



Kobuk Valley Wilderness Character Baseline Assessment

Building Blocks for Wilderness Stewardship

Natural Resource Report NPS/KOVA/NRR—2016/1103



ON THE COVER

Photograph of sunset on the Kobuk River, Kobuk Valley National Park.
Photograph by Paul Stolen, National Park Service.

Kobuk Valley Wilderness Character Baseline Assessment

Building Blocks for Wilderness Stewardship

Natural Resource Report NPS/KOVA/NRR—2016/1103

Nyssa Landres

National Park Service
P.O. Box 1029
Kotzebue, AK 99752

January 2016

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

Please cite this publication as:

Landres, N. 2016. Kobuk Valley wilderness character baseline assessment: Building blocks for wilderness stewardship. Natural Resource Report NPS/KOVA/NRR—2016/1103. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figures.....	v
Tables.....	vi
Appendices.....	vii
Executive summary.....	viii
Acknowledgements.....	ix
List of Acronyms	x
Introduction.....	1
Wilderness character in the National Park Service	4
Administrative setting of the Kobuk Valley Wilderness.....	5
Geographic setting of the Kobuk Valley Wilderness	7
Kobuk Valley wilderness character narrative	9
Untrammeled	11
Natural	13
Undeveloped.....	15
Opportunities for Solitude or Primitive and Unconfined Recreation	17
Other Features of Value.....	19
Iñupiat Homeland	20
Wilderness Character Monitoring Baseline	23
Wilderness character monitoring measures.....	23
Process used to identify measures	25
Overview of wilderness character monitoring measures	27
Untrammeled Quality	28
1-1: Number of actions that manipulate wildlife or vegetation.....	29
1-2: Percent of wildfires suppressed.....	32
1-3: Number of unauthorized actions that manipulate plants, wildlife, insects, fish, pathogens, soil, water, or fire	34
Natural Quality	36
2-1: Number of non-native plant species.....	37
2-2: Number of human-wildlife incidents	39

Contents (continued)

	Page
2-3: Acidifying and fertilizing pollutants	41
2-4: Extent of landscape connectivity	43
Undeveloped Quality	45
3-1: Number of sub-surface installations	46
3-2: Number of above-ground developments.....	48
3-3: Weight of abandoned debris	50
3-4: Acres of inholdings	52
3-5: Number of helicopter supported projects.....	53
3-6: Hours of fixed-wing aircraft flight time.....	55
3-7: Miles of administrative snowmachine use	58
Solitude or Primitive and Unconfined Recreation Quality.....	60
4-1: Number of research-days	61
4-2: Number of commercial operations.....	63
4-3: Number of aircraft landing sites.....	65
4-4: Index of management restrictions	67
Other Features of Value Quality.....	69
5-1: Percent of impacted and threatened cultural resource sites	70
Measures suggested for future use	72
Extent of impacted viewshed.....	72
Soundscape	73
Night sky illumination.....	74
Measures not used for wilderness character monitoring	76
Wildlife hunting regulations.....	76
Area covered by active thaw slumps	77
Shrubification	78
Conclusions.....	81
Untrammeled Quality	82
Natural Quality	83

Contents (continued)

	Page
Undeveloped Quality	84
Solitude or Primitive and Unconfined Recreation Quality.....	86
Other Features of Value Quality.....	87
Looking Ahead	88
Literature Cited	91

Figures

	Page
Figure 1. Keeping It Wild hierarchical framework.....	3
Figure 2. <i>Keeping It Wild in the National Park Service</i> , front cover.....	4
Figure 3. Map of Kobuk Valley National Park and Wilderness.	6
Figure 4. Land ownership around Kobuk Valley National Park and Wilderness. NPS data.....	7
Figure 5. Hours of fixed-wing aircraft flight time legacy data.	56
Figure 6. Miles of administratively authorized snowmachine use over time.....	59

Tables

	Page
Table 1. Acres of wilderness in Kobuk Valley National Park	6
Table 2. Key to status, trend, and confidence symbols.	25
Table 3. Wilderness Character Monitoring Measures used for the Kobuk Valley Wilderness.....	27
Table 4. Measures of the Untrammeled Quality used to monitor the Kobuk Valley Wilderness.....	28
Table 5. General guidance for counting trammeling actions	30
Table 6. Protocol for counting trammeling actions.....	30
Table 7. Legacy data, percent of fires suppressed.....	33
Table 8. Measures of the Natural Quality used to monitor the Kobuk Valley Wilderness.....	36
Table 9. Non-native species in the region	38
Table 10. Index to evaluate pollutant levels.....	42
Table 11. Evaluating Nitrogen and Sulfur Concentration.....	42
Table 12. Detailed data, extent of landscape connectivity	44
Table 13. Measures of the Undeveloped Quality used to monitor the Kobuk Valley Wilderness.....	45
Table 14. Legacy data, number of sub-surface installations	47
Table 15. Legacy data, number of above-ground developments.....	49
Table 16. Detailed data: above-ground developments	49
Table 17. Detailed data – Baseline value of weight of abandoned debris.....	51
Table 18. Supplemental data, acres of inholdings.....	52
Table 19. Legacy data, number of helicopter supported projects.....	54
Table 20. Legacy data, hours of fixed-wing aircraft flight time	57
Table 21. Measures of the Solitude or Primitive and Unconfined Recreation Quality of wilderness used to monitor the Kobuk Valley Wilderness	60
Table 22. Legacy data, number of research-days	62
Table 23. Detailed data, landing strips.....	66
Table 24. Index for scoring management restrictions	68
Table 25. Restrictions on visitor behavior: Calculation of 2014 baseline value.....	68
Table 26. Other Features of Value Quality used to monitor the Kobuk Valley Wilderness.....	69

Tables (continued)

	Page
Table 27. Suggested measures for future used to monitor the Kobuk Valley Wilderness.....	72
Table 28. Evaluating natural soundscape – adapted from Denali Backcountry Management Plan, pp. 48.....	74
Table 29. Measures not used for monitoring the character of Kobuk Valley Wilderness.	76
Table 30. Trends in the Untrammeled Quality of Kobuk Valley Wilderness	82
Table 31. Trends in the Natural Quality of Kobuk Valley Wilderness	83
Table 32. Trends in the Undeveloped Quality of Kobuk Valley Wilderness.....	84
Table 33. Trends in the Solitude or Primitive and Unconfined Recreation Quality of Kobuk Valley Wilderness	86
Table 34. Trends in the Other Features of Value Quality of Kobuk Valley Wilderness	87
Table 35. Examples of actions that likely are not, and likely are trammeling actions based on the scale and scope of the action and its effects on the earth and its community of life.....	C-5

Appendices

	Page
Appendix A – Overview of the framework for wilderness character monitoring	A-1
Appendix B – Priority ranking of all measures considered	B-1
Appendix C – What is a trammeling action?	C-1

Executive summary

This report is the baseline assessment of wilderness character for the Kobuk Valley Wilderness. The intent of the assessment is to facilitate a comprehensive understanding of a) the key features of the Kobuk Valley's wilderness character, and b) how the wilderness character of Kobuk Valley is changing over time. Together, this information provides a holistic understanding of the Kobuk Valley Wilderness and what sets it apart from other public lands, and other wilderness areas, nationwide.

This baseline assessment defines 19 measures of wilderness character that will be used to monitor change in the wilderness character of Kobuk Valley into the future. For each of these 19 measures, the measures' relevance to the wilderness character of Kobuk Valley is described, as are specific monitoring protocols to assure consistent monitoring methods over time. The measures were identified based on national guidance, and selected at the local level through a collaborative and iterative process with park staff.

The legislative mandate of the Wilderness Act of 1964 is to preserve the wilderness character of the area, a mandate affirmed in National Park Service policy. To inform how wilderness character is changing over time, this report specifies the current status of the measure, as well as the trend in each measure since the designation of the Kobuk Valley Wilderness in 1980. Overall, wilderness character across the Kobuk Valley Wilderness has had a downward trend since 1980. An in-depth summary and discussion of the trends in wilderness character since designation for each quality of wilderness character is described in the Conclusions section of this report.

This report is intended to serve as a standalone document to assist in ongoing wilderness character monitoring for the Kobuk Valley Wilderness. Ultimately, the purpose of this baseline assessment is to help improve wilderness stewardship and preserve the area's wilderness character.



Boat on the Kobuk River in fall. Photo NPS.

Acknowledgements

Special thanks to the staff of Western Arctic National Parklands for their assistance and knowledge throughout the production of this report. Dan Stevenson spent innumerable hours discussing minutiae of the Kobuk Valley area and wilderness, his incredible depth of expertise made this report possible. Frank Hays was instrumental in organizing staff for this report and generally working to improve WEAR wilderness stewardship. Marci Johnson, Peter Neitlich, Dave Swanson, Linda Hasselbach, Jim Lawler, Hannah Atkinson, Mike Holt, Linda Jeschke, Willie Goodwin, Valerie Atkinson, and so many others made this report possible through their insightful feedback, sharing of data, and willingness to sift through drafts.

Thanks also to Adrienne Lindholm, Elizabeth Mejicano, and Peter Landres who all helped tremendously by providing discerning comments on wilderness character monitoring along the way.

Thank you all for your contributions and support.



Frost on sand. Photo by Melanie Flamme, NPS.

List of Acronyms

ADF&G – Alaska Department of Fish & Game
AKEPIC – Alaska Exotic Plants Information Clearinghouse
ALD – Active layer detachment
AMS – Asset Management System
ANCSA – Alaska Native Claims Settlement Act of 1973
ANILCA – Alaska Native Interest Lands Conservation Act of 1980
ARCN – Arctic Network Inventory & Monitory Program
ASMIS – Archeological Sites Management Information System
BELA – Bering Land Bridge National Preserve
BHIMS – Bear-Human Incident Management System
BLM – Bureau of Land Management
EIS – Environmental Impact Statement
CAKR – Cape Krustenstern National Monument
CFR – Code of Federal Regulations
CUA – Commercial Use Agreement
EA – Environmental Assessment
FBMS – Financial and Business Management System
FS – Forest Service (U.S. Department of Agriculture)
FSB – Federal Subsistence Board
FWS – U.S. Fish and Wildlife Service
IRMA – Integrated Resource Management Applications Portal
GIS – Geographic Information System
GMU – General Management Unit
GPS – Global Positioning System
KOVA – Kobuk Valley National Park
MHIMS – Musk Oxen-Human Incident Management System
MRA – Minimum Requirements Analysis
MRLC – Multi-Resolution Land Characteristics Consortium
NADP – National Atmospheric Deposition Program
NEPA – National Environmental Policy Act of 1979
NIFC – National Interagency Fire Center
NLCD – National Land Cover Database
NOAT – Noatak National Preserve
NPS – National Park Service
NWPS – National Wilderness Preservation System
OAS – Office of Aviation Services
RTS – Retrogressive thaw slump
SUP – Special Use Permit
WCMD – Wilderness Character Monitoring Database
WCM – Wilderness Character Monitoring
WEAR – Western Arctic National Parklands
WFMI – Wildland Fire Management Information

Introduction

The Wilderness Act of 1964 (16 U.S.C. § 1131) was passed by a nearly unanimous vote in the United States Congress to protect natural lands from the threats of “expanding settlement and growing mechanization.” The primary mandate given by the Wilderness Act is to “preserve the wilderness character of the area,” a responsibility given to each agency that administers any area designated as wilderness (Section 4(b)).

Wilderness character is a holistic concept based on the interaction of (1) biophysical environments primarily free from modern human manipulation and impact, (2) personal experiences in natural environments generally free from the encumbrances and signs of modern society, and (3) symbolic meanings of humility, restraint, and interdependence that inspire human connection with nature. Taken together, these tangible and intangible values define wilderness character and distinguish wilderness from other all lands (Landres et al. 2015). This definition of wilderness character was developed by an interagency monitoring team – including the Department of the Interior Bureau of Land Management, U.S. Fish and Wildlife Service, National Park Service, U.S. Geological Survey, and the U.S. Forest Service (Department of Agriculture) – to establish a common understanding of wilderness character. Developed in 2015, this definition builds on 15 years of experience developing and implementing wilderness character monitoring.

Wilderness character encompasses the five qualities that are described in the definition of wilderness from Section 2(c) of the Wilderness Act. These five qualities are collectively used to monitor how stewardship actions, impacts from modernization, and changes occurring from outside the wilderness itself, preserve or degrade a wilderness over time. The five qualities apply to all wilderness areas – regardless of their size, location, administering federal agency, or other unique place-specific attributes since they are based on the legal definition of wilderness in the Act. Descriptions of the five qualities as derived from Section 2(c) of the Wilderness Act are below.

Untrammeled

Wilderness is “...an area where the earth and its community of life are untrammeled by man”

Wilderness ecological systems are essentially unhindered and free from the intentional actions of modern human control or manipulation when the Untrammeled Quality is preserved.

Natural

Wilderness “...is protected and managed so as to preserve its natural conditions”

Wilderness ecological systems are substantially free from the effects of modern civilization when the Natural Quality is preserved.

Undeveloped

Wilderness is “...an area of undeveloped Federal land ... without permanent improvements or human habitation”

Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation when the Undeveloped Quality is preserved.

Solitude or Primitive and Unconfined Recreation

Wilderness “...has outstanding opportunities for solitude or a primitive and unconfined type of recreation”

Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation when the quality of solitude or primitive and unconfined recreation is preserved.

Other Features of Value

Wilderness “...may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value”

Other tangible features of scientific, educational, scenic, or historical value in wilderness preserve wilderness character when they are preserved.

In addition to the five tangible qualities of wilderness character, wilderness also has important intangible aspects that are difficult or impossible to quantify or monitor. These intangible aspects are diverse and can include the scenic beauty, spiritual experience, immensity of an area, and the opportunity for self-discovery, self-reliance, and challenge that comes from wilderness settings. Currently, these intangible aspects of wilderness can only be addressed in narrative form.

In 2008, an interagency Team published *Keeping It Wild: An Interagency Strategy for Monitoring Trends in Wilderness Character Across the National Wilderness Preservation System* (Landres et al. 2008). Based on the lessons learned during the implementation of the monitoring strategy outlined in *Keeping It Wild* from 2008 to 2014 across the National Wilderness Preservation System (NWPS), the framework of wilderness character monitoring was revised and replaced by *Keeping It Wild 2: An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System* (Landres et al. 2015). The wilderness character monitoring strategy for the Kobuk Valley Wilderness contained in this document reflects the revised strategy based on *Keeping It Wild 2*.

The updated framework of wilderness character monitoring is based on the qualities defined above. Each quality is divided into a hierarchical set of monitoring questions, indicators, and measures to assess trends in wilderness character over time. Monitoring questions frame wilderness character monitoring to answer particular management questions; indicators are distinct and important elements within each monitoring question; and measures are a specific aspect of wilderness on which data are collected to assess trend of an indicator (Landres et al. 2008 and 2015). Expanded definitions of qualities, monitoring questions, indicators, and measures are available in Appendix A. While the qualities, monitoring questions, and indicators are nationally consistent, measures are specific and sometimes unique to individual wilderness areas (Figure 1).

This framework balances national and local needs for monitoring by defining locally relevant measures whose trends can be compiled at higher levels for national or regional reporting. This interagency monitoring strategy:

- Provides on-the-ground information to assess trends and make defensible decisions;
- Provides valuable information on wilderness on regional and national scales;
- Provides a set of key wilderness stewardship goals;
- Communicates a common definition of wilderness character;
- Communicates a tangible vision of wilderness within the agency and to the public;
- Clarifies how stewardship decisions and actions influence wilderness;
- Evaluates and documents the effects of actions taken inside the wilderness and effects from threats outside the wilderness;
- Synthesizes data into a single, holistic assessment of wilderness character;
- Creates a legacy of staff experience and knowledge of a wilderness;
- Improves on-the-ground wilderness stewardship.

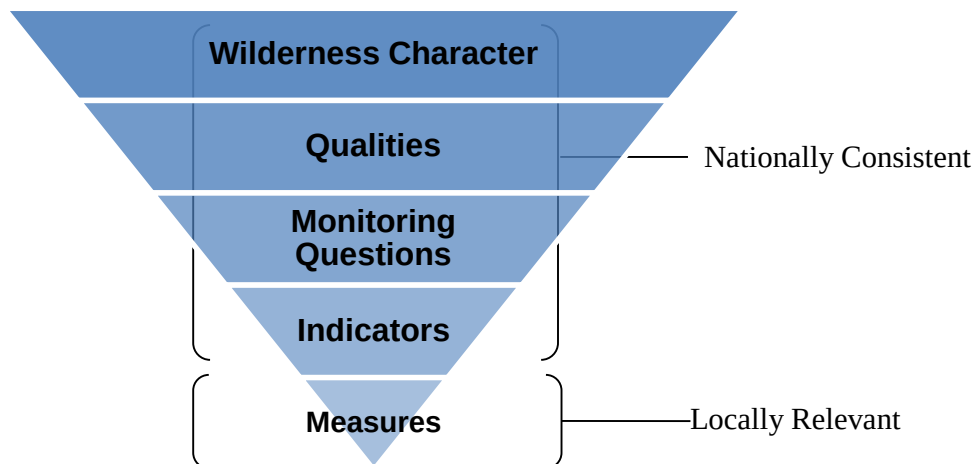


Figure 1. Keeping It Wild hierarchical framework.

