



Denali National Park and Preserve State of the Backcountry – 2012

Natural Resource Report NPS/DENA/NRR—2014/865





ON THIS PAGE

Stampede townships, September 2012

NPS Photo

ON THE COVER

Park Ranger Patrolling the Denali Wilderness, July 2012

NPS Photo

Denali National Park and Preserve State of the Backcountry – 2012

Natural Resource Report NPS/DENA/NRR—2014/865

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Denali Ranger and Volunteer monitoring northern Wilderness boundary, September 2012.
NPS Photo

October 2014

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Natural Resource Stewardship and Science
Fort Collins, Colorado

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Executive Summary

Denali National Park and Preserve (DNA) encompasses the heart of the Alaska Range in interior Alaska. It is home to North America's tallest mountain, extensive mountain glaciers, tight river canyons, broad braided river valleys, sweeping tundra, robust populations of Dall Sheep, moose, caribou, black and grizzly bear, lynx, and wolf, one of the oldest cultural histories documented in North America, and unique paleontological resources. In 1980, over 4 million acres were added to the Park through the passage of Alaska National Interest Land Conservation Act (ANILCA) bringing over 6 million acres of wild lands under protection to preserve extensive, unaltered ecosystems in their natural state. In addition, most of the original Park was designated as the Denali Wilderness adding 2,124,783 acres to the National Wilderness Preservation System.

The purpose of this report is to document the state of DNA's backcountry by summarizing implementation of the Backcountry Management Plan, wilderness character indicators, and other current and relevant data. Backcountry is defined as "all park and preserve lands, except the park road corridor and adjacent development zones and backcountry day use areas..." page iii of the DNA Backcountry Management Plan (National Park Service 2006).

The Denali Backcountry Management Plan (BCMP) ([link](#)) was completed in 2006 after a long and extensive National Environmental Policy Act Environmental Impact Statement process. The BCMP identifies indicators and sets standards for desired conditions in 12 different management zones with different levels of standards. These indicators and standards are specifically used to help protect the wilderness resource values throughout DNA's backcountry, both designated Wilderness and eligible wilderness. More information on Denali's indicators and standards can be found in Table 1 on page 32 of the summarized Backcountry Management Plan, [here](#). They were established prior to the current Wilderness Stewardship Framework, which is focused on assessing and protecting Wilderness Character. Wilderness Character is defined in the Wilderness Act as comprised of five qualities: natural, undeveloped, untrammeled, opportunities for solitude or primitive and unconfined recreation, and other features and values. The indicators and standards established in the BCMP focus on specific wilderness resource values which provide critical information on some of the conditions comprising of DNA's Wilderness Character. To effectively monitor all five qualities of wilderness, DNA's Wilderness Character monitoring program will incorporate additional indicators and standards. A first summary of DNA's Wilderness Character and associated indicators and standards can be found in Table 3 on page xiii.

Table 2 below is a summary of conditions using BCMP backcountry indicators with the most currently available data. Standards are expected to be achieved for 95% of all measurements or samples obtained through monitoring over the course of a visitor season.

Utilizing the new 'State of the Park' reporting process, DNA staff summarized the status and trends of wilderness stewardship and character as shown below in Table 3. The first section of this report explains the data and rationale used to produce the summary below.

Table 1. Key to status, trend, and confidence symbols.



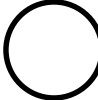






Condition Status		Trend in Condition		Confidence in Assessment	
	Resource is in Good Condition		Condition is Improving		High
	Warrants Moderate Concern		Condition is Unchanging		Medium
	Warrants Significant Concern		Condition is Deteriorating		Low

Table 2. Current status of backcountry indicators in Denali National Park and Preserve. See above for a key to the symbols used. Standards are expected to be achieved for 95% of all measurements or samples obtained through monitoring over the course of a visitor season.





BCMP Indicator Summary 			
Indicator	Status/ Trend	Rationale	Information Source
Natural sound disturbance		Levels of motorized noise vary substantially across the park, many areas of the backcountry are out of standard as identified in the BCMP. Voluntary best practices for air tour operators adopted in 2012 appear to help reduce overflight noise over some of the popular backpacking areas in the Denali Wilderness accessed off the Park Road (OP1).	Betchkal, 2013a&b; NPS unpublished data; Fix and Hatcher 2011; Denali Aircraft Overflights Advisory Council, 2012
Trail and campsite disturbance		Appropriate densities of social trails and campsites are known to exist in the Denali designated Wilderness (Old Park 1 management zone, (OP1)), and the rest of the park and preserve. Preliminary results show low to moderate growth of four informal trails in OP1 between 1997 and 2012. Monitoring for change in other management units has not been conducted.	NPS unpublished data
Evidence of modern human use		A survey of backcountry visitors in 2010 indicates 82% reported encounters with modern equipment within the standard. The net change in the number of installations parkwide has increased by 19 in the last 5 years.	Fix and Hatcher 2011; NPS unpublished data

Table 2. Current status of backcountry indicators in Denali National Park and Preserve. See above for a key to the symbols used. (continued)




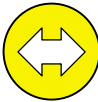


BCMP Indicator Summary			
Indicator	Status/Trend	Rationale	Information Source
Landscape modifications		All visible mitigations for visitor use such as constructed trails, route markers, signs, bridges, etc. are stipulated in management plans.	NPS unpublished data
Litter and human waste		The 2010 backcountry visitor survey reports that 11% of backcountry visitors encountered litter and/or human waste in the popular areas of Old Park 1 and 17% in Management Area B (Units 41 and 42). These are the areas commonly accessed from the Park Road. This is above the BCMP standard of 5% or less. Anecdotally identified sanitation problems on the West Buttress climbing route of Mt. McKinley has led to recent attention for fostering better sanitation practices including the use of the Clean Mountain Can. However the majority of human waste is still thrown in crevasses on this route.	Fix and Hatcher 2011; NPS unpublished data
Encounters with other people		A survey of backcountry hikers in 2010 indicates that 76% of visitors surveyed encountered 2 other hiking parties or less (the standard) in the popular areas of the east side of the Denali Wilderness. This sample is somewhat polluted by higher encounter rates along formal trails, which have a higher standard of 10. The majority of visitors on the popular Triple Lakes Trail likely encounter 10 parties or less (within the standard), however, through hiking parties may encounter more than 10 on a busy day. No data is available for other areas in the park and preserve.	Fix and Hatcher 2011; NPS unpublished data
Encounters with large groups		Encounters with large groups appears to be consistent with the desired conditions in the BCMP.	Fix and Hatcher 2011; NPS data
Camping density		A survey of backpackers in 2010 indicates that 94% of those surveyed were able to camp out of sight and sound of other backpackers in the popular areas accessed from the Park Road (OP1 and part of B). No data is available for other areas in the park and preserve but are likely consistent with levels desired in the BCMP.	Fix and Hatcher 2011

Table 2. Current status of backcountry indicators in Denali National Park and Preserve. See above for a key to the symbols used. (continued)




BCMP Indicator Summary 			
Indicator	Status/ Trend	Rationale	Information Source
Management presence		From the 2010 survey of backcountry hikers, encounters with rangers, other park staff, or researchers is very low. No data is available from other areas of the park and preserve but likely consistent with levels desired in the BCMP.	Fix and Hatcher 2011
Wildlife population, demographics and distribution		Denali’s fauna remain relatively unchanged compared to their population status prior to the Euro-American occupation of Alaska. Predator-prey interactions continue with minimal human influence. However, recent changes in regulations on adjacent lands, which allow more harvest (i.e., trapping, killing), may influence the local population dynamics of those resident species that cross outside park boundaries. Park effort to document changes in species populations varies significantly across species. Ten common songbird species, several small mammal species, moose, and Dall’s sheep have stable populations over the last five years. Grizzly bear trend based on vital rates indicates an annual decline of 0.37%. Caribou herd size has increased to an estimate of 2,300 in 2012. Density of wolves in fall 2012 was at a 25-year low. All measures of Golden Eagle reproductive success have declined since 1988; from 2008 to 2012, the rate of egg-laying continued to decline and included some of the lowest rates since the start of the study. Trumpeter Swans have increased in abundance and distribution since 1975, but the increase has slowed since 2005.	Denali State of the Park Report 2013

Table 3(a). Denali National Park and Preserve - Wilderness stewardship in State of the Park Report.





Wilderness Stewardship		
Actions and Practices	Condition Status/Trend	Rationale
Information		Informational support for wilderness stewardship as of 2012 included having available a compilation of legislative direction and history, science-based information, and policy support from park management.
Plans		Implementation of the Backcountry Management Plan (BCMP) will gain momentum in 2013 now that staffing changes have stabilized. There is a staff dedicated to wilderness stewardship. A robust wilderness monitoring program is in place—gaining support both internally and with park partners. This program includes monitoring of soundscapes, aircraft overflights, wildlife and natural conditions, the number and type of installations, social trails, encounter rates with other hikers or backpackers, and other indicators of visitor experience in the backcountry. The Wilderness Character Mapping Project (to be completed in 2013) and associated training were built from the foundation of the BMP.
Training		Key staff completed trainings in 2012 through the Arthur Carhart Wilderness Training Center. A wilderness workshop for all park staff was conducted in April 2013 to enhance wilderness knowledge and stewardship by both new and long-time park employees.

Table 3(b). Denali National Park and Preserve - Wilderness character in State of the Park Report.



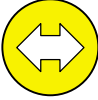

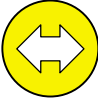


Wilderness Character 		
Quality	Condition Status/Trend	Rationale
Natural		Most ecosystem components including populations of plant and animal species are healthy. The effects of climate change are of concern for glaciers, permafrost, and other ecosystem components. Wolf population size has decreased while predator control pressures have increased adjacent to the park.
Undeveloped		Installations (e.g., plot markers, weather stations) and new trails in Wilderness have complied with NEPA requirements and minimum requirements analysis. However, the net number of installations has increased in the last five years and more installations for scientific and administrative use are planned. The amount of aircraft use for park administration is stable; however there have been efforts to reduce impacts over designated Wilderness. Anecdotal evidence of illegal snowmachine incursions into the Denali Wilderness is cause for concern.
Untrammeled		The amount of poaching and illegal taking of other park resources is likely stable at low levels. Human-wildlife incidents are few and minor (except for a bear-related fatality in 2012). Radio-collared animals are captured in a humane way—the collaring of wildlife allows park managers to be better stewards from the knowledge gained. Two small human-caused fires were suppressed in the last five years.
Solitude or Primitive and Unconfined Recreation		Visitors have the outstanding opportunity to experience <i>solitude or primitive and unconfined recreation</i> (SPUR) in millions of acres of wilderness. Wilderness zones range from having a small quota of visitors per night to having no quota. Access to areas is as easy or difficult as the visitor desires. Numbers of aircraft overflights have remained about the same, however visitors in wilderness continue to experience visual and sound impacts of these overflights. Opportunities for solitude are fewer in popular areas for day users along the park road, for climbers along on the West Buttress route, and for visitors at air tour/taxi landing portals.

Table 3(b). Denali National Park and Preserve - Wilderness character in State of the Park Report (continued).

Wilderness Character		
Other Features and Values		<p>Since the discovery of the first dinosaur track fossil in 2005, hundreds of sites with thousands of trace fossils have been found, with new fossils found every year. A park-wide inventory of paleontological resources is underway, and known sites that are at-risk or significant are monitored every other year.</p> <p>Cultural resources are recognized as part of the fabric of wilderness in Denali. Less than one percent of the park has been surveyed for prehistoric or historic resources. Of what is known there is a rich prehistoric and historic record, not all of which is adequately documented. Multiple studies have been conducted in cultural anthropology in the northwest area of the park, but little work has been conducted elsewhere.</p>

Acknowledgements

A special thanks is extended to all park staff and others for their significant contributions to this report. It was possible only because of the strong sense of community reflective of a truly committed staff. Specific thanks go to Philip Hooge, Elwood Lynn, Pete Webster, Dave Schirokauer, Jon Paynter, Dan Ostrowski, Marisa James, Martha Armington, Missy Smothers, Elizabeth Beavers, Davyd Betchkal, Britta Schroeder, Alzono Mandanna, Alison Carlyle, Andrew Ackerman, Brian Napier, Kristin Pace, Sam Hooper, Jess Toubman, Denny Capps, Amy Craver, Pheobe Gilbert, Larry Weddle, and many others. This document has the benefit of the ground breaking work of Joe Van Horn, retired DENA Wilderness Coordinator. Without his dedication to Denali this report would have been impossible. Thanks also to the Denali Citizen's Council for their thoughtful review of a near final draft of the document. Finally, this document was possible due to the support of the Denali National Park and Preserve Leadership Team (DLT). Thank you all for you contributions and support.

Introduction

Denali National Park and Preserve (DNA) encompasses the heart of the Alaska Range in interior Alaska (Figure 1). It is home to North America's tallest mountain, extensive alpine glaciers contributing to valley glaciers creating long rivers of ice, tight river canyons, broad braided river valleys, lush forests, sweeping tundra, widely dispersed wetlands and permafrost, robust populations of Dall sheep, moose, caribou, black and grizzly bear, lynx, wolf, one of the longest cultural histories documented in North America, and unique paleontological resources. The east-west trending crest of the Alaska Range creates a dramatic climate gradient with a relatively dry subarctic interior type climate on the north side and a wetter, more moderate maritime influence on the south side.

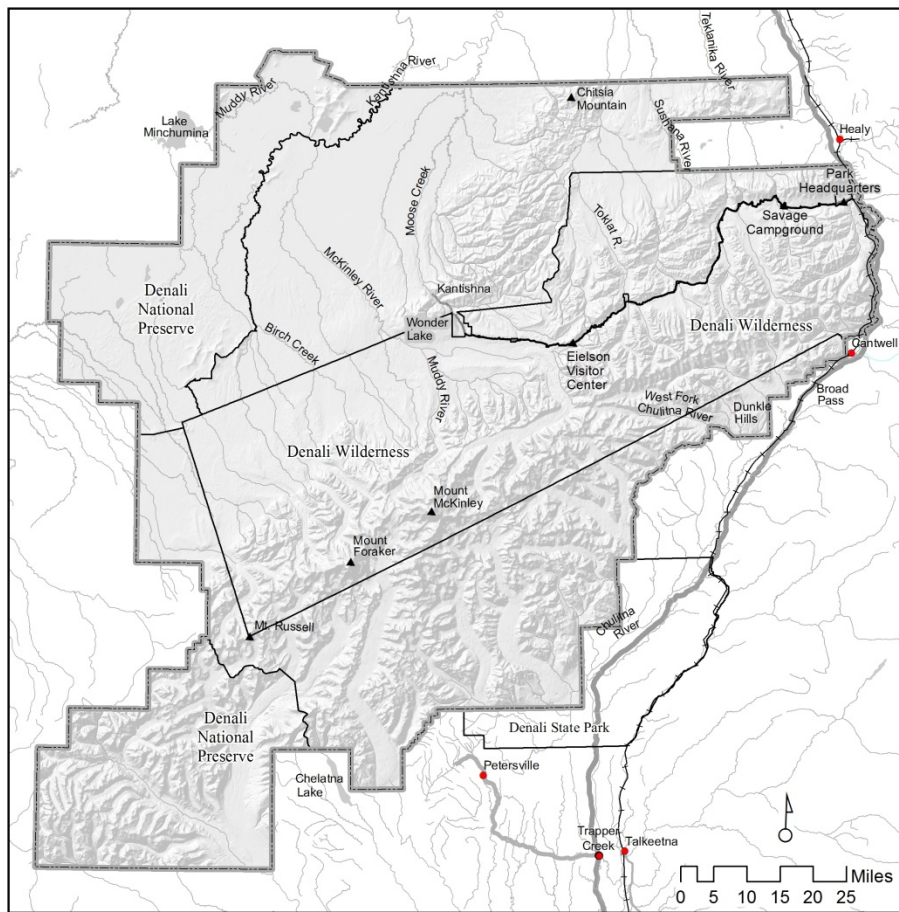


Figure 1. Denali National Park and Preserve.

Since 1917, these federal lands have been managed and expanded for their natural wild condition. The original Congressional purpose for Mount McKinley National Park was as a game refuge and for the benefit and enjoyment of the people. Since then, repeatedly, Park management has emphasized the importance of preserving natural intact ecosystems, abundant wildlife, scenic, and recreational values. These values are derived from the wild nature of these special places and protected by

National Park Service (NPS) policy, regulations and even more specifically, Wilderness designation by the US Congress. In 1980, under passage of the Alaska National Interest Lands Conservation Act (ANILCA), over 6 million acres of wild lands were brought under protection to preserve extensive, unaltered ecosystems in their natural state. One of the purposes of ANILCA as stated in Section 101, is to preserve nationally significant “wilderness” values. In Section 202(3)(a) ANILCA states a fundamental purpose of the Denali National Park and Preserve additions “to provide continued opportunities, including reasonable access, for ... wilderness recreational activities.” ANILCA designated 99% of the ‘Old Park’ as Wilderness, the most protected level of Federal conservation lands and provided legal parameters by which the National Park Service would manage those lands. This added 2,124,783 acres to the National Wilderness Preservation System. A large majority of the additional lands added as park and preserve are considered eligible to be designated Wilderness as documented in the DENA ANILCA Wilderness Recommendations EIS (NPS 1987).

For the purposes of this document the term ‘backcountry’ refers to “all park and preserve lands, except the park road corridor and adjacent development zones and backcountry day use areas...” (page iii DENA Backcountry Management Plan (BCMP) (NPS 2006)). This can be restated to mean all areas other than the Denali Road corridor and frontcountry areas will be managed to protect the wilderness character of DENA (all green areas in Figure 2).

Denali National Park and Preserve mission statement is to, “...protect intact, the globally significant Denali ecosystems, including their cultural, aesthetic, and wilderness values, and ensure opportunities for inspiration, education, research, recreation, and subsistence for this and future generation.” (Denali National Park and Preserve Foundation Statement, 2014)

The purpose of this report is to document the state of DENA’s backcountry by summarizing Backcountry Management Plan and wilderness character indicators and presenting related data and information. This report supplements the short summary on wilderness character as reported in National Park Service, State of the Park Report for Denali National Park and Preserve. (Denali National Park and Preserve, in process).

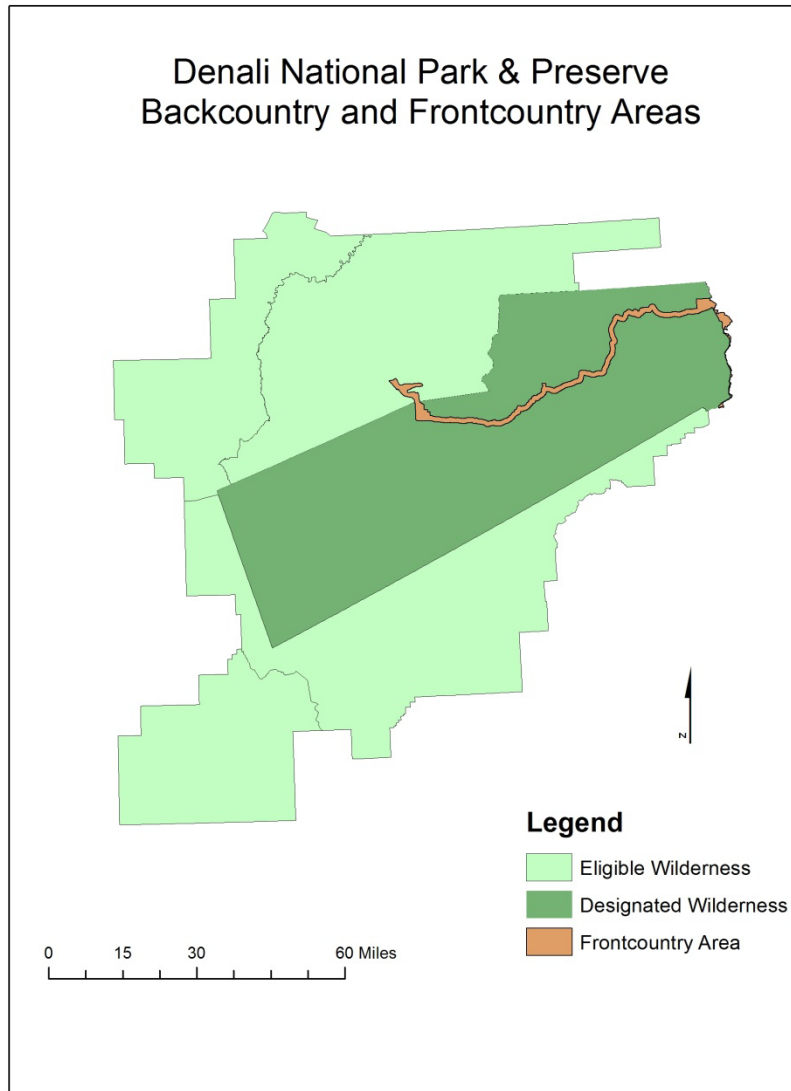


Figure 2. Backcountry (green) and frontcountry (brown) areas of DENA.

This report will be prepared periodically by the DENA Wilderness Coordinator in close cooperation with Resource Management, Facilities Management, Interpretation, and other Park staff. This year's report is intended to meet the following objectives:

- Summarize current conditions, including use levels, management activities, resource inventory and monitoring efforts and results, condition of backcountry facilities, and backcountry management accomplishments for the calendar year 2012.
- Provide a status report on the implementation and use of the Denali National Park and Preserve Backcountry Management Plan
- Document the wilderness character of the backcountry and any apparent trends.

A separate companion document will put forth recommendations for future management actions through analysis of annual and historic data.

Backcountry Management Plan Implementation Summary

Denali Aircraft Overflights Advisory Council

The Denali Aircraft Overflights Advisory Council, a FACA (Federal Advisory Committee Act) chartered group, was established in 2007 with the task of advising the Denali Superintendent and management team on how to mitigate the impacts on the park from aircraft overflights. The Council is comprised of representatives from various user groups including air taxi operators, aviation interest groups, and backcountry and wilderness advocates. Collected and interpreted acoustic data are typically presented to the council on a biannual basis for use in making informed recommendations.

In April of 2012, the council made its most current recommendation, Air Tour Operator Aviation Best Practices (available online [here](#)). The intention of these recommendations is to improve opportunities for solitude in popular backpacking areas of Denali's designated Wilderness. They recommended that aviators adopt certain practices when flying in the area between the park road and the spine of the Alaska Range, which has the highest protection in the Denali Backcountry Management Plan, is frequently used by backpackers, and a high level of expectation for solitude. On a voluntary basis, aviators were asked to maintain a minimum altitude of 8,000 feet above mean sea level in the area, and to utilize the lowest possible power settings. They were also asked, when weather conditions allowed, to completely avoid flying in the area directly over the spine of the range. See below for a summary based on monitoring and evaluating the avoidance area.

Wilderness Character Mapping Project

In an effort to understand and document the current condition of the Denali Wilderness, park staff have been working on a wilderness character map with Peter Landres and James Tricker of the Aldo Leopold Wilderness Research Institute. This model utilizes geographic information system (GIS) layers to graphically represent each of the five qualities from the wilderness character framework for monitoring (Landres et al. 2008). The five qualities are; untrammeled, natural, undeveloped, solitude or a primitive and unconfined type of recreation, and other features. The goal of this project is more clearly understand the current conditions, to act as a tool in the evaluation of future projects, and find ways to mitigate impacts to and preserve DENA's wilderness character.

Indicator Monitoring

The BCMP specifies indicators to track visitor experience and resource conditions through monitoring. Indicators are selected to represent those resources and conditions that are allowed to change until they approach the quantitative thresholds and include the following:

Resource Conditions

- Trail and campsite disturbance
- Evidence of modern human use*
- Landscape modifications*
- Litter and human waste*
- Natural sound disturbance
- Wildlife populations, demographics, and distribution

Social Conditions

- Encounters with other people*
- Encounters with large groups*
- Camping Density*
- Accessibility
- Management presence*

The indicators are monitored by periodic data collection by NPS staff and/or visitor survey at least every 5 years. The indicators identified with * are recommended by the BCMP to be included in the visitor survey. Standards for the indicators depend on the purpose of each management area, those details are not included here but there is an excellent set of tables beginning on p.32 of the consolidated Backcountry Management Plan, [here](#). Standards relative to each indicator and management area are discussed in the indicator summaries below. According to the BCMP, to achieve the standard would require “95% of all measurements or samples obtained through monitoring over the course of a visitor season (e.g. May to September for summer, February to April for late winter activities).”

The first visitor survey was conducted in 2010 with a cooperative agreement with Peter Fix at the University of Alaska Fairbanks (Fix and Hatcher 2011), 446 day hikers and 191 backpackers replied to surveys customized for each type of trip and focused on the portion of the Denali Wilderness that sees the most backpacking and day hiking use (Old Park 1 (OP1) management area). This portion of the wilderness requires backcountry permits to camp overnight in backcountry units that have limits or quotas to the number of people staying overnight, these are Units 1-43 (except 22). The summary tables below from the 2010 visitor survey refer to the backcountry units shown in Figure 3.

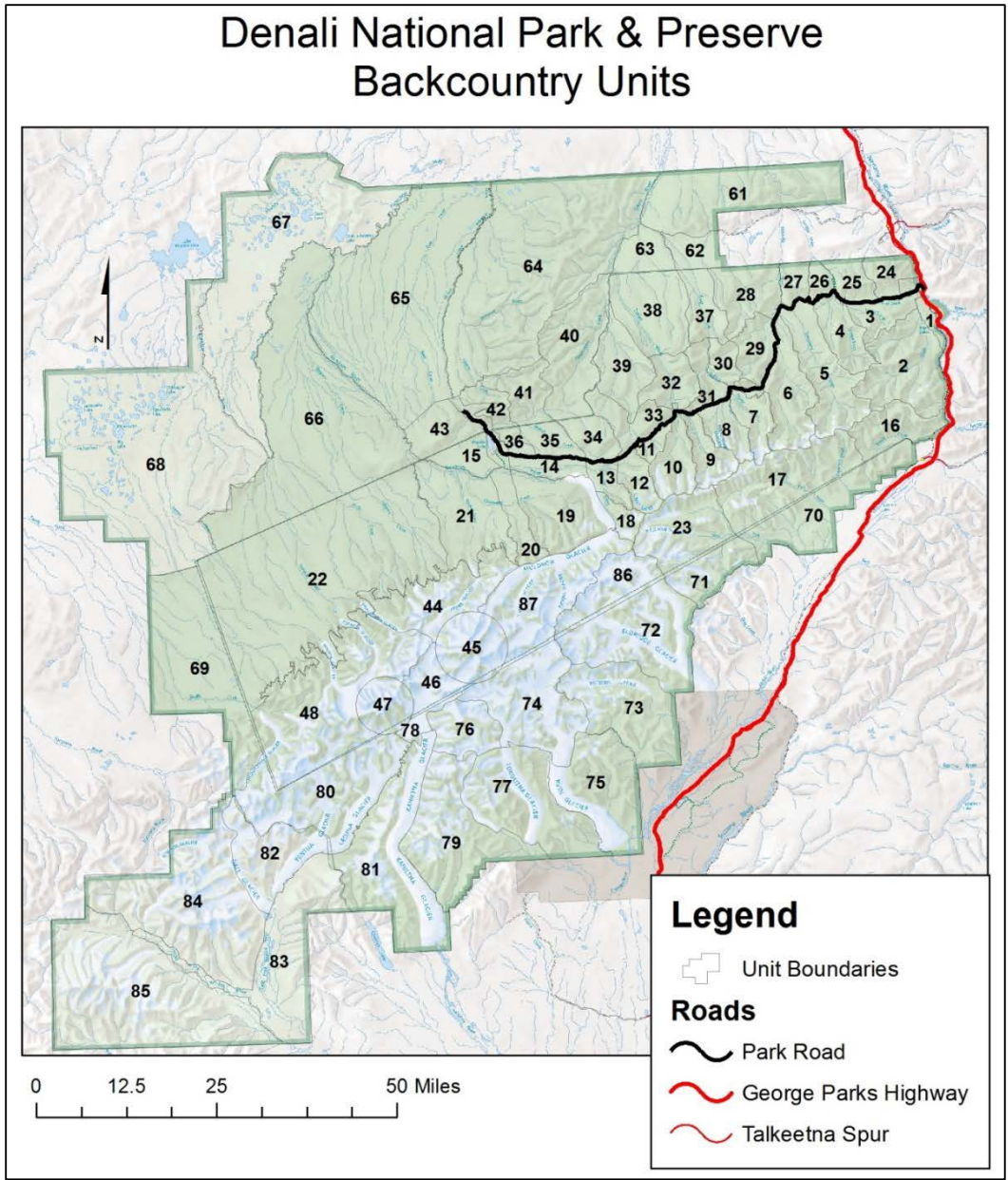


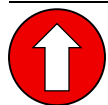
Figure 3. Denali National Park and Preserve backcountry units.

Backcountry Observation Database Summary

In 2012, an effort was being made to improve the usefulness of the Backcountry Observations Database (BOD). The BOD is a collection of observations of human impacts recorded during backcountry patrols. The 2013 summer season will see the continued collection of data to enter into the BOD and analysis of the data with respect to the BCMP indicators.

