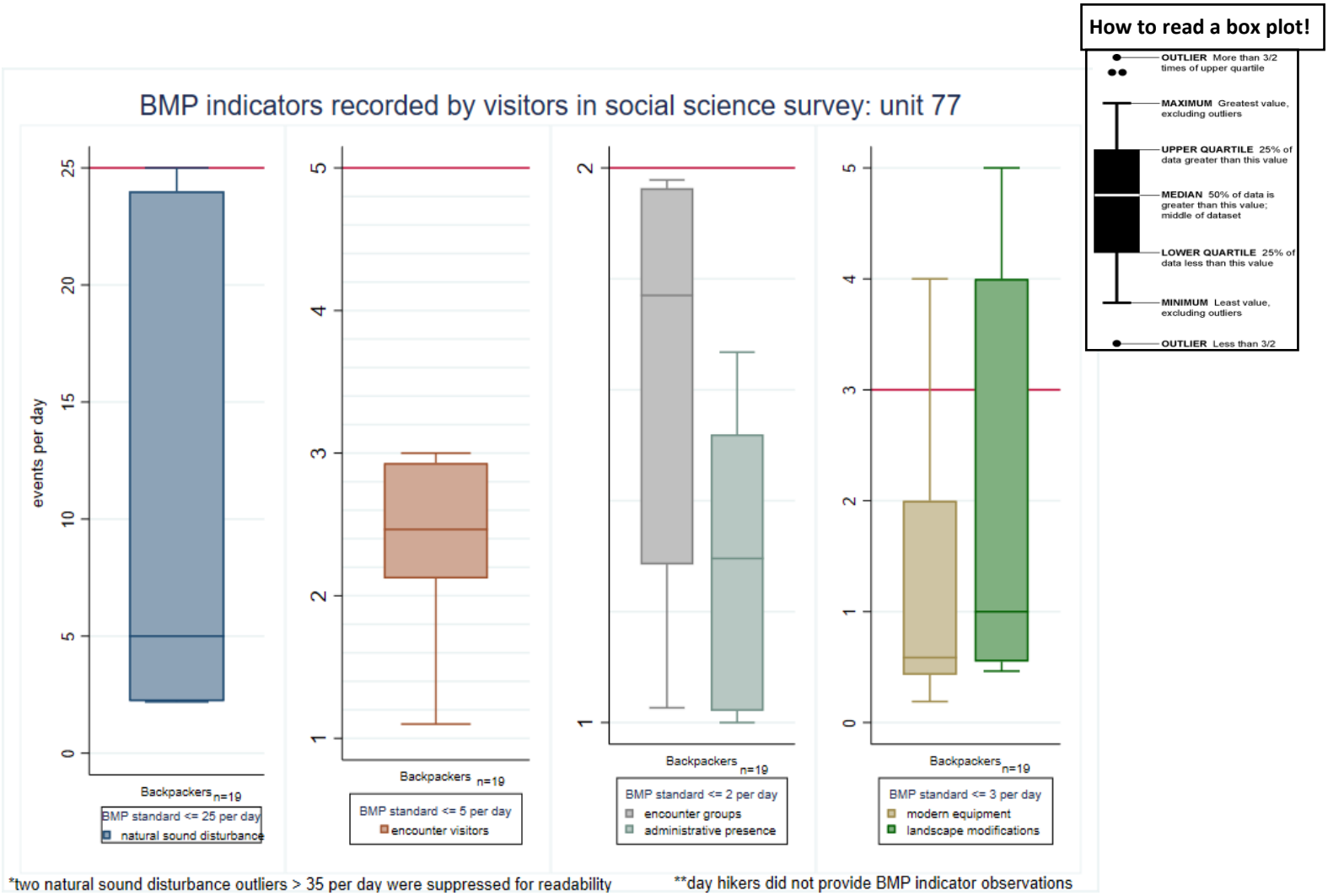


Figure 1. BMP indicators recorded by visitors in a social science survey.

Natural Sound disturbance: In the visitor survey, the top 50% of backpackers' observations were above 5 events per day, with a upper quartile range to 24 and a maximum range to 25 events per day. Two outlier events greater than 35 events per day were suppressed for readability of the plots. Other than the two outliers, backpacker observations did not exceed the BMP standard for Mgmt. Area A.

NPS sound monitoring program (2005-2018): The average natural sound disturbance events per hour recorded by sound station and backcountry ranger patrols is **.75 events per hour** or 12 events per defined backcountry visitor day (16 hours). The median visitors recorded for natural sound disturbance was 5 daily events The sound station estimate of 12 is well within the interquartile and max range recorded by backpackers. The corroboration of NPS

Camping Density: No data. Backpackers did not provide any responses to the question: "Were you able to camp out of sight/sound of others?" We cannot definitively say that the camping density standard is met for this unit.

NPS Data Collection and Administrative Presence (2011-2017):

Total miles patrolled: 33 (all in 2014 for monitoring)

Visitors Encountered in 2014: 2 Litter/Sanitation Encountered in 2014: 2

The BMP indicator mean levels show the average daily event a visitor experiences hiking in unit 77. The mean natural sound disturbance of 11.1 is below the BMP standard of 25 events per day, but 11% of total days sampled in unit 77 had visitors recording more than 25 encounters per day (Table 1, Figure 2).