This monitoring strategy offers a consistent means for documenting the status and trends in wilderness character and wilderness management within a wilderness. Under this monitoring strategy, trends in wilderness character are classified as upward (positive), downward (negative), or stable. These trends are both nationally consistent and independent of the unique aspects specific to any given wilderness; therefore, trends in wilderness character can be compared between wildernesses or across regions. These trends cannot be used to “rate” or “grade” stewardship, however, since they are meaningless when taken out of the context of wilderness character monitoring—wilderness character monitoring is a tool to holistically assess the preservation of wilderness character, not to place judgment on managers. Similarly, while *trends* can be compared between wildernesses, comparing *wilderness character itself* among different wildernesses is inappropriate. Each wilderness is unique in its legislative and administrative direction, and in its social and biophysical setting; therefore wilderness character in a particular wilderness cannot, and will not, be compared to that of another wilderness.

The purpose of this report, the measures of wilderness character, and the wilderness character narrative is to improve wilderness stewardship by informing managers' understanding of the wilderness they manage, how wilderness character is changing over time, and why changes may have occurred. The following report establishes a baseline condition and monitoring strategy for the Kobuk Valley Wilderness based on the five qualities of wilderness character and measures that are specific to the Kobuk Valley Wilderness and are indicative of local trends in wilderness character. An online Wilderness Character Monitoring Database (at <https://wc.wilderness.net/>) accompanies this document and includes entries for all measures and baseline data specific to this wilderness where trends in wilderness character can be monitored.

Wilderness character in the National Park Service

Preserving wilderness character in the National Park Service (NPS) is vital to national wilderness preservation. The NPS administers 40% (43,932,843 acres) of designated wilderness within the NWPS with approximately 52% of the total acreage in the NPS designated as wilderness. A total of 83% of NPS lands are formally eligible, proposed, potential, or recommended wilderness – more total land and a greater proportion of land than any other wilderness management agency.

NPS policy affirms the mandate of the Wilderness Act to preserve wilderness character. The NPS 2006 Management Policies on Wilderness Preservation and Management assert preservation of wilderness character as one of the first and foremost directives and cite wilderness character as a consideration for a range of actions spanning resource management, environmental compliance, analysis of minimum requirements, protection of cultural resources, management of facilities and signs, and interpretation and education.

Director's Order #41: Wilderness Stewardship, signed in 2013, provides specific direction for the preservation of wilderness character, stating that each wilderness park:

- “will integrate the concept of wilderness character into park planning, management, and monitoring,”
- “should develop a wilderness character narrative,”
- “will conduct a wilderness character baseline assessment...and conduct ongoing monitoring of trends.”

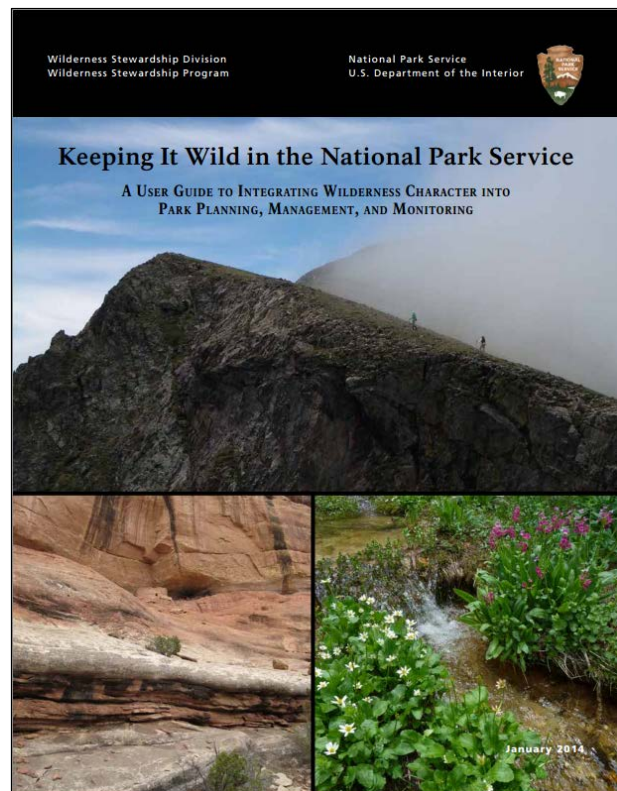


Figure 1. *Keeping It Wild in the National Park Service*, front cover.

Director's Order #41 also references the five qualities of wilderness character outlined in *Keeping It Wild 2* and directs managers to the NPS User Guide (described below) to inform the implementation of these wilderness character directives.

Spurred by NPS policy and building on the framework of *Keeping It Wild*, the National Park Service Wilderness Character Integration Team published *Keeping It Wild in the National Park Service: A User Guide to Integrating Wilderness Character into Park Planning, Management, and Monitoring* (hereafter referred to as the NPS User Guide) in 2014 (Figure 2). The purpose of the NPS User Guide is to provide a NPS-specific reference tool to help managers “integrate wilderness character into park planning, management, and monitoring” while serving as a companion document to the 2014 *Wilderness Stewardship Plan Handbook: Planning to Preserve Wilderness Character*. Both documents are included as part of Reference Manual 41: Wilderness Stewardship, which acts as the primary level 3 guidance for wilderness stewardship in the NPS.

This assessment of wilderness character for the Kobuk Valley Wilderness is intended to fulfill the first step of the directive in Director's Order 41 which states “wilderness parks will conduct a wilderness character assessment, which includes identifying what should be measured, establishing baseline data, and conducting ongoing monitoring of trends.” Additionally, this document is intended to fulfill the NPS User Guide recommendation that encourages every park with wilderness resources “to identify any immediate concerns in wilderness, and to inform managers and the public about the current status of wilderness character.”

Administrative setting of the Kobuk Valley Wilderness

The Kobuk Valley National Park and Wilderness (KOVA) were established in 1980 under the Alaska National Interest Lands Conservation Act (ANILCA). The purposes for which the Kobuk Valley National Park and Wilderness were established are described in section 201 of ANILCA and are listed below.

- “To maintain the environmental integrity of the natural features of the Kobuk River Valley, including the Kobuk, Salmon, and other rivers, the boreal forest, and the Great Kobuk Sand Dunes, in an undeveloped state;”
- “To protect and interpret, in cooperation with Native Alaskans, archeological sites associated with Native cultures;”
- “To protect migration routes for the Arctic caribou herd;”
- “To protect habitat for, and populations of, fish and wildlife including but not limited to caribou, moose, black and grizzly bears, wolves, and waterfowl;” and
- “To protect the viability of subsistence resources” (Public Law 96-487).

Further information on these purposes can be found in the Kobuk Valley National Park Foundation Statement, available online at:

http://www.nps.gov/kova/learn/management/upload/KOVA_FS_Draft_021010.pdf.

All lands in Kobuk Valley that are designated and eligible as wilderness are managed as wilderness and are included in this report. This approach is in accordance with NPS policy to manage lands

eligible for wilderness designation as wilderness, and with the mandate to preserve their wilderness character. As a result, this wilderness character monitoring report encompasses all 1.7 million acres that are designated and eligible as wilderness. A detailed breakdown of wilderness status in Kobuk Valley National Park is depicted in Table 1 and in Figure 3. All lands designated and eligible as wilderness in Kobuk Valley National Park are collectively referred to as the “Kobuk Valley Wilderness” or “Kobuk Valley” in this report.

Table 1. Acres of wilderness in Kobuk Valley National Park

Designated wilderness	Eligible as wilderness	Ineligible as wilderness
176,000 acres	1,541,000 acres	28,000 acres
Total area encompassed by this report: 1,717,000 acres		

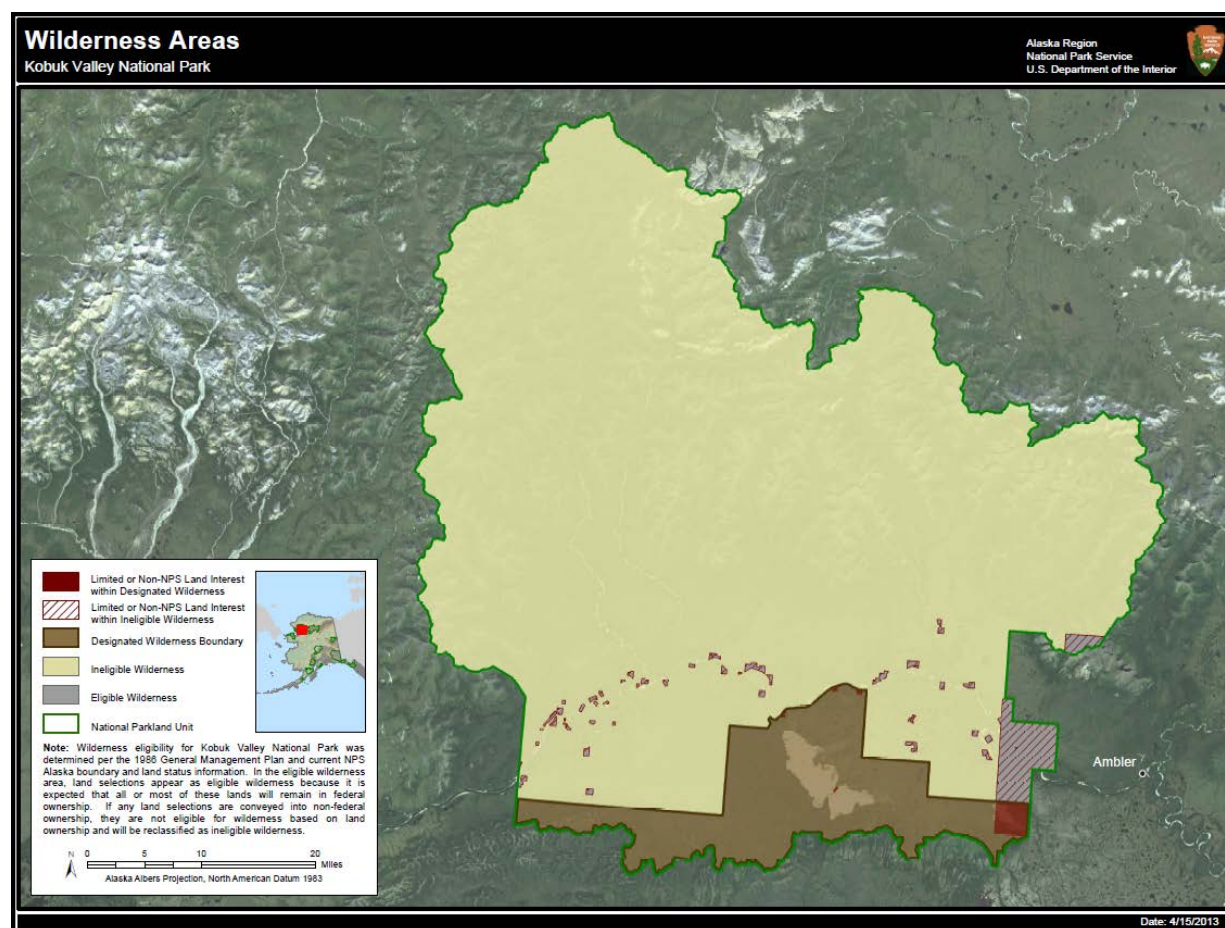


Figure 2. Map of Kobuk Valley National Park and Wilderness.

Kobuk Valley National Park is managed as part of Western Arctic National Parklands (WEAR), a complex of four parks which are managed from Kotzebue, Alaska. The other parklands managed as part of WEAR are Cape Krusenstern National Monument, Bering Land Bridge National Preserve, and Noatak National Preserve.

Kobuk Valley National Park is managed as part of Western Arctic National Parklands (WEAR), a complex of four parklands which are managed from Kotzebue, Alaska. The other parklands managed as part of WEAR are Noatak National Preserve (NOAT), Cape Krusenstern National Monument (CAKR), and Bering Land Bridge National Preserve (BELA).

Geographic setting of the Kobuk Valley Wilderness

The Kobuk Valley Wilderness is located in northwest Alaska in the southwestern Brooks Range Mountains and Kobuk River lowlands. Predominately surrounded by other public lands, Kobuk Valley National Park is part of a vast network of protected lands. While of these lands have varying levels of conservation protection, the expanse of remote, adjoining protected areas makes land ownership boundaries difficult to identify on the ground without a global positioning system (GPS) unit.

To the north, Kobuk Valley is bordered by the Noatak National Preserve and Wilderness, also managed by the NPS. To the south, Kobuk Valley is bordered by the Selawik National Wildlife Refuge and Wilderness, managed by the U.S. Fish and Wildlife Service. To the east and west, land ownership is an amalgam of Bureau of Land Management (BLM), State of Alaska, NANA Regional Corporation and Village lands. These land ownership boundaries are depicted in Figure 4.

When Kobuk Valley is considered as part of this regional view, the park becomes part of a network of federal lands managed as wilderness that spans 18 million acres, including lands in the Noatak National Preserve, Gates of the Arctic National Park & Preserve, and Selawik National Wildlife Refuge.

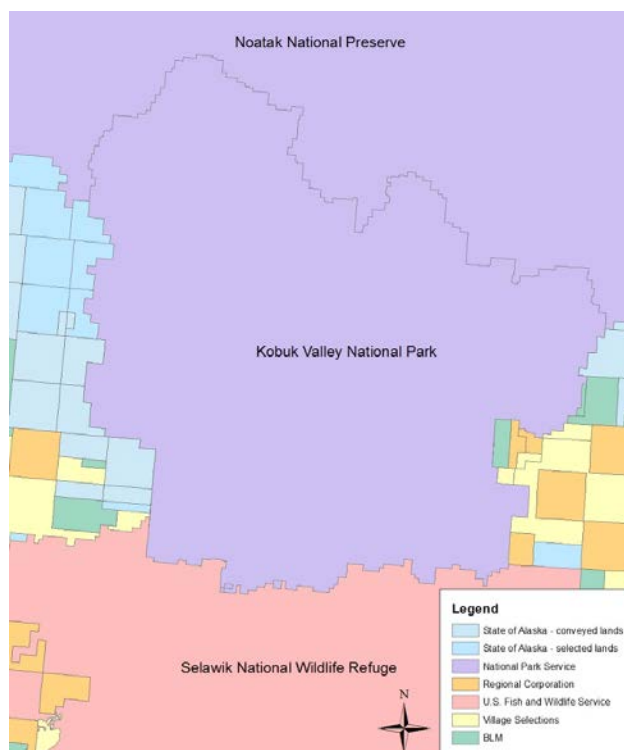


Figure 3. Land ownership around Kobuk Valley National Park and Wilderness. NPS data.

In this corner of bush Alaska without access by road, population centers are small and dispersed. The Northwest Arctic Borough encompasses all of the communities near the park. The Northwest Arctic Borough includes 13 arctic and subarctic villages and a population of approximately 7,500 individuals (U.S. Census data 2010). Many residents of these villages, including Kiana, Ambler, Kotzebue, Noorvik, Shugnak, Kobuk, Selawik, Kivalina, Deering, and Buckland, use the park. Kotzebue is the largest population center in the region, with a population of approximately 3,300 individuals (U.S. Census data 2010).

Kobuk Valley wilderness character narrative

Note: This narrative describes the wilderness character of all lands in Kobuk Valley National Park designated and eligible as wilderness. This approach is in accordance with NPS policy to manage lands eligible for wilderness designation, as wilderness, and with the mandate to preserve their wilderness character.

Located in the heart of Northwest Alaska, the landscape of the Kobuk Valley Wilderness and National Park (Kobuk Valley) is constantly in flux. Rivers flow in meandering curves, carving deep channels into glacial and alluvial deposits. Sand dunes reshape their silhouettes as wind undulates across their ridges. In this landscape, cycles of change span the scale of minutes to millennia – salmon return to their spawning grounds after years at sea; tendrils of black spruce roots reach down into the crystalline sand, stabilizing ancient dunes; and in the arctic summer, the sun skims the horizon but never sets, until ice and snow freeze the land in an icy grip of winter darkness each year. As a display of these cycles, Kobuk Valley is a sanctuary for wilderness values and wildlife; a place for life in the arctic to play out as it has for millennia.

The Iñupiat have lived here for thousands of years and are an indelible part of this landscape. Kobuk Valley is a rich homeland with the biannual migration of caribou, profusion of salmon and whitefish in the rivers, and an abundance of plant life growing on the river terraces. The Iñupiat Ilitqusiat – that which makes us who we are – defines values of humility, respect for nature, and cooperation; values which live on in this landscape as the law of the land. Here, wilderness helps bridge the values and land ethic of Native Alaskans and those of people from around the world.

Kobuk Valley straddles the Kobuk River midway in its descent from the Western Brooks Range. Lively clearwater tributaries, including the Salmon, Akillik, Hunt, Kaliguricheark, Tutuksuk, and Kallarichuk rivers, flow from the Baird Mountains which enclose the north side of the park and wilderness. The Baird's jagged peaks are acutely remote with few visitors besides Dall's sheep and migrating caribou. In the south, the Kobuk River slowly meanders across the lowlands and acts as a primary travel route between local



Great Kobuk Sand Dunes. Photo by Constance Baltuck, NPS.

villages, and provides access to traditional fishing and hunting camps. Sand dunes tower above the surrounding river terraces, some standing 100 feet tall, in stark contrast to the surrounding riparian environment. The southern portion of Kobuk Valley is comparatively accessible – a gentler

landscape with rolling hills and wide river deltas, and the Waring Mountains resting on the southern horizon. Seamlessly flowing into one another, the diverse terrains of Kobuk Valley encapsulate the rich variety of ecological communities present across the Western Brooks Range Mountains.