Natural Sound Disturbance

Summary



Levels of motorized noise vary substantially across the park; many areas of the backcountry are out of standard as identified in the BCMP. Three sources of information corroborate the condition of the natural soundscape: 1) In 2010 a survey of backcountry visitors about their day hiking and backpacking trips in the popular areas accessed off of the Denali Park Road (Fix and Hatcher 2011); 2) the soundscape inventory and monitoring program which uses temporarily installed automated sound monitoring stations to continuously record sound for a few weeks at a time. Over a ten-year period, stations are being placed at six new locations each year on a 10x10 km grid of 60 points spread evenly throughout the park, In addition every year a few other stations are placed in areas of management interest (Betchkal, 2013a&b); 3) Park staff record aircraft overflight noise dose data while hiking in the backcountry. For a more detailed explanation of methods and results see the sections below.

Voluntary best practices for air tour operators adopted in 2012 appear to help reduce overflight noise over some of the popular backpacking areas in the Denali Wilderness accessed off the Park Road (OP1), but overall these areas are still out of standard.

Survey of Backcountry Visitors

Denali's Backcountry Management Plan specifies that certain indicators can be monitored every five years by visitor survey. While natural sound disturbance is not required for this survey, it was included. Both day hikers and backpackers were asked the same questions with regards to their experience with motorized sound while in the backcountry:

A. Motorized sound _____#

What percent of your time in the backcountry did you hear motorized sound?

Please check one: ___0-24% ___25-49% ___50-74% ___75-100%

For brevity only the results of the number of encounters is presented here (Table 4). For a more detailed explanation and analysis see the report by Fix and Hatcher (2011). The standard for the Old Park 1(OP1) management area is a maximum of 2 events of motorized sound per day. The standard for the B management area is a maximum of 10 events/day. Table 4 shows the percentage of respondents that replied to be within the standard. Results by unit were restricted to those with 10 or greater responding to the question (n). According to the BCMP, to meet the standard would require that 95% of all respondents indicate they experienced conditions within the standard. While all

Table 4. Natural sound disturbance data from the 2010 visitor survey.

Unit	n	% in standard Dose of daily Motorized Sound events
4	18	44
5	20	10
6	78	18
7	18	22
8	27	30
9	56	38
10	56	32
11	46	48
12	81	48
13	39	31
15	10	60
18	24	58
24	31	35
25	42	64
26	25	48
28	10	60
29	34	41
31	49	49
32	42	52
33	95	55
34	33	55
39	16	69
OP1	906	59
B	11	73

backcountry units are substantially out of standard, with a range of 10% to 73% (in red in Table 4), there is some uncertainty as to whether respondents indicated individual motorized sources (i.e. separate aircraft) or a single events which could include noise from multiple aircraft linked together in the same time period. However, this issue is unlikely to move many results in or out of standard.

Soundscape Inventory and Monitoring Program

Soundscape research and monitoring has been underway at Denali since 2001. Natural and human-generated sounds are systematically inventoried across the entire landscape of the park, including popular backpacking areas, Mt. McKinley climbing routes, and along the park road. From the 18000+ hours of digital recordings and sound levels that have been documented, park staff can estimate the condition of the soundscape with respect to the 2006 Backcountry Management Plan indicators: (1) the number of times per day that motorized sounds are audible (events per day); (2) the maximum percentage of time per hour that motorized sounds are audible (percent time audible (PTA)); and a (3) the maximum loudness (calibrated sound pressure level (SPL) in decibels (dBA)) of noise events. The sound-level data are used to compare the levels of human-made sounds to the natural ambient levels. Sound data are also converted into a visual representation - or spectrogram - from which a trained technician can identify aircraft overflights. Each aircraft is categorized by propulsion type (propeller plane, jet plane, or helicopter) for further understanding of daily traffic patterns.

More information on Denali's Soundscape indicators and standards can be found in Table 1 on page 32 of the summarized Backcountry Management Plan, [here](#).

Soundscape staff implemented the seventh season of a systematic sampling plan in 2012, deploying seven automated sound monitoring stations and rotating them across 11 locations. These locations were: three winter-season sites, 6 Central Alaska Network (CAKN) Inventory & Monitoring Program grid points, and 2 locations to monitor the 2012 voluntary Air Tour Operator Aviation Best Practices. Over a ten-year period, stations are being placed at six new locations each year—each randomly selected from a 10x10 km grid of 60 points spread evenly throughout the park, see Figure 4.

From the acoustic data processed since 2006, Denali's natural soundscape is primarily characterized by the energy of wind and water – and at certain times or locations, the striking absence of that energy. In fact, the natural ambient level is closely related to wind speed (logarithmic relationship). The quietest level is typically governed by the power and distance from nearby water sources. Overlain upon these steady physical sounds are seasonal or daily cycles affected by sunlight or temperature. For instance, both the singing of birds or debris flows down steep-walled valleys follow a predictable daily pattern of occurrence related to light and heat energy from the sun.

Human caused noise also follows a definite spatial-temporal pattern. At locations near common flightseeing routes, traffic rates commonly exceed 30 overflights per day. Near landing strips, it is common to hear more than 80. On the other hand, locations father away from common flightseeing routes rarely exceed ten overflights per day. This variation in traffic becomes clearer when visualized spatially. The map below shows a pie-chart breakdown of traffic by aircraft type for every

site sampled in the inventory to date. The radius of the pie-chart circle is proportional to the average number of aircraft overflights per day.

Detailed soundscape data reports can be found on the Denali website:

<http://www.nps.gov/dena/naturescience/soundscape.htm>

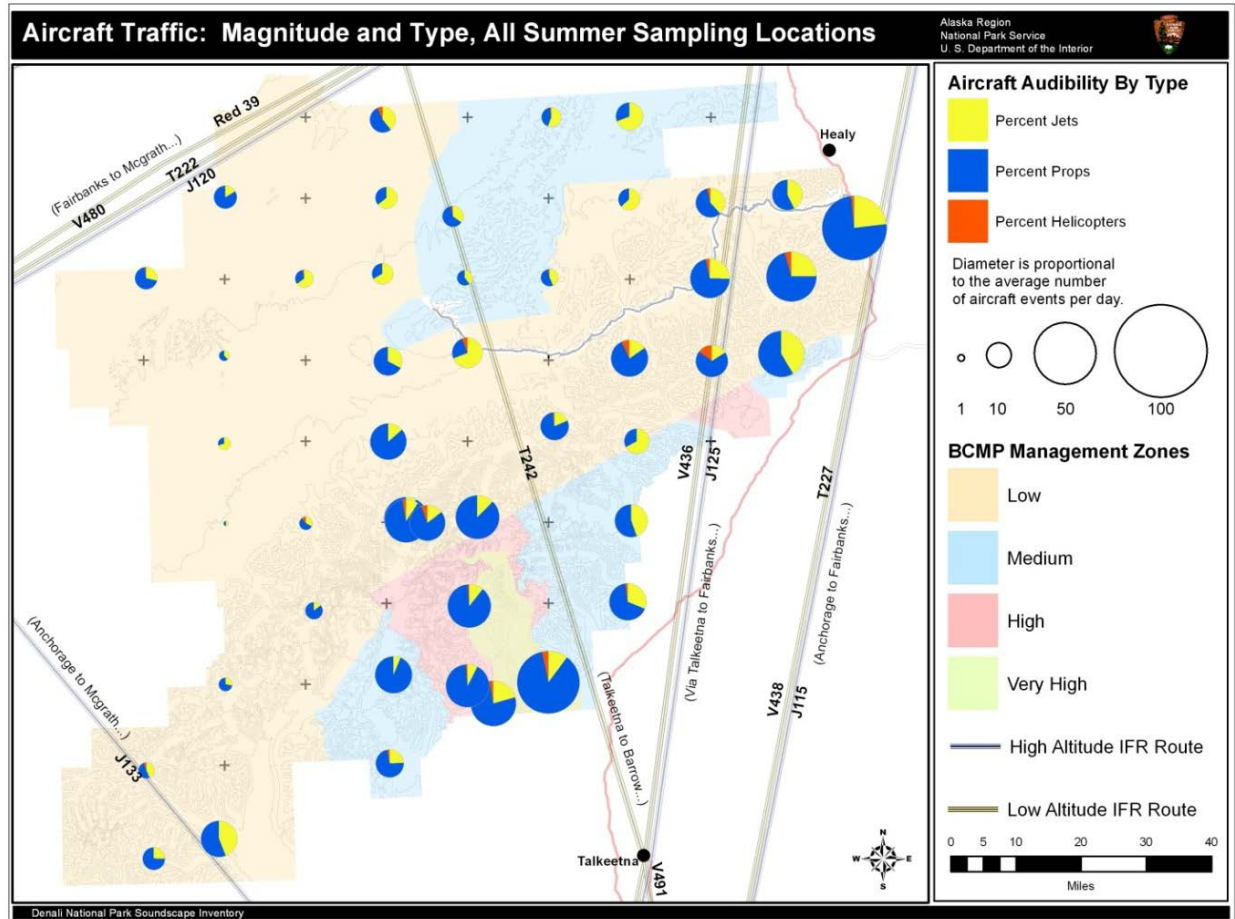


Figure 4. Map showing soundscape station data collected from 2001 to 2012 across Denali National Park and Preserve. The diameter of each circle is proportional to the average number of aircraft sound events each per day.

Monitoring to evaluate the Aircraft Overflight Committee 2012 Best Practices

A soundscape station was placed on the Upper West Branch of the Toklat River to specifically monitor whether aircraft overflights changed in the voluntary avoidance area along the crest of the Alaska Range in response to the 2012 best practices. In terms of the backcountry management plan's soundscape standards, there was no change in exceedance for either the percent time audible (PTA) nor sound pressure level (SPL) indicators. This is slightly misleading, however, because the median SPL of aircraft decreased between 2009 and 2012 from 53.0 to 49.1 dBA, a moderate improvement of 3.9 dBA. This could be attributed to operators attempting to increase their distance from the ground towards the suggested altitude of 8,000 feet above mean sea level. The reason the change is not apparent, in terms of the standard itself, is because the change in maximum sound pressure level

was mostly above the 45 dBA standard – an improvement, but not to the point of attaining the desired conditions stipulated in the BCMP.

Another twist to the interpretation of the soundscape standards was, in 2012, there were more days in which no noise events were detected – decreasing exceedance of the events per day standard substantially, from 100% to 83%. This is slightly misleading, however, as the average number of aircraft per day stayed largely the same between 2009 and 2012, measured at 19.3 and 20.5 events per day, respectively. It becomes clear that the Events Per Day standard excels at quantifying the number of days almost completely without noise, but may not perform well as an indicator of change for overall traffic through an area. See Table 5 below for a summary of soundscape metrics at Upper West Branch Toklat during the 2009 and 2012 field seasons.

Table 5. Comparison of soundscape conditions at Upper West Branch Toklat, 2009 and 2012.

Year	% Time Standard	Events Standard	SPL Standard	Median Sound Pressure Level	Average Number of Events Per Day	% Time Aircraft
2009	28% of all hours	100% of all days	89% of all events	53.0 dBA	19.3	3.7%
2012	26%	83%	88%	49.1 dBA	20.5	3.8%

Shaded columns indicate Denali Backcountry Management Plan Standards.

The purpose of the Cathedral Mountain location was to monitor whether soundscape conditions along the park road corridor changed in response to the best practice enacted during the summer of 2012. The 2012 data is compared to 2007 data from the same area (Table 6 below). (For a detailed record of these baseline data, see Withers 2012.)

Table 6. Comparison of soundscape conditions at Cathedral Mountain, 2007 and 2012.

Year	% Time Aircraft	% Time Standard	Events/day Standard	SPL Standard
2007	3.6%	32% of all hours	100% of all days	100% of all events
2012	5.2%	37%	80%	66%

Shaded columns indicate Denali Backcountry Management Plan Standards.

Patrol-based Overflight Observations Summary

History and Purpose

Between 1999 and 2005, Denali backcountry rangers collected data on aircraft overflights while on patrol. Ultimately, these data assisted in formulating soundscape indicators and standards for the 2006 Backcountry Management Plan. Along with visitor surveys collected by Swanson et al. (2002), these early data suggested that indicators, such as the number of events per day over the natural ambient level, the percentage of an hour for which motorized noise is audible, and the maximum sound pressure level of an event, were most salient in representing the desired condition of Denali's backcountry. These indicators are now the mainstay of automated soundscape monitoring techniques in the park.

Observations of aircraft overflights were reinstated during the 2012 field season as part of an ongoing effort to monitor backcountry conditions. The main purpose was in response to a request of the Denali Overflights Advisory Council to provide spatially-rich feedback on the effects of the 2012 best practice, and also to revisit the park's understanding of natural sound disturbances that a hiker might experience while moving across the wilderness.

Method

For every day in the field, rangers noted the date and time they began listening in the morning, the time they stopped listening at night, the weather, and the backcountry unit number they were in. For each noise event the following observations were made:

(1) Duration of the noise event (1) "*less than 1 minute*", (2) "*1 to 5 minutes*", and (3) "*greater than 5 minutes.*" These categories are based on the lognormal distribution of durations as measured by sound stations. In other words, most events recorded by sound stations are between 1 and 5 minutes long. The intent of using categories was to monitor where and when events of extreme duration occur instead of using an exact measurement of duration. This small change saved considerable time and effort for observers in the field.

(2) The number of aircraft that generated continuous noise in the event, categorized by aircraft propulsion type (*propeller, jet, or helicopter*). (A noise event may contain more than one aircraft if the sound of multiple aircraft overlapped.)

(3) The loudest level of an event was rated on a three-point scale: (1) "*Faint, barely audible, aircraft might be only heard and difficult to locate visually*", (2) "*Clearly audible above normal background noise with no difficulty*", and (3) "*Distracting for conversation, completely dominates soundscape drowning out even loud sounds of nature such as wind or sounds of water.*"

Comments and reference locations were added for context when necessary.

In 2012, rangers collected data systematizing weather observations to improve consistency. Four metrics directly related to aviation safety were chosen: visibility, surface wind speed (as a proxy for wind speed at elevation), precipitation, and cloud ceiling. Presence of high wind at altitude was

separately noted, especially as evidenced by lenticular clouds. When compiled, these weather data are useful in understanding the detection of aircraft through time.

Finally, several measures were specifically added to report on the north-side aviation best practice. Rangers kept track of which flights were over the avoidance zone along the spine of the range, those which were flying at an altitude under 500 feet off the ground (an extreme case), and those considered to be flying under 8000 feet above mean sea level.

Upon return, field notes were transcribed into a standardized spreadsheet form. Noise events in the form were geo-tagged by querying the patrol GPS tracklog for a spatial coordinate that matched the time at which each event began. These spatially referenced data were entered into an Access database, from which a large portion of subsequent analyses were designed. Data exported from the database were further analyzed with GIS software.

Results

The following table (Table 7) describes the monitoring efforts during both the contemporary (2012) and legacy (2004 & 2005) patrol aircraft overflight data sets. The range of dates sampled as well as the number of hours spent listening were similar during both seasons. Geotagged observations were a new addition to the 2012 analysis, see Figure 5.

Table 7. Basic metadata for both legacy (2004 & 2005) and contemporary (2012) patrol aircraft overflight data collection efforts.

Metadata	2012	2004 & 2005
Analysis Period	4/27/2012 - 9/19/2012	5/18/2004 - 9/18/2005
Number of Hours Sampled	1630 hours	1652 hours
Total Length of Tracklogs	1099 miles	<i>No Tracklogs Collected</i>
Total Number of Events Observed	1409 noise events	3295 noise events
Events/Hour Listened, only units with >25 Hours Listened during both efforts	1.4 events/hour	2.1 events/hour

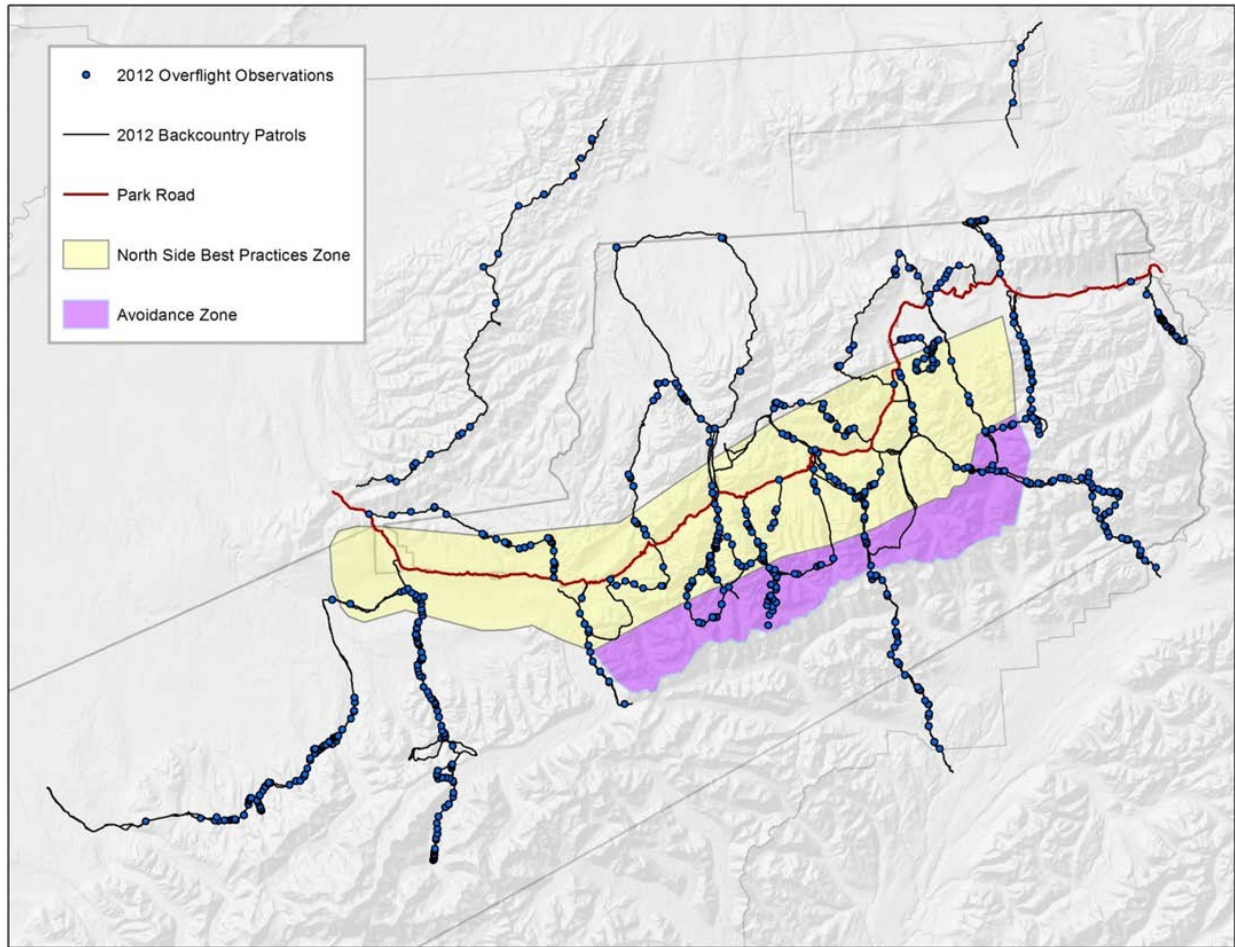


Figure 5. All overflight observations for the 2012 season (circles). GPS tracklogs and the north side best practice zone are also shown.

Analysis of 2012 North-Side Best Practice

One assessment of whether or not aviators adopted the voluntary best practice was a count of observations over the avoidance zone. In order for this to have practical use, only observations that were within visible distance of the avoidance zone were summarized. This distance was determined to be four miles. While within this distance, backcountry rangers observed that 11% of aircraft flew over the zone, 73% of aircraft did not fly over the zone, and 16% were unknown (due to clouds, landscape features, etc.)

A count of those aircraft that chose to fly at the recommended 8000 feet above mean sea level reveals that about half of the aircraft flew above 8000 feet, and about a tenth were confirmed to be flying below (see Table 8 and Figure 6 below). A similar figure was calculated for an altitude of 500 feet off the ground – again with little difference between flights over the best practice zone or those outside.

Loudness scores were different inside and outside of the best practice zone. Aircraft were more moderate within the zone, with fewer very loud or very quiet events detected. If the recommended

best practice moved aircraft away from the spine, a possibility for this observation is that the loudest events have moved farther way (either vertically or horizontally) – reducing how loud they sound - and the quietest events slipped far enough away that they became entirely undetectable.

Table 8. A summary of observed differences between aircraft traffic inside and outside the best practice area.

Evaluated Metric		Inside the Best Practice Area	Outside the Area	Difference [In – Out]
Over 8000 Feet?	Yes	52.6%	52.3%	0.2%
	No	9.7%	8.5%	1.1%
	Unknown	37.8%	39.1%	-1.3%
Under 500 Feet?	Yes	2.3%	2.7%	-0.4%
	No	76.5%	86.6%	-10.1%
	Unknown	21.3%	10.8%	10.5%
Sound Intensity	(1) Barely Audible	28.0%	32.3%	-4.3%
	(2) Clearly Audible	64.2%	56.8%	7.5%
	(3) Interferes With Speech	7.8%	10.9%	-3.2%

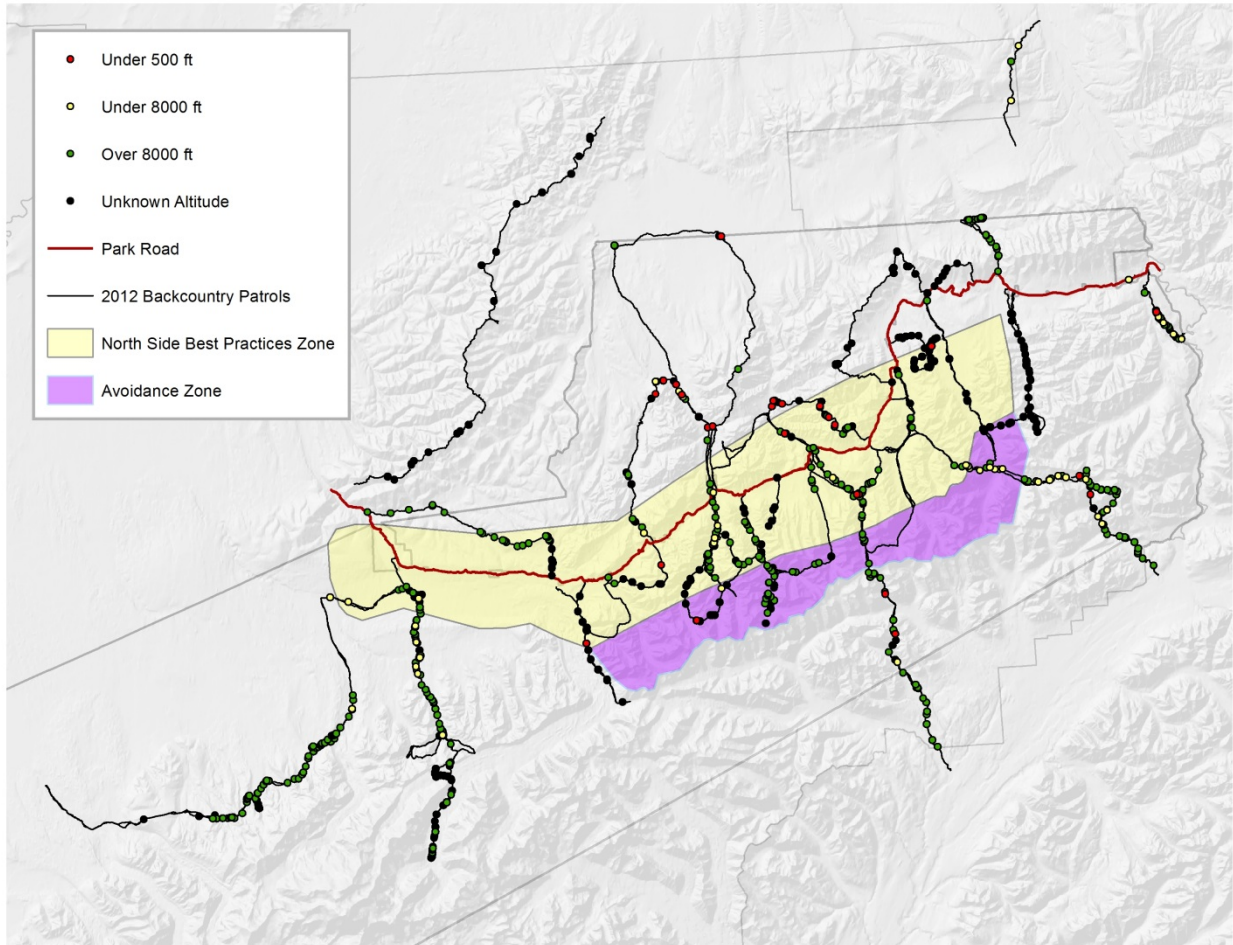


Figure 6. Overflight observations that were observed to be *under* 8000 feet above mean sea level (yellow) or *under* 500 feet above ground level (red).

Comparison to Automated Sound Monitoring Systems

One of the purposes of this project was to understand natural sound disturbances that hikers experience as they move through the wilderness. At no point during the planning or data collection phases were observations expected to show similarity to long-term, stationary grid-sampled data from the soundscape inventory. Of course, both observation methods should be describing the same air traffic patterns – and it follows that over long time periods the aggregated data should converge to a similar description of the impacts.

Upon evaluation, backcountry observers and sound stations do agree closely with regard to many soundscape metrics. Good examples of agreement include: the distribution of event detection rates on any given day (Figure 7 shown below), detection rates by hour of the day, length of time between events (commonly called noise free interval), or percent-wise breakdowns of noise by propulsion type. The relationship between weather and event detection is also similar between the two sets, but an explicit comparison of categorical and numeric scales is not possible.

Agreement between the data sets is important because it suggests both methods offer repeatable and precise descriptions of natural sound disturbance. It also shows that several assumptions of the science hold true – especially the choice of grid scale for the soundscape inventory. Finally, it is apparent that backcountry patrol observations are especially valuable in their ability to assess trend on a much shorter timeframe than automated monitors when patrols are routed wisely.

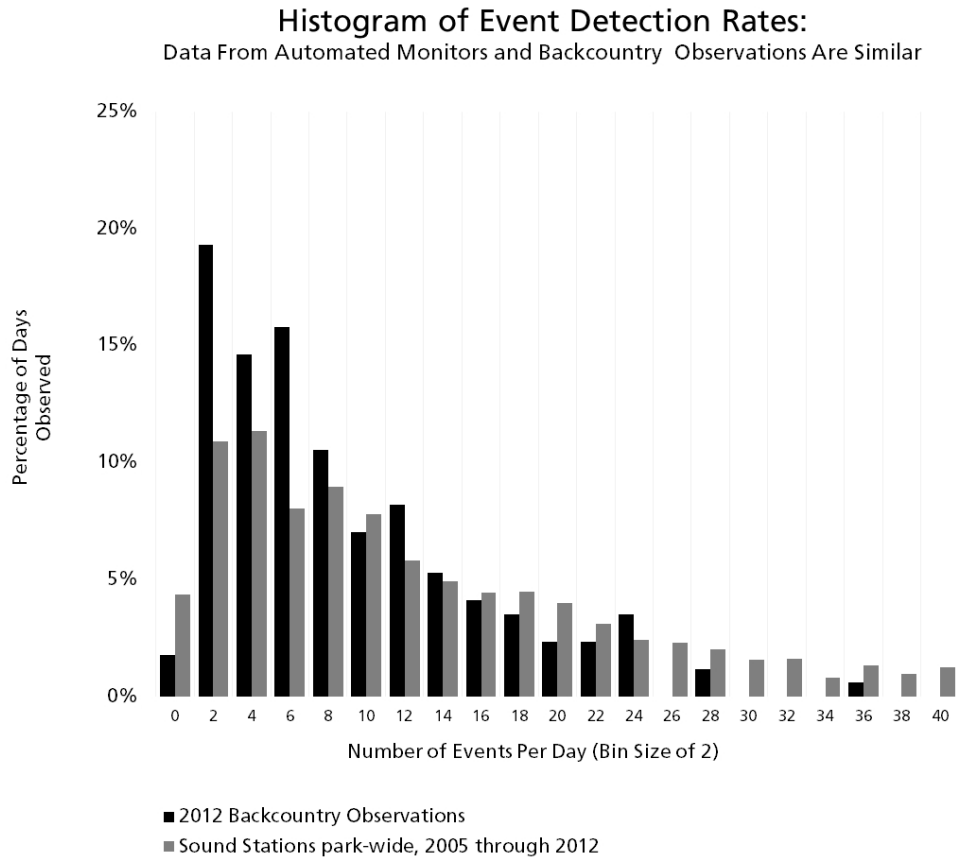


Figure 7. Comparison of event detection rates from backcountry patrol observations from 2012 and automated sound stations 2005 through 2012.

Noise Free Interval Analysis

Measuring average event rates is one good way to describe noise disturbance over long time frames, but the condition of the soundscape is more than just the total number of noise events detected. Their spacing in time plays an equally important role. For instance, one longer interval of quietude is generally more desirable than several short, consecutive intervals.

As part of this analysis, the noise free interval between each event was calculated. The median noise free interval for all patrol time was 0.41 hours (24.6 minutes) with an interquartile range of 0.67 hours. In other words, half of all observed events occurred less than 25 minutes after another event. Histogram analysis of the results shows that few day time noise free intervals were observed to be more than 3 hours long (see Figure 8 below) The maximum noise free interval was 11.5 consecutive hours of listening time.