Table 1. BMP indicator means and percent days in standard 2018: social science survey data

Indicator	**Mean daily events (2018) n = 19**	**Percent *days* in standard: 2018**	**State of Unit 77 in 2018**
Natural sound disturbance	11.1	89% in standard	
Encounter visitors	1.66	95% in standard	
Encounter groups	.54	99% in standard	
Modern equipment	1	98% in standard	
Landscape modification	1.75	75% in standard	
Admin. presence	.417	100% in standard	
Litter	0	100% in standard	

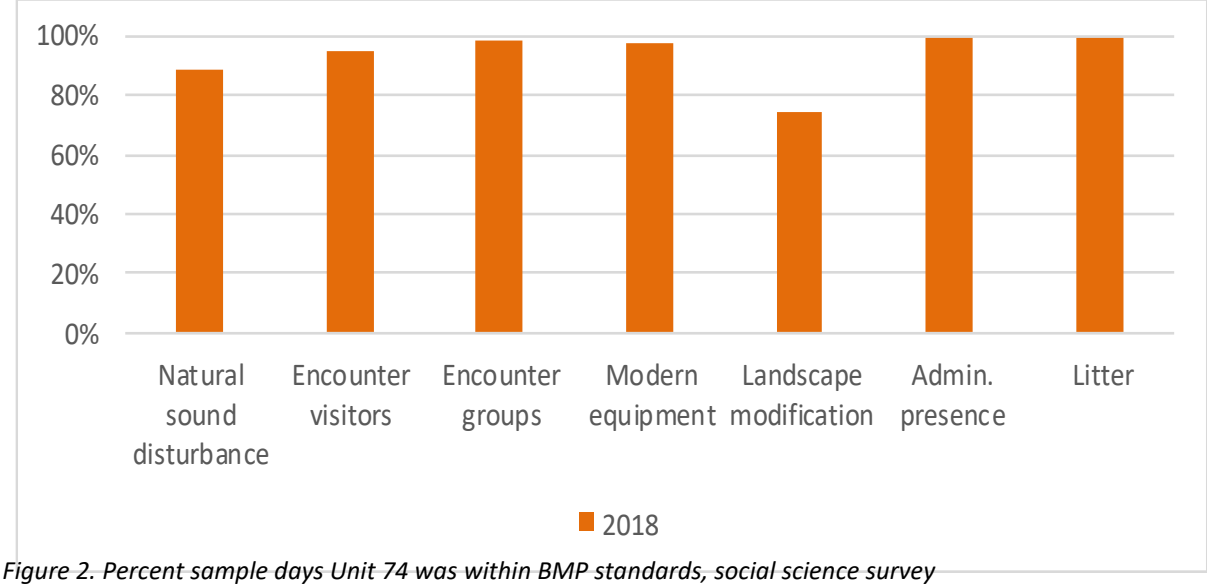


Figure 2. Percent sample days Unit 74 was within BMP standards, social science survey

Main Impacts to Visitor Experience: Visitors were asked to identify the degree of negative or positive impact on their experience (Figure 3) for natural sound disturbance daily events above 5 per day; encounters with visitors, groups, and administrative presence above 2 per day. The indicators that visitors to unit 74 stated were the most impactful on their experience were: natural sound disturbance, encountering visitors and groups, and administrative presence. 50% visitors to unit 77 found natural sound disturbance to be a positive impact.

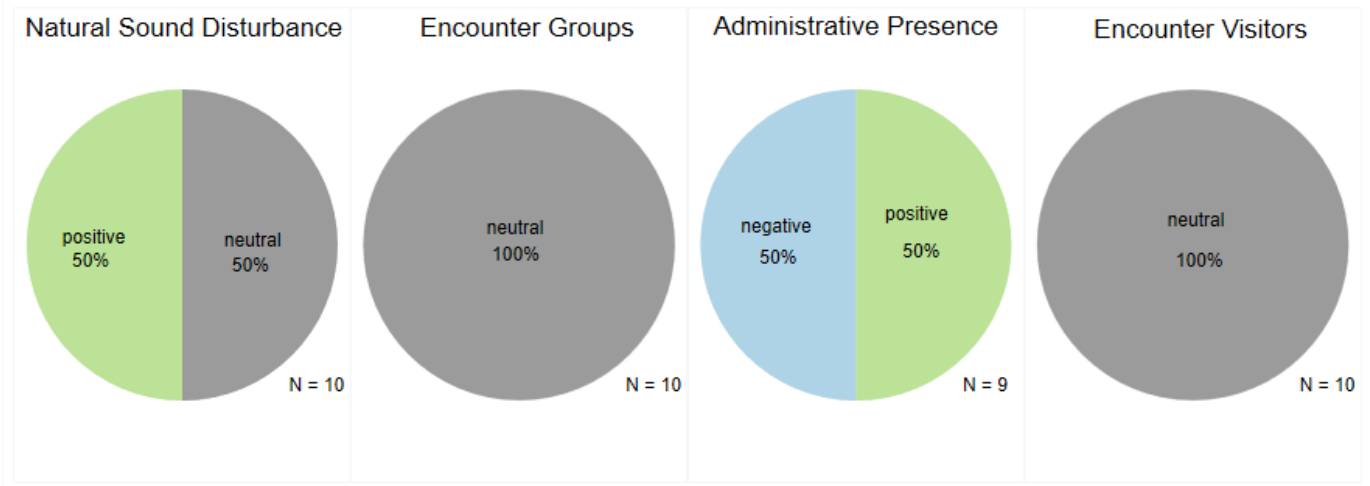


Figure 3. Positive or negative impact to visitor experience by BMP indicator