Kobuk Valley is part of a 17 million acre contiguous expanse of arctic and subarctic wildlands preserved as wilderness, bordered by the Noatak and Gates of the Arctic Wildernesses to the north and the Selawik Wilderness to the south. Still, the future of Kobuk Valley is uncertain. Imminent threats from climate change, developing technologies, changing use patterns, and potential regional developments make preserving the wilderness character of Kobuk Valley challenging; effective stewardship requires coordination between land managers and local users, and a land ethic of respect and humility by all.

Untrammeled

Wilderness is essentially unhindered and free from modern human actions that intentionally control or manipulate the community of life.

The boundaries of Kobuk Valley are natural features made by watersheds and ridgelines. Encircled by mountains, Kobuk Valley is bordered by the Baird Mountains to the north, Jade Mountains to the east, Waring Mountains to the south, and Kallarichuk Hills to the west. Yet without a map, it is impossible to tell where the Kobuk Valley Wilderness and National Park end and where the surrounding forest and mountains begin. As wildlife move through the landscape as they have for centuries, their paths are unobstructed by roads or trails. No human-made barriers, roads, or trails, confine these lands.

Rivers flow freely through Kobuk Valley with no human-made diversions and no bridges spanning



the rivers. The entire Kobuk River watershed is unfettered, meandering freely across its floodplain. Oxbow lakes, sloughs, and meandering scrolls, assert that the Kobuk has defined its own course over thousands of years. The

Meander scrolls in the Kobuk River. Photo by Ken Hill, NPS.

Salmon River is the longest tributary to the Kobuk River within the park. Designated as a Wild and Scenic River, the Salmon River flows 70 miles from the limestone cirques of the highest peak in the park, Mt. Angayukaqsrq, to the Kobuk River. Over its course, the Salmon River flows through the ecotone of tundra-covered highlands and forested lowlands – a river and landscape essentially unmodified from human intentions.

Forested slopes of black and white spruce, and expanses of tundra provide ample fuel for wildfires across Kobuk Valley. Fires can burn thousands of acres, spilling into adjacent wilderness areas and continuing their blazing path until they burn out of their own accord. Fire has maintained its natural regime here for thousands of years, often ignited by lightning strikes. Recent fire history is etched in black onto hillsides and barren tree trunks. Occasional fuels reduction projects around allotments and cabins are the only exceptions to the natural fire cycle here.

Kobuk Valley is virtually unaffected from the intentional manipulation of modern technologies and civilization, defying these forces through the sheer size, diversity, and severity of its environment.

Still, some authorized trammeling actions take place, including permitted research activities such as wildlife collaring and the regulated harvest of natural resources via hunting, fishing, and trapping. Unauthorized actions may occur on rare occasions, where the size and remoteness of the park can make it difficult for managers to monitor everything that occurs within the boundaries of Kobuk Valley.

Effects of climate change may also influence the untrammeled quality in the future, for instance, by prompting park managers to increase fuel management as wildfire regimes change, or to contain invasive or non-native plant species arriving in the region. Likewise, as environmental niches shift with climate change, managers may feel the need to support wildlife transplanting and relocation activities. Any such proposed activity would need to be evaluated within the untrammeled quality and all qualities of wilderness character.

Natural

Wilderness maintains ecological systems that are substantially free from the effects of modern civilization.

Kobuk Valley is epitomized by diverse and contrasting seasons. Summers are a colorful flourish of activity. Plants send new shoots towards the sun, black and brown bears emerge from their winter dens, and the land hurries to make the most of the long days and abundant light. Deep winters shroud the land in snow and ice. Life or movement appear absent until a closer look reveals a tessellation of activity; perhaps tracks from marten or lynx, or the brush of wingtips from an owl or ptarmigan.



Caribou in winter. Photo by NPS.

Each year, the Western Arctic Caribou Herd travels through Kobuk Valley during the herd's spring and fall migrations; hundreds of thousands of caribou swim across the Kobuk River and traverse high mountain passes in the Baird Mountains. Their hooves carve sinuous trails across Kobuk Valley –



Edge of the Great Kobuk Sand Dunes. Photo by Constance Baltuck, NPS.

trails aggregated over thousands of years. Other iconic species including wolves and wolverines, Dall's sheep and moose, brown bears and red foxes, beaver and marten, golden eagles, bald eagles and peregrine falcons, rove throughout Kobuk Valley. Black bears can also be found in the forests of Kobuk Valley, which form the northwestern most corner of their range. Interactions between these species as predator and prey are intact – the same cycles of survival and resilience that have played out in this harsh environment for millennia.

Sand dunes are perhaps the most recognized symbol of Kobuk Valley with dunes arcing high above the verdant river terrace. These sand dunes are the largest and most active in the Alaskan arctic and provide habitat for regionally notable species, including the sandy tiger beetle and wood frog. The Kobuk pea plant, *Oxytropis kobukensis*, is endemic to the Kobuk sand dunes and is found nowhere else in the world.

The Kobuk Valley arctic-subarctic ecotone where boreal forest transitions to tundra, creates a natural laboratory for climate change where the northern and southern regions of the wilderness are differentiated by biome. Forests of white and black spruce cover large expanses of lowlands and along streams, with pockets of birch and balsam poplar, willow, alders and blueberries tucked in among the spiny forest. Moving northward and upward in elevation, the forest becomes interspersed with tundra. A mosaic is created by the alternating pattern of tundra and forest. In some areas, open stands of spruce grow above a thick groundcover of yellow-colored lichens, creating a bright and easily traversed woodland. In contrast, impenetrable thickets of willow and alder often grow along the rivers and streams.

The Kobuk River spans the lifecycles of two types of fish; both salmon and whitefish species spend most of their adult life in saltwater, before returning to spawn in the freshwater rivers of Kobuk Valley. Salmon species that spawn in Kobuk Valley die – a one way trip bringing ocean nutrients back to terrestrial landscapes. Conversely, whitefish can breed repeatedly, returning to same sites to spawn over many years. Whitefish are an important staple for the subsistence of local communities as whitefish are abundant in the Kobuk River all year long.

Climate change will significantly affect Kobuk Valley. With longer summers and warmer winters, trees and shrubs migrating northward into tundra, and thawing permafrost causing areas to slump and change shape, the effects of climate change are already being felt. Regional wildlife habitats may shift poleward, bringing novel wildlife species to the region. The natural quality of Kobuk Valley is also threatened by proposed development and its effects on natural systems, including air and water quality. At the seams of development, increased visitation and climate change threaten to bring non-native plant species to the region, such as quackgrass and elodea, an aquatic invasive plant.



Yellow asteraceae flowers on the sand dunes. Photo by Josh Foreman.



Fall colors. Photo by Dan Stevenson, NPS.

Undeveloped

Wilderness retains its primeval character and influence, and is essentially without permanent improvements or modern human occupation.

With few improvements on the landscape, Kobuk Valley has retained its natural character and remained without permanent developments over the millennia. Without roads, trails, or signs, Kobuk Valley is a remnant of an earlier era when wayfinding was passed down through generations.

Heavily forested in the south, the Kobuk Valley hides its few human-made developments well. Tucked among trees and along brushy stream banks, physical developments in Kobuk Valley are rarely visible from afar and Kobuk Valley retains a feeling of freedom from modern influences. Still, visitors may round a bend in the river or crest a remote ridge while hiking to find unexpected scientific instrumentation or debris from historic mining or military training exercises – appearing today as piles of rusting 55-gallon drums and glimmering, metallic 15-foot fuel pods. These reminders of modernity are an unexpected vestige of modernity in a landscape that appears otherwise wild.



Camp on banks of Salmon River. Photo by Josh Morehouse, NPS.

Established to “...maintain the environmental integrity of the natural features of the Kobuk River Valley... in an undeveloped state” the undeveloped quality of Kobuk Valley is paramount. Modern technologies threaten this undeveloped quality as motorized use and mechanization increase, and industrial developments are proposed nearby. Changing technologies also have the potential to increase pressure for development as possibilities for mining, access, and infrastructure expand.

The Alaska National Interest Lands Conservation Act of 1980 (ANILCA) allows use of motorboats, airplanes and snowmachines in Alaskan wilderness. Still, these uses represent one of the primary impacts to the undeveloped quality of Kobuk Valley. As the main travel route between local villages, the Kobuk River transports goods and people inland from the Chukchi Sea via motorboats in the summer and snowmachines in the winter. The majority of motorboat and snowmachine use is localized along the Kobuk River and southern portion of the wilderness. In addition, the

Kobuk River is important for subsistence caribou hunting, a tradition going back millennia; in the fall, motorized use levels can rise significantly along the river corridor.

Motorized uses are also changing with new technologies. For instance, more powerful, fuel-efficient snowmachines allow users to travel farther into the snowy, steeper foothills of the Baird Mountains

and other previously difficult to access terrain. Helicopters, used periodically for law enforcement and scientific activities, allow increased accessibility to the northern portion of Kobuk Valley, traditionally only accessible via a 5-day backpacking trip. Fixed-wing aircraft are also frequently used to access Kobuk Valley, though landing sites are limited in the northern part of the wilderness and park.

Inholdings are prevalent along the Kobuk River – places local families have used for generations as fish camps are still used in the same way today. Some inholdings represent a potential threat to the undeveloped quality of Kobuk Valley as new commercial uses of these private lands may bring increasing impacts to wilderness character.

Research activities may also impact the undeveloped quality of wilderness. While opportunities for scientific research in Kobuk Valley are extensive, research activities are often accompanied by temporary or permanent, developments and impacts to wilderness character. Extended research camps may leave behind social trails, bear attractants, and trampled vegetation long after the research itself has been completed and the camp disassembled. Likewise, sub-surface resource markers are often used to mark long-term research monitoring sites. While these markers are not visible, they affect the undeveloped quality of Kobuk Valley. Science is a fundamental value of Kobuk Valley and wilderness, but each project must be balanced for its impacts to wilderness character and benefits to stewardship and society.

Opportunities for Solitude or Primitive and Unconfined Recreation

Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.

Time has little meaning in Kobuk Valley. Witness to the prolonged sunsets and sunrises that graze the arctic horizon, awareness grows to the slow movements of the arctic sun and moon which govern the days, nights, and seasons here.

Visitors must move at the pace of this landscape. Immersed in the rivers that weave through the valleys as visitors float downstream, or traversing through miles of tangled alders, where travel is



Kobuk River near Onion Portage. Photo by Paul Stolen, NPS.

similar to hiking through a jungle-gym, visitors find their travels orchestrated by Kobuk Valley. Unable to escape harsh weather or hoards of insects and disconnected from modern technologies, self-reliance is imperative and consequences for mistakes are high. Immense and severe, the environments of Kobuk Valley are not easy and they are not kind. But with this rigor comes humility, as well as discovery, challenge, exploration, and revitalization.

There are no trails, permits, or fees, and no cell phone service to connect visitors with the outside world. From this freedom emerges simplicity, where the flow of the landscape governs day-to-day life by weather, wildlife, and whims of exploration.

A continuum of solitude extends between the northern and southern regions of the park. In the south, the sand dunes act as islands of accessibility in comparison with the rest of the wilderness. In addition, use of the Kobuk River and motorized uses there significantly affect the remoteness of the area. The Baird Mountains in the northern portion of the wilderness however, are a rugged testament to Alaskan wilderness – isolated, severe, and expensive to access. Across this landscape, visitors' experiences are likely to be quite different. Still, in comparison to the range of experiences and solitude across wilderness nationwide, the entirety of Kobuk Valley offers incredible opportunities for solitude and connection with the land.

Most visitors find this land fosters a deep sense of connection. With every footstep, visitors follow the paths of ancient peoples and ancestors; shards of chert and depressions of house pits provide a glimpse into traditions of use from countless generations. Visitors may also come across local peoples subsisting on the land – gathering berries, hunting, fishing, or tending to racks of drying salmon. For most visitors, this encounter forges an appreciation and respect for the lifeways that continue here today.

Natural sounds and vistas prevail across Kobuk Valley. Wolves howl in the distance and perhaps, the snorts and clicking hooves of caribou from just outside of the tent. In the summer, the land hums with mosquitoes and life hurrying to prepare for another winter. Panoramas of successive mountain ranges recede into the distance. In the winter, silence lies thick over Kobuk Valley with the snow; pierced only by the thrum of a snowmachine or plane until the sound is swallowed in the frozen forests. In the darkness of winter, visitors can see the northern lights dancing in brilliant greens, purples, and yellows.

Access to Kobuk Valley is ephemeral and unpredictable – dependent on weather, water, and snow and ice conditions. The presence of viable aircraft landing sites also directs access, with sites often changing year-to- year as rivers redistribute gravel bars and lakes dry out or form anew. All trips to Kobuk Valley by commercial users, individuals, and the National Park Service, must allow days of leeway for the countless factors that influence when access, or egress, is feasible. Access is one of the greatest influences on opportunities for solitude and unconfined recreation in Kobuk Valley. Limited to sporadic sites, access into and out of the wilderness is determined by aircraft landing sites, navigable waterways, and often, the high cost of travel and gasoline. These portals of access can concentrate campfire rings, social trails, litter, and human waste, which detract from the solitude Kobuk Valley otherwise imparts. Likewise, the high cost of travel and access can be prohibitive to many visitors.

In the future, opportunities for solitude and primitive and unconfined recreation in Kobuk Valley face a number of changes and potential threats. Soundscapes currently pervaded by natural sounds may change from motorized transport and nearby development, and night sky illumination may increase with regional mineral developments. Regional developments also have the potential to dramatically affect the accessibility of Kobuk Valley. Even on a smaller scale, changing technologies, such as increased use of GPS navigation and satellite phones affect how visitors interact with this landscape.



Salmon River. Photo by Ken Hill.

Other Features of Value

Wilderness may contain other features of scientific, educational, scenic, or historical value.

The history of Kobuk Valley forms a rich current within the wilderness, underlying all activities that take place today and spanning cultural, ethnographic, archeological, paleontological, and historical resources. Kobuk Valley has supported continuous human use for thousands of years. Over the millennia, human behavior and actions here have maintained a remarkable continuity, where the same hills, ridges, and streams that draw visitors today are often the same features that attracted the Iñupiat in years past.

Onion Portage, a National Historic Landmark, epitomizes this continuity of use. For thousands of years and continuing to this day, Iñupiat hunters have waited here for caribou to cross the Kobuk River in their biannual migration. Where the Iñupiat waited, they left behind a rich history of artifacts that now constitute one of the most significant cultural resource sites in the region. The archeological stratigraphy where these artifacts were found has helped establish region-wide cultural chronology – vital to deciphering the cultural and archeological history that pervades the region. Throughout the entirety of Kobuk Valley, important cultural and archeological sites assert the intricate and unending Iñupiat homeland here. Today, the Native communities of Kiana, Kobuk, Noorvik, Shugnak, Ambler, and Kotzebue maintain a strong connection to Kobuk Valley – continuing traditions begun thousands of years ago.

Subsistence uses of the land live on in Kobuk Valley, showing the sociocultural traditions and values of those who continue to thrive in this challenging environment. Hunting, trapping, and gathering berries and other resources are common and allow many local people to subsist off the land as they have since time immemorial. Each year, caribou, moose, salmon, whitefish, and other animals are



Giddings Cabin near Onion Portage. Photo by Dan Stevenson. NPS.

taken from this wilderness and the meat is cached to help families survive through the winter. Into the future however, ongoing cultural uses in Kobuk Valley may change with societal norms and as technologies influence subsistence lifeways.

A diverse geologic history also underlies Kobuk Valley. Limestone caves, glacial drift and alluvial deposits, ancient moraines, mineral terranes that can cause rivers to run red with silt rich in iron oxides contribute to the character of Kobuk Valley. The rich minerals beneath Kobuk Valley have made parts of the region attractive for

mineral extraction, the development of which threaten the area's wilderness character. Still, many of the geologic and other resources of Kobuk Valley remain relatively unknown and are only coarsely understood. This "unknown" is vital to the wilderness character of Kobuk Valley where exploration, novelty, and discovery are real.

Iñupiat Homeland

Native Alaskans have lived in the landscapes of Kobuk Valley since time immemorial. These lands provide cultural identity, sustenance, and a way of life. Kobuk Valley and the surrounding river valleys are the ancestral home of the Iñupiat people. They know the intricate cycles of seasons and life that are needed to survive here – when the caribou will cross the Kobuk River at Paatitaaq, also known as Onion Portage; how to read the frozen rivers for thin or hollow ice; and which eddies to seine for whitefish in the summer. The people know this land; it is their livelihood and it is their home. In years past, Iñupiat men would hike north into the Baird Mountains in the late summer to harvest caribou. If the caribou were scarce, the men hunted bear and sheep for the sustenance and fat while in the mountains. In the final days before the rivers froze for the winter, the men would build Umiaks, skin kayaks, and float home along the rivers flowing from the Baird Mountains before winter set in.