An important comparison can be made to better understand the how impacts to Denali’s soundscape change with time: They can be compared to the case where noise events occur at totally random times. By using the number of hours sampled (L) and the total number of events observed (N) from Table 7 above, it is possible to randomly generate N events from 0 (the beginning of the time spent listening) to L hours and histogram the noise free intervals.

When the histograms are compared (Figure 8), noise free intervals in Denali are consistently shorter than expected for randomly occurring events. (The median value of the random data was 0.71 hours with an interquartile range of 1.1 hours.) This shouldn’t be a surprise, though, for a number of reasons - weather windows drive overall patterns of flight and certain hours of the day or days of the week are typically busier for tourism business. Both of these pressures on the timing of overflights should shorten noise free intervals.

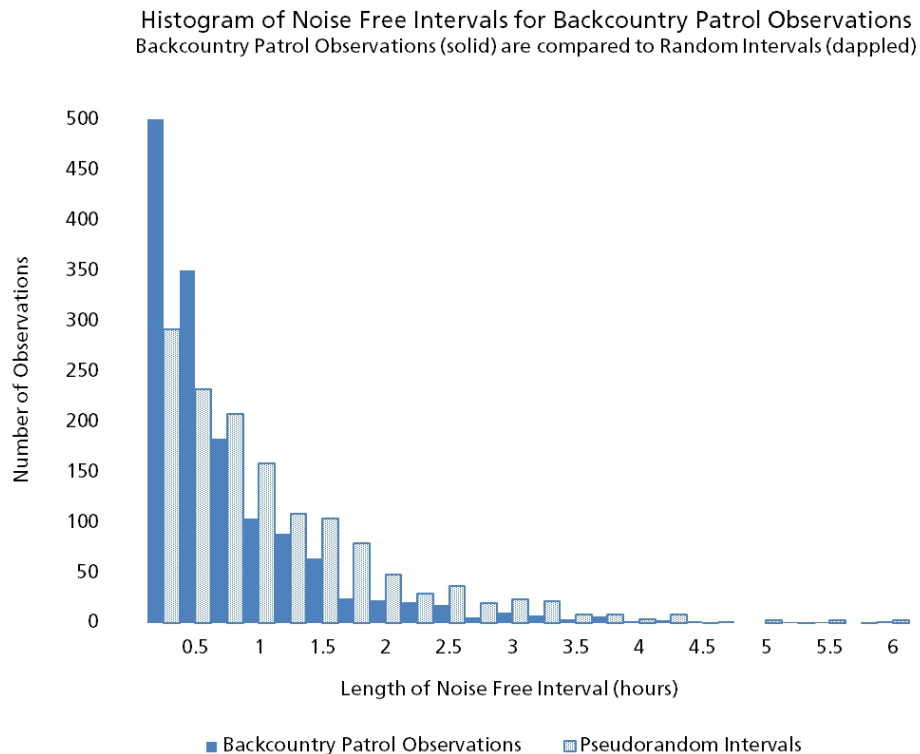


Figure 8. Histogram of noise free intervals for backcountry patrol observations. Backcountry patrol observations (solid) are compared to pseudorandom intervals (dappled gray).

Comparison of 2012 Results to Legacy Data

As can be seen in Table 7 above, there was a considerable difference in the average detection rate of aircraft between 2004/05 and 2012 efforts. When all units are summarized together, nearly twice as many events were detected during the earlier efforts when normalized for the time spent listening. However, some units had very short durations of patrol time during either effort – as few as three or four hours in some cases. A more robust comparison involves only summarizing those units that had

25 or more hours of patrol time during both data collection efforts. Even then, 1.5 times as many events were detected in 2004 and 2005.

Although the study did not explicitly attempt to determine a cause for these changes, there are several possibilities. The first is that the National Park Service itself has been trying to avoid flight paths over the designated Wilderness and instead fly north around the outer range when travelling between Kantishna and the entrance. This would move about 2 events per day out of the units south of the park road. For a typical 14 hour day of observation that would amount to about -0.15 events per hour listened.

Another apparent and positive change to Denali's soundscape condition between 2005 and 2012 has been mentioned repeatedly during Denali Overflights Advisory Council meetings: ERA Aviation has moved some of their helicopter flights out of the park, choosing instead to offer landings in the Alaska Range east of the Nenana River. In the case that they did move one flight out of the park per day, this would amount to two less events in the core units south of the road. For a typical 14 hour patrol day, that is another -0.15 events per hour listened. If two flights per day were moved the change is doubled to about -0.3 events per hour listened.

These two changes do not add up to the difference actually observed. Technology may provide another explanation. A general trend in Denali since the 1990's has seen the incorporation of larger aircraft into commercial fleets. This tendency to carry more visitors in fewer aircraft could also explain a reduction in the detection rate between efforts.

Trail and Campsite Disturbance

Informal trail monitoring summary



Appropriate densities of social trails and campsites are thought to exist in the Denali designated Wilderness (Old Park 1 management zone, (OP1)), and the rest of the park and preserve. Preliminary results show low to moderate growth of four informal trails in OP1 between 1997 and 2012. Monitoring for change in other management units has not been conducted.

Informal Trails (IT's) also known as social trails, are non-maintained trails, used by both humans and animals as travel corridors through various terrain and vegetation types. Informal trails created by wildlife are a natural part of the landscape and not a problem. Some ITs are a concern and monitored because they affect wilderness character and visitor experience. If left unchecked, ITs can cause human induced impacts including trampling of vegetation, soil compaction, and soil erosion.

“Trail and campsite disturbance” is listed as a resource condition indicator in Denali's Backcountry Management Plan. Depending on the Management Area, the BCMP specifies one of two desired conditions for this indicator: 1) Low: Visitors notice few if any signs of social trails, campsites, or cut or broken vegetation; 2) Medium: Visitors notice occasional social trails, campsites, or cut and broken vegetation. According to the BCMP the “Medium” descriptor is intended to match conditions in the Old Park in areas accessible from the park road corridor.

Backcountry rangers began to inventory and monitor “the extent and conditions of informal trails” in 1976 (Van Horn 2011). Monitoring efforts continued led by Resource Manager John Dalle-Molle and Biological Technician Joe Van Horn through the 1980s. The “staff initially surveyed the road corridor for the location of typical travel routes leading into the backcountry that were used by either overnight or day hikers” (Van Horn 2011). The information was recorded on data sheets, general locations were drawn on maps and photos were taken with the associated trails.

In 1995, another park-wide effort was performed, which included the application of “trail condition measurements in a three-tiered monitoring system designed to:

1. Detect the creation of new impacted areas, including trails and various other sites impacted by foot traffic within the road corridor
2. Evaluate the conditions of all impacted areas through application of standardized monitoring procedures, and
3. Monitor changes in conditions at selected locations, particularly those with substantial impact or having historical significance.” (Van Horn 2011)

Since 1976, rangers and other staff have created a foundation to build upon. Improved technology and continued program support will lead to more management understanding and options to address social trailing issues.

In 2011, Dr. Jeff Marion of Virginia Polytechnic Institute and State University and park staff developed a “comprehensive monitoring approach” (Marion & Wimpey, 2011). During the summer of 2012, seasonal rangers Alonzo Mandanna and Sarah Hayes tested and applied the new monitoring protocols. After reviewing the data dictionaries, revisions were made to better suit Denali’s specific needs. Two survey types from the protocol were employed to assess and measure the informal trails in the park; 1.) Access and 2.) Census-based surveys.

The access survey is an efficient method to “document the number and the distribution of all ITs that intersect a road or formal trail corridor” (Marion & Wimpey, 2011). This method allows for quick data gathering, but leaves out information such as the destination or impacts found further along the trail.

A census survey records the geographic location, spatial spreading “and lineal extent of all ITs judged to be predominantly human use” (Marion & Wimpey, 2011). Adding additional assessment indicators will allow for more detailed information about the impact area and when census surveys are reapplied over time, managers will be able to precisely track and “characterize changes in the number, spatial distribution, length of ITs” and condition changes (Marion & Wimpey, 2011).

In 2012, the access survey was conducted along the south side of the park road between mile markers 3, at the HQ flagpole, and mile marker 88 at the old park/new park sign. Rangers looked for where social trails exited from the road, marking those locations and 20 feet down the trail for reference points. The census method was applied to areas of high impact and through the backcountry units south of the park road, 1-15, 18-20. Refer to the map below (Figure 9) to see the areas mapped.

Both systems of survey utilize mapping grade GPS devices (GPS Trimble GeoXH and GeoXT) to record informal trails and sample data, and cameras were used to create a photographic log of the current state of impact. The GPS data was post-processed by using GPS Pathfinder, Arc Map and GPS Photolink, and imported along with attribute and digital photographs into ArcGIS geodatabase files for further analysis and archiving. In 2013, the methods and focus of the Informal Trail mapping project will move to and along the north side of the park road, between mile marker 3 to mile marker 88 and through backcountry units 24-39.

The following data shows the number of ITs found while conducting the Access Survey along the south side of the park road. The data has been separated and paired with the corresponding units that the ITs lead into. The Census Survey data follows in Table 9, and Figures 10 and 11.

Access Survey results:

Unit 3: 21 social trails

Unit 4: 25 social trails

Unit 5: 9 social trails

Unit 6: 36 social trails

Unit 7: 5 social trails

Unit 8: 13 social trails

Unit 9: 2 social trails

Unit 10: 2 social trails

Unit 11: 9 social trails

Unit 12: 4 social trails

Unit 13: 9 social trails

Unit 14: 30 social trails

Wonder Lake Area: 40 social trails

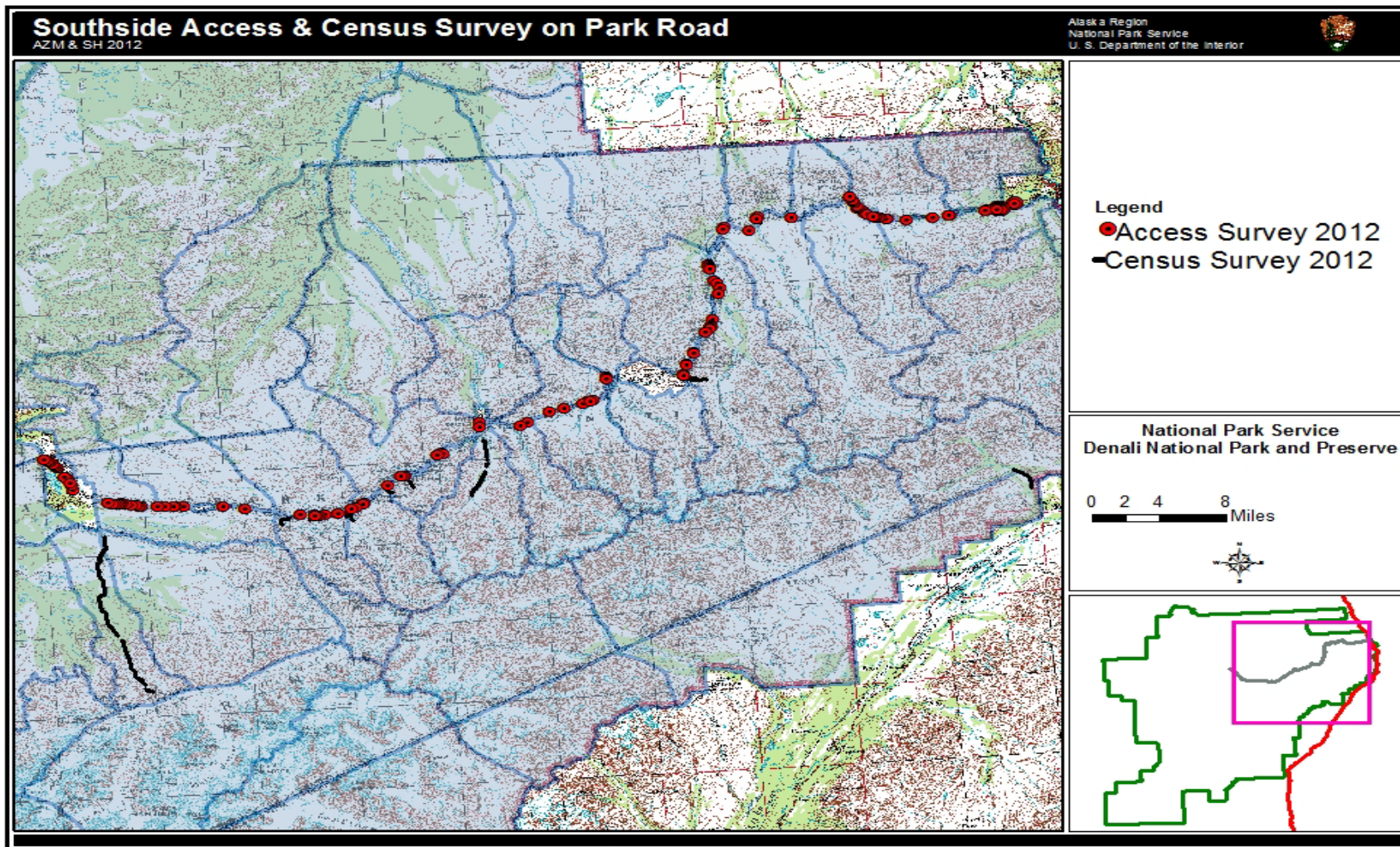


Figure 9. Access Survey and Census Survey data from 2012 along the south side of the Denali Park road.

Table 9. 2012 Census Survey results: BC unit and total length of ITs in each unit.

Area	1997	2012	Change
Unit 6 – Cathedral - main trail	7363 ft.	8918 ft.	1555 ft.
Unit 6 – Cathedral - Spider trails	n/a	6582 ft.	n/a
Unit 10 – West Branch Toklat	n/a	6597 ft.	n/a
Unit 11 – Upper West Stony Creek*	5544 ft.	5944 ft.	400 ft.
Unit 11 – Fish (Krier) Creek**	2057 ft.	2709 ft.	652 ft.
Unit 12 – Eielson VC - south	n/a	20,164 ft.	n/a
Unit 13 - Grassy Pass	1609 ft.	n/a	n/a
Unit 13 - Grassy View Overlook	1583 ft.	4216 ft.	2633 ft.
Unit 16 – Windy Creek	n/a	2137 ft.	n/a
Unit 20 – McGonagall Pass***	82,613 ft.	Undeterminable	n/a
Unit 32 – Middle Toklat	n/a	320 ft.	n/a

n/a – this does not mean that the trails were not present in 1997, but they may not have been mapped.

* Unit 11 – Upper West - the main trail decreased and a few spur trails have formed.

** Unit 11 – Fish Creek – the trails branched off more.

*** Unit 20 – McGonagall Pass – the file and data are incomplete.

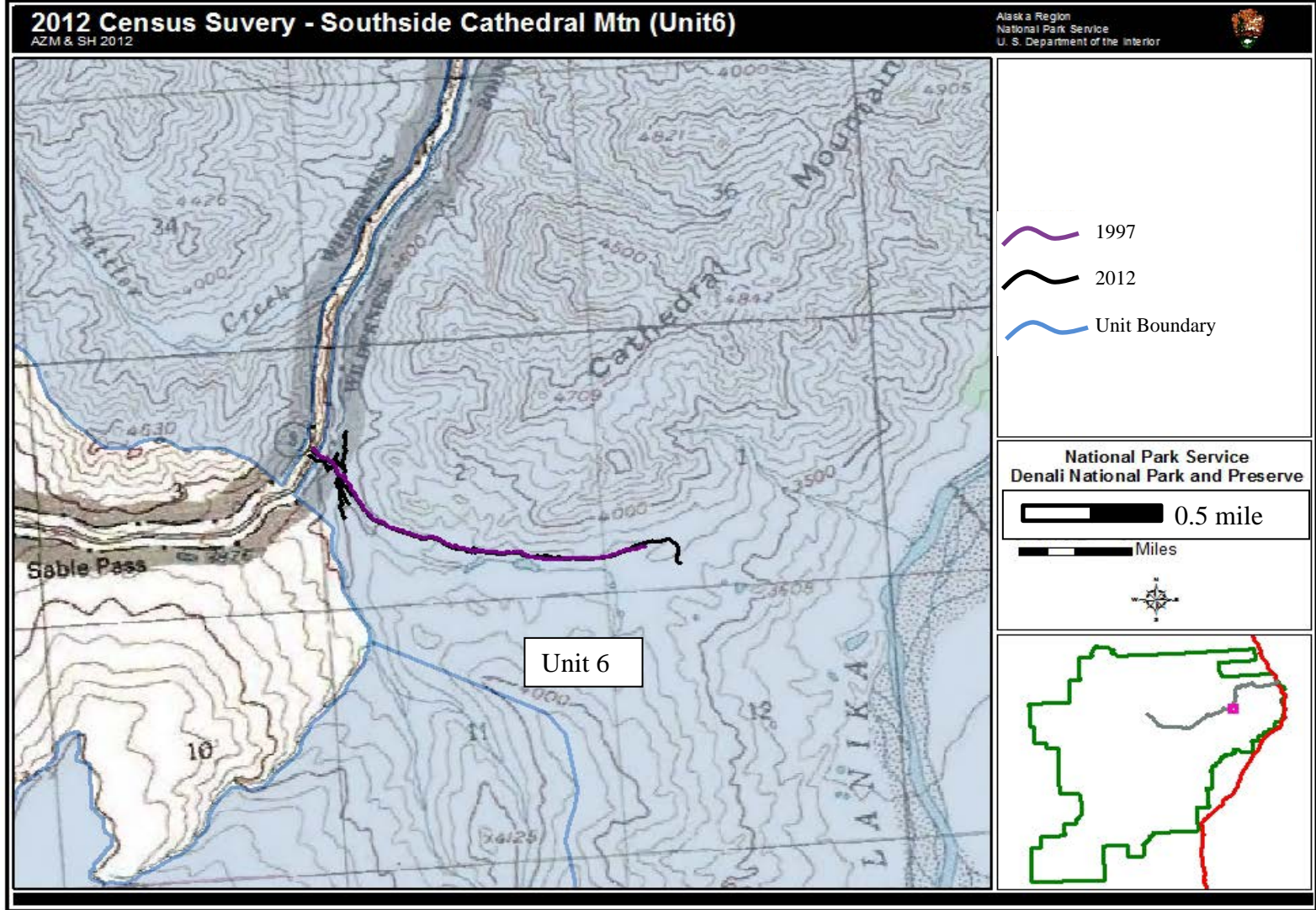


Figure 10. 2012 Census Survey data for the south side of the Denali Park road for the Cathedral Mountain area in Backcountry Unit 6. The 2012 trail in black extends 1555 ft. east of that mapped in 1997 (purple).

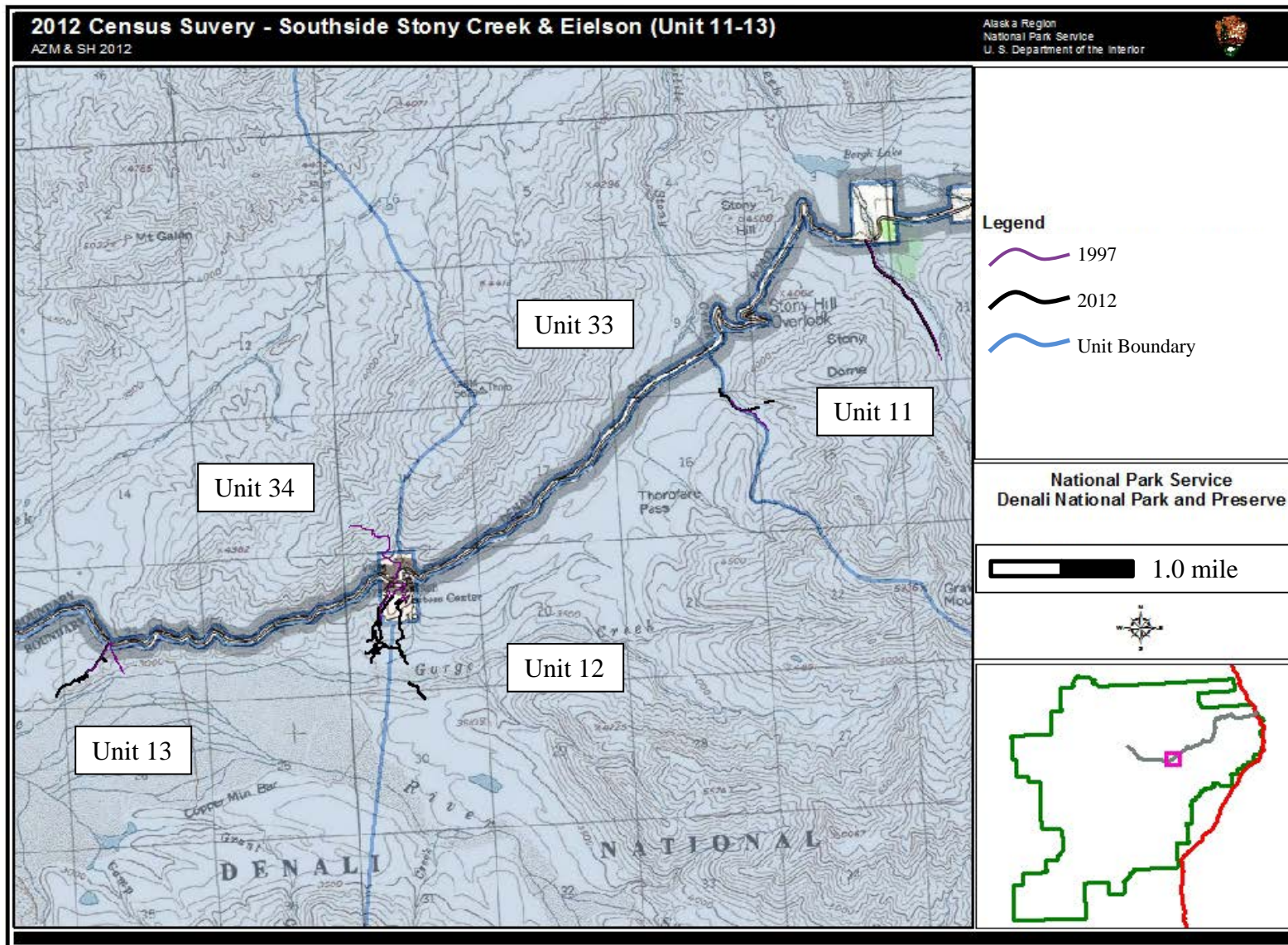
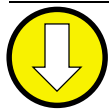


Figure 11. 2012 Census Survey data for the south side of the Denali Park road for the Stony Creek and Eielson areas, backcountry units 11-13.

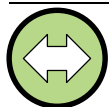
Evidence of Modern Human Use

Summary Encounters with Modern Equipment



A survey of backcountry visitors in 2010 indicates 82% reported encounters with modern equipment that were within the standard. The net change in the number of installations park-wide has increased by 19 in the last 5 years.

Summary Encounters with Landscape Modifications



All visible mitigations for visitor use such as constructed trails, route markers, signs, bridges, etc. are stipulated in management plans.

Survey of Backcountry Visitors

Denali's Backcountry Management Plan specifies that certain indicators can be monitored every five years by visitor survey. Backpackers and day hikers were asked the same question about evidence of modern human use and landscape modifications:

B. Modern equipment	___# Encounters
<i>Includes communication facilities or structures, research equipment, chain saws, and motorized vehicles. Does not include portable devices (GPS units, cell phones), stoves, tents, subsistence equipment, historic buildings/structures, or aircraft.</i>	
What percent of your time in the backcountry was modern equipment visible?	
Please check one: ___0-24% ___25-49% ___50-74% ___75-100%	
C. Landscape modifications	___# Sightings
<i>Includes communication facilities or structures, research equipment, chain saws, and motorized vehicles. Does not include portable devices (GPS units, cell phones), stoves, tents, subsistence equipment, historic buildings/structures, or aircraft.</i>	
What percent of your time in the backcountry was modern equipment visible?	
Please check one: ___0-24% ___25-49% ___50-74% ___75-100%	

Table 10. Evidence of modern human use from the 2010.

Unit	n	% in standard Encounters Modern Equipment
4	20	90
5	20	85
6	77	87
7	17	71
8	27	63
9	55	78
10	54	76
11	45	87
12	87	82
13	40	73
15	10	80
18	25	96
24	27	74
25	44	84
26	24	79
28	10	70
29	34	71
31	49	94
32	39	85
33	91	77
34	31	84
39	15	100
OP1	891	82
B	12	75

For brevity only the results of the number of encounters with modern equipment is presented here (Table 10). Results from the landscape modification question are not included because they are obfuscated by asking about the Denali Park Road which is not intended to be included in assessing standards. For a more detailed explanation and analysis see the report by Fix and Hatcher (2011). The standard for the Old Park 1(OP1) and B management areas is a maximum of 1 encounter with modern equipment per day. Table 10 shows the percentage of respondents that replied to be within the standard. According to the BCMP, to meet the standard would require that 95% of all respondents indicate they experienced conditions within the standard. Most backcountry units are

somewhat out of standard. Units with 90-100% in standard are in black, those with 75-89% are in orange and those below 75% are colored red.

Installations Monitoring and Database

The NPS Alaska Regional Office developed a geo-database to track installations in Alaska's wilderness and parks. The portion for Denali is now maintained by the park and the database has the capability to store many attributes including description, size, purpose, date installed, date removed, etc. Installation and removal of installations for the 5-year period of from 2007-2012 was analyzed for designated Wilderness. The number of installations in this period appears to have increased by 19 (Table 17). Many installations were installed before 2007 and are still present. The actual total number of installations is unknown as the database needs to be reviewed for completeness.

Examples of installations that have been installed and then removed include soundscape monitoring stations, time lapse cameras, and radio collars. Examples of permanent installations include radio repeaters, seismographs, glacier monitoring stakes, rebar for vegetation plots, etc.

All future installations in the DENA Wilderness will be evaluated through the appropriate National Environmental Policy Act (NEPA) and minimum requirement analysis process, (weather stations, research equipment, telecommunications infrastructure, etc.). All installations, if approved, will be added to GIS layer with removal dates identified for temporary installations.

Airstrip Monitoring

DENA has documented all known airstrips within the Park and created a GIS layer with this information (Figure 12). Field staff monitor the conditions and use of airstrips on an irregular basis.

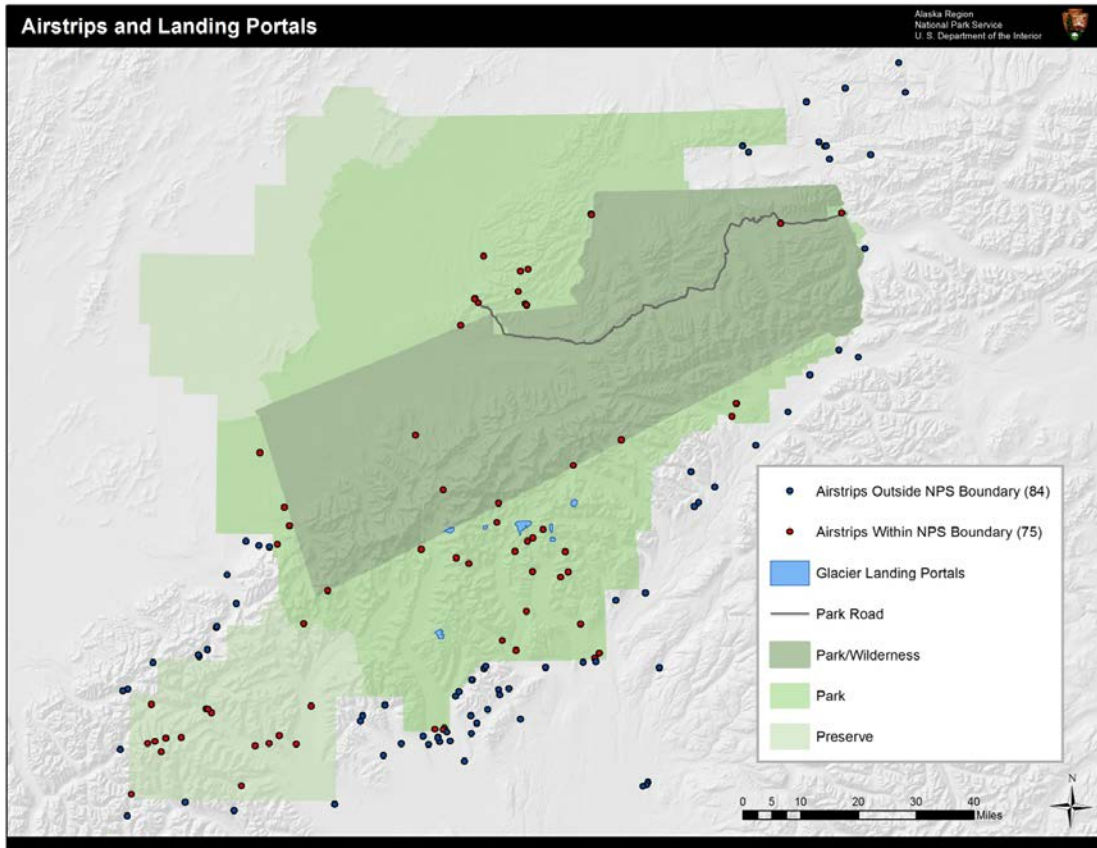


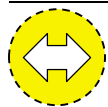
Figure 12. Locations of airstrips and landing portals.