The Iñupiat understand the connectivity in this land. Here, the weather, seasons, river currents, animal tracks and movements, ice patterns, time of day, and countless other factors combine to create a holistic understanding of this landscape. The Iñupiat use all of this to know where and when to safely and successfully harvest natural resources. Knowledge of these subtle interactions defines Iñupiat lifeways, where personal knowledge is combined with knowledge of past generations to create a dynamic and holistic view of the land that is necessary to survive here.

Knowledge of this land and its resources has been passed down through generations and Iñupiat elders, families, and traditions are the bearers of this knowledge. When elders speak, telling stories of places, hunting, and survival, everyone listens and learns. For example, Iglukisaaq is where a boulder at the river edge is said to be a stone juggled by a giant; Kapuqqaġvik is the “fish spearing place.” Yet this information is larger than words on a page and cannot be fully captured in a book;



Baird Mountains. Photo NPS.

it lives on in the people with more detail and nuance than can be described – it must be lived. This is the only way to truly know the Kobuk Valley landscape by name and use. Intricate knowledge is associated with every inch of this wilderness, asserting that local people with their history and culture are indelibly linked to the landscape and its character.

Many changes have come in recent centuries, brought by the arrival of new peoples and cultures. And the local villages have adapted; change and adaptation are constant for the Iñupiat. When

caribou herds declined or snow fell earlier than normal, the people adapted. When modern technologies arrived in villages bringing firearms, diesel fuel, snowmobiles, and powerboats, the people adapted. Through these changes the land remains vital to Iñupiat culture and a deep respect is maintained for this wilderness and its inhabitants.

Though Kobuk Valley Wilderness and National Park crosses their homeland, the Iñupiat see no boundaries as they look across this landscape – there is no line where wilderness begins or ends. Yet people see that change and development are coming to the region. Protected areas and wilderness are seen as places where traditional ways of life can continue, assuring that a way of life in which humans are part of the natural world lives on.

Contributors Andrew Ackerman, Social Scientist
Ken Adkisson, Subsistence Manager
Hannah Atkinson, Cultural Resource Specialist
Willie Goodwin, Tribal Liaison
Frank Hays, Superintendent
Mike Holt, Chief of Cultural Resources
Linda Jeschke, Chief of Interpretation
Marci Johnson, Biologist
Jim Lawler, ARCN Coordinator
Nyssa Landres, Wilderness Planner
Peter Neitlich, Ecologist
Stephanie Stephens, Acting Superintendent
Dan Stevenson, Ranger Pilot



Kobuk Valley lake and mountains, Photo NPS.

Wilderness Character Monitoring Baseline

The baseline assessment of wilderness character for the Kobuk Valley Wilderness is described in this section. Spanning from how each measure were chosen, to how each will be monitored into the future, this section provides a comprehensive picture of what wilderness character monitoring for the Kobuk Valley Wilderness will look like.

Wilderness character monitoring measures

This section describes in detail the measures selected to monitor the Kobuk Valley Wilderness. Together, these measures constitute the baseline assessment of wilderness character for the Kobuk Valley Wilderness. This baseline assessment describes the first year in which all measures report data and when consistent monitoring protocol are established. For the Kobuk Valley Wilderness, the year of this baseline assessment is 2014. The mandate of the Wilderness Act and NPS policy however, is to preserve wilderness character beginning when the wilderness is designated, or when the area is determined to be as eligible wilderness according to NPS policy.

To account for change in the wilderness character of the Kobuk Valley Wilderness since 1980, each measure also includes the “trend since wilderness designation.” This component of the baseline assessment is not a required element. Rather, including this trend was requested by staff for two primary reasons: first, to provide a more comprehensive understanding of wilderness character in the Kobuk Valley Wilderness; second, to minimize the loss of institutional knowledge regarding wilderness character by including all information available to date. Given that this baseline assessment is being developed almost 35 years after the wilderness was designated, knowledge of how the wilderness has changed since designation is limited and will likely decrease into the future. Between staff turnover, rapid change in arctic environments, and potential development of resource extraction operations, staff assert that including trend since wilderness designation adds valuable information to this baseline assessment of wilderness character in Kobuk Valley. Unfortunately, for many measures data is incomplete reaching back to 1980. In these instances, staff used professional judgement in combination with all available data to assign the trend reported here. Data confidence is indicated for all trends to ensure transparency of the assigned trend.

It is important to note that this indication of trend since 1980 and use of profession judgement therein is different from trends used for wilderness character monitoring purposes. Likewise, wilderness character monitoring trends are only assessed from the first year of quantitative data onward.

For each measure, the following aspects are described: baseline data value, year(s) of data, trend since wilderness designation, background information, measure description & collection protocol, data source, data frequency, and significant change. The content and purpose of each of these sections is described below.

- **Baseline data value** – specifies the data value for each measure entered into the WCMD for the baseline year, which is 2014 for wilderness character monitoring in the Kobuk Valley Wilderness. Please note that the WCMD uses “year measured” to refer to the year of any given data value (e.g., the “year measured” of the “2014 data value” is 2014).

- **Year(s) of data** – specifies the year(s) in which the data were collected. Depending on the structure of the measure, the “year of data” may not be the same as the baseline year. For example, the “year of data” for a 2014 data value might be 2014, or 2013, or 2009-2013, or Fiscal Year 2013, etc. This terminology matches what is used in the WCMD.
- **Trend since wilderness designation** – provides an indication of the current status and trend for the measure since Kobuk Valley Wilderness was established in 1980. Trends are depicted based on the symbols in Table 2, and can be “upward,” “downward,” or “stable.” These trends are based on professional judgment by resource specialists when data are unavailable. More information on how legacy data is incorporated into ongoing wilderness character monitoring is available in *Keeping It Wild 2* (Landres et al. 2015, p.19).
- **Condition status** – refers to the current condition of the measure. Condition status was determined by relevant literature and documentation on the history of the measure, and professional judgement by resource specialists.
- **Background information** – defines the context and relevance for the measure at an individual wilderness and addresses why the measure was selected.
- **Measure description and collection protocol** – defines what is being measured and how, including the process through which data is compiled or gathered. “Collection protocol” is defined and used in this document to refer to the process by which data is gathered from existing sources and does not include in-the-field data collection instructions. If field data collection protocols are relevant to a measure and available, a location of where the protocol can be found is included.
- **Data source** – defines where information for the measure can be found into the future. The intent of this section is to encourage written documentation of wilderness character so that information is accessible into the future.
- **Data frequency** – defines how often data for this measure should be entered into the WCMD. Frequency is typically determined by the time frame in which data become available under existing monitoring protocols for use in wilderness monitoring.
- **Data adequacy** – defines the reliability of the data to assess trends in the measure. Data adequacy is based on data quantity and data quality. Data quantity refers to the level of confidence that all appropriate data records have been gathered. Data quality refers to the level of confidence about the source(s) of data and whether the data are of sufficient quality to reliably identify trends in the measure. Further information on the role of data quantity and quality in wilderness character monitoring is available in the Forest Service Technical Guide (Landres et al. 2009, p. 26, hereafter referred to as the “FS Technical Guide”). Subjective evaluation of these two aspects is used to determine data adequacy as high, medium, or low. Please note that the WCMD refers to data adequacy as “data confidence.”
- **Significant change** – defines how much change a measure must undergo to indicate a changing trend in wilderness character for a particular measure. “Significant change” is defined and used in this document differently than definitions used by other departments

within the NPS and is not intended to mean “statistically significant change” nor imply use of the Environmental Impact Statement (EIS) process under the National Environmental Protection Act (NEPA).

Table 2. Key to status, trend, and confidence symbols.

Condition Status		Trend in Condition		Data Adequacy	
	Warrants Significant Concern		Upward trend in the measure		High
	Warrants Moderate Concern		Stable trend in the measure		Medium
	Resource is in Good Condition		Downward trend in the measure		Low

Together, these sections provide a comprehensive overview of each measure, provide transparency into wilderness character monitoring measures selected at the park, and form the basis of the wilderness character monitoring strategy of the Kobuk Valley Wilderness. A summary of the information in this report most pertinent to day-to-day use by park staff is located on the WEAR shared drive Wilderness folder.

Process used to identify measures

The process used to identify and select measures to monitor wilderness character is outlined below. All actions were carried out by the Wilderness Planner unless otherwise specified.

- **Gather information** – Background information was gathered to understand the wilderness and park including the history, ecosystems, and potential threats in the future. This information was gathered by reading background and guiding documents for the wilderness and park, working with park staff and other individuals, and visiting the wilderness.
- **Create list of possible measures** – Preliminary measures were identified and compiled for all indicators based on the information gathered and a workshop held with park staff in July 2014. Several measures were based on measures described in wilderness character monitoring documents – including the FS Technical Guide (Landres et al. 2009), National Park Service User Guide (Landres et al. 2014), U.S. Fish and Wildlife Service (USFWS) Wilderness Character Monitoring reports (USFWS unpublished data), *Keeping It Wild* (Landres et al. 2008), *Keeping It Wild 2* (Landres et al. 2015), and refined to suit Kobuk Valley Wilderness.
- **Refine measures** – Measures were prioritized and refined through discussing measures with staff and evaluating the significance, feasibility, vulnerability, and reliability of measures (see table in Appendix B). The availability of reports and scientific information currently and into the future was also considered.

- **Approval of measures** – The final list of measures was developed and submitted to Adrienne Lindholm (Alaska Region NPS Wilderness Coordinator) and Peter Landres (Ecologist, Aldo Leopold Wilderness Research Institute).
- **Write report** – Each measure was described, including background information, collection protocol, data adequacy, data source, and significant change. All measures were written into the final report and the report was submitted to supervisors.
- **Locate and synthesize data** – Available scientific information for each measure was collected by contacting relevant individuals and pulling information from the internet and parklands shared drive. Data were processed as necessary.
- **Enter data** – data were entered into the WCMD, at <http://wc.wilderness.net/>.
- **Incorporate comments** – changes, edits, and feedback from park staff and wilderness supervisors were received by Wilderness Planner. Edits were incorporated into the final draft.
- **Approval of final report** – report was finalized and approved by supervisors, including the Kobuk Valley Wilderness Coordinator, WEAR Superintendent and Alaska Region NPS Wilderness Coordinator.

Overview of wilderness character monitoring measures

The table below lists all 19 wilderness character measures that establish the Kobuk Valley Wilderness character monitoring baseline. Each measure is described in more detail in its respective section later in the report. Additional measures may be used to monitor the Kobuk Valley Wilderness in the future; these measures lack the data necessary to be included and are listed in the “Measures suggested for future use” section.

Table 3. Wilderness Character Monitoring Measures used for the Kobuk Valley Wilderness

Quality	Indicator	Measure
Untrammeled	Actions authorized by the federal land manager that intentionally manipulate the biophysical environment	1-1: Number of actions that manipulate wildlife or vegetation 1-2: Percent of wildfires suppressed
	Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment	1-3: Number of unauthorized actions that manipulate plants, wildlife, insects, fish, pathogens, soil, water, or fire
Natural	Plants	2-1: Number of non-native plant species
	Animals	2-2: Number of human-wildlife incidents
	Air and water	2-3: Acidifying and fertilizing pollutants
	Ecological processes	2-4: Extent of landscape connectivity
Undeveloped	Presence of non-recreational structures, installations, and developments	3-1: Number of sub-surface installations
		3-2: Number of above-ground installations
		3-3: Weight of abandoned debris
	Presence of inholdings	3-4: Acres of inholdings
	Use of motor vehicles, motorized equipment, or mechanical transport	3-5: Number of helicopter supported projects 3-6: Hours of fixed-wing aircraft flight time 3-7: Miles of administrative snowmachine use
Solitude or primitive and unconfined recreation	Remoteness from sights and sounds of human activity <i>inside</i> the wilderness	4-1: Number of researcher-days
	Remoteness from sights and sounds of human activity <i>outside</i> the wilderness	4-2: Number of commercial operations within 10 miles
	Facilities that decrease self-reliant recreation	4-3: Number of aircraft landing sites
	Management restrictions on visitor behavior	4-4: Index of management restrictions
Other features of value	Deterioration or loss of integral cultural features	5-1: Percent of impacted and threatened cultural resource sites

Untrammelled Quality

Wilderness is essentially unhindered and free from modern human actions that control or manipulate the community of life.

The Untrammelled Quality of wilderness character tracks the actions of humans in wilderness that intentionally manipulate the biophysical environment. Actions that intentionally manipulate or control ecological systems inside wilderness degrade the Untrammelled Quality of wilderness character. This is true regardless of what instigated the action or if benefits to other qualities of wilderness character are gained by the action. Withholding action is a key concept for understanding this quality; management of wilderness, in contrast to management of other types of land, should be approached with restraint and humility. When monitoring the Untrammelled Quality we can track either the decision to manipulate the biophysical environment, or the opportunity for humans to let natural processes occur without intervention. Further information on determining whether an action meets criteria to be included in the Untrammelled Quality of wilderness character can be found in the “What is a trammeling action?” document, included as Appendix C of this report.

Table 4. Measures of the Untrammelled Quality used to monitor the Kobuk Valley Wilderness

Indicator	Measure	Frequency	Data Adequacy	Significant Change	Baseline Value
Actions authorized by the federal land manager that intentionally manipulate the biophysical environment	1-1: Number of actions that manipulate wildlife or vegetation	1 year	High	Any	1 action
	1-2: Percent of wildfires suppressed	5 years	High	p-value ≤ 0.05	14%
Actions not authorized by the federal manager that intentionally manipulate the biophysical environment	1-3: Number of unauthorized actions that manipulate plants, wildlife, insects, fish, pathogens, soil, water, or fire	5 years	Low	Any	0 actions

1-1: Number of actions that manipulate wildlife or vegetation

Untrammelled Quality • Actions authorized by the federal land manager that intentionally manipulate the biophysical environment

Wilderness character monitoring baseline:

Baseline data value: 1 action

Year of data: 2014 (calendar year)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: High

Background & Context

Actions that intentionally manipulate, hinder, restrict, or control “the earth and its community of life” are considered trammeling actions. Actions occurring as part of research projects and administrative actions that have foreseeable and substantial impacts on the biophysical environment impact the Untrammelled Quality of wilderness. This measure focuses on intentional manipulations of wildlife or vegetation because they are the most relevant types of trammeling actions in the Kobuk Valley Wilderness and are highly relevant to its wilderness character. Manipulations of other parts of the biophysical environment are not included in this measure because they are highly unlikely to occur.

At this time, few authorized actions occur within the Kobuk Valley Wilderness that manipulate wildlife or vegetation. The only authorized trammeling action in Kobuk Valley is caribou collaring along the Kobuk River at Onion Portage, which has occurred annually since 1988. It is of note that the section of Kobuk Valley which encompasses Onion Portage is currently a Native selection under the Alaska Native Claims Settlement Act of 1973 (ANCSA). If this selection is conveyed, then the area where the collaring actions occur will be located outside the park and no longer considered as a trammeling action for the Kobuk Valley Wilderness. However, other impacts from the collaring (e.g., collars as mobile installations and motorized use to access the site) will remain.

Additional actions that manipulate wildlife or vegetation have the potential to occur here in the future. Examples of actions that manipulate wildlife or vegetation that would be included here are: control of nuisance wildlife such as porcupines or Arctic ground squirrels, facilitated migration or control of shifting wildlife habitats due to climate change, spraying of herbicide, and any other large-scale vegetation control efforts.

Measure Description & Collection Protocol

This measure monitors the number of administratively-authorized actions that intentionally manipulate wildlife or vegetation. To determine whether an authorized action that manipulates wildlife or vegetation is or is not a trammeling action, the document “What is trammeling action?” should be consulted, available in Appendix C. The number of actions reported is based on guidance in Tables 5 and 6 (next page). This measure uses the total number of actions that occur in one calendar year and *does not* use a weighting system to evaluate actions based on their predicted or potential magnitude based on guidance in *Keeping It Wild 2* (Landres et al. 2015, p. 35).

Table 5. General guidance for counting trammeling actions

In general:	
•	Only count actions that are of sufficient scale (that cross the threshold);
•	All actions above the threshold are counted equally;
•	Actions are counted once per year the action occurs;
•	Minimum requirements analyses (MRAs) or National Environmental Policy Act (NEPA) analyses can often (though not always) be used to indicate actions in wilderness.

Scale is an important consideration in counting trammeling actions, but only to a certain point. If it is determined that the magnitude of an action's consequences will exceed a certain threshold, the action is counted as a trammeling. All trammeling actions that cross this threshold are counted equally, regardless of the extent of their effects (e.g., spraying herbicide on 100 acres is equivalent to spraying herbicide on 1,000 acres; treating one invasive plant species is equivalent to treating five invasive plant species). Below that threshold, however, actions are not considered significant enough to be counted as a trammeling action (e.g., hand pulling a couple of invasive plants, removing one or two hazard trees, etc.). The intent of this measure is to track whether management programs are trending toward more or less human manipulation in the wilderness; therefore, this approach to counting trammeling actions focuses on the *decision* to trammel, and not on the *magnitude* of trammeling's effects.

Table 6. Protocol for counting trammeling actions (adapted from the FS Technical Guide 2009, pp. 55)

Type of action	Example	Counting rule	Reporting
Single action at a single location	Spotted knapweed treated in a single location	Count as one action	Report one action
Single action at multiple locations	Spotted knapweed treated with in several locations	Count as one action	Report one action for the single species regardless of the number of locations
Multiple actions at a single location	Spotted knapweed and Canada thistle are sprayed in the same location	Count as multiple actions	Report one action for each species; e.g., one treatment on two species = two actions
Multiple actions at multiple locations	Mechanical treatment is used in addition to herbicide	Count as multiple actions	Report one action for each treatment on each species; e.g., two treatments on two species = four actions
Action occurs within a single year	Herbicide treatment occurs between June and July 2015	Count as one action	Report one action
Action spans multiple years without interruption	Herbicide treatment initiated in August 2015 ends in April 2016	Count as one action	Report as one action in year 2015
Action spans multiple years with interruption	Herbicide treatment initiated in August 2015 ends in April 2016, and is reinitiated in August 2016	Count as multiple actions	Report as one action in year 2015 and one action in year 2016

Actions taken by the State of Alaska with the knowledge and approval of the NPS are considered authorized actions and included under this measure.

To obtain information on the number of trammeling actions occurring in the Kobuk Valley Wilderness in any given year, a variety of sources must be consulted. Possible sources include:

Special Use Permits (SUPs), Minimum Requirements Analyses (MRAs), notes and records from the Natural Resources Division, and research applications and permits (available through the Integrated Resource Managed Applications Portal, also referred to as IRMA). The total number of actions to intentionally manipulate wildlife in the Kobuk Valley Wilderness is entered into the WCMD annually. Over time, an increase in the number of trammeling actions would indicate a downward trend for this measure.

Data Source

SUPs, MRAs, and EIS or Environment Assessment (EA) reports; also by contacting the park Natural Resources Division.

Note: Documentation may come up with park codes of 'KOVA or 'WEAR.' *Both* must be searched.

Data Adequacy

High – data quantity and quality are high because this measure only counts authorized actions, which are reliably and completely documented.

Frequency

Annually – every year data for this measure will be entered into the WCMD.

Significant Change

Any change is considered significant for this measure.



Aspen trees in Kobuk Valley. Photo by Hannah Williams, NPS.

1-2: Percent of wildfires suppressed

Untrammeled Quality • Actions authorized by the federal land manager that intentionally manipulate the biophysical environment

Wilderness character monitoring baseline:

Baseline data value: 14%

Year of data: 2014 (calendar year)

Comments: Data was collected from 2010-2014 (calendar years)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: High

Background & Context

Wildfires in the Kobuk Valley Wilderness typically burn thousands of acres each year. The integrity of natural fire regimes are preserved in the Kobuk Valley Wilderness, where the primary influence on fires are local variables such as vegetation composition and local-scale climate, among other factors (Higuera et al. 2011). The majority of wildfires in the Kobuk Valley are naturally ignited by lightning, but there are occasionally human-caused fires, or fires used for management purposes such as prescribed burns. Fires typically only receive a suppression response when the fire threatens an allotment, cabin, or lands beyond park boundaries that do not support natural fire regimes. Given the great extent of fire activity in the Kobuk Valley Wilderness, the percentage of fires that receive a suppression response is significant to the Untrammeled Quality of the Kobuk Valley's wilderness character.

Measure Description & Collection Protocol

This measure monitors the percent of naturally ignited wildfires occurring within five calendar years that receive a suppression response. Suppression responses are evaluated based on the Fire Protection Type (sometimes referred to as Fire Protection Code) assigned to the fire. The Fire Protection Type is comprised of two numbers: the first number indicates the general type of fire (wildfire, prescribed fire, natural outs, etc.), the second number indicates what corresponding management response was taken. If the Fire Protection Type does not adequately convey whether the fire was suppressed, any manipulation of the fire is considered a suppression activity. A key to the Fire Protection Types can be found in the document "NPS Wildland Fire Report Form: Instructions and Forms" (revised 2007) and can be found online through the National Interagency Fire Center (NIFC). The most common codes assigned to fires in the Kobuk Valley Wilderness are 14 and 22, both of which are considered "non-suppressed."

Data are obtained through Wildland Fire Management Information (WFMI) databases, which are housed by NIFC. New users must request access to the database to view and download records to calculate the value for this measure. Once access is obtained, fire data for Kobuk Valley can be downloaded in a variety of formats, all of which include the Fire Protection Type for each fire, along with other pertinent information such as the fire year and location. Data can thus be queried to show the Fire Protection Types for all fires in Kobuk Valley for the year being monitored. The final value entered into the WCMD is the percent of all fires over five calendar years with a Fire Protection

Type that indicates a suppression response was not initiated. In the event that no fires occur within the five year monitoring period, “0%” will be entered into the WCMD. Over time, an increase in the percentage of fires that receive a suppression response would indicate a downward trend for this measure.

Data Source

WFMI databases; “NPS Wildland Fire Report Form: Instructions and Forms” available online at: https://www.nifc.blm.gov/fire_reporting/NPS/doc/NPS_Wildland_Fire_Report_Form_Instructions_Oct_2007.pdf (accessed June 2014).

Data Adequacy

High – data quality and quantity for this measure are high because data on all fires are reported with high accuracy and completeness.

Frequency

Every 5 calendar years data for this measure is entered into the WCMD.

Significant Change

Linear regression analysis, $\alpha = 0.05$, for all data 1980-present is used to determine if any site has a significant trend. At this time there is no statistically significant trend in the data (p-value = 0.16).

Table 7. Legacy data, percent of fires suppressed

Five-year intervals	Number of naturally caused fires	Number of fires suppressed	Percent of fires suppressed
1980-1984	8	8	100%
1985-1989	2	1	50%
1990-1994	4	0	0%
1995-1999	1	1	100%
2000-2004	4	1	25%
2005-2009	1	0	0%
2010-2014	7	1	14%

1-3: Number of unauthorized actions that manipulate plants, wildlife, insects, fish, pathogens, soil, water, or fire

Untrammelled Quality • Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment

Wilderness character monitoring baseline:

Baseline data value: 0 actions

Year of data: 2014 (calendar year)

Comments: Data was collected from 2010-2014 (calendar years)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: Low

Background & Context

Unauthorized trammeling actions in the Kobuk Valley Wilderness are rare, but significant to wilderness character. Examples of actions that would be counted in this measure include unauthorized actions by other agencies, citizen groups, or individuals that intentionally manipulate the biophysical environment. Accidental ignition of human caused fire and Defense of Life and Property (DLP, defined on p. 35) actions are not considered trammeling actions because the actions are not taken to intentionally manipulate the biophysical environment.

Measure Description & Collection Protocol

This measure monitors the number of actions not authorized by the NPS that are taken by individuals, citizen groups, or other agencies and are intended to manipulate, at a broad-scale, any component of the biophysical environment (e.g., purposely releasing non-native species, predator control actions in excess of legal limits, etc.). Actions taken by the State of Alaska with the knowledge and approval of the NPS are considered authorized actions and not included under this measure.

Any unauthorized trammeling action of sufficient scale is included in this count. All unauthorized trammeling actions are counted for the past five calendar years following the same protocols outlined in measure 1-1 (actions that manipulate wildlife or vegetation). Over time, an increase in the number of unauthorized actions intended to manipulate the biophysical environment would indicate a downward trend for this measure.

Data Source

Law enforcement records.

Data Adequacy

Low – data quantity and quality are partial and medium, respectively, because actions may occur without the knowledge of the NPS given the size and remoteness of much of the parklands.

Frequency

Every 5 calendar years data for this measure will be entered into the WCMD.

Significant Change

Any change is significant for this measure.



Great Kobuk Sand Dunes in a storm. Photo by Laura Cattrall, NPS.

Natural Quality

Wilderness maintains ecological systems that are substantially free from the effects of modern civilization.

The Natural Quality of wilderness character assesses the integrity of local ecosystems and their freedom to change and develop without human manipulation. The Natural Quality tracks the effects of human actions and modern civilization on natural ecosystems (in contrast to the Untrammeled Quality which tracks the actions themselves). Ecosystems include all living and non-living things in an area, as well as the interactions between them. Within wilderness, changes to the Natural Quality can be caused directly or indirectly, intentionally or unintentionally. Monitoring ecosystem changes inside wilderness is key to understanding how human actions impact the Natural Quality of wilderness. The majority of data used to monitor measures of the Natural Quality for the Kobuk Valley Wilderness are drawn from existing regional monitoring programs to minimize duplicative efforts.

Table 8. Measures of the Natural Quality used to monitor the Kobuk Valley Wilderness

Indicator	Measure	Frequency	Data Adequacy	Significant Change	Baseline Value
Plants	2-1: Number of non-native plant species	5 years	Low	Any	0 species
Animals	2-2: Number of human-wildlife incidents	1 year	Low	2 incidents or greater	0 incidents
Air and water	2-3: Acidifying and fertilizing pollutants	5 years	Medium	Any	3
Ecological processes	2-4: Extent of landscape connectivity	5 years	High	p-value ≤ 0.05	100%



Vegetation on sand dunes. Photo by Adrienne Lindholm, NPS.

2-1: Number of non-native plant species

Natural Quality • Plants

Wilderness character monitoring baseline:

Baseline data value: 0 species

Year of data: 2014 (calendar years)

Comments: Data was collected from 2010-2014 (calendar years)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: Low

Background & Context

The Kobuk Valley Wilderness is home to complex native communities of plants and animals that have developed over thousands of years. The delicate composition of native plant communities is threatened by the influx of invasive plants, which are considered one of the greatest threats to biodiversity (Hooper et al. 2005). Likewise, climate change has the potential to affect the transport and introduction of new species and how they become established (Hellmann et al. 2008). Invasive plants display rapid growth, spread with little or no human assistance, and are expensive to remove and difficult to control once established (Hejda et al. 2009). Invasive plants are a concern because they threaten the genetic integrity of native flora through hybridization, can out-compete native plant species for limited resources, and can change the structure and function of ecosystems (Walker and Smith 1997). Establishment of invasive plants can also result in loss of habitat and food sources for native insects, birds, fish, and other wildlife (Hejda et al. 2009).

In Kobuk Valley, one of the primary concerns for the introduction of non-native and exotic species is via travel corridors, such as the Kobuk River, aircraft landing sites, and other locations that receive frequent use. In addition, due to the large size of the Kobuk Valley Wilderness, there are concerns about the park's capacity to detect invasive species before they become widespread. At this time, no non-native or exotic plant species are known to be present in the Kobuk Valley Wilderness.

Measure Description & Collection Protocol

This measure monitors the number of non-native or exotic plant species documented within the Kobuk Valley Wilderness. All species considered non-native or exotic by the Alaska Exotic Plant Management Team are counted within this measure. This measure monitors the *total* number of known non-native species present in the Kobuk Valley Wilderness, not only new discoveries. For instance, if pineapple weed is discovered in 2014, it would contribute a value of "1" to the total value entered into the WCMD every entry thereafter unless pineapple weed is eradicated. As of 2014, there are no known non-native or exotic plant species present in the Kobuk Valley Wilderness. However, there is significant potential for non-native plant species to be introduced or found. A list of invasive plant species common to Alaska is available in Table 9, along with the invasiveness ranking of each species on a scale of 1-100, where 100 is the most invasive and 1 is the least, as evaluated by the Alaska Exotic Plant Management Team. The total number of known non-native plant species present in the Kobuk Valley Wilderness is entered into the WCMD every five years. Over time, an increase in the number of non-native plant species would indicate a downward trend for this measure.

Definitions

- *Non-native plant species* – plants whose presence in a given area is due to the accidental or intention introduction by humans.
- *Invasive* – exotic plant species that produce viable offspring in large numbers and have the potential to establish and spread in natural areas.

Data Source

Alaska Exotic Plant Management Team data *and* through Alaska Exotic Plants Information Clearinghouse (AKEPIC), available online at: <http://aknhp.uaa.alaska.edu/maps-js/integrated-map/akepic.php> (accessed August 2014). Both sources should be checked.

Data Adequacy

Low – data quantity and quality are low and medium, respectively, for this measure because data are drawn from the research and datasets of the Alaska Exotic Plant Management Team, which only visit the Kobuk Valley Wilderness sporadically. However, data that are collected are of good quality.

Frequency

Every 5 calendar years data for this measure will be entered in to the WCMD.

Significant Change

Any change is considered significant for this measure.

Table 9. Non-native species in the region

Common name	Scientific name	Relative threat level
Common Plantain	<i>Pantago major</i>	44
Herb Sophia	<i>Descurainia sophia</i>	41
Common Dandelion	<i>Taraxacum officinale</i>	58
Foxtail Barley	<i>Hordeum jubatum</i>	63
Shepherd's Purse	<i>Capsella bursa-pastoris</i>	40
Lambsquarters	<i>Chenopodium album</i>	37
Night-flowering Silene	<i>Silene noctiflora</i>	42
Quackgrass*	<i>Elymus repens</i>	59
Mouse-ear Chickweed	<i>Cerastium fontanum</i>	36
Annual Bluegrass	<i>Poa annua</i>	46
Narrowleaf Hawksbeard	<i>Crepis tectorum</i>	56
Elodea**	<i>Elodea canadensis</i>	Unavailable
Bird cherry†	<i>Prunus padus</i>	Unavailable

*Quackgrass is currently of great concern and has been found within 50 miles of the parklands.

**Elodea is an aquatic plant currently found in interior Alaska. It is a species of high concern for the Kobuk Valley River and its tributaries.

†Bird cherry tree was found at Walker Lake in Gates of the Arctic National Park in 2012.

2-2: Number of human-wildlife incidents

Natural Quality • Animals

Wilderness character monitoring baseline:

Baseline data value: 0 incidents

Year of data: 2014 (calendar year)

Trend since wilderness designation:



Condition: Warrants moderate concern

Trend: Downward

Confidence: Low

Background & Context

Wildlife is one of the most iconic aspects of many remote Alaskan parklands. When wildlife and humans encounter each other, it can be dangerous for both parties. Human-wildlife incidents can indicate habituation to humans and deviations from natural behavior patterns. This type of distinct change in the behavior and nature of wildlife correspondingly indicates a change in the Natural Quality of wilderness character.

Measure Description & Collection Protocol

This measure monitors the number of human-wildlife incidents that occur within the Kobuk Valley Wilderness over a one year period. Human-wildlife incidents would include any instances of DLP (defined below), reported instances of wildlife damaging property, consuming human food or garbage, or the deployment of bear spray.

Data on the number of DLPs occurring with the Kobuk Valley National Park can be obtained by contacting the Alaska Department of Fish & Game (ADF&G). Other instances of human-wildlife incidents are available in the Bear-Human Incident Management System (BHIMS), the Musk Oxen-Human Incident Management System (MHIMS), and any other records of human-wildlife incidents. The number of incidents obtained from these databases are summed, regardless of species, and the total number of human-wildlife incidents is entered into the WCMD. Over time, an increase in the number of human-wildlife incidents would indicate a downward trend for this measure.

Definitions

- *Defensive of Life and Property (DLP)* – when life or property is at risk, individuals may kill game as a defense of life and property. Under Alaska State law, DLP actions are monitored by the ADF&G. All DLP actions are required to be reported to the agency in writing within 15 days of the incident, and surrender the skull and hide (for bears, wolves, etc.) or meat (for moose, caribou, etc.) to the state (5AAC 92.410). ADF&G maintains these records.
- *Incident* – an interaction between wildlife and a human in which wildlife act aggressively. The results of such an interaction can be either benign or injurious to the human.

Data Source

ADF&G databases on DLP actions, available by contacting the Division of Wildlife Conservation; BHMIS, MHIMS and other incident databases available on regional shared drives, or by contacting park Natural Resource Division.

Data Adequacy

Low – data quantity is partial because data acquisition is through to self-reporting and incidents often go unreported. Data quality is low because reported incidents are often incomplete. Professional judgement may be used to evaluate or interpret measure over time because of its low data adequacy, for instance, the trend since 1980 was evaluated based on professional judgement.

Frequency

Annually – every calendar year data for this measure will be entered into the WCMD.

Significant Change

A change of 2 incidents or greater is considered significant for this measure.



Caribou Antlers near Kobuk River. Photo by Paul Stolen.

2-3: Acidifying and fertilizing pollutants

Natural Quality • Air and water

Wilderness character monitoring baseline:

Baseline data value: 3

Year of data: 2014 (calendar year)

Comments: Data was collected from 2010-2014 (calendar years)

Trend since wilderness designation:



Condition: Warrants moderate concern

Trend: Downward

Confidence: Medium

Background & Context

Pollutants have become a growing concern for air and water quality in the Kobuk Valley in recent years. Of particular concern are pollutants that cause acidification or fertilization, such as nitrogen and sulfur, and these are correspondingly monitored as part of the Arctic Network Inventory and Monitoring Program (ARCN) Vital Sign of Wet and Dry Deposition (Lawler et al. 2009). While the Kobuk Valley Wilderness is far away from large cities, pollutant sources vary from global deposition brought on winds and with snow and rain, to local sources like the Red Dog Mine, 90 miles to the northwest. Contaminants found in the wilderness have included excess nitrogen and sulfur, mercury and other heavy metals, and persistent organic pollutants. For the Kobuk Valley region, rising levels of sulfur and nitrogen (often from coal-burning in Asia) have the potential to degrade tundra and alpine vegetation and boreal forest epiphytes, which are highly sensitive to these pollutants (Lawler et al. 2009; Sullivan et al. 2011).