Off Highway Vehicle Use and Monitoring

DENA has documented off road vehicle (ORV) trails adjacent to park boundaries, in particular along the northeastern and eastern boundaries near the communities of Healy and Cantwell. The ORV trails in the boundary areas near Healy are used by hunters, commercial groups, and recreational riders. Some of these trails have encroached into the park. When found, they are added to the GIS ORV layer for future reference and resource damage is documented. The use of ORVs is only allowed in the Cantwell area of the park for subsistence users. These trails are monitored annually by Resources staff (e.g. [Bembenek and Roland 2009](#)).

Litter and Human Waste

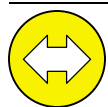
Summary



The 2010 backcountry visitor survey reports that 11% of backcountry visitors encountered litter and/or human waste in the popular areas of Old Park 1 and 17% in Management Area B (Units 41 and 42). These are the areas commonly accessed from the Park Road. This is above the BCMP standard of 5% or less. Sanitation problems on the West Buttress climbing route of Mt. McKinley and a subsequent study of human waste fate and transport on the Kahiltna Glacier (Loso et al. 2013) has led to recent attention for fostering better sanitation practices including the use of the Clean Mountain Can. However the majority of human waste is still thrown in crevasses on this route.

Encounters with People

Summary



A survey of backcountry hikers in 2010 indicates that 76% of visitors surveyed encountered 2 other hiking parties or less (the standard) in the popular areas of the east side of the Denali Wilderness. This sample is somewhat polluted by higher encounter rates (with a higher standard rate) along formal trails, such as Mt. Healy Overlook and Savage River Loop. The majority of visitors on the popular Triple Lakes Trail likely encounter 10 parties or less (within the standard), however, through hiking parties may encounter more than 10 on a busy day. No data is available for other areas in the park and preserve.

Survey of Backcountry Visitors

Denali's Backcountry Management Plan specifies that certain indicators can be monitored every five years by visitor survey. Backpackers and day hikers were asked the same question about encounters with other people:

D. Park visitors (count groups as one "visitor sighting")	___# Sightings
<i>Unaided (no binoculars or scopes) recognition of other park users, including recreation and subsistence users. This does not include visitors in aircraft.</i>	
What percent of your time in the backcountry were other park visitors visible? Please check one: ___0-24% ___25-49% ___50-74% ___75-100%	
E. Groups of visitors larger than six	___# Encounters

The standard for the Old Park 1(OP1) and B management areas is a maximum of two encounters with other groups per day. In addition, both areas stipulate encounters with groups larger than six is okay.

Table 11 shows the percentage of respondents that replied to be within the two encounters/day standard. Fourteen percent of all backpackers and day hikers reported seeing groups larger than six in both OP1 and B. According to the BCMP, to meet the standard would

Table 11. Encounters with people from the 2012 visitor survey.

Unit	n	% in standard Encounters with People
4	21	81
5	20	95
6	82	90
7	18	94
8	29	93
9	56	93
10	56	82
11	45	87
12	87	61
13	39	82
15	10	60
18	25	96
24	29	14
25	46	13
26	26	69
29	36	94
31	49	92
32	41	95
33	94	56
34	32	72
39	15	100
OP1	923	76
B	11	82

require that 95% of all respondents indicate they experienced conditions within the standard. Most backcountry units are close to the standard. Units with 90-100% in standard are in black, those with 75-89% are in orange and those below 75% are colored red. For a more detailed explanation and analysis see the report by Fix and Hatcher (2011).

The West Buttress Route is deemed a Special Use area by the BCMP to “provide a seasonal route to the summit of Mount McKinley that can accommodate large numbers of climbers during the primary climbing season.” It is a seasonal management area from late April to mid-July, otherwise it is surrounded by and takes on the standards of OP1 out of that season. During the climbing season the area has no standard for encounter rates and allows for camping within sight and sound of other visitors. In 2009 Dr. Jon Kedrowski at Texas State University administered a survey to climbers during the climbing season at the Kahiltna Glacier Basecamp, most of whom were climbing the West Buttress Route (Kedrowski 2009). The objective of the study was to summarize demographics, visitor experiences, and perceptions of inherent risks of the climb. Of the 310 surveys that were administered 72 were returned and analyzed. The climbers were asked three questions related to crowding. “Is the crowding within acceptable limits for you?” 78% said yes. “Are there too many people trying to climb Mt. McKinley?” 72% said no. “Is the mountain too crowded?” 81% said no.

Encounters on the Triple Lakes Trail

In 2011, the Triple Lakes Trail construction project was completed. The project was a major, multi-year investment of labor and supplies by Denali National Park to provide an opportunity for visitors to have an active, moderately challenging outdoor experience within close proximity of the Entrance Area campus. In 2010, Park Concessions began issuing guided hike permits on the Rock Creek and Triple Lakes trails, to interested businesses. Anecdotal observations, concessions activity reports for Triple Lakes Trail, and trail counter monitoring in 2010 and 2011, indicate that use of the Triple Lakes Trail increased rapidly.

Triple Lakes Trail is designated a “Backcountry Hiker Area” in the BCMP, which will “Provide day use trails into the backcountry in areas that are accessible to many visitors. Year-round or seasonal. No camping is allowed on the trails” (NPS 2006). However, there are several informally established campsites at two of the lakes off of the main trail. The Backcountry Hiker Area has medium to high desired resource and social indicator conditions designated in the BCMP. Specifically, hiker encounters with other people have a specified “Very High” encounter rate with a maximum of 10 parties encountered per day. Encounters with large groups are possible although the BCMP doesn’t target a specific number or percentage. The group size limit for a day use group is 12 as in the rest of the Wilderness and the backcountry unit quota (Unit 1) is a maximum of 12 people per night.

In order to understand patterns of visitor use and encounter rates, park staff used automated field counters to monitor hiker volumes mixed with first person observations to observe “actual encounters” of the Triple Lakes Trail in summer 2012. Observers tried to mimic the “average” hiker by traveling at ~ 2 mph.

The goals of this data collection include 1) provide an understanding of the current levels and the range of hiker numbers and encounters on the trail that will serve as a baseline for future years; 2) to

determine the relationship between number of hikers detected with the counters and the frequency and types of actual encounters, at any given time; 3) allow managers to determine if current concessions allocations are appropriate given use levels.

The map (Figure 13) and Tables 12, 13, and 14 below show the patterns of use from the data of trail counters installed at five locations at equal intervals along the trail and actual encounter rates by trained observers during a total of 35 visits to the four ~2.2 mile long trail segments. The highest use occurs closest to the north and south trailheads (counters 1 and 5) as most hikers likely hike only a portion of the trail from either end and then turn around. If these hikers' experience on the trail is counted as a "day", as per the BCMP, then hiking parties completing a round trip on either segment 1 or 4 would likely experience a level of encounters within the desired condition for both the average and the maximum encounters observed (see summary by round trip table below). However, visitors hiking out and back on two segments could experience encounters above the desired condition and those through hiking the entire trail either northbound or southbound are more likely to experience a higher number of encounters (8 and 17 southbound and 7 and 15 northbound on average and maximum respectively).

Correlation analysis of actual encounters data with actual number of individual hikers observed shows that they are roughly correlated, but not closely enough to be useful. For two of the counters (4 and 5), we can roughly predict group sizes from the time stamped counter data. Individual counts from the counter data was lumped into groups if counts fell within 1 minute of each other. Further analysis was unavailable at the deadline for this report.

The daily average visitor use at trail counter locations (see map below). This data spans June 14 through August 18, 2012 the period for which all counters were installed simultaneously. Counter data from 1, 2, 4, and 5 were divided by two, as most visitors use the trail in an out and back fashion (versus through hiking). Counter 3 is presumed to count mostly through hikers and was not divided by 2. An adjustment factor based on 2 calibration sessions at counter 5 yielded a factor of 1.67. Calibration sessions at the other counters did not prove as fruitful with very low to no visitor counts. A factor of 1.14 was applied to these based on limited data at counter 1.

Table 12. Daily average visitor use at each trail counter.

Site Name	Daily Average
Triple Lakes #1 (AD)	54.7 (38.0%)
Triple Lakes #2 (AD)	13.1 (9.1%)
Triple Lakes #3 (A)	17.5 (12.2%)
Triple Lakes #4 (AD)	15.3 (10.6%)
Triple Lakes #5 (AD)	43.4 (30.1%)

A = adjustment applied, D = divide by 2 applied, F = filtering applied

Table 13. Summary of actual encounters on round trip hikes for each trail segment. Actual Encounters Summary by Round Trip on each Trail Segment.

Segment	n	Ave Sample Time	Parties			Individuals			Percent Time Large Groups
			Average	Maximum	Min	Average	Max	Min	
1	7	2:09	4	9	2	9	18	3	0
2	5	2:03	2	6	0	4	11	0	0
3	8	1:14	3	7	1	6	15	2	0
4	15	1:49	3	8	1	10	24	2	33
All	35	1:47	3	9	0	8	24	0	14

Table 14. Summary of actual encounters for through-hikers. Actual Encounters Summary for Through-Hikers.

Segment	Direction	n	Average Sample Time	Parties			Individuals			Percent Time Large Groups
				Average	Max	Min	Average	Max	Min	
1	N	7	0:53	2	4	0	4	8	0	0
2	N	4	0:45	1	2	0	2	4	0	0
3	N	6	0:58	2	3	0	4	5	0	0
4	N	11	0:58	3	6	0	10	20	0	45
Totals Northbound				8	17	1	17	45	2	0
1	S	7	1:00	2	5	0	5	14	0	0
2	S	5	0:54	2	5	0	3	10	0	0
3	S	5	0:54	2	4	1	5	10	2	0
4	S	11	0:55	2	3	0	4	11	0	0
Totals Southbound				8	17	1	17	45	2	0

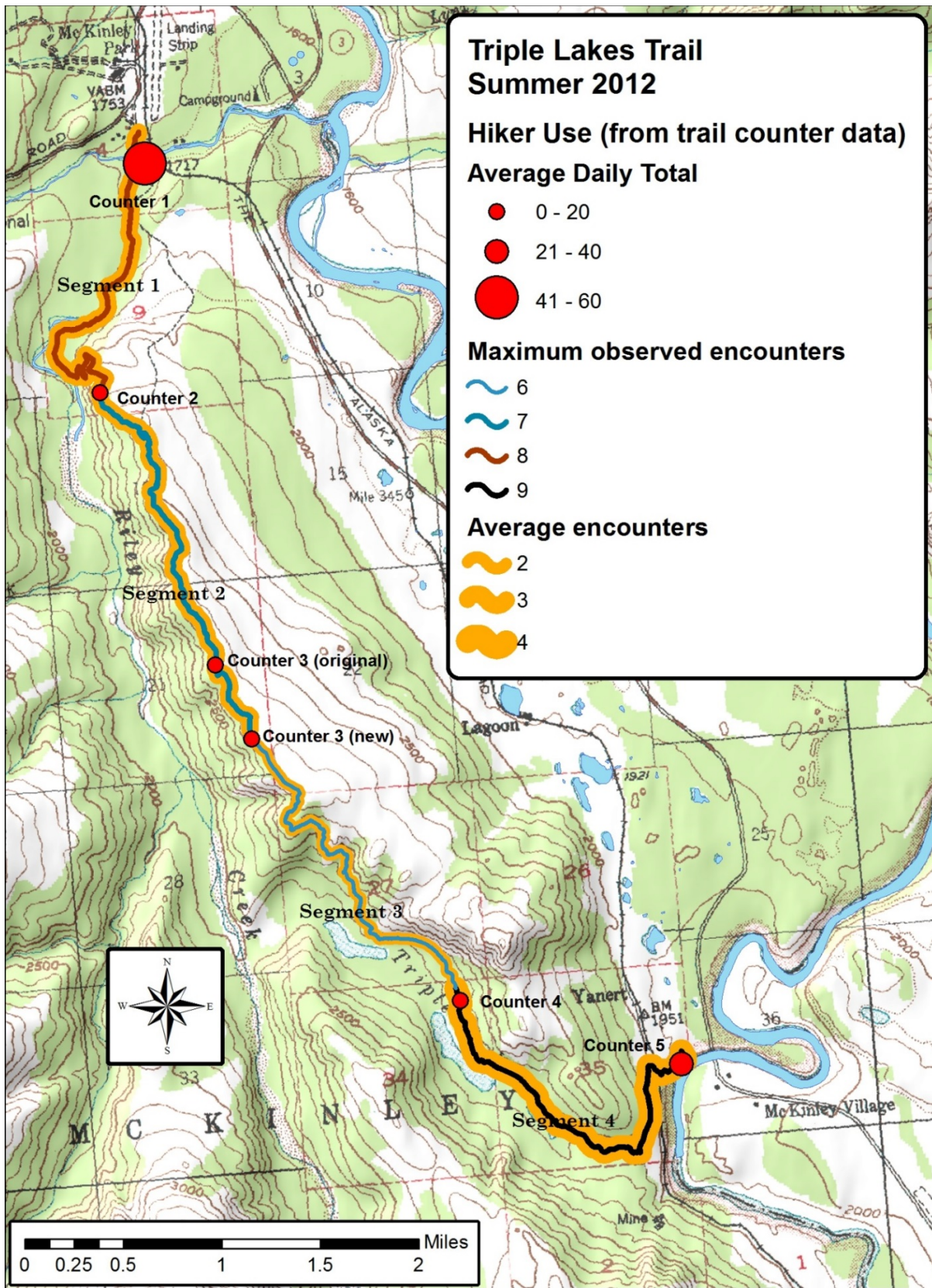


Figure 13. Map of counter locations and use in 2012 on Triple Lakes Trail.

Camping Densities

Summary



The BCMP states, “This category refers only to the opportunity to camp outside of sight or sound of other park visitors; however, visitors may still choose to camp where they can see or hear others. ‘Sight or sound’ refers to unaided recognition of another campsite from where the visitor camps for the night.” A survey of backpackers in 2010 indicates that 94% are able to camp out of sight and sound of other backpackers in the popular areas accessed from the Park Road (OP1 and part of B). No data is available for other areas in the park and preserve but likely consistent with levels desired in the BCMP.

See Table 2-7 on page 48 of the BCMP and [Fix and Hatcher \(2011\)](#) for additional information.

Survey of Backcountry Visitors

Denali’s Backcountry Management Plan specifies that certain indicators can be monitored every five years by visitor survey. In the summer 2010 survey 191 backpackers replied to surveys with the following question about camping densities:

Were you able to camp out of sight and sound of other park visitors?
 __Yes __No

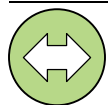
Table 15. Camping Density from the 2010 visitor survey.

Area	Unit	n	Number	% in standard		
		3	1	1	0	
		4	15	0	100	
		5	19	0	100	
		6	59	3	95	
		7	13	1	92	
		8	18	5	72	
		9	43	4	91	
		10	45	1	98	
		11	13	0	100	
		12	35	2	94	
		13	29	0	100	
Old Park 1		14	1	0	100	
		15	7	0	100	
		16	1	0	100	
		18	22	0	100	
		19	6	0	100	
		24	3	0	100	
		25	2	0	100	
		26	18	0	100	
		28	4	0	100	
		29	11	4	64	
		30	3	0	100	
		31	24	4	83	
		32	30	0	100	
	33	28	4	86		
	34	21	1	95		
	35	8	1	88		
	36	2	0	100		
	38	3	0	100		
	39	14	1	93		
	41	3	0	100		
B		42	8	1	88	91
						All % in standard 94

The standard for the Old Park 1(OP1) and B management areas is that backpackers should always have the opportunity to camp out of sight and sound of others. Table 15 shows the number and percentage of respondents that indicated they were not able to camp out of sight and sound of others. Of all those that responded to this question 94% in OP1 and 91% in B reported being able to camp out of sight and sound of others, just below the standard of 95. Most backcountry units represented near or above the standard. Units with 90-100% in standard are in black, those with 75-89% are in orange and those below 75% are colored red. For a more detailed explanation and analysis see the report by Fix and Hatcher (2011). See the Encounters with People section above for a discussion survey results about perceptions of crowding of climbers on the West Buttress Route.

Administrative Presence

Summary



From the 2010 survey of backcountry hikers, encounters with rangers, other park staff, or researchers is very low. No data is available from other areas of the park and preserve but with known levels of staffing and science use, administrative presence is likely consistent with levels desired in the BCMP. The BCMP states, “This category only includes interactions with administrative and research personnel, which are not included with the encounter rate standards given above.

Survey of Backcountry Visitors

Denali’s Backcountry Management Plan specifies that certain indicators can be monitored every five years by visitor survey. Backpackers and day hikers were asked the same question about the presence of administrative staff:

F. National Park Service rangers or researchers
 ____ # Encounters

Include interactions with rangers or researchers. Do not include interactions with NPS aircraft or research equipment (include these in the Motorized Sound or Modern Equipment sections, respectively).

The standard for the Old Park 1(OP1) is “medium”, which is defined as “Rangers may make routine visitor contacts, so visitors may be aware of administrative presence.

Visitors may occasionally encounter staff or permitted researchers involved in the inventory and monitoring projects and research in some areas”. The standard for management area B is “low”, which is defined as, “Administrative presence is generally limited to emergency activities and occasional patrols, with research and monitoring projects in some areas.” There are no quantitative thresholds for these standards but the levels of encounters appear to be in standard for those surveyed in OP1 and B (Table 16)

According to the BCMP, encounters with staff would not be included in the encounters with people, however, this was not specified in the survey so likely polluted some answers for that indicator. For a more detailed explanation and analysis see the report by Fix and Hatcher (2011).

Accessibility

The BCMP (NPS, 2006) states, “NPS management largely determines the degree of accessibility by providing facilities (such as trails) or services (transportation, guide services) that determine how easy or difficult it is to travel in an area of the park. Terrain also plays a role, primarily in the alpine mountaineering areas that require specialized equipment and knowledge. These are the only areas

Table 16. Administrative presence from 2010 visitor survey.

Unit	n	Average Encounters
4	21	0.19
5	21	0.00
6	85	0.06
7	19	0.00
8	32	0.19
9	59	0.05
10	57	0.11
11	48	0.33
12	95	0.43
13	38	0.05
15	10	0.10
18	25	0.08
24	35	0.17
25	46	0.85
26	26	0.27
28	10	0.30
29	38	0.21
30	10	0.30
31	49	0.14
32	43	0.16
33	110	0.87
34	36	0.25
39	16	0.00
OP1	535	0.29
B	11	0

that achieve a 'very low' rating, although the availability of guide services that can provide equipment and instruction can boost the rating to a 'low.' Areas accessible to day visitors who decide to visit spontaneously without planning or preparation achieve a 'high' rating." See Table 2-8 on page 48 of the BCMP for additional information.

Wilderness Character Summary

Summary for State of the Park Report

In late 2012, the Park conducted a ‘State of the Park’ workshop to produce a summary report documenting the status and trends of Park resources. Part of this effort resulted in a short summary of the wilderness character qualities (natural, undeveloped, untrammled, opportunities for solitude or unconfined recreation, and other features of value). This short summary also appears in the executive summary of this document. A more detailed description of the data and rationale used to generate the short summary is found in Table 17 below.

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013.



Measure		Supporting Data	Explanation and Rationale
Natural Quality			
Indicator: Plants			Denali has no measures for plants
Indicator: Animals			
Wildlife populations	See 2013 DENA State of the Park Report		Denali’s fauna remain relatively unchanged compared to their population status prior to the Euro-American occupation of Alaska. Predator-prey interactions continue with minimal human influence. However, recent changes in regulations on adjacent lands, which allow more harvest (i.e., trapping, killing), may influence the local population dynamics of those resident species that cross outside park boundaries. Many other human activities beyond park boundaries have the potential to negatively affect migratory species, which may lead to a loss of native species or population declines over time. Park effort to document changes in species populations varies significantly across species. Ten common songbird species, several small mammal species, moose, and Dall’s sheep have stable populations over the last five years. Grizzly bear trend based on vital rates indicates an annual decline of 0.37 percent. Caribou herd size has increased to an estimate of 2,300 in 2012. Density of wolves in fall 2012 was at a 25-year low. All measures of Golden Eagle reproductive success have declined since 1988; from 2008 to 2012, the rate of egg-laying continued to decline and included some of the lowest rates since the start of the study. Trumpeter Swans have increased in abundance and distribution since 1975, but the increase has slowed since 2005. The total number of reported bear-human interactions dropped between 2008 and 2012.

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).




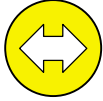
Measure		Supporting Data	Explanation and Rationale
Indicator: Air and Water			
Air Quality Index	See 2013 DENA State of the Park Report		Air quality in Denali is generally very good, although small amounts of airborne contaminants are transported into the park each year from local, regional, and international sources. Some park ecosystems are considered to be highly sensitive to atmospheric deposition of sulfur and nitrogen. Visibility is typically exceptional, although changing fire regimes due to climate change may increase the number of hazy days.
Indicator: Climate Change			
Scenic and Geologic Features and Geomorphic Processes	See 2013 DENA State of the Park Report		Geophysical processes continue to modify Denali's mountain massif through tectonic action and the erosive forces of flowing glacial ice. Denali's scenic resources include late night sunlit vistas during summertime and dark night skies in the winter, spring, and fall. Landscape changes often take place at imperceptible rates, although some events such as landslides, earthquakes, and surging glaciers are notable reminders that the landscape is constantly changing. Monitoring has demonstrated an accelerated rate of change in many geophysical features due to climate change, including observations of thinning and retreating glaciers and thawing permafrost.
Indicator: Ecological Processes			
Wildlife Habitat and Ecosystem Function: Aquatic and Terrestrial	See 2013 DENA State of the Park Report	 	Aquatic: Data on the condition of aquatic ecosystems are spatially limited. Based on the available data, water quality in rivers and streams is expected to be good and to meet standards. Fish, invertebrate, and diatom communities appear to be in a natural condition. Denali is working to restore natural channels, flow, and riparian vegetation on placer-mined streams near Kantishna. Caribou and Slate creeks have been removed from the impaired stream list because of improved turbidity, but Stampede and Slate creeks have been added to the list due to high levels of arsenic and antimony. Average mercury concentrations in lake trout are above published thresholds for the health of some fish-dependent wildlife species. Lakes in some areas show decreases in surface area. Terrestrial: Climate change is likely affecting the diversity and distribution of forest, shrub, and tundra plant communities, and has been documented in repeat photography and repeat vegetation sampling. Anecdotal evidence suggests that aspen green-up occurs earlier now than in the past. Three of the five largest fire years in the park have occurred in the last 11 years. The total number of days when fire was active on the landscape has exceeded 60 days in 9 of the last 23 years, whereas prior to 1989 (includes some years of fire suppression), there were no years in the 38 years of record in which the number of days of fires exceeded 60 days.

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).

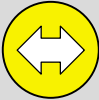

Measure	Supporting Data	Explanation and Rationale																													
Undeveloped Quality																															
Indicator: Presence of non-recreational structures, installations and developments																															
Net change in number of structures and installations for administrative use and research/monitoring	<table border="1"> <thead> <tr> <th data-bbox="422 548 527 634"></th> <th data-bbox="527 548 722 634">New Installations</th> <th data-bbox="722 548 911 634">Installations Removed</th> <th data-bbox="911 548 1249 634">Net change in # of installations</th> </tr> </thead> <tbody> <tr> <td data-bbox="422 634 527 695">2007</td> <td data-bbox="527 634 722 695">3</td> <td data-bbox="722 634 911 695">3</td> <td data-bbox="911 634 1249 695">0</td> </tr> <tr> <td data-bbox="422 695 527 755">2008</td> <td data-bbox="527 695 722 755">15</td> <td data-bbox="722 695 911 755">3</td> <td data-bbox="911 695 1249 755">12</td> </tr> <tr> <td data-bbox="422 755 527 815">2009</td> <td data-bbox="527 755 722 815">5</td> <td data-bbox="722 755 911 815">5</td> <td data-bbox="911 755 1249 815">0</td> </tr> <tr> <td data-bbox="422 815 527 875">2010</td> <td data-bbox="527 815 722 875">1</td> <td data-bbox="722 815 911 875">1</td> <td data-bbox="911 815 1249 875">0</td> </tr> <tr> <td data-bbox="422 875 527 935">2011</td> <td data-bbox="527 875 722 935">11</td> <td data-bbox="722 875 911 935">4</td> <td data-bbox="911 875 1249 935">7</td> </tr> <tr> <td data-bbox="422 935 527 995">Total</td> <td data-bbox="527 935 722 995">35</td> <td data-bbox="722 935 911 995">16</td> <td data-bbox="911 935 1249 995">19</td> </tr> </tbody> </table>		New Installations	Installations Removed	Net change in # of installations	2007	3	3	0	2008	15	3	12	2009	5	5	0	2010	1	1	0	2011	11	4	7	Total	35	16	19		These data are from the NPS Alaska Region Installations Database and represent only installations that have a date range from 2007 forward within designated Wilderness. Many installations were installed before 2007 and are still present but are not captured here. Examples of installations that have been installed and then removed include soundscape monitoring stations, time lapse cameras, and radio collars. Examples of permanent installations include radio repeaters, seismographs, glacier monitoring stakes, rebar for vegetation plots, etc.
	New Installations	Installations Removed	Net change in # of installations																												
2007	3	3	0																												
2008	15	3	12																												
2009	5	5	0																												
2010	1	1	0																												
2011	11	4	7																												
Total	35	16	19																												
Indicator: Presence of recreational structures, installations and developments		Denali has no measures for recreational structures, installations and developments																													
Indicator: Use of motor vehicles, motorized equipment, and mechanical transport																															

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).

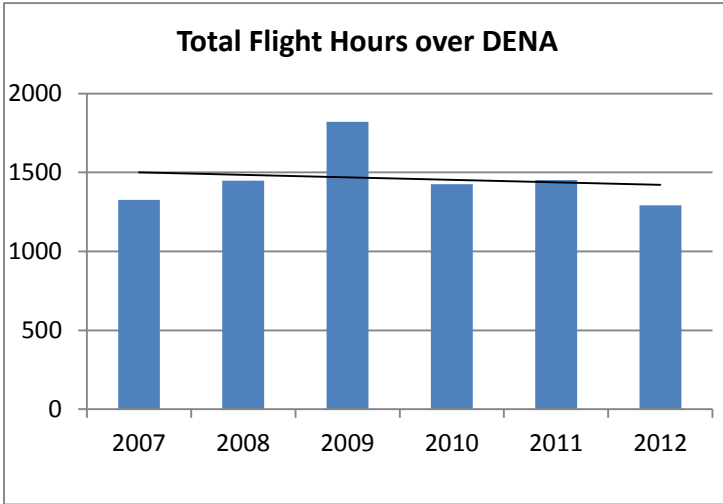
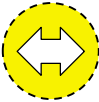

Measure	Supporting Data	Explanation and Rationale															
Number of hours of administrative use of aircraft	 <table border="1" data-bbox="466 394 1184 894"> <caption>Total Flight Hours over DENA</caption> <thead> <tr> <th>Year</th> <th>Flight Hours (Approximate)</th> </tr> </thead> <tbody> <tr> <td>2007</td> <td>1300</td> </tr> <tr> <td>2008</td> <td>1450</td> </tr> <tr> <td>2009</td> <td>1800</td> </tr> <tr> <td>2010</td> <td>1400</td> </tr> <tr> <td>2011</td> <td>1450</td> </tr> <tr> <td>2012</td> <td>1300</td> </tr> </tbody> </table>	Year	Flight Hours (Approximate)	2007	1300	2008	1450	2009	1800	2010	1400	2011	1450	2012	1300		<p>Helicopter landings in Wilderness are often used as a measure for degradation to the undeveloped quality. Denali staff lack consistent parkwide data on helicopter and fixed wing landing data through time. However, administrative use of aircraft often involves landings and low altitude flying and so total flight hours are used as a proxy for landings. The five-year trend appears fairly stable. Flight hours in 2009 are higher than average due to extra fixed wing flights for moose surveys (repeated every 3-4 years). More precise accounting of motorized and mechanized use includes aircraft landings, ATV, Snowmachine, and motorized tool use is needed.</p>
Year	Flight Hours (Approximate)																
2007	1300																
2008	1450																
2009	1800																
2010	1400																
2011	1450																
2012	1300																
Indicator: Inholdings																	
Area of inholdings	<p>There are no inholdings within designated Wilderness, but 27,330 acres in eligible wilderness with ~1,000 acres expected to be exchanged or conveyed in the near future.</p>		<p>This may not be dynamic indicator for tracking undeveloped quality of wilderness but does show the intention to decrease non-Park oriented land use within eligible wilderness in DENA.</p>														

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).