Measure Description & Collection Protocol

This measure monitors the condition of acidifying and fertilizing pollutants in Kobuk Valley through air quality assessments conducted by ARCN. This measure represents a holistic state-of-understanding of the status of the acidifying and fertilizing pollutants in the Kobuk Valley Wilderness as evaluated by ARCN. As of 2014, this measure draws on multiple values and monitoring methods collected over time and interpreted by ARCN for the Wet and Dry Deposition Vital Sign. Current sampling methods include using the moss *Hylocomium splendens* as a passive sampler, assessing the effects of observed pollutant levels on changes in lichen community structure in long-term vegetation monitoring plots, and incorporating data from the nearest National Atmospheric Deposition Program (NADP) air quality monitoring stations.

In their reports, the ARCN draws conclusions on the changing amounts and impacts of these pollutants in Kobuk Valley. Based on their conclusions, a score is assigned using the index in Table 10. This index pertains only to amounts of acidifying and fertilizing pollutants. Even if other pollutants (such as mercury and other heavy metals) are found to significantly affect other resources, that information is not counted here. To supplement this index, the guidance developed by the national Inventory and Monitoring Branch of Air Quality to evaluate the concentration of nitrogen or sulfur in wet deposition are depicted in Table 11. The categories described in Table 11 are used to inform the overall score assigned based on Table 10. All documents used to assess pollutant levels and determine the assigned score for the Kobuk Valley Wilderness must be cited in the “Comments”

section of the WCMD. Over time, an increase in the index score would indicate a downward trend for this measure.

Table 10. Index to evaluate pollutant levels

Assessment of pollutant levels	Score
Low	1
Low-Moderate	2
Moderate	3
High	4
Very high	5

Data Source

ARCN Reports for Wet and Dry Deposition, available online at: <http://science.nature.nps.gov/im/units/arcn/vitalsign.cfm?vsid=3> (accessed July 2014); or by contacting Vital Sign PI.

Table 11. Evaluating Nitrogen and Sulfur Concentration

Nitrogen OR Sulfur levels (kg/ha)	Status
<1 kg/ha	Good
1-3	Moderate
>3	Significant concern

Data Adequacy

Medium – data quantity and quality are moderate because of the lack of consistent monitoring methods available at this time and the ongoing development of monitoring protocol. Data adequacy may be revised as consistent monitoring protocols are finalized.

Frequency

Every 5 calendar years data for this measure will be entered into the WCMD.

Significant Change

Any change is considered significant for this measure.

2-4: Extent of landscape connectivity

Natural Quality • Ecological processes

Wilderness character monitoring baseline:

Baseline data value: 100%

Year of data: 2014 (calendar year)

Comments: Data was collected from 2010-2014 (calendar years)

Trend since wilderness designation:



Condition: Good

Trend: Downward

Confidence: High

Background & Context

Landscape connectivity can be defined as the degree to which a landscape facilitates or impedes movement between resources patches (Taylor et al. 1993). Conversely, fragmentation is considered the disruption of continuity (Lord & Norton 1990). Landscape connectivity and fragmentation are of particular relevance to ecosystem processes because they are vital to landscape structure, (Taylor et al. 1993), metapopulation dynamics (Levins 1970), and depending on the extent of fragmentation, can have a strong bearing on biodiversity (Fahrig 2003). Both connectivity and fragmentation, are commonly assessed via habitat loss (Harrison and Bruna 1999). While the pattern and distribution of habitat loss is an important component of fragmentation and connectivity (Tischendorf & Fahrig 2000; Harrison & Bruna 1999), the limited extent of habitat loss near the Kobuk Valley Wilderness make the distribution of habitat loss less meaningful to include at this time.

As a conservation area, the lands encompassed within the Kobuk Valley Wilderness are not threatened by fragmentation. However, not all of the lands surrounding Kobuk Valley possess the same level of protection. Some adjacent lands, including areas managed by the State of Alaska and BLM have the potential for resource extraction and other development. Because ecosystem processes and species movements occur across Northwestern Alaska, habitat changes in these surrounding areas affect the integrity of the landscape that includes the Kobuk Valley Wilderness.

Localized loss of habitat from human development and alteration is a key component contributing to landscape fragmentation and connectivity. At this time, there is minimal human development that contributes to a loss of connectivity with the Kobuk Valley Wilderness. Still, the extent of landscape connectivity is highly relevant to ecological processes and the wilderness character of the area.

Measure Description & Collection Protocol

This measure monitors the percentage of the area within a 10-mile buffer of the edge of the Kobuk Valley Wilderness where ecosystems have been explicitly modified or changed by modern humans. This includes any major development, as well as any other appreciable impacts to landscape connectivity by modern human activity. Data are obtained via the National Land Cover Database (NLCD) for Alaska. The land cover dataset for Alaska is downloaded from the Multi-Resolution Land Characteristics Consortium (MRLC) website.

The dataset is imported into a geographic information system (GIS) and clipped to a 10-mile buffer around the park boundary. Based on this clip, the total number of 30-meter raster squares that are classified as “developed” of any intensity, or are known to be developed even if not specifically indicated in the dataset, are subtracted from the total number of pixels. The number that remains reflects the number of “unmodified” pixels, which is then divided by the total number of pixels in the 10-mile buffer zone around the wilderness (excluding the area of the wilderness itself). This results in a percentage of area that is not affected by human-caused change, which is entered into the WCMD. Over time, a decrease in the percentage of intact landscape connectivity would indicate a downward trend for this measure.

Data Source

MRLC website, available online at: <http://www.mrlc.gov/nlcd2011.php> (accessed March 2015), National Land Cover Database for Alaska.

Data Adequacy

High – data quantity is complete because data are available for the complete area needed for analysis. Data quality is medium because the resolution is small enough (30 meters) to capture the majority of developments, but is not considered entirely sufficient because some developments are not coded correctly and need to be verified prior to incorporation in wilderness character monitoring.

Frequency

Every 5 calendar years data for this measure will be entered into the WCMD.

Significant Change

Linear regression analysis, $\alpha = 0.05$, for all data available is used to determine if there is a significant trend in the measure. No trend is available at this time.

Table 12. Detailed data, extent of landscape connectivity

Total number of pixels:	15,806,853
Number of human-modified pixels:	879
Number of unaffected pixels:	15,805,974
Percentage of intact landscape connectivity:	100%

Undeveloped Quality

Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation.

The Undeveloped Quality of wilderness is the most familiar and recognizable quality of wilderness for many people. Without buildings, evidence of other humans, or improvements on the landscape, the Undeveloped Quality of wilderness speaks to “man himself as a visitor who does not remain” and the absence of lasting improvements to the landscape that would change this visitor relationship. Motor vehicles, motorized equipment, and mechanical transport also affect how humans interact with wilderness landscapes. These uses likewise diminish the primeval character and influence of wilderness, and are correspondingly monitored within the Undeveloped Quality of wilderness character.

Table 13. Measures of the Undeveloped Quality used to monitor the Kobuk Valley Wilderness

Indicator	Measure	Frequency	Data Adequacy	Significant Change	Baseline Value
Presence of non-recreational structures, installations, and developments	3-1: Number of sub-surface installations	1 year	High	p-value ≤ 0.05	153 sub-surface installations
	3-2: Number of above-ground installations	1 year	High	Any	8 above-ground installations
	3-3: Weight of abandoned debris	5 years	Medium	≥ 500 lbs	9,860 lbs
Presence of inholdings	3-4: Acres of inholdings	5 years	High	Any	7,225 acres
Use of motor vehicles, motorized equipment, or mechanical transport	3-5: Number of helicopter supported projects	1 year	High	≥ 2 projects	3 projects
	3-6: Hours of fixed-wing aircraft flight time	1 year	Medium	p-value ≤ 0.05	152 hours
	3-7: Miles of administrative snowmachine use	1 year	Medium	p-value ≤ 0.05	528 miles

3-1: Number of sub-surface installations

Undeveloped Quality • Presence of non-recreational structures, installations, and developments

Wilderness character monitoring baseline:

Baseline data value: 153 sub-surface installations

Year of data: 2014 (calendar year)

Trend since wilderness designation:



Condition: Warrants moderate concern

Trend: Downward

Confidence: High

Background & Context

The presence of permanent, non-recreational structures directly affects the Undeveloped Quality of the Kobuk Valley Wilderness. While sub-surface installations (e.g., rebar site markers) do not affect the viewshed of the wilderness, they are permanent installations in wilderness and thus important to monitor because they influence wilderness character. These sub-surface or near surface installations are typically used to mark research plots or specific resources, such as those markers used for cultural resources documentation. These installations constitute the majority of installations in the Kobuk Valley Wilderness as of 2014.

Measure Description & Collection Protocol

This measure monitors the number of permanent, sub-surface installations in the Kobuk Valley Wilderness. All sub-surface and flush-with-surface installations in the Kobuk Valley Wilderness are counted in this measure, including sub-surface rebar stakes that mark study locations and cultural resource site markers that are typically flush to the ground surface. Any installations in place longer than six months are considered permanent for the purposes of this measure, in accordance with monitoring protocols developed by the Alaska Region GIS Team.

Data on installations in Alaska National Parks are coordinated and managed by the Alaska Region GIS Team following the release of a memorandum, "Implementation of Science in Wilderness Working Group Recommendations," signed by the Regional Director in July 2010. This memorandum called for a baseline GIS layer of installations and facilities in parks to be established and maintained for all Alaska National Parks. This measure draws directly on that data.

The installations dataset can be found in Alaska Pak Theme Manager through ArcGIS, where installations are divided into four categories: "instrumentation," "communications," "markers," and "generic." Installations are also classified as "above surface," "below surface," or "flush with surface." To obtain the data on the number of research plot markers, the marker layer must be queried for the number of installations that are "below surface" or "flush with surface." To obtain data for the number of cultural resource site markers, the Cultural Resources Division must be contacted. The number of installations derived from each source is summed and the total number of sub-surface installations is entered into the WCMD. Over time, an increase in the number of sub-surface installations would indicate a downward trend for this measure.

Definitions

- *Sub-surface installation* – any installation that is completely below ground level, or does not extend higher than the ground surface at any point. If an installation has both above-ground and sub-surface components (e.g., a weather station that is set in the ground), the installation is considered above-surface.

Data Source

“Installations in Wilderness” dataset developed and maintained by the Alaska Region GIS team. Data from this layer are available through the Alaska Pak in ArcGIS, or by contacting the regional GIS team. Cultural resource monumentation data is obtained by contacting the park Cultural Resource Division.

Data Adequacy

High – data adequacy is high because the database contains comprehensive information on installations in the Kobuk Valley Wilderness and protocols are in place to update this information periodically.

Frequency

Annually – every calendar year data for this measure will be entered into the WCMD.

Significant Change

Linear regression analysis, $\alpha = 0.05$, for all data 1980-present is used to determine if any site has a significant trend. At this time there, is a statistically significant downward trend in the data (p-value = 0.0001).

Table 14. Legacy data, number of sub-surface installations

Year	Additional sub-surface installations placed	Total sub-surface installations present
1980	0	0
2009	32	32
2010	3	35
2011	71	106
2012	47	153
2014	0	153

3-2: Number of above-ground developments

Undeveloped Quality • Presence of non-recreational structures, installations, and developments

Wilderness character monitoring baseline:

Baseline data value: 13 above-ground developments

Year of data: 2014 (calendar year)

Trend since wilderness designation:



Condition: Good

Trend: Downward

Confidence: High

Background & Context

The presence of permanent, non-recreational installations and structures directly influences the Undeveloped Quality of the Kobuk Valley Wilderness. In particular, installations that rise above ground level are often highly visible due to the region's predominantly low-lying vegetation and expansive views. As of 2014, the majority of installations in the Kobuk Valley are sub-surface or flush-with-surface installations (monitored in measure 3-1). Larger, above-ground developments are fewer in number and range from scientific equipment such as weather monitoring stations, to ranger stations.

ANILCA allows for the construction of permanent installations for subsistence purposes. Proposed developments typically prompt an EA under NEPA and a MRA to be conducted before being constructed. The development of any installations or structures, regardless of their purpose, influences the Undeveloped Quality of the area's wilderness character.

Measure Description & Collection Protocol

This measure monitors the number of permanent, non-recreational, above-surface installations and structures in the Kobuk Valley Wilderness. The total number of installations and structures present in the wilderness is counted annually. Any installations in place longer than six months are considered permanent for the purposes of this measure, in accordance with monitoring protocols developed by the Alaska Region GIS Team.

Data on installations in Alaska National Parks are coordinated and managed by the Alaska Region GIS Team following the release of a memorandum, "Implementation of Science in Wilderness Working Group Recommendations," signed by the Regional Director in July 2010. This memorandum called for a baseline GIS layer of installations and facilities in parks to be established and maintained for all Alaska National Parks. This measure draws directly on that data.

The installations dataset can be found in Alaska Pak Theme Manager through ArcGIS, where installations are divided into four categories: "instrumentation," "communications," "markers," and "generic." Installations are also classified as "above surface," "below surface," or "flush with surface." To obtain the data on the number of research plot markers, the marker layer must be queried for the number of installations that are "above surface." To obtain data for the number of cultural resource site markers, the Cultural Resources Division must be contacted. The number of installations derived from each source is summed and the total number of above-surface installations

is entered into the WCMD. Over time, an increase in the number of above-ground developments would indicate a downward trend for this measure.

Definitions

- *Above-surface development* – any installation or structure that extends above the surface of the ground. If an installation has both above-ground and sub-surface components (e.g., a weather station that is set in the ground), the installation is considered above-surface.

Data Source

“Installations in Wilderness” dataset developed and maintained by the Alaska Region GIS team. Data from this layer are available through the Alaska Pak in ArcGIS, or by contacting the regional GIS Team.

Data Adequacy

High – data adequacy is high because the database contains comprehensive information on installations in the Kobuk Valley Wilderness and protocols are in place to update this information periodically.

Frequency

Annually – every calendar year data for this measure will be entered into the WCMD.

Significant Change

Any change is considered significant for this measure.

Table 15. Legacy data, number of above-ground developments

Year	Additional installations placed	Total installations present
1980	0	5
1992	1	6
2009	1	7
2011	1	8
2014	0	8

Table 16. Detailed data: above-ground developments

Type of installation	Number
Instrumentation	3
Administrative installation	5
Total value entered into WCMD:	8

3-3: Weight of abandoned debris

Undeveloped Quality • Presence of non-recreational structures, installations, and developments

Wilderness character monitoring baseline:

Baseline data value: 9,860 lbs

Year of data: 2014 (calendar year)

Trend since wilderness designation:



Condition: Warrants moderate concern

Trend: Upward

Confidence: Medium

Background & Context

Large trash in wilderness is an issue that affects many of Alaska's wilderness areas as a result of activities that occurred prior to the area's designation as wilderness, such as mining operations or military exercises. In the Kobuk Valley Wilderness, debris includes remnants from military training exercises in the 1960s, discarded 55-gallon drums, trespass cabins, downed aircraft, abandoned snowmachines, and abandoned caches or other large items. Consistent with guidance in *Keeping It Wild 2*, this "mega-trash" is considered to affect the Undeveloped Quality of wilderness.

The total weight of known trash items in wilderness represents a highly significant measure for wilderness character monitoring. With this information, managers are able to easily assess both the impact of debris on wilderness character and the direct benefit to wilderness character from stewardship actions to remove it.

Measure Description & Collection Protocol

This measure monitors the weight of all known debris in the Kobuk Valley Wilderness. Micro-trash (small items such as small amounts of trash found at campsites, wrappers, ropes, or other small items) is not monitored as a part of this measure. The value reported in the WCMD is necessarily an estimate and may rise significantly if new locations of discarded debris are discovered. The total weight of known debris present in the wilderness is entered into the WCMD every five calendar years, so as to more accurately capture changes in information about the weight of debris in wilderness and to capture the effects of stewardship actions. Over time, a decrease in the total weight of abandoned debris in wilderness would indicate an upward trend for this measure.

Data Source

Chief Ranger and Backcountry or Law Enforcement Rangers.

Data Adequacy

Medium – data quality is medium because many numbers relating to item quantity and weight are estimated due to the nature of the debris. Data quantity is partial because only known debris can be included.

Frequency

Every 5 calendar years data for this measure will be entered in to the WCMD.

Significant Change

Change of 500 lbs or greater is considered significant for this measure.

Table 17. Detailed data – Baseline value of weight of abandoned debris

Item	Known number	Weight (lbs)	Total (lbs)
55-gallon drum	78	45	3,510
Fuel pod	3	450	1,350
5-gallon gas can	0	8	0
Mining debris	1	5,000	5,000
Weight of debris in wilderness:			9,860 lbs



Debris at old mining site. Photo by Logan Hovis, NPS.

3-4: Acres of inholdings

Undeveloped Quality • Presence of inholdings

Wilderness character monitoring baseline:

Baseline data value: 7,225 acres

Year of data: 2014 (fiscal year)

Comments: Data was collected from 2010-2014 (fiscal years)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: High

Background & Context

Inholdings, including allotments, are prevalent in Alaskan wilderness and the Kobuk Valley National Park. The acres of inholdings is significant to wilderness character because inholdings are not subject to the same management restrictions as the surrounding lands that are managed as wilderness. These lands can be developed for purposes at the discretion of the landowner, and thereby have the potential to significantly impact the wilderness area.