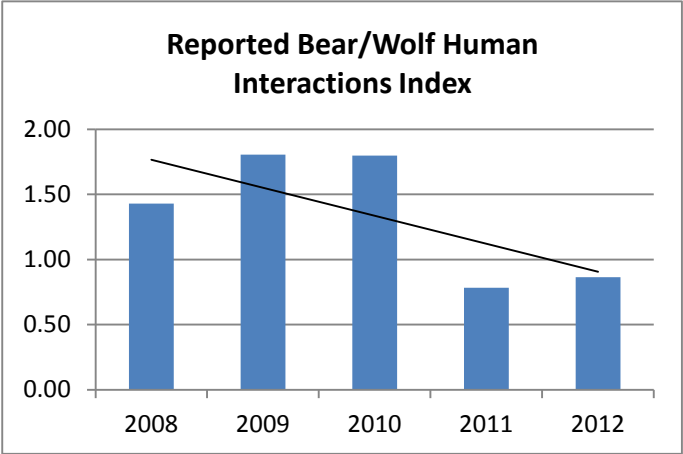
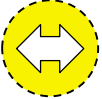
Measure	Supporting Data	Explanation and Rationale												
<p>Untrammelled Quality</p>														
<p>Indicator: Actions not authorized by Federal land manager that manipulate the biophysical environment</p>														
<p>Index of backcountry interactions between bears/wolves and humans.</p>	<p style="text-align: center;">Reported Bear/Wolf Human Interactions Index</p>  <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Reported Bear/Wolf Human Interactions Index Data</caption> <thead> <tr> <th>Year</th> <th>Index Value</th> </tr> </thead> <tbody> <tr> <td>2008</td> <td>1.45</td> </tr> <tr> <td>2009</td> <td>1.85</td> </tr> <tr> <td>2010</td> <td>1.85</td> </tr> <tr> <td>2011</td> <td>0.8</td> </tr> <tr> <td>2012</td> <td>0.9</td> </tr> </tbody> </table>	Year	Index Value	2008	1.45	2009	1.85	2010	1.85	2011	0.8	2012	0.9	<p></p> <p>The index is the ratio of bear-human and wolf-human interactions to the number of Northside backcountry user nights. The trend appears downward but the number of interactions reported may be driven by backcountry information center, interpretative, visitor use assistant, and other Park staffs' level of effort in urging visitors to turn in reports if they have them. 2012 was a difficult year with DENA's first bear related fatality of a backcountry hiker.</p>
Year	Index Value													
2008	1.45													
2009	1.85													
2010	1.85													
2011	0.8													
2012	0.9													

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).

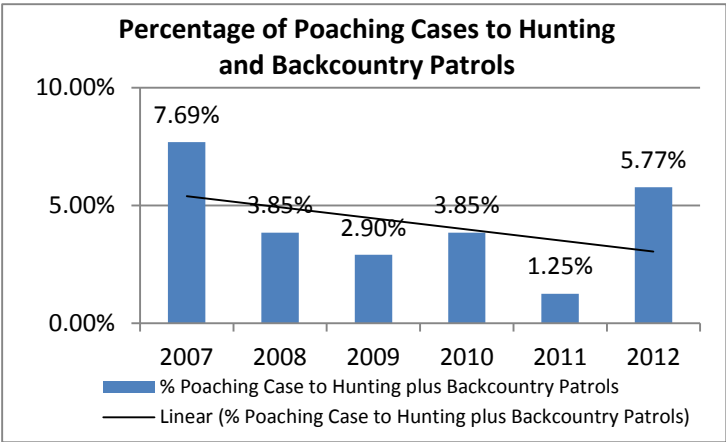


Measure	Supporting Data	Explanation and Rationale															
Ratio of poaching to total number of backcountry and hunting patrols	 <table border="1"> <caption>Percentage of Poaching Cases to Hunting and Backcountry Patrols</caption> <thead> <tr> <th>Year</th> <th>% Poaching Case to Hunting plus Backcountry Patrols</th> </tr> </thead> <tbody> <tr> <td>2007</td> <td>7.69%</td> </tr> <tr> <td>2008</td> <td>3.85%</td> </tr> <tr> <td>2009</td> <td>2.90%</td> </tr> <tr> <td>2010</td> <td>3.85%</td> </tr> <tr> <td>2011</td> <td>1.25%</td> </tr> <tr> <td>2012</td> <td>5.77%</td> </tr> </tbody> </table>	Year	% Poaching Case to Hunting plus Backcountry Patrols	2007	7.69%	2008	3.85%	2009	2.90%	2010	3.85%	2011	1.25%	2012	5.77%		<p>In relation to the total number of backcountry and hunting patrols performed the level of poaching cases is low with only 1-3 per year and appears to be on a downward trend since 2007.</p>
Year	% Poaching Case to Hunting plus Backcountry Patrols																
2007	7.69%																
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2010	3.85%																
2011	1.25%																
2012	5.77%																
Indicator: Action authorized by Federal land manager that manipulate the biophysical environment																	
Number of fire management actions (acres burned) in the Limited Areas that deviate from Fire Management Plan	<p>Only two small actions in 2009 approach this indicator: 1) One human caused fire suppressed in designated Wilderness, in a Limited Fire Management Unit (FMU) (5.1 acres affected); 2) One fire suppressed and actions to minimize growth on one fire in a Modified FMU in eligible wilderness (250.1 acres affected).</p>		<p>Fire is a prominent ecosystem process on the north side of the Alaska Range. Except for several historic cabins and small bush communities there is very little development to protect from fire.</p>														

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).

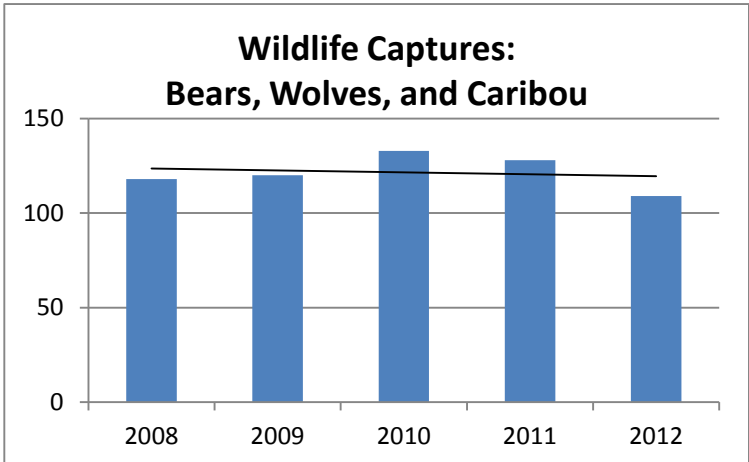



Measure	Supporting Data	Explanation and Rationale													
<p>Number helicopter landings to radio collar animals</p>	 <table border="1"> <caption>Wildlife Captures: Bears, Wolves, and Caribou</caption> <thead> <tr> <th>Year</th> <th>Number of Captures</th> </tr> </thead> <tbody> <tr> <td>2008</td> <td>~115</td> </tr> <tr> <td>2009</td> <td>~115</td> </tr> <tr> <td>2010</td> <td>~135</td> </tr> <tr> <td>2011</td> <td>~125</td> </tr> <tr> <td>2012</td> <td>~105</td> </tr> </tbody> </table>	Year	Number of Captures	2008	~115	2009	~115	2010	~135	2011	~125	2012	~105		<p>Radio and GPS tracking collars are installed and maintained on bears, wolves, caribou, and moose as part of the NPS inventory and monitoring program. The animals are captured and treated humanely and this data adds valuable knowledge to habitat use patterns and population ecology. Each time an animal is collared the helicopter landing is recorded thus the ratio is 1:1. Moose data were not available in time for this report.</p>
Year	Number of Captures														
2008	~115														
2009	~115														
2010	~135														
2011	~125														
2012	~105														
<p>Solitude or Primitive and Unconfined Recreation Quality</p>															
<p>Indicator: Remoteness from sights and sounds of human activity inside the wilderness</p>															
<p>Number of backcountry visitor nights</p>	<p>2007 BC Permit database and Talkeetna permit database: 28,436</p>	<p>2012 BC Permit database and Talkeetna permit database: 28,510</p>	 <p>Encounter rates with other groups of visitors is a standard measure for this indicator. Encounter rates for backpackers are reported in Fix and Hatcher (2011) for a snapshot of conditions. Most backcountry visitors find the solitude they seek. Lacking consistent annual data the number of backcountry visitor nights is used as a proxy to find the trend for areas of DENA that are commonly visited by backcountry travelers.</p>												

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).

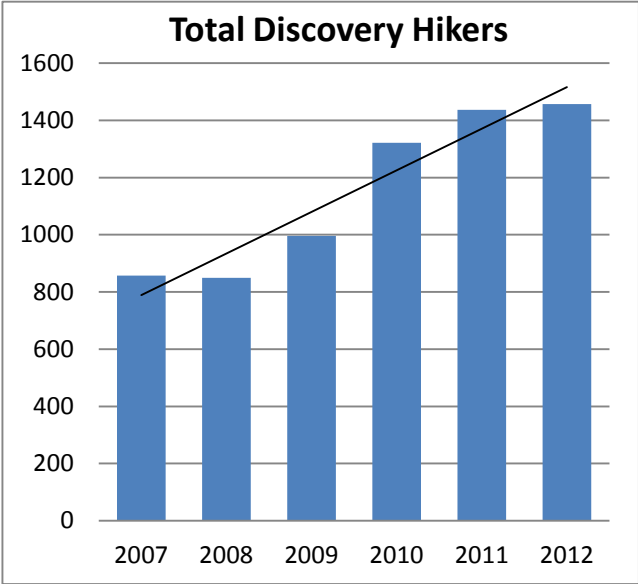

Measure	Supporting Data	Explanation and Rationale														
<p>Number of visitors taking Discovery Hikes</p>	 <table border="1"> <caption>Total Discovery Hikers</caption> <thead> <tr> <th>Year</th> <th>Number of Hikers</th> </tr> </thead> <tbody> <tr> <td>2007</td> <td>~850</td> </tr> <tr> <td>2008</td> <td>~850</td> </tr> <tr> <td>2009</td> <td>~1000</td> </tr> <tr> <td>2010</td> <td>~1300</td> </tr> <tr> <td>2011</td> <td>~1450</td> </tr> <tr> <td>2012</td> <td>~1450</td> </tr> </tbody> </table>	Year	Number of Hikers	2007	~850	2008	~850	2009	~1000	2010	~1300	2011	~1450	2012	~1450	<p>Encounter rates with other groups of visitors is a standard measure for this indicator. Encounter rates for day hikers near the park road are reported in Fix and Hatcher (2011) for a snapshot of conditions. Visitors surveyed in several popular hiking areas report encounter rates above those stipulated in the BCMP. Lacking consistent annual data we use number of Discovery hikers as a proxy to find the trend for number of day hikers near the Denali park road. This is not a robust measure of encounter rates in areas of day hiking relatively close to the Park Road; rather it shows the trend in the increase in demand for off trail day hiking experiences. In addition these hikers likely account for most of the off trail use by day hikers and thus affect encounter rates in these areas. Discovery hikes are off-trail day hikes led by an NPS interpretive ranger with up to 12 people. While they may contribute to lower levels of solitude within a few miles of the park road they provide a valuable experience for those hesitant to strike out into Denali's "trail-less" wilderness on their own. NOTE: the large jump in numbers in 2010 is due to increasing the number of hikes per day from 1 to 2.</p>
Year	Number of Hikers															
2007	~850															
2008	~850															
2009	~1000															
2010	~1300															
2011	~1450															
2012	~1450															
<p>Indicator: Remoteness from sights and sounds of human activity outside the wilderness</p>																
<p>Soundscape impacts: Maximum number of noises per day that exceed natural ambient sound level</p>		<p>Trending in motorized traffic varies across regions of the park. The four soundscapes resampled between 2010 and 2012 appeared to change in accordance with aviation best practices. (Denali Aircraft Overflights Advisory Council, 2012.) In a popular backcountry unit south of the road, median air traffic rates dropped by two events per day, but increased by two over the road corridor, suggesting displacement of traffic towards a less sound-sensitive area. (Betchkal, 2013a.) On the West Buttress climbing route of Denali, the median number of overflights per day dropped from 26 to 21, a decrease of about 5 events per day. (Withers and Betchkal, 2013.) On the McKinley Bar trail where no best practice was enacted, traffic rates remained unchanged from 2005 condition – a median of 13 per day. (Betchkal, 2013b.) It is important to note that the BCMP standards established in 2006 were based on local knowledge and no quantifiable data.</p>														

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).


Measure	Supporting Data	Explanation and Rationale
Soundscape impacts: Maximum loudness of motorized noise.		Trending in loudness of motorized events varies across regions of the park. The four soundscapes resampled between 2010 and 2012 appeared to change in accordance with aviation best practices. (Denali Aircraft Overflights Advisory Council, 2012.) In a popular backcountry unit south of the road, median maximum noise level dropped about 4 dBA, from 53.0 to 49.1 dBA – a small but noticeable difference – while levels over the nearby road corridor remained constant. (Betchkal, 2013a.) On the West Buttress climbing route of Denali, the median sound pressure level dropped from 57.5 to 45.2 dBA, a decrease of about 12 dBA (Withers and Betchkal, 2013) – resulting in sound conditions half as loud to climbers. (Cowan, 1993.) On the McKinley Bar trail where no best practice was enacted, median noise levels remained unchanged from the 2005 condition of 37.9 dBA. (Betchkal, 2013b.) It is important to note that the BCMP standards established in 2006 were based on local knowledge and no quantifiable data.
Indicator: Facilities that decrease self-reliant recreation		

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).


Measure	Supporting Data	Explanation and Rationale																																													
<p data-bbox="191 626 443 724">Number of authorized trails, bridges, and signs.</p> <p data-bbox="191 899 470 1094">*Trails leave the frontcountry developed area and are not entirely in designated wilderness. Information provided by DENA Trails, Dan Ostrowski, Jared Zimmerman, and Margret McKinley.</p>	<table border="1" data-bbox="495 467 1199 834"> <thead> <tr> <th>Trail</th> <th>Miles</th> <th>Bridges</th> <th>Signs</th> <th>Features, structures</th> </tr> </thead> <tbody> <tr> <td>McKinley Bar*</td> <td>1.6</td> <td></td> <td>0</td> <td>330' of boardwalk 2 puncheon</td> </tr> <tr> <td>Savage River*</td> <td>2.0</td> <td>1</td> <td>2</td> <td>1 log bench</td> </tr> <tr> <td>Savage Cabin</td> <td>0.2</td> <td></td> <td>6</td> <td></td> </tr> <tr> <td>Savage Alpine*</td> <td>3.5</td> <td></td> <td>0</td> <td>150' of boardwalk 1 puncheon</td> </tr> <tr> <td>Triple Lakes*</td> <td>8.0</td> <td>1</td> <td>8</td> <td>150' of boardwalk</td> </tr> <tr> <td>Polychrome</td> <td>0.1</td> <td></td> <td>0</td> <td></td> </tr> <tr> <td>Thorofare Ridge*</td> <td>0.5</td> <td></td> <td>1</td> <td></td> </tr> <tr> <td>2013 Totals</td> <td>15.9</td> <td>3</td> <td>17</td> <td>660' boardwalk</td> </tr> </tbody> </table>	Trail	Miles	Bridges	Signs	Features, structures	McKinley Bar*	1.6		0	330' of boardwalk 2 puncheon	Savage River*	2.0	1	2	1 log bench	Savage Cabin	0.2		6		Savage Alpine*	3.5		0	150' of boardwalk 1 puncheon	Triple Lakes*	8.0	1	8	150' of boardwalk	Polychrome	0.1		0		Thorofare Ridge*	0.5		1		2013 Totals	15.9	3	17	660' boardwalk	<div data-bbox="1220 824 1318 922" style="text-align: center;">  </div> <p data-bbox="1356 362 1877 873">NPS constructed trails and associated installations have increased in recent years, consistent with the park's Entrance Area and Road Corridor Development Concept Plan (NPS 1996). These wilderness trails primarily serve popular areas adjacent to the frontcountry and have been determined necessary to protect the natural quality of these areas. The creation of formalized trails & associated rehabilitation of social trail networks can have a positive impact on protecting park resources and include the Polychrome Loop, Thorofare Ridge, Eielson Area, Skyline Drive, Blueberry Hill, McKinley Bar, Savage Canyon Loop, Savage Rock, and Triple Lakes Trails.</p> <p data-bbox="1356 911 1877 1393">Since 2007, there has been an increase in the number of miles of official trail maintained and its associated infrastructure (bridges, boardwalk, signing) within the Denali Wilderness. This can be attributed to both new trail construction and to bringing non-maintained trails (social trails) up to an acceptable standard in an effort to reduce overall trail impacts to the area. As a general rule, DENA has a "no formal trails" policy in the backcountry. All trail development is identified on pages 66 and 67 of the <i>Consolidated General Management Plan for Denali National Park and Preserve</i> (Denali National Park and Preserve, 2009).</p>
	Trail	Miles	Bridges	Signs	Features, structures																																										
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<table border="1" data-bbox="495 899 1199 1284"> <thead> <tr> <th>Year</th> <th>Trail miles</th> <th>Bridges</th> <th>Signs</th> <th>Other trails infrastructure</th> </tr> </thead> <tbody> <tr> <td>2007</td> <td>11</td> <td>2</td> <td>9</td> <td>1 log bench, 300' boardwalk</td> </tr> <tr> <td>2008</td> <td>11</td> <td>2</td> <td>9</td> <td>1 log bench, 300' boardwalk</td> </tr> <tr> <td>2009</td> <td>11</td> <td>2</td> <td>9</td> <td>1 log bench, 300' boardwalk</td> </tr> <tr> <td>2010</td> <td>13</td> <td>2</td> <td>17</td> <td>1 log bench, 300' boardwalk</td> </tr> <tr> <td>2011</td> <td>14</td> <td>3</td> <td>17</td> <td>1 log bench, 350' boardwalk</td> </tr> <tr> <td>2012</td> <td>15</td> <td>3</td> <td>17</td> <td>1 log bench, 500' boardwalk</td> </tr> <tr> <td>2013</td> <td>16</td> <td>3</td> <td>17</td> <td>1 log bench, 500' boardwalk</td> </tr> </tbody> </table>	Year	Trail miles	Bridges	Signs	Other trails infrastructure	2007	11	2	9	1 log bench, 300' boardwalk	2008	11	2	9	1 log bench, 300' boardwalk	2009	11	2	9	1 log bench, 300' boardwalk	2010	13	2	17	1 log bench, 300' boardwalk	2011	14	3	17	1 log bench, 350' boardwalk	2012	15	3	17	1 log bench, 500' boardwalk	2013	16	3	17	1 log bench, 500' boardwalk							
Year	Trail miles	Bridges	Signs	Other trails infrastructure																																											
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Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).

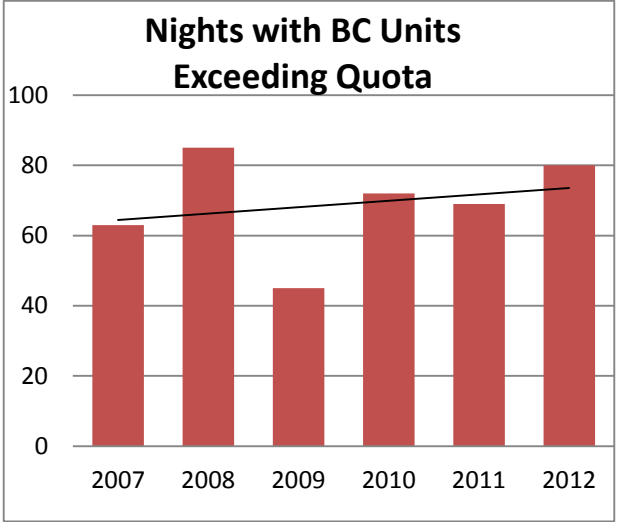

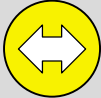

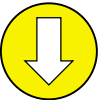
Measure	Supporting Data	Explanation and Rationale														
Indicator: Management restrictions on visitor behavior																
Number of units out of quota/ year.	 <table border="1" data-bbox="338 427 953 945"> <caption>Nights with BC Units Exceeding Quota</caption> <thead> <tr> <th>Year</th> <th>Number of units out of quota</th> </tr> </thead> <tbody> <tr> <td>2007</td> <td>63</td> </tr> <tr> <td>2008</td> <td>85</td> </tr> <tr> <td>2009</td> <td>45</td> </tr> <tr> <td>2010</td> <td>72</td> </tr> <tr> <td>2011</td> <td>69</td> </tr> <tr> <td>2012</td> <td>80</td> </tr> </tbody> </table>	Year	Number of units out of quota	2007	63	2008	85	2009	45	2010	72	2011	69	2012	80	 <p>Denali’s backcountry is divided into 75 units (Units 1-48 and 61-87 as identified in the DENA Revised Draft Backcountry Management Plan, April 2005) with varying restrictions on visitor behavior. The popularly traveled units have a quota on the number of people that are allowed to occupy that area each night. This measure shows the number of nights in a season that park staff issuing backcountry permits allows more people to occupy a unit than stipulated. This relaxation of the rules represents less restriction on visitor behavior and greater opportunity for an unconfined experience but may reduce opportunities for solitude. Denali offers a range of opportunities for an unconfined wilderness experience with the most heavily used areas having the most restrictions in order to protect opportunities for solitude and impacts from social trails and littering. It appears that the trend on this measure is fairly stable with some significant variation from year to year.</p>
Year	Number of units out of quota															
2007	63															
2008	85															
2009	45															
2010	72															
2011	69															
2012	80															
Other Features of Value Quality																
Indicator: Deterioration or loss of integral geological or paleontological features																
Paleontological resources	See State of the Park Report	 <p>Since the discovery of the first dinosaur track fossil in 2005, hundreds of sites with thousands of trace fossils have been found, with new fossils found every year. A park-wide inventory of paleontological resources is underway, and known sites that are at-risk or significant are monitored every other year.</p>														

Table 17. Denali Wilderness Character Evaluation for the State of the Park Status and Trend of Wilderness Character, February 26, 2013 (continued).

Measure	Supporting Data		Explanation and Rationale
Indicator: Deterioration or loss of integral historical or cultural features			
Cultural resources	See State of the Park Report		<p>Cultural resources are recognized as part of the fabric of wilderness in Denali. Less than one percent of the park has been surveyed for prehistoric or historic resources. Of what is known there is a rich prehistoric and historic record, not all of which is adequately documented. Multiple studies have been conducted in cultural anthropology in the northwest area of the park, but little work has been conducted elsewhere. There are no Traditional Cultural Properties recorded in the park. As elders pass away, knowledge of such places will diminish.</p>

Wilderness and Backcountry Use

Backcountry Permits and Use

The number of Backcountry Use Permits (BUP) issued for visitors backpacking in Denali National Park and Preserve is a subset of total backcountry overnight use. However, it is an effective management tool to track overnight use in the Wilderness and backcountry of the Park. The units that require BUPs are those on the north side of the Alaska Range Crest that are easily accessible from the Denali park road and George Parks Highway (and hence more popular). Backcountry Units 1 through 48, 86, and 87 require a BUP while units 61 through 85 do not (see Figure 3, page 5 for a map of units). In addition, the Backcountry Units which have an overnight limit (# of people) are 1 through 43 which ranges from 2 to 12 people depending on the unit. Figure 3 shows the location of the backcountry units.

The Backcountry Information Center issues BUPs during the summer season (May – September). The winter visitor center at the Murie Science and Learning Center building issues BUPs in the shoulder and winter seasons. Over the last ten years there is a downward trend in the number of BUPs issued from a high of 2,384 in 2002 to a low of 1,512 in 2007, see Figure 14.

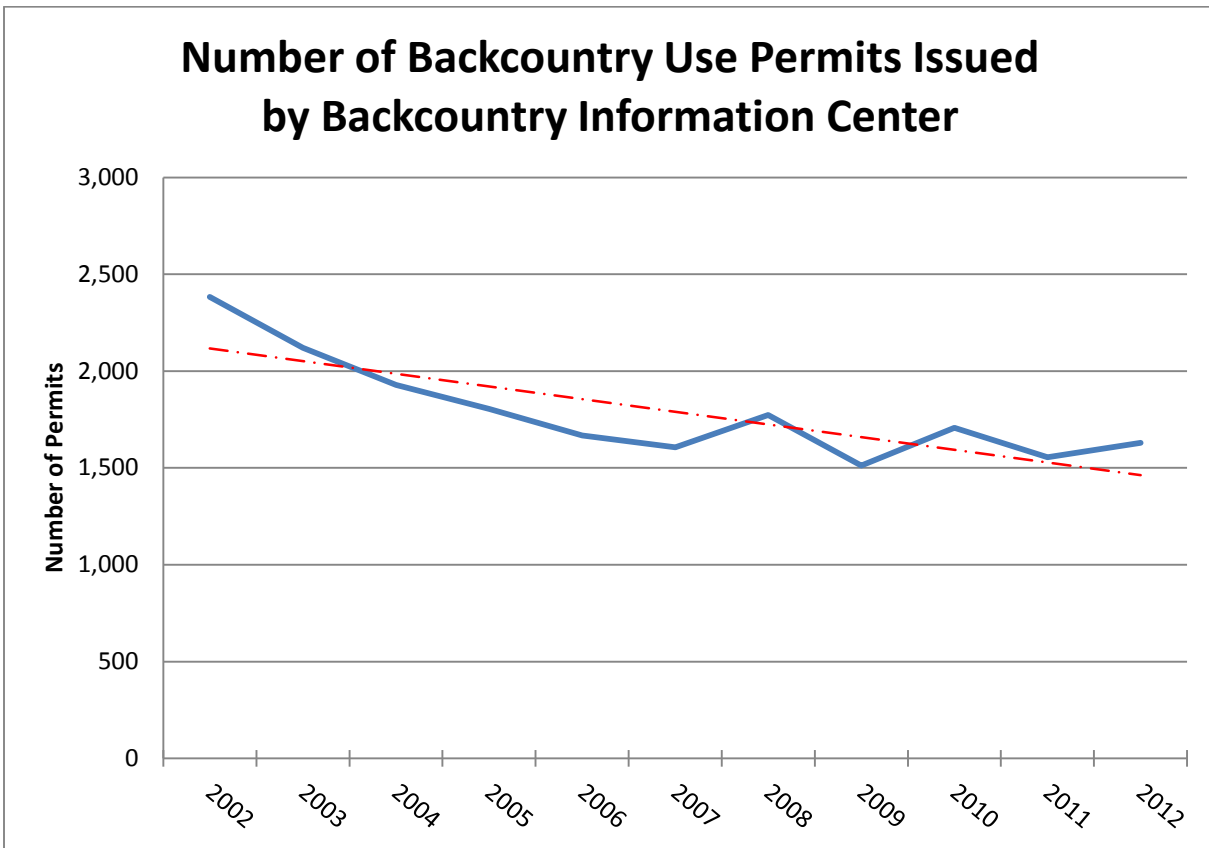


Figure 14. Number of Backcountry Use Permits issued by the Backcountry Information Center. Information obtained from Backcountry Permit Database, trend line displayed.

Mountaineering use, as recorded with the issuance of mountaineering permits at Denali National Park and Preserve, has remained stable with a slight upward trend line since at least 2002. See Figure 15. That positive trend can be attributed to the increase in permits being issued to ‘Other Mountaineering’ use and not on Mt. McKinley or Mt. Foraker where permits are required (and capped at 1500 climbers on Mt. McKinley). However, registration to climb other peaks in DENA is on a voluntary basis and therefore reported numbers may be lower than actual.

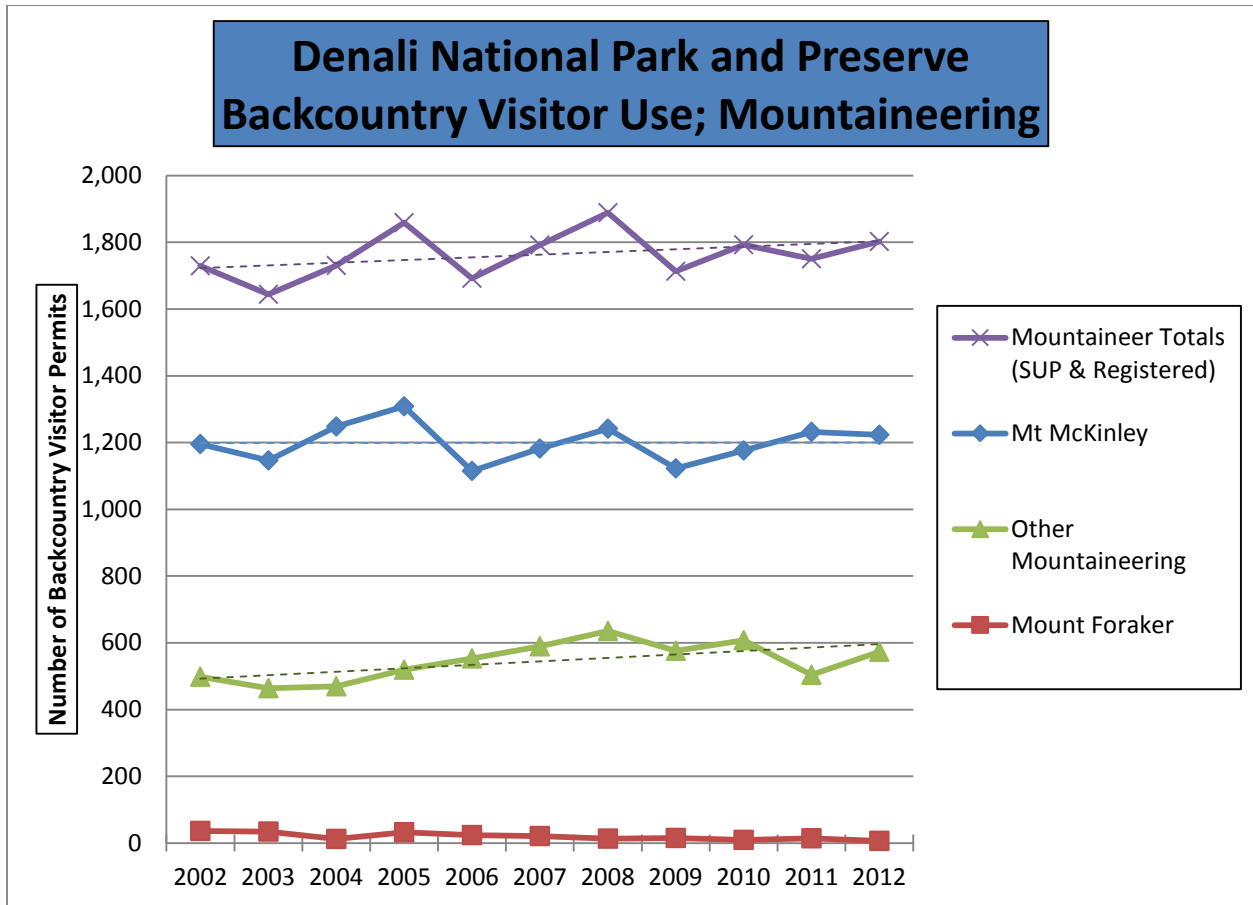


Figure 15. Denali National Park and Preserve Backcountry Visitor Use; Mountaineering Information obtained from Backcountry Permit Database and Mountaineering Use Database. Trendlines displayed.

The number of backcountry visitor nights spent in Denali National Park and Preserve has remained fairly stable with a relatively flat trend line since 2002 (see Figure 16). The number of visitors nights for backcountry permits have shown a very slight downward trend in overnight use since 2002.

Overnight visitor use for mountaineering is regulated via a mountain permit for Mt. McKinley and Mt. Foraker. Mountain use permits for Mt. McKinley are capped at a total of 1,500 climbers between April 1 and August 1 each year. Currently permits for Mt. Foraker are not capped. Mountaineering use nights have exhibited a slight positive trend since 2002 (see Figure 16) which has influenced the overall backcountry visitor use nights trend to be a relatively flat trend over that same time period. Note that mountaineering permits are issued to individuals while north side permits are issued to groups.

Denali National Park and Preserve Backcountry Visitor Use Nights

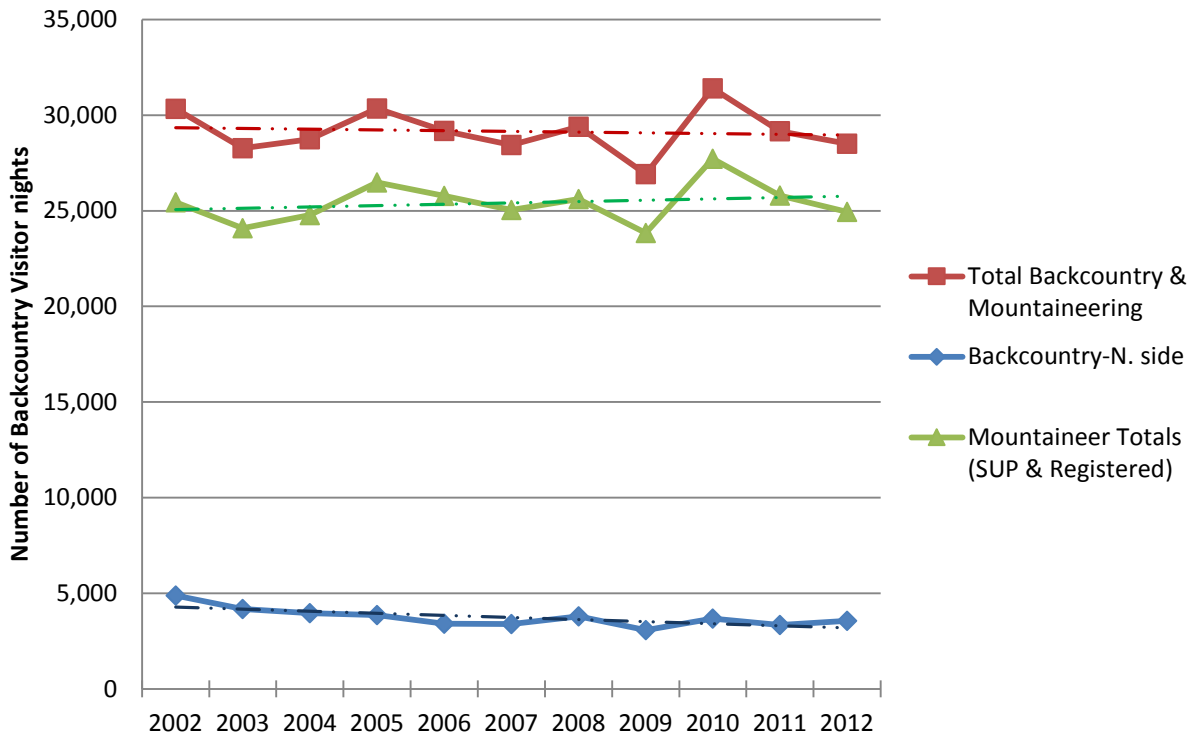


Figure 16. Denali National Park and Preserve backcountry visitor use nights. Information obtained From Backcountry Permit Database and Mountaineering Use Database.

Backcountry Concessions Use

Backcountry concessions use provides valuable visitor services in a range of activities from guided hikes and access to remote areas via air taxi during the summer months, guided sport hunting on Preserve lands in the fall, to dog sled trips in the winter. The total number of visitors who take advantage of these services (excluding the primary transportation services provided on the Denali Road) is a small percentage of total Park use. However, it provides a greater breath of recreational opportunities than the National Park Service could offer alone while supporting the purposes for which the Park was established. A summary of commercial companies operating in the backcountry, services they provide, and number of people served, follows in Table 18.



Figure 17. Camp Denali is one of the commercial companies providing backcountry experiences (NPS photo, 2010).

Table 18a. Commercial interpretive hiking companies operating in the backcountry, use areas and levels.

Interpretive Hiking; Company	Area of Authorization	Clients 2012	Clients 2011	Clients 2010	Clients 2009	Clients 2008	Clients 2007
Denali Backcountry Lodge	The Kantishna Area as defined as that area of Denali National Park and Preserve within Backcountry Units 40, 41, 42, 43 and the park road and Skyline Drive corridors in the new park addition between Backcountry Unit 42 and 43. The Wonder Lake Area including the McKinley Bar Trail, Blueberry Hill, attendance at Wonder Lake NPS Interpretive programs, and Reflection Pond.	2,086	3,279	2,976	2,366	2,523	
Kantishna Roadhouse	Same as above.	1,704	1,623	1,692	1,574	2,187	1,845
Denali Wilderness Centers (Camp Denali)	Same as above, plus historic rights which include up to 28 hiking trips per week into the old park.	3,924	3,700	3,543	3,402	3,601	3,457
Totals		7,714	8,602	8,211	7,342	8,311	5,302

Table 18b. Commercial sport hunting companies operating in the backcountry, use areas and levels.

Sport Hunting; Company	Area of Authorization	Clients 2012	Clients 2011	Clients 2010	Clients 2009	Clients 2008
Alaska Remote Guide Service	North of the Yentna	10	6	4	4	3
Bearfoot Adventures	South of the Yentna	have not received yet	1	4	5	3
Totals			7	8	9	6

Table 18c. Commercial dog sled passenger and freight companies operating in the backcountry, use areas and levels.

Dog Sled, Passenger; Company	Area of Authorization	Clients 2011-12	Clients 2010-11	Clients 2009-10	Clients 2008-09	Clients 2007-08
Earthsong Lodge	Northeastern park boundary entry	"Trips about the same as last years, but more people are choosing shorter trips. More outside the park".	did not report; did pay CFF	12	12	16
Denali West Lodge	Western park boundary entry	did not operate	did not operate	did not operate	did not operate	did not operate
Denali North Side Supply (freight)	DNP&P	is not authorized to have clients	-	-	-	-
Totals				12	12	16

Table 18d. Commercial air taxi companies operating in the backcountry, use areas and levels.

Air Taxi; Company	Area of Authorization	Clients 2012	Clients 2011	Clients 2010	Clients 2009	Clients 2008	Clients 2007	Clients 2006
Kantishna Air Taxi	McKinley Airstrip and Kantishna Air Strip							
	Flightseeing		1153	956	987	1173	1131	1078
	Air Taxi		885	804	733	883	830	803
Totals			2038	1760	1720	2056	1961	1881

Information in all tables for this section provided by Martha Armington; DENA Concessions Mgmt. Specialist.

Guided Hiking

Commercially guided day hikes within DENA appeared slightly lower in 2012 than previous years (Figure 18). This section does not include guided hikes for non-commercial, educational use (see below for that summary).

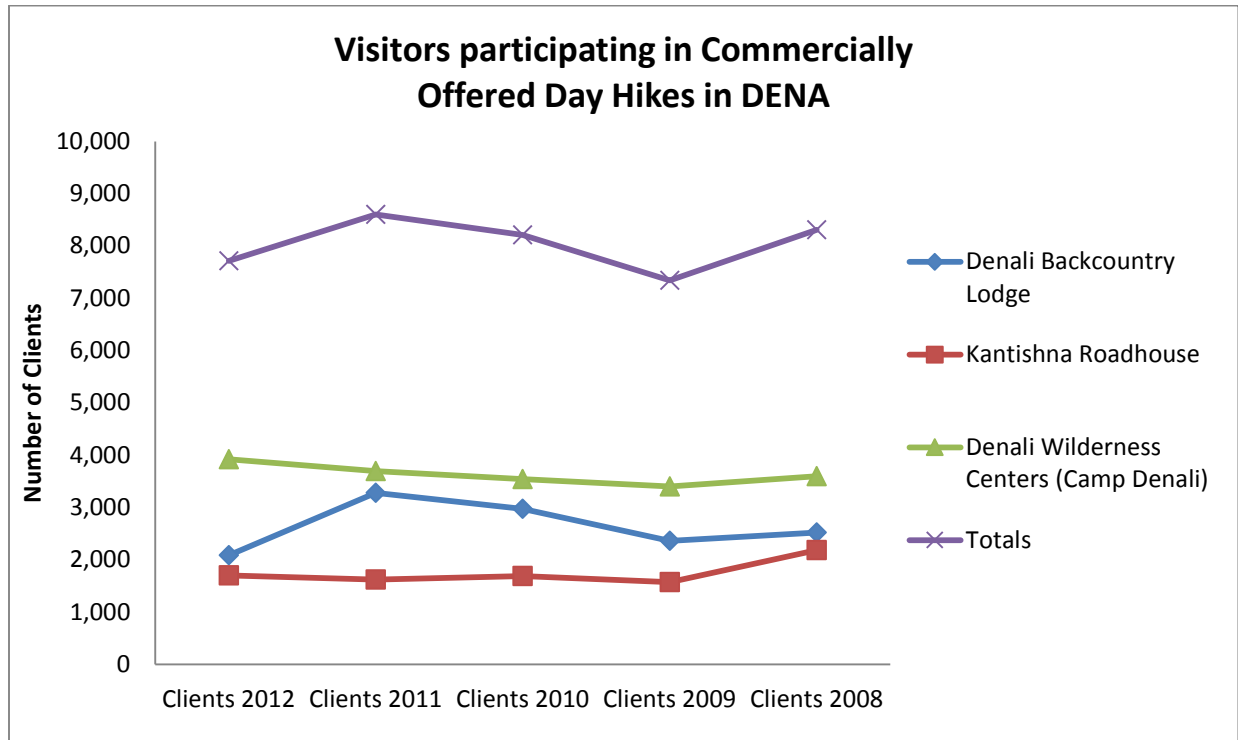


Figure 18. Visitors participating in commercially offered day hikes in DENA. Information in all tables for this section provided by Martha Armington; DENA Concessions Mgmt. Specialist.

In addition, Alaska Alpine Adventures, Get Up and Go, Denali Sightseeing, Explore Denali (Aramark), and Ruby Range had CUAs for day hiking in areas other than frontcountry within DENA. Alaska Alpine Adventures reported 1 day trip into Backside Lake, Get Up and Go had a few day trips to Triple Lakes, Ruby Range reporting taking the shuttle to Fish Creek for day hikes, and Denali Sightseeing did not report any activity.

An area of recent overnight commercial activity has been the Backside Lake area. Alaska Alpine Adventures has reported use in 2011 and 2012 of 337 and 257 visitor nights respectively. Due to the existence of sensitive plants and soils, DENA staff visited Backside Lake to document impacts on September 8, 2011. Return visits by DENA Staff are scheduled in July 2013.

Guided Climbing

Guided climbing within DENA is managed under concessions contracts on Mt. McKinley within designated Wilderness, and under commercial use authorizations outside of designated Wilderness.

Below is a list of concession operators who guide on Mt. McKinley.

Table 19. Concession operators who guide on Mt. McKinley.

Alaska Mountaineering School P.O. Box 566 Talkeetna, AK 99676 Phone: (907) 733-1016 Fax: (907) 733-1362 www.climbalaska.org	Alpine Ascents International 109 W. Mercer St. Seattle, WA 98119 Phone: (206) 378-1927 Fax: (206) 378-1937 www.alpineascents.com	American Alpine Institute 1515 12th Street Bellingham, WA 98825 Phone: (360) 671-1505 Fax: (360) 734-8890 www.alpineinstitute.com
Mountain Trip International, LLC P.O. Box 658 Ophir, Colorado 81426 Phone: (970)369-1153 Fax: (303) 496-0998 www.mountaintrip.com	N.O.L.S. P.O. Box 981 Palmer, AK 99645 Phone: (907) 745-4047 Fax: (907) 745-6069 www.nols.edu	Rainier Mountaineering, Inc. P.O. Box Q Ashford, WA 98304 Phone: (360) 569-2227 Fax: (360) 569-2982 www.rmiguide.com

The percentage of total visitor nights on Mt. McKinley attributed to commercial use (concessions contracts) has risen since 2008 while overall use has retained a constant trend, indicating fewer non-guided climbers. (Figures 19 and 20). The number of climbers has remained below the cap of 1500 over these years.

Other mountaineering guides are permitted, with the issuance of a Commercial Use Authorization (CUA), to guide climbers outside the designated Wilderness area of Denali, in the "new park additions" that were added after December 2, 1980. Commercial guiding companies with CUAs are listed in Table 20.

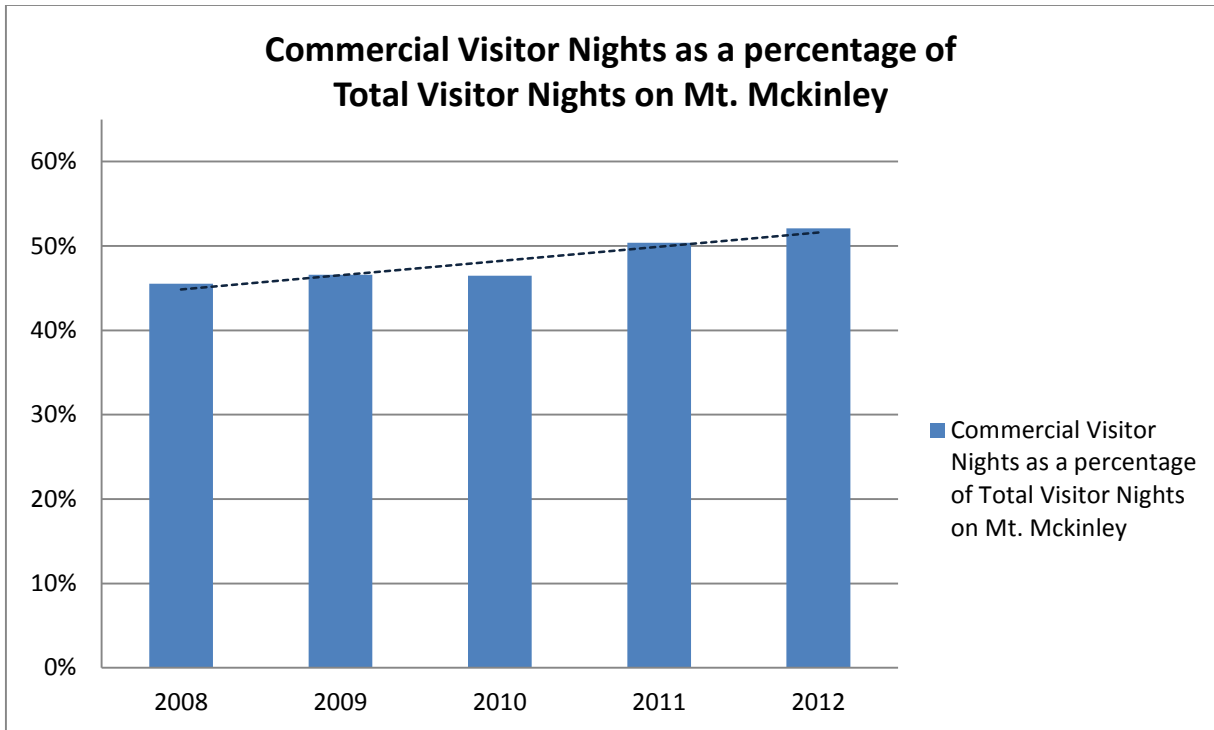


Figure 19. Commercial visitor nights as a percentage of total visitor nights on Mt. McKinley. Data provided by Missy Smothers. Trend line displayed.

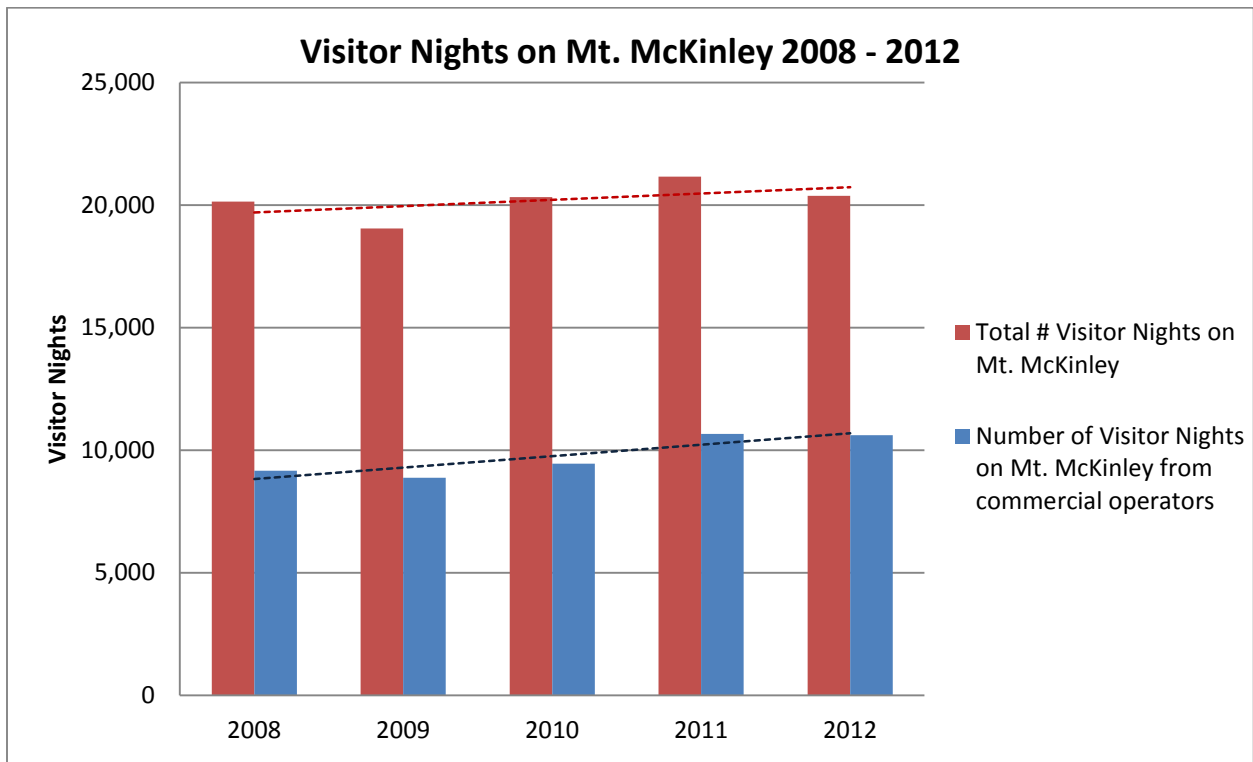


Figure 20. Visitor nights on Mt. McKinley 2008-2012. Data provided by Missy Smothers. Trend line displayed.

Table 20. Commercial guides with Commercial Use Authorization.

Alaska Mountaineering School, LLC 13765 Third Street Talkeetna, AK 99676 907-733-1016	ALPINE ASCENTS INTERNATIONAL 109 West Mercer Street Seattle, WA 98119 phone: (206) 378-1927 fax: (206) 378-1937	American Alpine Institute 1515 12th Street Bellingham, WA 98225 Email: info@alpineinstitute.com 800-424-2249 Fax: (360) 734-8890	Climbing Life Guides http://climbinglife.com/
Colorado Mountain School Phone: 800-836-4008 x3 info@totalclimbing.com	Mountain Trip Alaska 15445 Kreitel St. Anchorage, AK 99516 866-886-TRIP (8747)	North Cascades Mountain Guides 48 Lost River Road Mazama, WA 98833 (509) 996-3194 (phone) (888) 544-0511 (fax) info@ncmountainguides.com	Rigging for Rescue, LLC Mike and Joanie Gibbs P.O. Box 745 324 5th Street Ouray, CO 81427 (970) 325-4474 info@riggingforrescue.com
San Juan Mountain Guides PO BOX 3242 Durango, CO 81302 800.642.5389 Fax: 866.548.1157	Skyward Mountaineering 2412 Hidden Valley Drive Grand Junction, CO 81507 [970] 209-2985 vince@skywardmountaineering.com	Southwest Adventure Guides, LLC PO Box 3242 Durango CO 81302 800-642-5389 info@swaguides.com	McCarthy-Kennecott, Alaska 1-888-933-5427 info@steliasguides.com

Guided Hunting

There are only two commercial hunting guide companies legally operating on DENA lands (Preserve Lands), see Table 21. It appears that there was an increase in the number of total hunting clients served in 2012 over previous years.

Table 21. Commercial hunting guides permitted to operate on Preserve lands.

Wayne Kubat Alaska Remote Guide Service PO Box 874867 – Wasilla, AK 99687 Phone/Fax: (907) 376-9568	Chet and Halie Benson 907-240-4868 moreinfo@BearfootAdventures.net
--	--

Scenic Air Tour Landings

The following four flightseeing concessionaires are permitted to land aircraft on glaciers in the 1980 additions to Denali National Park:

Fly Denali, with offices in Talkeetna and Healy, AK; 866-733-7768, www.flydenali.com

Sheldon Air Service, Talkeetna, AK; 907-733-2321, www.sheldonairservice.com

K2 Aviation, Talkeetna, AK; 800-764-2291, <http://www.flyk2.com/>

Talkeetna Air Taxi, Talkeetna, AK; 800-533-2219, www.talkeetnaair.com

Air Taxi Services

[Kantishna Air Taxi](#) provides air taxi services between the McKinley Park Airstrip, at the park entrance, and the Kantishna Airstrip, as well as flightseeing services from Kantishna.

Other air taxi companies, listed in Table 22, may operate in the preserve areas of the park:








Table 22. Air taxi companies that may operate in the Preserve area of DENA.







40-MILE AIR PO Box 539 Mile 1313 Alaska Highway Tok, Alaska 99780 Tel. (907) 883-5191 FAX (907) 883-5194 fortymi@aptalaska.net	Atkins Guiding & Flying Service (907-768-2143)	Denali Air, Inc. P.O. Box 82 Denali National Park, Alaska 99755 Mile 229.5 Parks Highway 907 - 683 - 2261 Fax: 907-683-1347 flightseeing@denalair.com	Sheldon Air Service PO Box 648 Talkeetna, AK 99676 (907) 733-23241
Kantishna Air Taxi PO Box 46 Denali Park, Alaska 99755 (303) 449-1146 (Oct-May) (907) 644-8222 (June-Sept.) info@katair.com	Lake Clark Air Inc. Port Alsworth, Alaska 99653 907.781.2208 Fax: 907.781.2215 888.440.2281 800.662.7661	Rust's Flying Service P.O. Box 190867 4525 Enstrom Circle, Anchorage, 99502 907-243-1595 Fax 907-248-0552 info@flyrusts.com	Talkeetna Air Taxi 14212 E. Second St. Talkeetna, AK 99676 : 907-733-2218 Fax: 907-733-1434 800-533-2219
Wrangell Mountain Air PO Box MXY - 25 McCarthy, Alaska 99588 (907) 554-4411 Fax (907) 554-4400 info@wrangellmountainair.com	Wright Air Service P.O. Box 60142 Fairbanks, AK 99706 (907) 474-0502 Fax: (907) 474-0375 www.wrightairservice.com		

Subsistence Use

Today, as in the past, many Alaskans live off the land, relying on fish, wildlife and other wild resources. Alaska Natives have used these subsistence resources for food, shelter, clothing, transportation, handicrafts and trade for thousands of years. Subsistence, and all it entails, is critical to sustaining both the physical and spiritual culture of Alaska Native peoples. It is an important tradition for many non-Natives as well. Title VIII of ANILCA protects subsistence needs for rural Alaskan residents in Denali. Subsistence opportunities are protected within Denali and those resources being used are generally stable (see Table 23). Specific areas of concern for subsistence users are furbearer and fishery populations. Intergenerational participation, youth interest and involvement, and general population decline in rural communities around Denali is resulting in a downward trend for the demand of resources by subsistence users.

Table 23. Condition of subsistence resources.

Subsistence			
Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Hunting, Fishing, and Trapping of Wildlife	Number of animals taken by subsistence harvest in the new park and preserve		Subsistence harvest levels of moose and caribou have remained about the same. Harvests in Game Management Units (GMU) 13E (new park) by Cantwell residents and GMU 16B (south preserve) by Skwentna residents are reported to the Federal Subsistence Permit System (harvest database). Harvests in GMU 20C (Kantishna area of new park) and in GMU 20C (north preserve) by Lake Minchumina residents are self-reported to the Subsistence Program Manager at Denali.
	Numbers, sex ratios, and age distribution of species subject to subsistence harvest in new park areas		Park staff conducted surveys of moose that are subject to subsistence harvest near Yentna and Cantwell most recently in 2008. The numbers, sex ratios, and age distribution of moose subject to subsistence harvest near Yentna and Cantwell are known from this moose survey. The next surveys of moose are scheduled for 2013.
	Populations sizes of harvested species		The Office of Subsistence Management (Federal Subsistence Permit System) keeps a database for moose and caribou harvested in GMU 13 (GMU 13E is in the preserve, and it would be qualified Cantwell residents who would harvest moose and caribou there).
	Density (abundance) and distribution of furbearers		In 1978, trapping activities and uses were documented (Bishop 1978). The Denali Subsistence Resource Commission has requested that the NPS begin furbearer studies to investigate changes in the number of marten, which is the most important harvested species for subsistence trappers in the park additions.
Hunting, Fishing, and Trapping of Wildlife	Density (abundance) and distribution of fish		The abundance of fish is declining according to a Traditional Ecological Knowledge (TEK) report (Williams et al. 2005)
Uses of Timber	Density (abundance) and distribution of timber for firewood and cabin logs		There has been a timber survey in the Windy Creek area near Cantwell (Sanders 2009), where anecdotally there is the most timber harvested for firewood. There has been no timber survey in the Lake Minchumina area where trap line cabins are located.

Subsistence			
Indicators of Condition	Specific Measures	Condition Status/Trend	Rationale
Opportunity for and Continuity of Subsistence Activities	Percentage of intergenerational trappers		Overall there are fewer youth involved in subsistence activities. Anecdotally, the population numbers (including youth) in subsistence communities are declining (Holen et al 2006).
	Percentage of people cutting firewood or cabin logs without a permit		The percentage of people cutting firewood without a permit is unknown. The percentage of people cutting logs for cabins without a permit is low (less than 5 percent). There is a known established process for applying to build trap line cabins.
	Percentage of people who want to harvest timber for firewood or cabin logs who are able to do so		An Environmental Assessment is required to rebuild a cabin. A permit is needed to harvest firewood. No requests for cabin logs or firewood have been denied 2008-2012.
	Percentage of people who want to trap who are able to do so		100%. There are no restrictions on trapping, so those who want to trap are able to do so.
	Percentage of people who want to subsistence fish who are able to do so		At this time, there are no known people who want to subsistence fish within the preserve.

Activities for the Administration of the Backcountry

Backcountry Patrols and Operations

Denali National Park and Preserve has a long history of patrol operations which have always been challenging due to the nature and scope of the central Alaskan landscape. Patrols are carried out by Park Rangers on foot, snow shoe, ski, dog team, horseback, snowmachines, and all-terrain vehicles in order to monitor human activity and resource conditions, provide education and/or enforcement, and help visitors in need. Although some data appears to be missing, Figure 21 shows the numbers of each type of patrol performed over the last five years. It is helpful in demonstrating an overall and general trend for backcountry patrols.

The Visitor and Resource Protection Division is currently organized into three Districts. The South District, which oversees mountaineering operations and performs a full range of Ranger duties for areas south of the Alaska Range crest, is based out of Talkeetna. The North District, which focuses Ranger operations along the park road, is based out of the headquarters area. The Backcountry District focuses on backcountry management park-wide, and is based out of the headquarters area.

Backcountry District Ranger staff is focused on providing visitor information through the Backcountry Information Center, monitoring of backcountry resources, and visitor and resource protection throughout Denali's backcountry and Wilderness. Backcountry District Rangers, who are commissioned, focus on resource protection throughout Denali and work with North and South District Rangers to conduct hunting, foot, snowmachine, ATV, and other patrols. Staff are particularly busy during hunting seasons.