Measure Description & Collection Protocol

This measure monitors the total acres of inholdings and allotments present within the Kobuk Valley Wilderness boundary. Acres of Native Corporation selections are not included in this measure because they are not inholdings or allotments. While Native Corporation selections may be subject to the same levels of protection as the surrounding wilderness depending on their location, they are generally considered as “Limited or Non-NPS Interest Lands” until their land status is resolved.

Data can be obtained by querying the NPS Land Status Geodatabase through the AK Pak Theme Manager. The total acres of privately held inholdings and allotments within the Kobuk Valley Wilderness, including those that are natively owned, is reported in the WCMD. Over time, a decrease in the total acres of inholdings would indicate an upward trend for this measure.

Data Source

NPS Land Status Geodatabase available through the AK Pak Theme Manager, or by contacting the Lands Department at the Alaska Regional Office.

Data Adequacy

High – data quantity and quality is high because of the formal process by which inholdings are acquired as well as the involvement of the Lands Department of the Alaska Regional Office which thoroughly documents these transfers.

Frequency

Every 5 fiscal years data for this measure is entered into the WCMD.

Significant Change

Any change is considered significant for this measure.

Table 18. Supplemental data, acres of inholdings

Ownership	Acres
Private/native allotments	7,225
Native Corporation selections	167,246

3-5: Number of helicopter supported projects

Undeveloped Quality • Use of motor vehicles, motorized equipment, or mechanical transport

Wilderness character monitoring baseline:

Baseline data value: 3 projects

Year of data: 2014 (calendar year)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: High

Background & Context

Under the provisions of the Wilderness Act, helicopters are to be used in wilderness only when they are the “minimum tool necessary to meet minimum requirements for the administration of the area for the purpose of [the Wilderness Act, Section 4(c)].” With its remoteness and difficulty of access, helicopters are sometimes necessary to reach locations in the Kobuk Valley Wilderness. Helicopters are used for a variety of projects, ranging from research to law enforcement, on a situation-dependent basis when the necessary point of access is not near a known landing strip or a lake viable for landing a float plane. Unlike fixed-wing aircraft which require landing strips or lakes to take off or land, helicopters have virtually no restrictions on access. With developing technologies, helicopters may, in some circumstances, be quieter than fixed-wing aircraft. However, they are not mentioned in ANILCA as an allowable use, in contrast to fixed-wing aircraft, and thus hold a different place in the law and management framework of the park.

While private helicopters are not monitored within this measure, this use may become more common in the Kobuk Valley Wilderness in the future. As fuel efficiency rises and the cost of helicopters themselves decreases, more local pilots who may or may not be aware of restrictions in the area may use privately owned helicopters to access areas in the Kobuk Valley Wilderness. Private helicopters may be used to access inholdings.

Measure Description & Collection Protocol

This measure monitors the number of projects that are supported by helicopters. The number of helicopter hours involved in each project is not counted to more fairly account for when helicopters are the minimum tool required to fulfill stewardship needs. Emergency use of helicopters is not counted as part of this measure. The total number of helicopter supported projects is obtained by contacting the park’s Research Coordinator and Law Enforcement Division. Over time, an increase in the number of helicopter supported projects would indicate a downward trend for this measure.

Data Source

Compliance documentation collected by park Research Coordinator.

Data Adequacy

High – data quantity and quality are high because all helicopter supported projects are authorized by the park compliance team, thus providing complete and reliable data.

Frequency

Annually – every calendar year data for this measure will be entered into the WCMD.

Significant Change

A change of 2 or more projects is considered significant for this measure.

Table 19. Legacy data, number of helicopter supported projects

Year	Number of projects
2011	4
2012	4
2013	4
2014	3



Fall colors near the Kobuk River. Photo by NPS.

3-6: Hours of fixed-wing aircraft flight time

Undeveloped Quality • Use of motor vehicles, motorized equipment, or mechanical transport

Wilderness character monitoring baseline:

Baseline data value: 152 hours

Year of data: 2014 (fiscal year)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: Medium

Background & Context

Fixed-wing aircraft are one of the primary modes of access to Alaskan wilderness areas due to the remoteness and scale of the landscape. Although allowed under ANILCA and Department of Interior regulations for specified purposes, use of fixed-wing aircraft, including float planes and wheeled planes, in wilderness impacts wilderness character and is therefore relevant to monitor in the Kobuk Valley Wilderness. The majority of park operations use fixed-wing aircraft for transport to and from park locations.

Measure Description & Collection Protocol

This measure monitors the hours of fixed-wing aircraft flight time in the Kobuk Valley Wilderness. All hours of administratively authorized, non-emergency flight time are counted here, including law enforcement flights, researcher flights, survey flights, and flights for visitors from regional or other offices. Flights conducted by private pilots or vendors for visitor, commercial, or hunting purposes are not counted here, as they cannot be reliably monitored at this time.

Data for this measure are obtained from the annual Office of Aviation Services (OAS) reports. These reports provide a breakdown of aircraft flight time by park in the Northern Hub zone, which includes all of the WEAR parklands. All flight hours pertaining to the Kobuk Valley Wilderness and for which WEAR pays for fuel and flight time should be included in this measure.

Thus, even when the flight is empty, its hours are counted; for instance, as would occur when a flight is dropping off a crew and will fly without NPS passengers on its return flight (known as “deadhead” flights). In other words, hours from both the flight to, and from, the site will be counted.



Float plane on Kobuk River. Photo by Paul Stolen, NPS.

Data may also be obtained by querying OAS datasets based on the cost of fixed-wing flight time billed to the park. For this method, OAS database managers must be given the appropriate cost

centers and billee code. When queried in this way, all WEAR operations are returned and so must be filtered by working with each Division (i.e., Law Enforcement, Natural Resources, Cultural Resources, Maintenance, etc.) to determine which flight hours pertained to Kobuk Valley. The Division flight hours are then summed to calculate the total flight hours for the wilderness.

To calculate the total number of flight hours reported, the total hours estimated by each Division are summed and entered into the WCMD. Data are reported based on fiscal year for this measure so as to allow for data acquisition using budget records. Over time, an increase in the number of hours of fixed-wing aircraft time would indicate a downward trend for this measure.

Data Source

OAS annual reports, available by contacting the Northern Hub Aviation Manager. Alternately, OAS datasets can be queried by cost center and WEAR billee code in the Financial Business Management System (FBMS) and Asset Management System (AMS), respectively.

Data Adequacy

Medium – data quantity and quality are partial and medium, respectively, because hours and flights are often not distinguished between parklands. Likewise, time spent flying to the park, but not yet in the park, is counted in this measure. Data adequacy may change into the future if more stringent protocols are put in place to more comprehensively monitor overflights.

Frequency

Annually – every fiscal year data for this measure will be entered into the WCMD.

Significant Change

Linear regression analysis, $\alpha = 0.05$, for all data 1990-present is used to determine if any site has a significant trend. At this time there is no statistically significant trend in the data (p-value = 0.62).

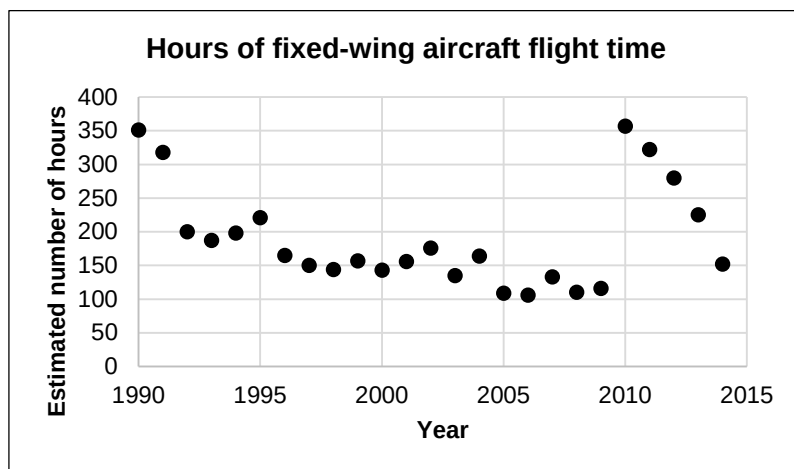


Figure 4. Hours of fixed-wing aircraft flight time legacy data.

Table 20. Legacy data, hours of fixed-wing aircraft flight time

Fiscal year	Estimated number of hours*
1990	351
1991	318
1992	200
1993	187
1994	198
1995	221
1996	165
1997	150
1998	144
1999	157
2000	143
2001	156
2002	176
2003	135
2004	164
2005	109
2006	106
2007	133
2008	110
2009	116
2010	357
2011	322
2012	280
2013	225
2014	152

* Data from 1990-2008 was calculated based on the assumption that 25% of WEAR flight hours occurred in Kobuk Valley (based on professional judgement). Data from 2009-2014 was calculated based on the assumption that 35% of flight hours occurred in Kobuk Valley due to the addition of ARCN or ADF&G flight hours, which are not otherwise accounted for in this reporting.

3-7: Miles of administrative snowmachine use

Undeveloped Quality • Use of motor vehicles, motorized equipment, or mechanical transport

Wilderness character monitoring baseline:

Baseline data value: 528 miles

Year of data: 2014 (fiscal year)

Trend since wilderness designation:



Condition: Good

Trend: Upward

Confidence: Medium

Background & Context

Under ANILCA, snowmachines are allowed in Alaskan wilderness areas and are used as one of the primary modes of access in the winter months. The Kobuk Valley Wilderness receives snowmachine use from both administrators and local residents. In general, the majority of snowmachine use is by local residents and occurs within 50 miles of Kotzebue and the village of Kobuk Valley. In the Kobuk Valley Wilderness, the majority of snowmachine use occurs in the lands designated as “eligible” wilderness because this area is closer to Kotzebue and other villages. Limited snowmachine use occurs in the portion of the Kobuk Valley that is designated as wilderness, though at much lower use levels due to the area’s remoteness.

Administrative snowmachine use is strongly influenced by changing budgets and personnel. In years where more staff have experience working with snowmachines and budgets are more flexible, considerably more administratively-authorized snowmachine use occurs. In addition, the reality that administrative use is distributed across all four parks means that only approximately one third of administratively-authorized snowmachine use out of Kotzebue goes into the Kobuk Valley National Park and Wilderness.

Measure Description & Collection Protocol

This measure monitors the number of miles traveled by administrative and other administratively authorized snowmachines in the Kobuk Valley Wilderness. All miles traveled of administratively authorized, non-emergency snowmachine use are counted here and may include backcountry patrols, law enforcement patrols, researcher use, or any other use conducted by administrative NPS. Snowmachine use by private individuals is not counted here, as this use cannot be reliably monitored at this time. If use levels by other users becomes available (through acoustic monitoring or other methods) it will be included in this measure and noted in the WCMD.

Miles are used as the unit of monitoring because it allows accurate monitoring of use levels without requiring careful documentation of use-days, which can be difficult to quantify for extended projects using multiple snowmachines and spanning multiple parklands. As of 2014, administrative and authorized snowmachine use is particularly low, following years of low budgets and minimal backcountry staff.

To obtain data for this measure, project leaders for each division (including, but not limited to the Protection, Cultural Resources, and Natural Resources Divisions) must be contacted to obtain an

estimate of the number of miles traveled in the Kobuk Valley Wilderness each year. In addition, the park research coordinator should be consulted to obtain an estimate of miles traveled by researchers.

Mileage estimates should include all trips authorized by WEAR and trips for which WEAR paid the fuel costs. This measure is based on the fiscal year to allow for continuous winter reporting. The estimated mileages of each Division are summed to attain the total number of miles, this total is entered into the WCMD. Over time, an increase in the number of hours of administrative snowmachine use would indicate a downward trend for this measure.

Data Source

Project leaders for each Division must be consulted for their estimate of use.

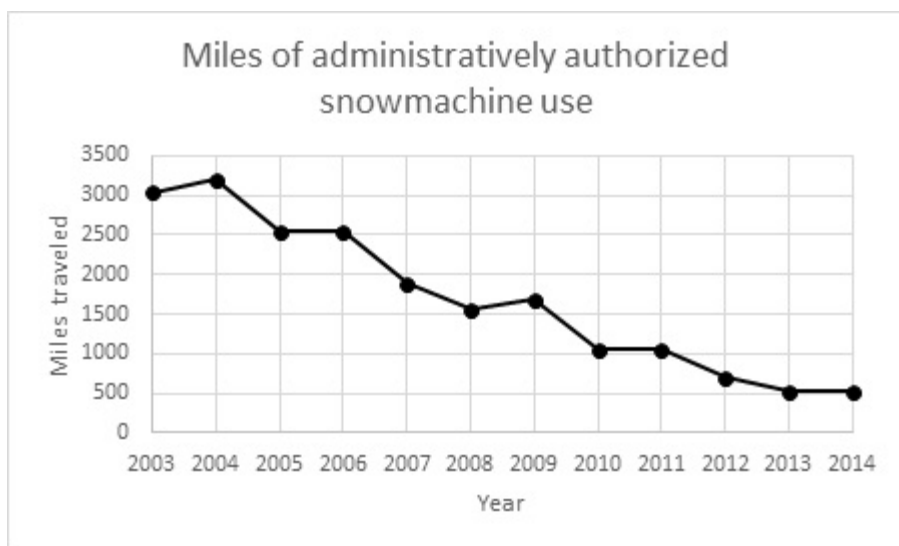


Figure 5. Miles of administratively authorized snowmachine use over time.

Data Adequacy

Medium – data quantity and quality are partial and medium, respectively, because the mileage is an estimate provided at the end of the winter season and it can be tough to differentiate mileage traveled at which park, as well as account for time spent traveling to the parklands.

Frequency

Annually – every fiscal year data for this measure will be entered into the WCMD.

Significant Change

Linear regression analysis, $\alpha = 0.05$, for all data 1980-present is used to determine if a significant trend is present.

Solitude or Primitive and Unconfined Recreation Quality

Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.

Opportunities for solitude or primitive and unconfined recreation can be difficult to find as modernization and civilization continue to expand. Managers cannot guarantee or require that visitors experience solitude or a primitive and unconfined type of recreation. Still, managers must protect and uphold the opportunity to have these experiences, even if not all visitors choose to partake in them. The Solitude or Primitive and Unconfined Recreation Quality focuses on the tangible aspects of the setting that affect the visitor experience, and not on the subjective nature of the visitor experience itself. Many intangible aspects of wilderness recreation (challenge, self-reliance, self-discovery, etc.) are not monitored under this quality, but are still integral to the wilderness experience.

Table 21. Measures of the Solitude or Primitive and Unconfined Recreation Quality of wilderness used to monitor the Kobuk Valley Wilderness

Indicator	Measure	Frequency	Data Adequacy	Significant Change	Baseline Value
Remoteness from sights and sounds of human activity <i>inside</i> wilderness	4-1: Number of research-days	1 year	Medium	p-value ≥ 0.05	95 days
Remoteness from sights and sounds of human activity <i>outside</i> wilderness	4-2: Number of commercial operations	5 years	Medium	Any	9 commercial operations
Facilities that decrease self-reliant recreation	4-3: Number of aircraft landing sites	5 years	Medium	Any	10 airstrips
Management restrictions on visitor behavior	4-4: Index of management restrictions	5 years	High	Any	7

4-1: Number of research-days

Solitude or Primitive and Unconfined Recreation Quality • Remoteness from sights and sounds of human activity inside wilderness

Wilderness character monitoring baseline:

Baseline data value: 95 days

Year of data: 2014 (calendar year)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: Medium

Background & Context

Research opportunities in the Kobuk Valley Wilderness are extensive. The designation of the area as a United Nations Biosphere Reserve, which was established in 1976, also affirms the area's value for research activities. Research continues to be one of the primary uses of the Kobuk Valley Wilderness. One of the fundamental roles wilderness serves nationwide is as a natural laboratory for natural change and processes. The value of research and monitoring in wilderness has been documented by Graber (2002), McCool and Cole (2000), Parsons (2000), and others, establishing that wilderness provides one of the premier environments to understand the natural processes and long-term change of natural environments (Six et al. 2000), effects of global climate change (Graumlich 2000) and other anthropogenic threats (Duriscoe 2001).

Research is fundamental component of the Kobuk Valley Wilderness. At the same time, research affects the remoteness of the area by bringing increased sights and sounds of people into the wilderness. Effects from research groups, like any other visitors, result from the presence of the individuals themselves, and in evidence left behind after the project such as social trails or trampled vegetation, resulting from concentrated, if temporary, use.

The majority of research in the Kobuk Valley Wilderness is conducted by the NPS itself, namely by ARCN or park staff (Hasselbach 2010, unpublished data). However, non-NPS projects, while fewer in number, have often been the largest projects in terms of number of field days and/or size of crews. NPS and non-NPS research use are combined into a single measure here because they have comparable effects on wilderness character.

Measure Description & Collection Protocol

This measure monitors the number of research-days as documented via the compliance process, wherein the proposed project dates and number of involved individuals are used to obtain data for this measure. The reality of variable weather conditions and changing plans makes monitoring the actual number of days spent in the field very difficult, and as a result, this measure focuses on the number of field-days approved by the compliance team. The park Research Coordinator keeps track of the proposed dates and the number of individuals involved.

To calculate the value entered into the WCMD, the number of field days by each research group and the number of individuals in that group are multiplied, then the number of research-days by each

group are summed. For instance a 3-person crew with 8 days in the field would contribute a value of 24 to the total number of research-days reported. The final number of research-days occurring in a one year period is reported in the WCMD. Over time, a decrease in the number of research-days indicates an upward trend for this measure.