One area of increasing visitor use, adjacent to Denali, is the Stampede corridor. This area has been a popular moose hunting area, but recent interest in the bus made famous by Christopher McCandless has caused use levels to increase. The bus is a destination for an unknown number of visitors, some of whom have needed to be rescued. Rescue operations have been provided by the State of Alaska with assistance from Denali when requested. Other areas, such as Dunkle Mine and the south side of the Alaska Range, have shown anecdotal increases in winter snow machine use, including occasional Wilderness/Old Park trespass.

As seen in Figure 21, since 2005 there has been a positive trend in the number of backcountry and hunting patrols documented by Rangers in the Park. In 2012, there was a sharp drop in the number of hunting patrols conducted, but this can be attributed to staff turnover. In the fall of 2012, the Park had 3 permanent GL-09 field Ranger positions and one GS-12 supervisory Park Ranger position vacant (this equates to 25% reduction in staff during the hunting season). Backcountry patrols are performed primarily by Backcountry District staff, 3 permanent field Rangers and 6 seasonal Backcountry Information Center staff during the summer months, shifting to just the 3 field Rangers during the winter. In addition, backcountry winter patrols are conducted by Kennels staff (2 permanent Rangers, 1 seasonal Ranger, and 2 volunteer dog mushers).

Mountaineering patrols are conducted by the Ranger staff working out of the Talkeetna Ranger Station. They focus patrols on Mt. McKinley and rely heavily on volunteer support throughout the climbing season (April 1 through August 1 each year) to fill the members of the climbing teams. Historically, there have been challenges in getting case incident reports entered into the DENA CIR database due the geographic separation of Park headquarters and Talkeetna Ranger Station. However, *Annual Mountaineering Summaries* have been done since at least 1979. They are posted on the Park website at <http://www.nps.gov/dena/planyourvisit/summaryreports.htm> and are an excellent source of information.

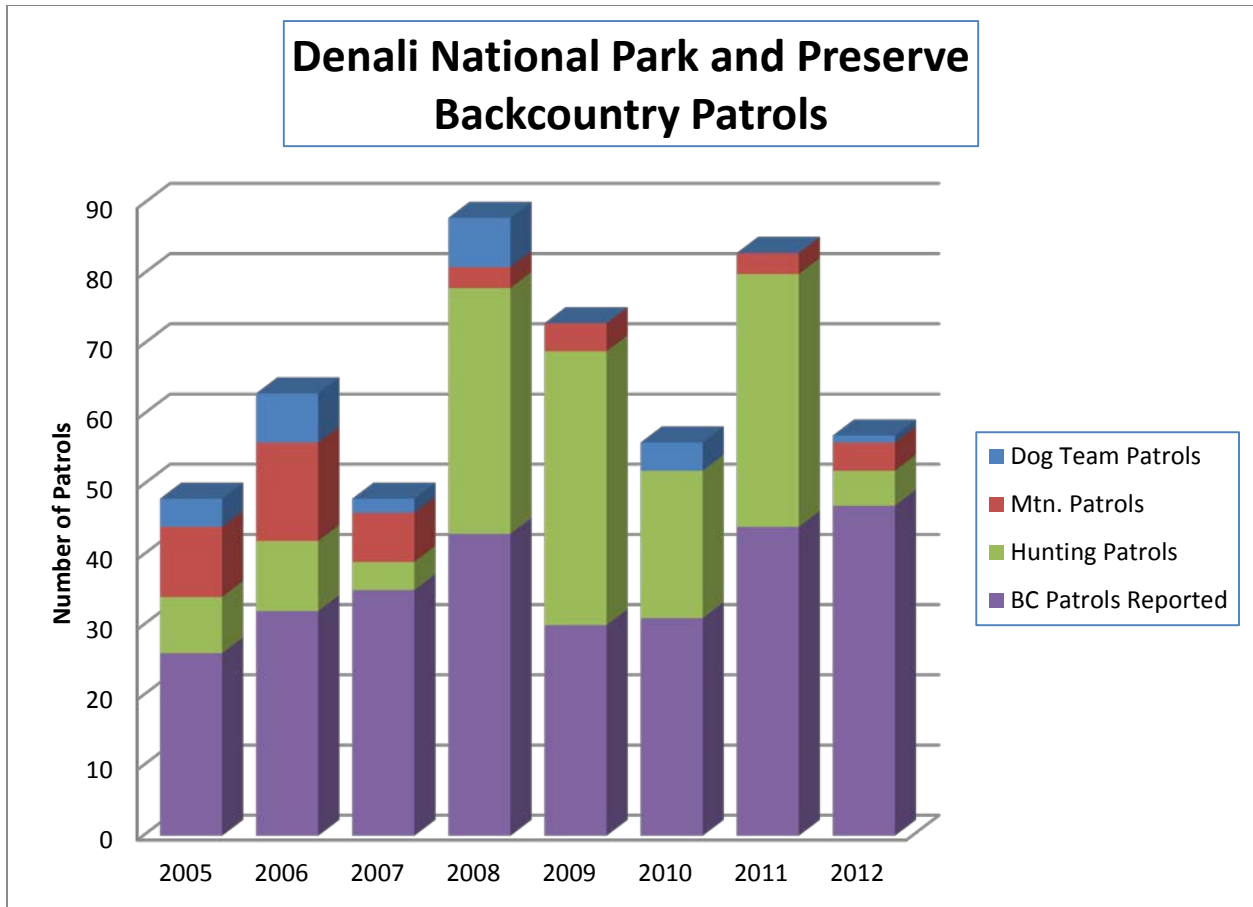


Figure 21. Denali National Park and Preserve backcountry patrols 2005-2012. Information from Case Incident Reporting system 2012.

In 2011, supervision of the Park’s kennels operations was moved from the Protection Division to the Interpretive Division. While this shift better integrated summer operations, which focused on interpretative themes associated with the history and role of dogs in Denali, it shifted the chain of command from an operational focus to an educational one. This shift also resulted in less oversight and supervision of winter patrol operations at the Kennels. Fortunately, Kennels staff are very professional and do an outstanding job in preparing and planning for winter operations with a focus on safety. Kennels staff, traditionally and currently, reach out to all Divisions to offer their assistance and services during the mushing season.

Scientific Research and Monitoring

Each year numerous projects occur in eligible and designated Wilderness in order to better understand the natural and cultural resources and visitor use in Denali.

Long term ecological monitoring in Denali occurs with the support of the Central Alaska Network (CAKN) of the NPS Inventory and Monitoring Program (I&M). Denali and I&M staff worked to choose and prioritize “vital signs” which are indicators that represent the components and long term ecological trends in Denali (MacCluskie and Oakley 2005).

The following “vital signs” are monitored on a regular basis at Denali. Those in bold include those for which work occurred in the backcountry in 2012:

Air Quality (no sites in backcountry)

Climate (no sites in backcountry)

Moose

Shallow Lakes

Snow Pack

Vegetation Structure and Composition

Wolves

Caribou

Glaciers

Golden Eagle

Passerine Birds

Permafrost

Plant Phenology

Small Mammals

Soundscape

Streams and Rivers

In 2012, 28 research permits were approved for work in eligible and designated Wilderness (Table 24).

Table 24. Research permits approved for work in eligible and designated Wilderness in 2012.

Study Title	Principal Investigator
An Investigation of Hiker Encounter Rates on the Triple Lakes Trail	Andrew Ackerman (NPS)
Soundscape Study of Denali National Park and Preserve (renewal) and addition of Bison Gulch winter site.	Davyd Betchkal (NPS)
Collecting Dragonfly larvae for mercury analysis as part of a nationwide NPS citizen science program	Andrea Blakesly (NPS)
Plate Boundary Observatory (PBO) component in Denali National Park to monitor tectonic and magmatic process using high precision GPS	Kyle Bohnenstiehl
Developing geophysical constraints on Alaska Range glacier ice volume estimates	Seth Campbell
Sand dune formation and human land use Beaver log Lakes, Denali National Park and Preserve, Central Alaska	Samuel Coffman
A noninvasive study to estimate wolverine populations in DENA	Greg Colligan (NPS)

Table 24. Research permits approved for work in eligible and designated Wilderness in 2012 (continued).

Study Title	Principal Investigator
Genes or environment? White spruce and the divergence effect at Alaska's tree lines	Pascal Eusemann
A detailed study of an ancient high latitude terrestrial ecosystem and its implications for understanding climate change: the dinosaurs and their ecosystems with the Lower Cantwell Formation in Denali National Park	Anthony Fiorillo
Monitoring of small mammal populations in Denali	Melanie Flamme
Lake Minchumina Cultural Resources Inventory Project	Charles Holmes
Rising temperatures and the influence of nonlinear thresholds on forest expansion in Denali	Rachel Isaacs
Melatonin as a countermeasure to the mal-effects of high altitude on sleep and cognitive function on North America's highest peak	Christopher Jung
Documenting natural and cultural resource change using repeat photography in Denali	Ron Karpilo
Nitrogen dynamics and the red senescence of three northern plants	Margie MacNeille
Acetazolamide for the prevention of high altitude illness: a comparison of dosing	Scott McIntosh
Monitoring Occupancy of Nesting Areas, Reproductive Success, and Nesting Phenology of Golden Eagles and Gyrfalcons in Denali	Carol McIntyre (NPS)
Parnassius pheobus (butterfly species) live close-up photographs	Kenelm Philip
Vermicomposting human waste in outside environment, Talkeetna, AK	Roger Robinson (NPS)
Monitoring dust palliative applications to the Denali Park road	Carl Roland (NPS)
Continued monitoring of vegetation succession on terraces of the McKinley River	Carl Roland (NPS)
Assessing off road vehicle (ORV) impacts in Denali	Carl Roland (NPS)
Insect pollinators in Denali: a survey of bees and flower flies PLUS NPS-wide bee study	Jessica Rykken
Spatial distribution of corticolous myxomycetes (related to "Genes or Environment? White Spruce and the divergence effect at Alaska's tree line)	Martin Schnittler
Mesocarnivore community response to wolf presence, prey availability, and snowpack	Kelly Sivy
Ecology of moose in Denali	Victor Van Ballenberghe
Drill site reconnaissance and snow chemistry survey in Denali	Cameron Wake
The critical role of biological weathering in shaping high altitude landscapes	Dragos George Zaharescu

Guided Hikes for Educational Purposes and Non-commercial Use

Each year, NPS Interpretive Rangers, Alaska Geographic staff, and Denali Education Center (DEC) staff lead visitors into Denali’s backcountry for day and overnight hikes. Alaska Geographic and DEC are non-profit partners with the NPS and affiliated with the Murie Science and Learning Center (MSLC). These hikes are primarily educational in nature and are done for non-commercial purposes as part of the NPS “Discovery Hikes” (day trips), MSLC field seminars (day and overnight trips), and DEC residential and youth programs.

These programs provide an outstanding opportunity for connection with wildness and the Denali Wilderness for many hikers unaccustomed to trail-less backcountry hiking. However, the groups do have an impact on wilderness character, primarily the opportunities for solitude.

The Ranger-led Discovery Hikes are fully off-trail hiking and currently offered every day during the main summer season (June 8- Early September). Prior to 2003, two hikes per day were led, while in 2004-2009 one hike per day was offered. Since 2010, two hikes per day have been offered (one east of Polychrome Overlook and one west). The number of participants per hike was limited to 11 beginning in 2006. In 2012, there was an average of 8 people per hike with over 1,400 people participating. Discovery Hike data is presented in Figure 22.

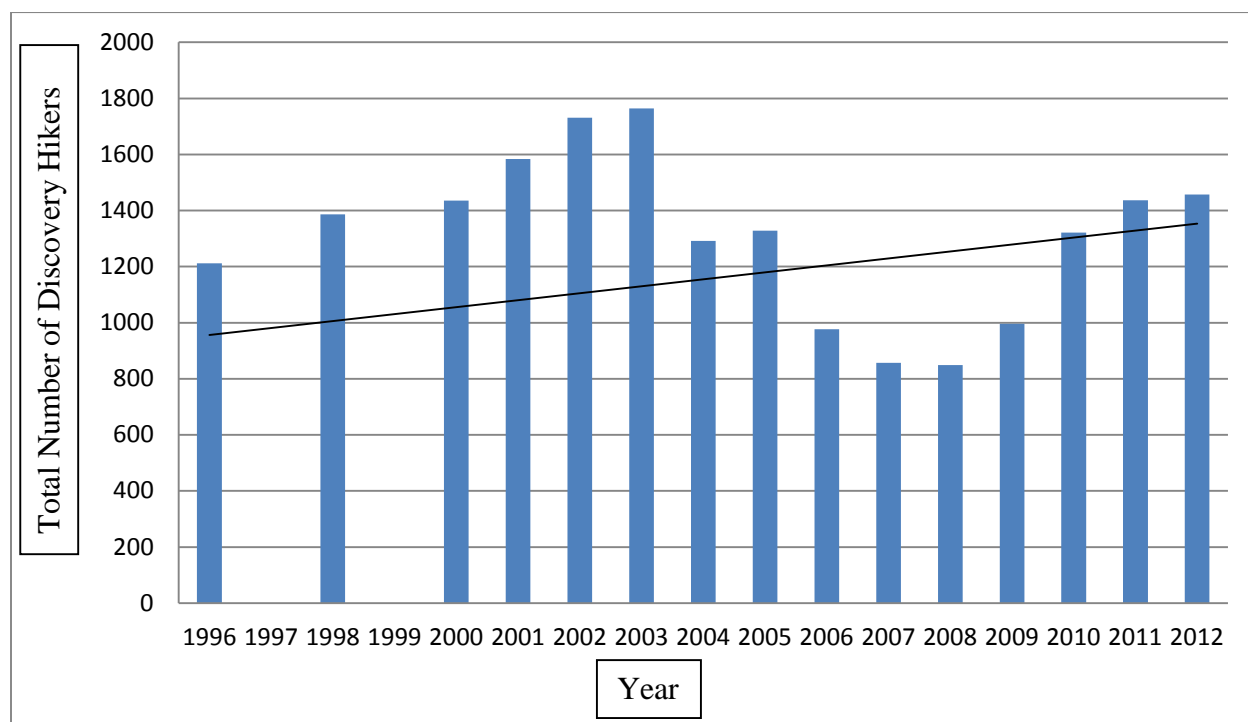


Figure 22. Total number of Ranger led Discovery Hikes from 1996 to 2012. Trend line displayed.

Since 2009, the routes that Discovery Hikes and MSLC seminar hikes have taken have been recorded geospatially and incorporated digitally into GIS. During the field season, this enables the Interpretive Rangers to avoid hiking a route (with non-durable surfaces) more than twice by communicating their routes on a shared map. At the end of the season, these routes are digitized and incorporated into GIS (see Figure 23 for 2012 routes). This dataset allows tracking of cumulative

impacts. For example, Figure 24 shows line density for all hikes between 2009 and 2012. Figure 25 is zoomed in on the Igloo Canyon area. This perspective shows how the line shading visually relates to track density. This analysis is used to identify areas at risk for excessive informal trail impacts, impacts to opportunities for solitude, and to identify recommendations of areas for Discovery Hike leaders to avoid.

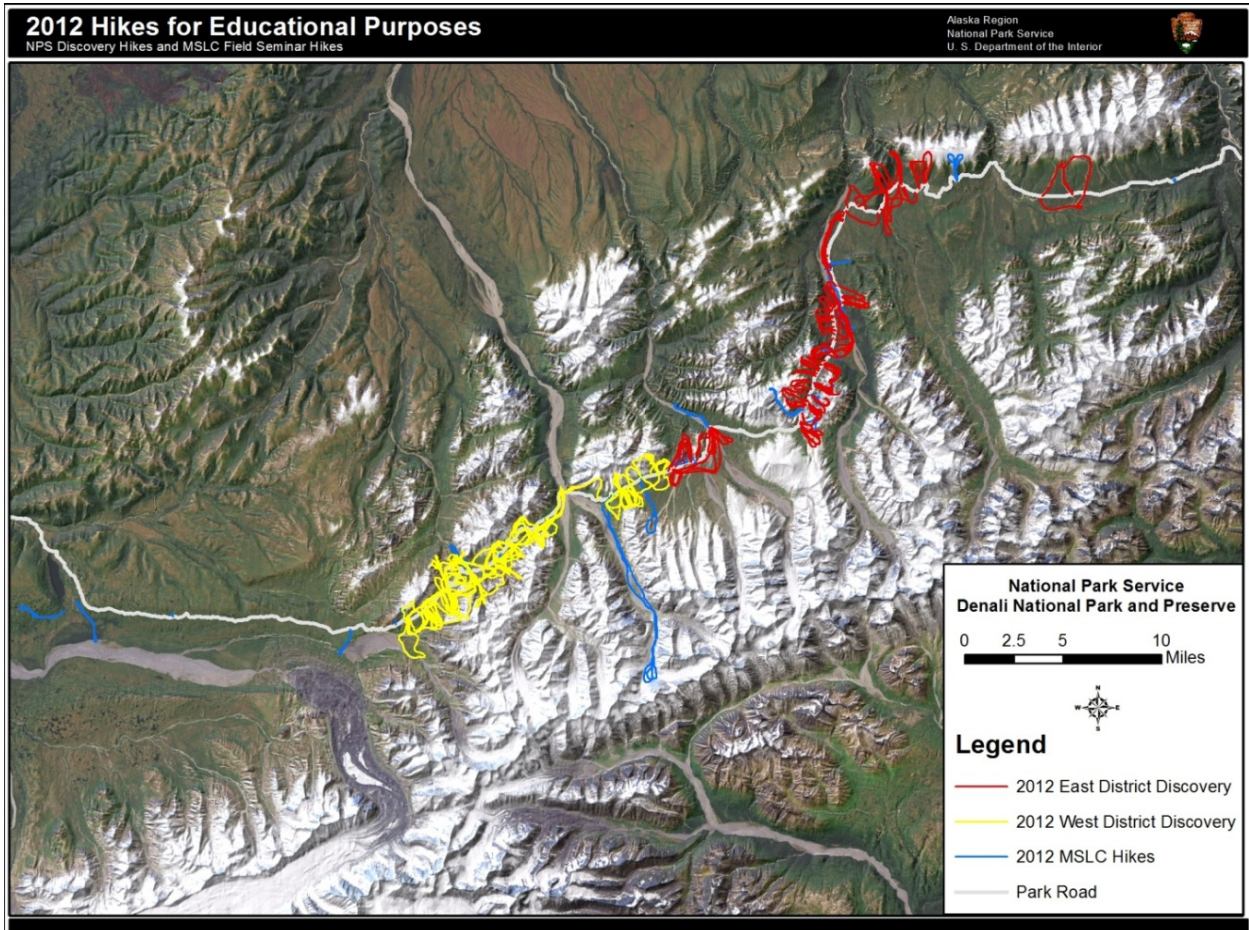


Figure 23. Hikes in 2012 for educational purposes, including Discovery Hikes and MSLC seminar hikes.

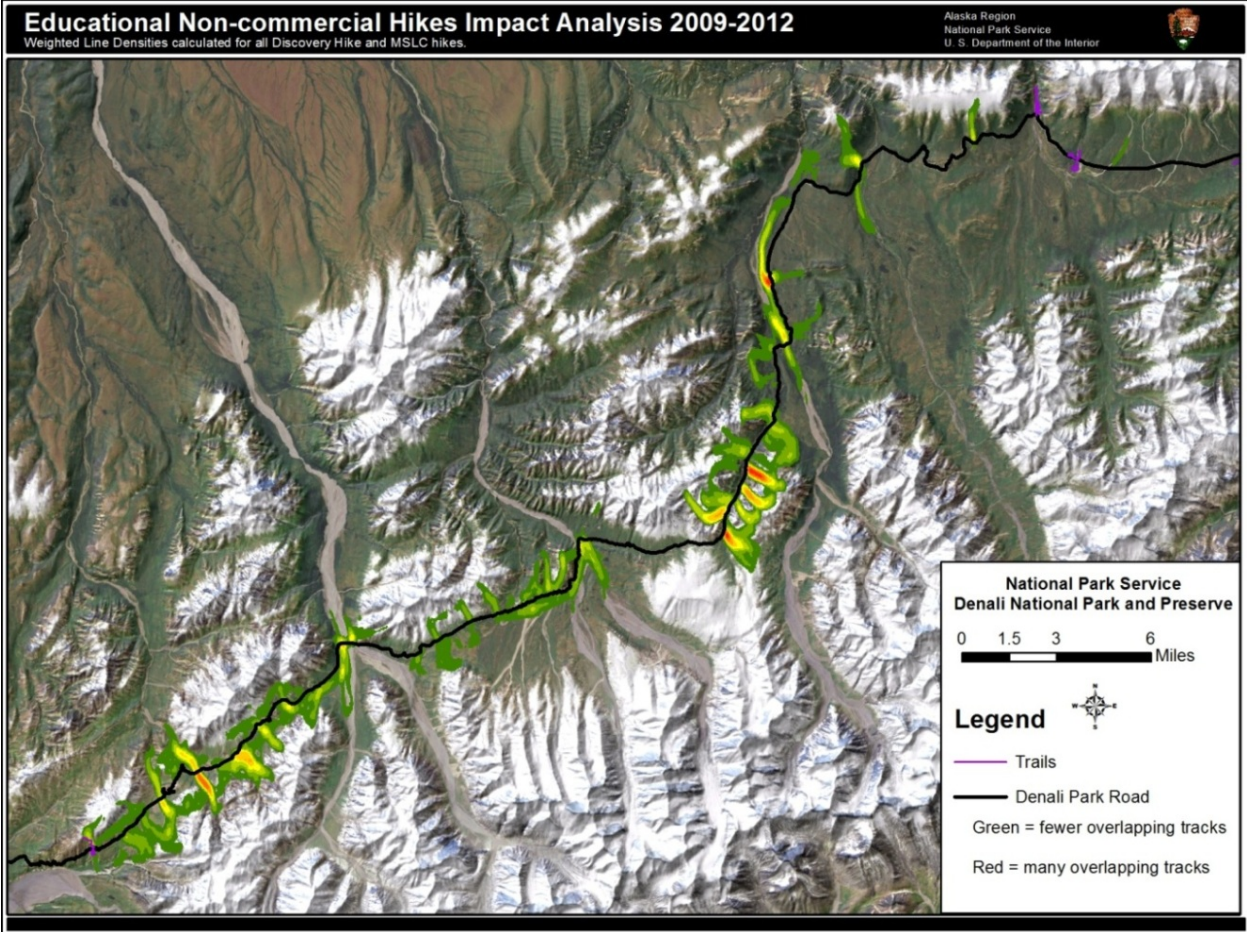


Figure 24. Weighted line densities calculated for educational non-commercial hikes, 2009-2012.

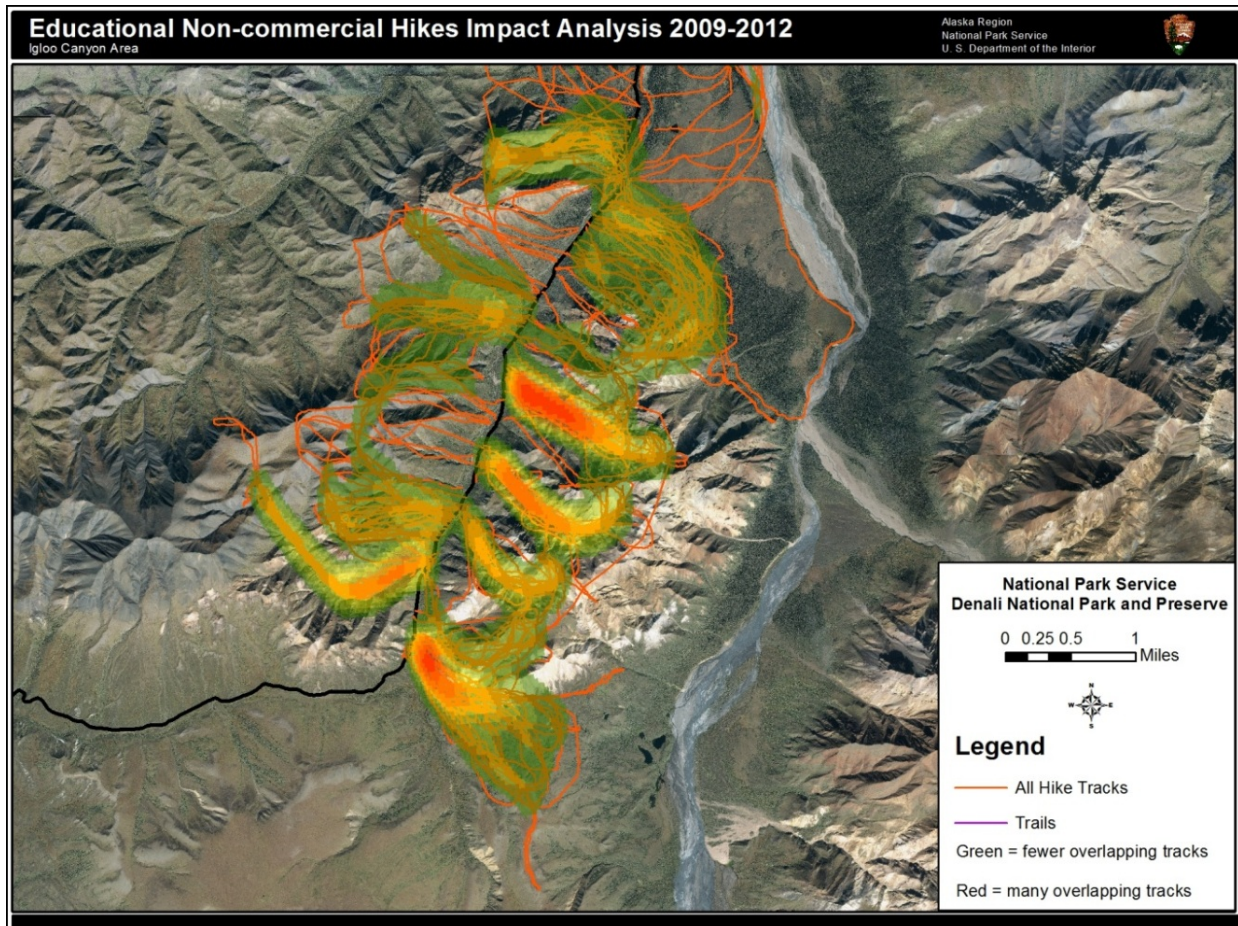


Figure 25. Weighted line densities calculated for educational non-commercial hikes in the Igloo area, 2009-2012.

Hikes for DEC programs are led by trained naturalists. DEC programs for adults and families occur only on designated trails. Hikes for youth programs occur both on and off trails. Trails used for these include McKinley Station, Rock Creek, and Horseshoe Lake in the Entrance Area of the park (non-backcountry). Some hikes are also led on the Triple Lakes, Savage Loop, and McKinley Bar trails in designated Wilderness. In summer 2012, there were 9 hikes led on the Savage Loop trail and 11 on the Triple Lakes trail for adult/family programs. Youth programs included Denali Discovery Camp, WILD about Denali, and Denali Backcountry Adventures. These programs provided opportunities for 100 local youth to explore the park both on and off trails in frontcountry and backcountry areas. Again, the benefit of offering these educational opportunities to visitors is thought to outweigh the impacts on wilderness character.

Fire Management

Wildland fire in the Park is managed according to the pre-designated responses depending on the Wildland Fire Units or Zones (NPS, 2004). The standard response within the majority of the Park is to monitor fire activity and allow the natural fire process to run its course. The most notable exceptions being in developed areas where fires would be suppressed.

The Wilderness Act and NPS policy encourage natural process where specific resource concerns are not jeopardized. Allowing natural fires within the Denali Wilderness has both short and long term benefits that enhance ecosystem health. Fire management actions within the Denali Wilderness since 2007 (see Table 25) have not resulted in any deterioration in the wilderness character of the area.

Table 25. Fire management activity, 2007-2012.

Year	Wilderness Category	Total number of fire management actions in Limited Areas that deviate from the Fire Management Plan	Total number of acres impacted by actions	Total number of wildland fire acres burned in DENA
2007	Wilderness	Zero	0	10
	eligible wilderness	Zero	0	81
2008	Wilderness	Zero	0	0
	eligible wilderness	Zero	0	107
2009	Wilderness	Zero, One human caused fire suppressed in wilderness, in a Limited FMU (5.1 acres affected)	0	647
	eligible wilderness	Zero, One fire suppressed and actions to minimize growth on one fire in a Modified FMU (250.1 acres affected)	0	4300
2010	Wilderness	Zero	0	0.1
	eligible wilderness	Zero	0	0.1
2011	Wilderness	Zero	0	0
	eligible wilderness	Zero	0	2535
2012	Wilderness	Zero	0	0
	eligible wilderness	Zero	0	4

Information provided by Larry Weddle, FMO Alaska Western Area Fire Management. Comment from Larry, "some of the nuances since Limited FMU, Wilderness and eligible wilderness don't always coexist".

Search and Rescue

Denali National Park has a general search and rescue response based out of the Park Headquarters area and a more specific mountaineering search and rescue response program based out of the Talkeetna Ranger Station. The mountaineering program at Denali provides a medical tent at the 14,000 foot camp of the West Buttress Route on Mt. McKinley during the climbing season, which is often staffed with a volunteer doctor to provide medical aide. This provides an invaluable service to climbers in need of medical attention. If this level of medical care was not available on the

Mountain, the search and rescue incident workload would increase dramatically. Historically, there have been challenges in getting case incident reports entered into the DENA CIR database due the geographic separation of Park headquarters and Talkeetna Ranger Station. However, Annual Mountaineering Summaries have been done since at least 1979. These annual summaries often include a medical and rescue summary information captured in the case incident report records. They are posted on the Park website at <http://www.nps.gov/dena/planyourvisit/summaryreports.htm> and are an excellent source of information.

The number of search and rescue operations in any given year is difficult to predict. It is often a combination of environmental conditions and total visitor use. Since 2005, there have been an average of approximately 20 search and rescue type incidents reported yearly in Denali’s case incident report database, with a low of 13 incidents in 2005, and a high of 31 in 2009 (Figure 26).

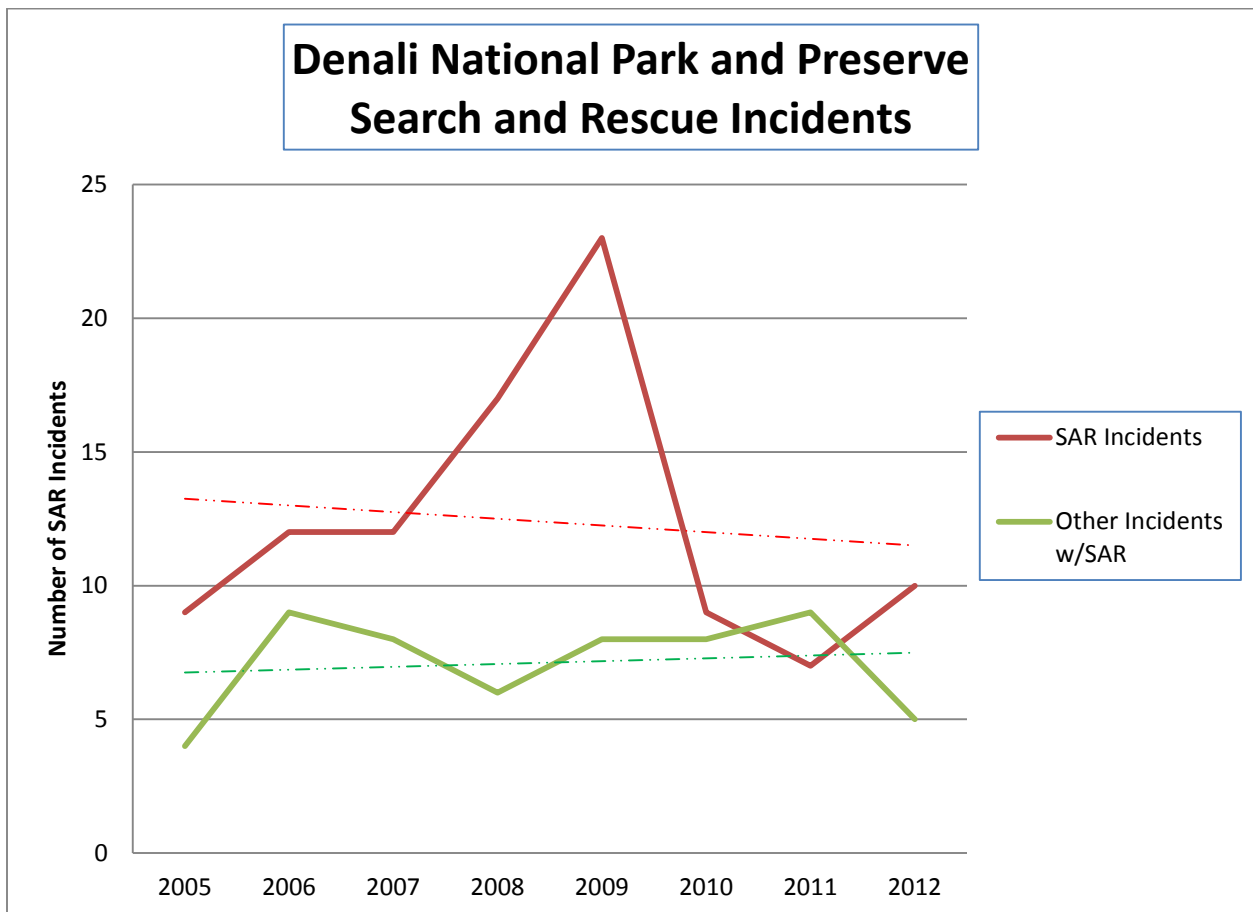


Figure 26. Denali National Park and Preserve Search and Rescue incidents 2005-2012. Information gathered from Case Incident Records and Climbing Program annual reports. Trend lines displayed.

Trail Construction and Maintenance

Trail work varies from year to year (see Tables 26 and 27). Trail construction for 2012 was primarily focused on the Savage Alpine Trail which is expected to be completed in 2013. Routine maintenance, including brushing, clearing water bars and tread work are carried out where needed. Areas of high visitor use and associated social trailing impacts continue to require a range of management actions from education to more formal trail development and rehabilitation.

Table 26. Summary of trail construction and maintenance by year, 2007-2012.

Year	Trail miles	Bridges	Signs	Other trails infrastructure
2007	11	2	9	1 log bench, boardwalk 300' of
2008	11	2	9	1 log bench, boardwalk 300' of
2009	11	2	9	1 log bench, boardwalk 300' of
2010	13	2	17	1 log bench, boardwalk 300' of
2011	14	3	17	1 log bench, boardwalk 350' of
2012	15	3	17	1 log bench, boardwalk 500' of

Table 27. Summary of trail construction and maintenance by location for 2012.

Trail	Miles	Bridges	Signs	Features, structures
McKinley Bar*	1.6		0	330' of boardwalk 2 puncheon
Savage River*	2.0	1	2	1 log bench
Savage Cabin	0.2		6	
Savage Alpine*	3.5		0	150' of boardwalk 1 puncheon
Triple Lakes*	8.0	2	8	150' of boardwalk
Polycrome	0.1		0	
Thorofare Ridge*	0.5		1	
2012 Totals	15.9	3	17	660' of boardwalk

Information provided by Dan Ostrowski, Jared Zimmerman, & Margret McKinley, DENA Trails Office

Since 2007, there has been an increase in the number of miles of official trail maintained and associated infrastructure (bridges, boardwalk, and signing) within the Denali Wilderness. This can be attributed to both new trail construction and to bringing non-maintained trails up to an acceptable standard. As a general rule, Denali has had a “no formal trails” policy. However, in heavily impacted areas, showing vegetation trampling, development of bare ground, soil compaction, erosion, and social trail development, formalized trails have mitigated impacts and better protected park resources.

Some areas present management challenges. The Savage Cabin Trail is accessed from the park road and extremely popular. It sees thousands of visitors each summer with a portion of the trail in designated Wilderness, yet it is maintained to frontcountry trail standards, while the Mt. Healy Overlook Trail is in a frontcountry developed area but maintained to backcountry trail standards.

The informal trail monitoring program at DENA will play a role in determining potential future actions at specific locations. It will be a tool to help outline when observed impacts trigger a suite of potential management actions. It can also help prioritize areas in most urgent need of management actions.

All trail development is identified on pages 66 and 67 of the Consolidated General Management Plan for Denali National Park and Preserve (Denali National Park and Preserve, 2009).

Administrative Aircraft Use

In 2000, the National Park Service issued a Director’s Order on Soundscape Preservation and Noise Management (D.O. #47) which requests park managers to evaluate noise within the park soundscape generated by park aviation missions. A mission is defined as flight time reported for a specific administrative project and may include several flights. Often the aircraft is shared between missions in the same day. In 2012, the Park tracked administrative aircraft use to obtain information on how many missions were ordered by the park, the number and spatiotemporal patterns of administrative overflights, and how well the NPS followed the Denali Aircraft Overflights Advisory Council’s 2012 Best Practices.

All missions ordered by the Park are reported internally with OAS-23 forms. These forms are compiled into spreadsheets that track the mission code for the flight and the flight date. From these spreadsheets, the total number of missions ordered by the park was determined for Fiscal Year (FY) 2012. See Figure 27.

All NPS aviation missions are required to be flight followed in real-time through the Alaska Region Communication Center (ARCC), which is located at DENA. All of the Park’s fleet aircraft are fitted with automated flight following (AFF) equipment, which allows for archival of the GPS tracklogs after flight following. Because of the nature of missions and the amount of requests for missions, vendors from private operators are also contracted to fly missions for the park. Some of the vendors use this AFF equipment, while for others, GPS data is collected from vendors from their aircraft mounted GPS units. Contracted helicopter flights are followed through Latitude Technologies, which

provides flight following and archived GPS tracklogs. The spatial data for all the FY 2012 flights were collected either through AFF, vendor’s personal GPS units, or through Latitude Technologies.



Figure 27. Number of flights per month by aircraft type in the Park in FY 2012.

Missions were tracked for the Fiscal Year 2012, which spanned October 1, 2011 to September 30, 2012. During this time period, 432 missions were ordered by the Park. Most days of the year (168) did not have any missions ordered by the Park. No missions were flown in December, while the month with the highest number of missions was August (see Figure 27). Not all of these were pertinent to DENA missions, but all were pertinent to NPS missions. For example, helicopters that were contracted for fires in other parks may have crossed the DENA park boundary. About 67% of the flights ordered were fixed wing, with over 35% of those flights being wildlife missions.

Of the 432 missions ordered by the NPS, 390 of these were pertinent to Park missions (Figure 28). Missions were split into critical and non-critical categories, critical are those that pertain to the health and safety of visitors and employees. The Park’s south district rangers’ collection of mountain fees or performance of operations related to mountaineering were classified under “Ranger”. A few examples of missions classified as “Recon” include Park fleet flights that checked environmental conditions for dogsled trips or took aerial photos of natural conditions. Missions classified as “Other” included fuel drops, check rides, and ferrying fleet aircraft to Fairbanks.

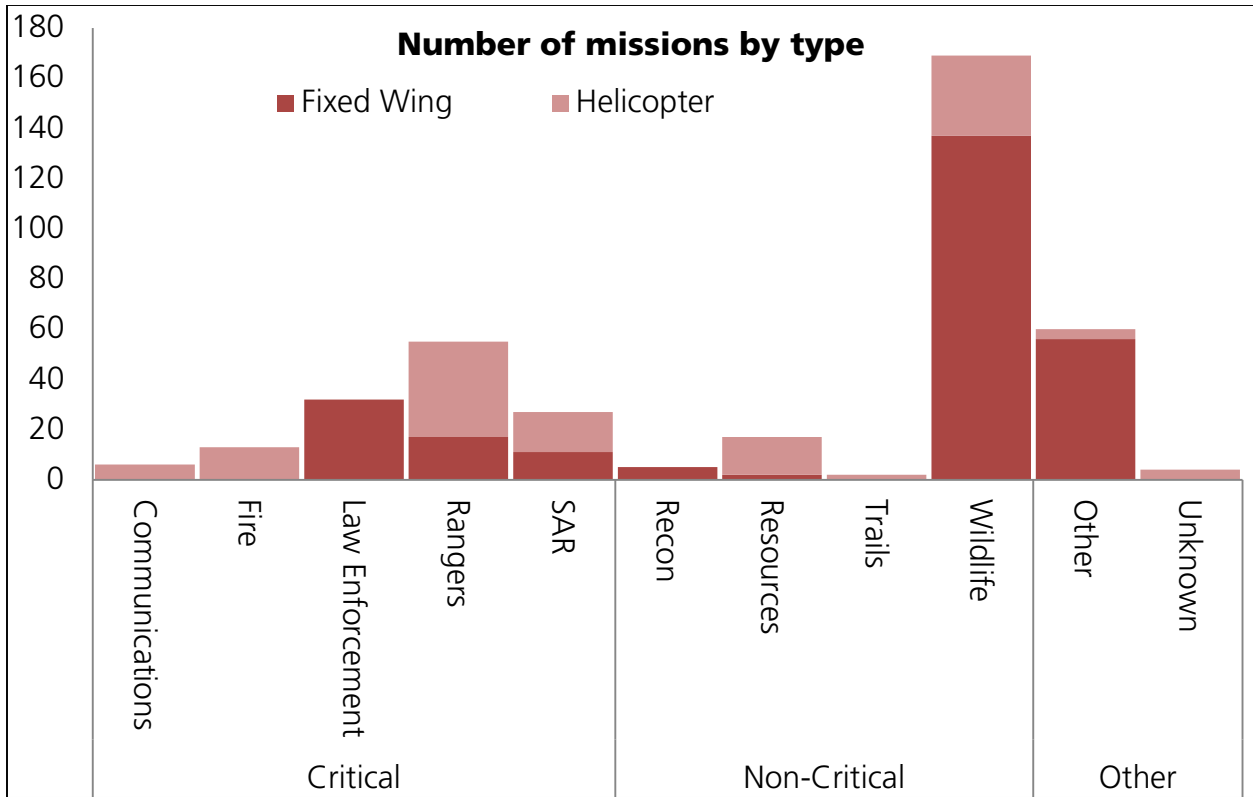


Figure 28. Number of missions ordered by the Park by type and by aircraft type for FY 2012.

From March 1 through September 30, 2012, 230 out of the 390 missions had AFF/GPS tracklog data available. Out of these 230 missions, no days had more than 4 missions per day, though the majority of days had at least one mission per day as shown in Figure 29.

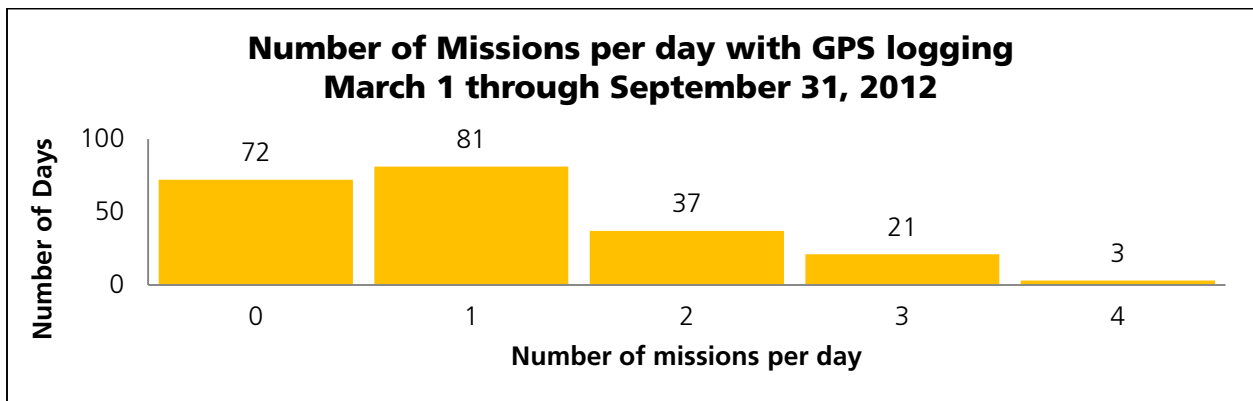


Figure 29. Histogram of missions per day for only those flights with GPS tracklogs crossing the park boundary from March 1 through September 31, 2012.

Regarding adherence to the Best Practice avoidance area, of the 230 missions with GPS, 91 of those missions (40%) took place within both the park road corridor and the north side region of the Alaska Range (see Table 28 and Figures 30 and 31). Ten percent of the flights with GPS data occurred within the Best Practice avoidance zone (the pink polygon in figure 31). The majority of flights within both areas were wildlife research and monitoring related missions

Data collection efforts will continue for FY 2013, with methods in place to collect GPS tracklog data on more aircraft through collaboration with vendors and the creation of a centralized database for internal flight reporting.

Table 28. Flights in Best Practices avoidance zone by mission.

Mission Designation	Mission Type	North Side Only	Park Road and North Side
Critical	Communications		2
	Fire		4
	Law Enforcement	3	7
	Rangers (General)		4
	SAR		5
Non-Critical	Natural and Cultural Resources	1	4
	Trails		
	Wildlife	20	53
Other	Other		9
	Recon		1
	Unknown	1	2
Total		25	91

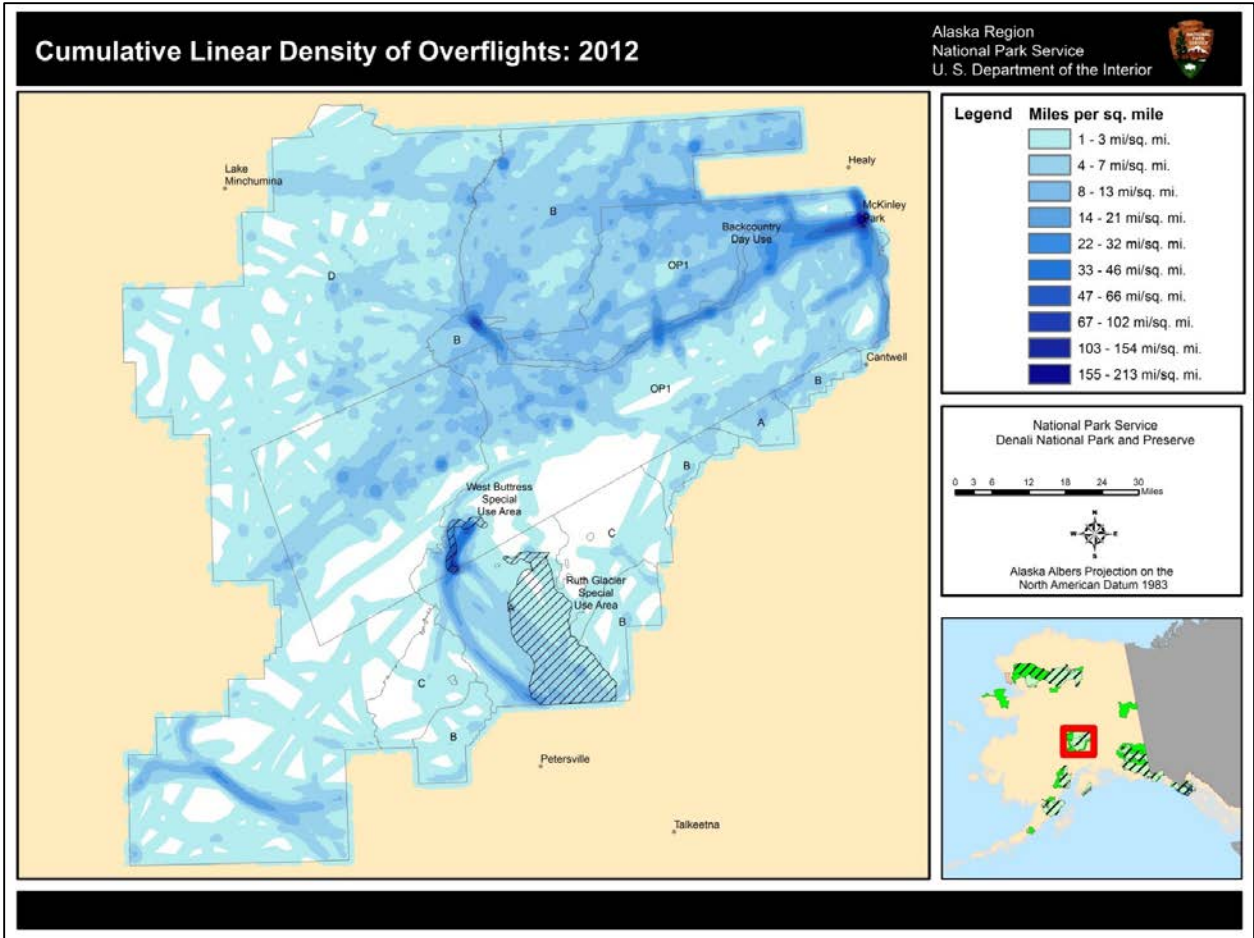


Figure 30. Cumulative Linear Density of miles per square mile of flight tracks over the Park from March 1 to September 30, 2012.

Flights in Best Management Practices Areas by Mission: 2012

Alaska Region
National Park Service
U. S. Department of the Interior

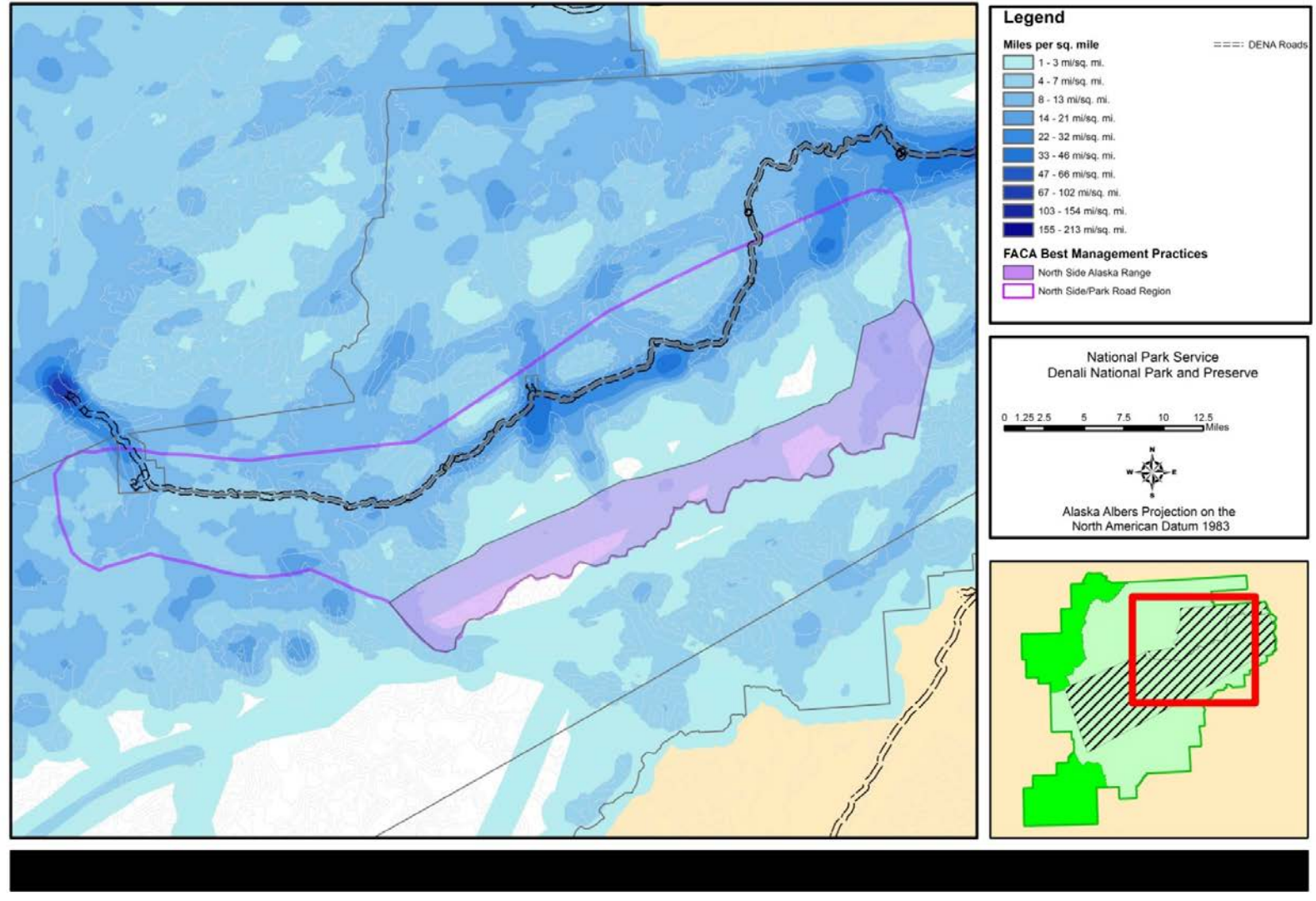


Figure 31. Cumulative Linear Density within the Best Management Practices areas from March 1 through September 30, 2012.

Wilderness Compliance

Minimum Requirements Analysis Summary

Park staff completed minimum requirement analysis on the following projects:

- DENA Savage Canyon Loop and Bar Trail Rehabilitation
- DENA Savage Alpine Trail
- DENA Programmatic Trails Maintenance Plan
- DENA Winter Plowing Environmental Assessment
- DENA Telecommunications Improvement Environmental Assessment

Twenty-eight research permits were issued in 2012 for projects that occurred in eligible and designated Wilderness. The minimum requirement concept was applied to all of them.

Wilderness Training and Education

Staff Training Summary

- BIC Training; Total Training Hrs. per employee: ~112 hrs over 4 weeks
- BIC Training for other Park Staff and Park Partners; wilderness safety & ethics
- Wilderness Character Mapping Project; assistance and guidance provided by Peter Landres and James Tricker from the Aldo Leopold Wilderness Research Center
- Interpretative Training with Wilderness Themes
- Kennels Staff Training to Park Staff, Partners, and public on role of sled dogs in helping preserve DENA's wilderness character

Other Training: Numerous Park Staff participated in a number of webinars offered through the Arthur Carhart National Wilderness Training Center (see Figure 32). These included a 'Regional Wilderness Stewardship Course' (a week long course in Munising, MI) and 'Minimum Requirements Analysis Live' (A ~50 hour distance learning course) for the Wilderness Resources Specialist. The Wilderness Coordinator took 'Wilderness Character and its Application to Wilderness Stewardship'.

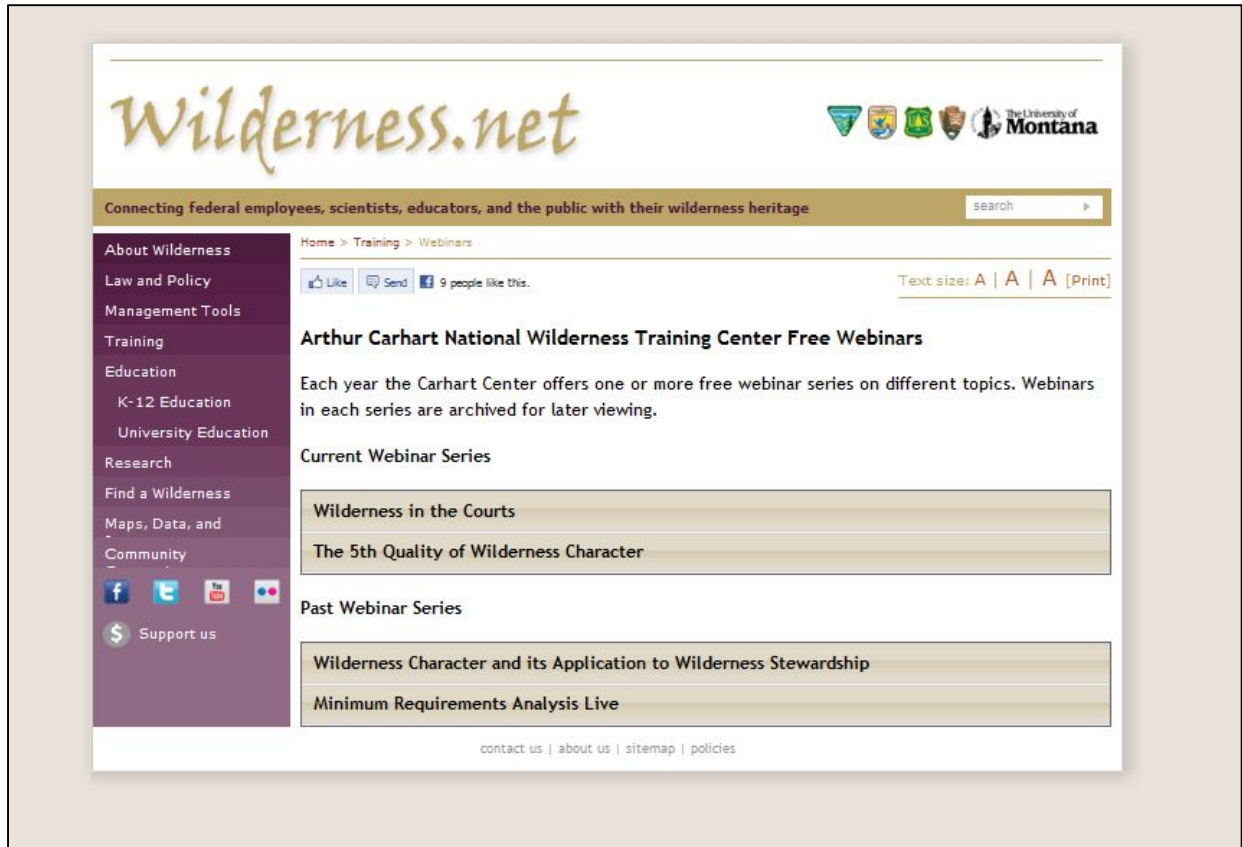


Figure 32. Screen shot showing Arthur Carhart National Wilderness Training Center webinar classes available in 2012.

Management Actions

Updates to Superintendent's Compendium

There were no updates to the Superintendent's compendium applicable for backcountry or Wilderness in 2012.

Policy Updates

There were some policy changes within the Park regarding Backcountry Management for 2012.

- The Backcountry Unit quotas were permitted to be exceeded for a family group who exceeded the quota limit if they were the only group within that unit. This rarely happened but was an adjustment from previous years. All exceptions to the backcountry zone quota was to be approved at the District Ranger or above level.
- Backcountry Cabin use underwent a number of changes in an attempt to streamline the process for staff use of the cabins.

Planning Efforts

Completed:

Vehicle Management Plan, Sept. 2012

Current:

Road Plowing for Winter Use

Telecommunications Improvement/Installations in Wilderness

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NPS 184/126876, October 2014

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