Data Source

Compliance documentation collected by park Research Coordinator.

Data Adequacy

Medium – data quantity is complete because data are available for all research projects via the compliance and permitting process. Data quality is medium because the numbers reported are based on the project proposal approved by the compliance team, which may not reflect the actual number of days spent in the field or the number of individuals involved.

Frequency

Annually – every calendar year data for this measure will be entered into the WCMD.

Significant Change

Linear regression analysis, $\alpha = 0.05$, for all data available is used to determine if any site has a significant trend. At this time no statistically significant trend can be determined as there are not yet five data points.

Table 22. Legacy data, number of research-days

Year	Research-days
2011	812 days
2012	181 days
2013	635 days
2014	95 days

4-2: Number of commercial operations

Solitude or Primitive and Unconfined Recreation Quality • Remoteness from sights and sounds of human activity outside wilderness

Wilderness character monitoring baseline:

Baseline data value: 9 operations

Year of data: 2014 (calendar year)

Comments: Data was collected from 2010-2014 (calendar years)

Trend since wilderness designation:



Condition: Good

Trend: Downward

Confidence: Medium

Background & Context

Commercial activities near the Kobuk Valley Wilderness range from small operations based in inholdings in the park, to operations based out of Kotzebue that bring clients to the sand dunes and other locations in the park. Commercial activities may range from eco-tourism, guiding, and other recreational activities, to extractive operations such as mining or timber harvest. Depending on the activity and proximity to Kobuk Valley, these operations have significant potential to impact the area's wilderness character.

This measure has been developed to monitor those commercial operations with potential impacts to the Kobuk Valley Wilderness as accurately as possible, and exclude operations that do not meaningfully impact the area's wilderness character. Relatively few commercial operations currently operate in Kobuk Valley, but their potential to increase in number and affect park resources is significant and likely to vary over time. As a result, these commercial operations are significant to the wilderness character of the area for their effects to the remoteness from sights and sounds of people outside the wilderness and a measure of solitude.

Measure Description & Collection Protocol

This measure counts the total number of known commercial operations that a) are physically located within 100 miles of Kobuk Valley, regardless of whether the operator maintains a CUA with the park, and b) are directly related to the park and park resources. Both of these criteria must be met in order for the operation to be counted. These criteria were established so as to only count those operations that meaningfully impact the remoteness from sights and sounds of people outside the wilderness. The buffer of 100 miles is used so as to prevent counting the small number of commercial operators that fly from Fairbanks or other distant locations. These operations are excluded because they use the park so relatively infrequently that counting them would artificially inflate the number of commercial operations while not correlating to on-the-ground impacts.

Examples of what would and would not be counted follow: Bering Air operations from Kotzebue to Ambler, Kiana, or other upriver villages would not be included since their operations are not related to the park, and do not use park resources, even though they operate within 100 miles of the park. However, operations such as a small, family owned boat tour service based out of Ambler would be counted. This is because the operation directly relates to park resources, and is located near the park.

The total number of commercial operations meeting the criteria described above are counted in this measure. Over time, a decrease in the number of commercial operations indicates an upward trend in this measure.

Data Source

Chief Ranger documentation, Commercial Use Authorization (CUA) documentation.

Data Adequacy

Medium – data quantity is medium because data quality is high and quantity is medium. Commercial operations are usually fully documented, resulting in high data quality. However, in some instances illegal commercial operations are not discovered immediately, resulting in medium data quantity.

Frequency

Every 5 calendar years data for this measure will be entered into the WCMD.

Significant Change

Any change is considered significant for this measure.



Cranes at sunset. Photo by Adrienne Lindholm, NPS.

4-3: Number of aircraft landing sites

Solitude or Primitive and Unconfined Recreation Quality • Facilities that decrease self-reliant recreation

Wilderness character monitoring baseline:

Baseline data value: 10 landing sites

Year of data: 2014 (calendar year)

Comments: Data was collected from 2010-2014 (calendar years)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: Medium

Background & Context

Aircraft landing sites are one of the only ways to access the Kobuk Valley Wilderness. The landing sites in the Kobuk Valley Wilderness are a loosely documented set of locations, known almost exclusively by local pilots, that act as portals by allowing people to access the wilderness without needing to travel hundreds of miles by boat, snow machine, or foot.

Landing sites are counted here as facilities that decrease self-reliant recreation because the access they provide diminishes opportunities for primitive recreation. While landing strips in the Kobuk Valley Wilderness are not “hardened” or formally recognized by the park, and often shift from year to year as gravel bars are re-distributed by the river, their prevalence is important to monitor.

Measure Description & Collection Protocol

This measure counts the total number of regularly used landing sites in the Kobuk Valley Wilderness that are accessed by fixed-wing aircraft. Many sites in the park could serve as landing sites, so to more accurately monitor the sites, this measure counts only those landing sites that are commonly used.

For upland sites to be counted they must allow access by wheeled plane, have a history of use or have been illegally modified so as to create a viable landing site. For gravel bar sites to be counted they must allow access via wheeled plane, and have been relatively consistently located and used at least once in the past five calendar year monitoring period. Gravel bars that are re-distributed every year or few years create some ambiguity in monitoring, however, by assessing these sites based on whether or not they were used within the monitoring period, regardless of aircraft type (e.g. Scout, Super Cub, Cessna 185, or Cessna 206), this ambiguity is reduced to an acceptable level. For float plane sites to be counted they must be consistently used within the monitoring period. While these definitions still allow some subjective assessment, the intent is to provide guidance that ensures the most consistent and reliable monitoring possible. A full list of landing sites currently assessed as part of this measure is available in Table 23.

These criteria and specifications are intended to further verify the intent of this measure: to quantify the number of sites being used, not the number of sites that could be used. Landing sites that are in use indicates to what extent people are not taking advantage of opportunities for primitive recreation.

The total number of landing sites meeting the criteria above are reported in the WCMD. Over time, a decrease in the total number of landing sites would indicate an upward trend for this measure.

Definitions

- *Landing site* – a landing area used by wheeled plane or float planes. The term is inclusive of all upland sites, gravel bars, and lakes with viable landing for aircraft.
- *Landing strip or airstrip* – “...a visible, marked, or known aircraft landing area. Airstrips may be marked, or unmarked but recognizable because they have been cleared of vegetation or other obstructions” (36 CFR 13.1). Landing strips for wheeled aircraft are typically 1000 feet long, exhibit wheel tracks down their length, and have disturbed or absent vegetation (depending on use levels).

Data Source

Chief Ranger and Backcountry or Law Enforcement Rangers.

Data Adequacy

High – data quantity and quality are partial and high, respectively, because sites that facilitate extensive access and are frequently used are documented, and only those that are infrequently used may be absent.

Frequency

Every 5 calendar years data for this measure will be entered into the WCMD.

Significant Change

Any change is considered significant for this measure.

Table 23. Detailed data, landing strips

Onion Portage (float plane)
Mouth of Kavet Creek (float plane)
Big Bend (float or wheeled plane)
Mouth of Salmon River (wheeled plane)
Great Kobuk Sand Dunes – 3 sites (wheeled plane)
Waring Mountains (wheeled plane)
Sheep Creek (wheeled plane)
Hunt River (wheeled plane)

4-4: Index of management restrictions

Solitude or Primitive and Unconfined Recreation Quality • Management restrictions on visitor behavior

Wilderness character monitoring baseline:

Baseline data value: 7

Year of data: 2014 (fiscal year)

Comments: Data was collected from 2010-2014 (fiscal years)

Trend since wilderness designation:



Condition: Good

Trend: Stable

Confidence: High

Background & Context

Visitor opportunities for primitive and unconfined recreation are significantly affected by the number and type of regulations in place. Currently, there are few restrictions placed on visitor behavior in the Kobuk Valley Wilderness. Those restrictions that are in place have been deemed necessary to protect other qualities of wilderness character.

Measure Description & Collection Protocol

This measure scores the restrictions to visitor behavior according to Table 24, as adapted from the Forest Service User's Guide 2009 (pp. 219). Restrictions are evaluated on the extent of areal closure inside the wilderness, with more extensive restrictions weighted more heavily. Each restriction is assigned a value based on its type and extent. After the score is assigned for each category of regulation, the scores are weighted to reflect the geographic coverage of the regulation as follows:

- 1 — the regulation applies to a sub-area of wilderness.
- 2 — the regulation applies to an entire wilderness.

This final score is reported in the WCMD. Over time, a decrease in the index value for this measure indicates an upward trend for this measure.

Data Source

Superintendent's compendium, available on shared drive and online at:

http://www.nps.gov/akso/management/current_compendiums.cfm (accessed July 2014).

Data Adequacy

High – data quantity and quality are complete and high, respectively, because restrictions are formally and completely available with full documentation.

Frequency

Every 5 fiscal years data for this measure will be entered into the WCMD.

Significant Change

Any change is considered significant for this measure.

Table 24. Index for scoring management restrictions

Category	Score	Type of restriction
Campfires	0	No regulation
	1	Designated sites, or requirements for ash trays
	2	Total prohibition
Camping	0	No restrictions
	1	Mandatory setbacks, designated sites
	2	Assigned sites
Fees	0	No fees
	1	Fees charged of selected user type
	2	Fees charged of all visitors
Permits	0	No permit or registration
	1	Voluntary self-registration
	2	Mandatory, non-limiting permit or registration
	3	Mandatory; use limited
Human waste	0	No regulation
	3	Pack out required
Length of stay	0	No restriction on length of stay
	1	Length of stay limited
Group size limit	0	No restriction
	1	Group size limits in place
Caches	0	No requirements
	1	Some requirements for storage in place
	2	Caches prohibited
Area closure	0	No restrictions
	1	Area closed for specific purposes, times of year, or locations
	2	Area closed to use

Table 25. Restrictions on visitor behavior: Calculation of 2014 baseline value

Type of regulation	Score	Geographic weight	Total score
Campfires	0	0	0
Camping	0	0	0
Fees	0	0	0
Permits	0	0	0
Human waste	0	0	0
Length of stay	1	2	2
Group size limit	1	2	2
Caches	1	2	2
Area closure	1	1	1
Total index score:			7

Other Features of Value Quality

Wilderness may also contain other tangible features of scientific, educational, scenic, or historical value.

Wilderness may possess physical, site-specific features of value that are integral to wilderness character and make the area's meaning and significance as wilderness clearer and more distinct. Use of this quality is not required, and if no site-specific features are identified, then this quality is not used. The primary challenge with this quality lies in determining which features are truly essential to the character of a particular wilderness. This determination of which features are truly essential to the character of a particular wilderness is made at the local unit level based on guidance in Keeping It Wild 2. Features included in the Other Features of Value Quality may also be counted under other qualities if relevant. For example, a building in the wilderness area that is on the National Register of Historic Places could add value to wilderness character under the Other Features of Value Quality for its historic or cultural significance, but as a structure in wilderness it would also be counted in the Undeveloped Quality.

Table 26. Other Features of Value Quality used to monitor the Kobuk Valley Wilderness

Indicator	Measure	Frequency	Data Adequacy	Significant Change	Baseline Value
Deterioration or loss of integral cultural features	5-1: Percent of impacted and threatened cultural resource sites	5 years	Medium	≥10%	51.25%



Archeological excavation at Igliqtiquigvigray. Photo by Hannah Atkinson, NPS.

5-1: Percent of impacted and threatened cultural resource sites

Other Features of Value Quality • Deterioration or loss of integral cultural features

Wilderness character monitoring baseline:

Baseline data value: 51.25 percent

Year of data: 2014 (calendar year)

Comments: Data was collected from 2010-2014 (calendar years)

Trend since wilderness designation:



Condition: Warrants some concern

Trend: Downward

Confidence: Medium

Background & Context

The Kobuk Valley Wilderness is part of the ancestral home of the Inupiat people and countless cultural and archeological resources are found within the Kobuk Valley Wilderness. With artifacts extending back thousands of years, the Kobuk Valley Wilderness contains archeological and cultural evidence from some of the first peoples to cross into the North American continent across the Beringia, the Land Bridge that connected Asia and North America 13,000 years ago. Today, archeological evidence can be found in stone tools, depressions left by house pits, cairns, ancient fire pits, and other artifacts. These resources are considered an invaluable part of the wilderness character in the Kobuk Valley, and loss of these resources degrades wilderness character. Today, these resources face threats from natural disturbance such as erosion, wildfire, floods, and animal digging, as well as human-caused disturbance such as looting, digging of catholes, fire rings, aircraft landings, and other visitor and authorized uses.

Due to the large size of the Kobuk Valley Wilderness, the majority of the area has not yet been surveyed for archeological or cultural resources – it is estimated that less than 1% of the entire wilderness has been surveyed (Holt, personal communication). As a result, reporting on the status of cultural resources here is necessarily limited in scope and is acknowledged as only including a subset of the resource.

Measure Description & Collection Protocol

This measure monitors the number of sites that have been surveyed in the past 5 years and have been assessed as being impacted or threatened from human or natural causes. During cultural resource fieldwork to re-survey previously documented sites or establish baseline information for sites, professional judgment in accordance with the National Historic Preservation Act of 1966 and the Archeological Resource Protection Act of 1979 is used to assess sites for entry into Archeological Sites Management Information System (ASMIS) database. This measure of wilderness character is drawn from records in the ASMIS database.

A percent is used to report this measure because the number of sites surveyed each year, and every 5 years, can vary widely. Likewise, many of the sites documented in the Kobuk Valley Wilderness are not monitored every year. By focusing wilderness character monitoring on sites updated within the past 5 years and using a percentage to document change, we are only monitoring those sites with recent updates, and in a way that does not purely reflect staff effort.

To obtain data for this measure, park cultural resource staff must be contacted to obtain a report from ASMIS databases. The query from ASMIS should reflect the number of sites surveyed in the past 5 years (for baseline or updates) and report the disturbances that threaten, or have already impacted, the sites. From this query, the percent of sites that are impacted or threatened can be calculated. This percentage is reported in the WCMD. Over time a decline in the percent of impacted and threatened sites indicates an upward trend for this measure.

Data Source

Archeological Sites Management Information System (ASMIS) databases; accessed by contacting park cultural resources staff.

Data Adequacy

Medium – data quantity is medium due to the large number of sites that need to be surveyed and the lack of resources and capacity to do so. Data quality is high because those sites that are surveyed are done so using reliable and accurate methodology.

Frequency

Every 5 calendar years data for this measure will be entered into the WCMD.

Significant Change

Change of 10% or greater is considered significant for this measure.



Sand dunes. Photo by Elise Kahl, NPS

Measures suggested for future use

The measures in this section were determined to be highly significant to wilderness character. The measures were not included however, because no data was available at the time the baseline was established. If data becomes available for any of these measures, making them viable to include as a wilderness character monitoring measure of the Kobuk Valley Wilderness, it is recommended that they are incorporated into the monitoring framework.

Table 27. Suggested measures for future used to monitor the Kobuk Valley Wilderness.

Indicator	Measure
Remoteness from sights and sounds of human activity inside wilderness	Extent of impacted viewshed
Remoteness from sights and sounds of human activity outside wilderness	Soundscape
	Night sky illumination

Extent of impacted viewshed

Solitude or Primitive and Unconfined Recreation Quality • Remoteness from sights and sounds of human activity inside wilderness

Background & Context

A viewshed unaffected from vestiges of modern society is one of the key elements that defines Alaskan wilderness. Remote vistas with no permanent evidence of modern human activity are common here and are a desired feature of Alaskan conservation areas. Impacts to the viewshed of the Kobuk Valley Wilderness significantly affect the remoteness from sights and sounds of people experienced by visitors. With minimal human-made developments affecting the viewshed of the Kobuk Valley, it can be particularly unexpected to come across these impacts and correspondingly any given development may have a disproportionate impact to visitor experience and wilderness resources than may occur in other, less remote wilderness areas.

It is also important to note that developments that affect viewshed are considered to include modern and permanent developments. For instance, a fish-camp is unlikely to be considered within this evaluation. Developments such as scientific instrumentation, ranger stations, and historic structures would be included. The inclusion of these developments is not to say that they do not have value or only negatively affect wilderness resources and character. Conversely, cultural and historic developments for instance, contribute positively to wilderness resources and character. However, the developments are monitored here because of their effects to the viewshed of Kobuk Valley Wilderness.

Measure Description & Collection Protocol

This measure monitors the percent of the Kobuk Valley Wilderness with a viewshed impacted from anthropogenic sources. Data is obtained through analyses conducted through technical assistance

from the NPS Air Resource Division, Visual Resource Specialists. The percent of the Kobuk Valley that experiences an impacted viewshed is reported in the WCMD. Over time, an increase in the number of acres with an impacted viewshed indicates a downward trend in wilderness character.

Note: as of March 2015 viewshed calculations have not been conducted and this measure has been entered into the WCMD in “inactive” status. As data becomes available, the measure’s status should be changed to “active” and baseline data should be entered.

Definitions

- *Viewshed* – the area of land, water, or other environment that is visible from a particular vantage point.

Soundscape

Solitude or Primitive and Unconfined Recreation Quality • Remoteness from sights and sounds of human activity outside wilderness

Background and context

Natural sounds are extremely important to wilderness character, where the opportunity to experience natural sounds is unimpaired by anthropogenic sources. The value of natural soundscapes has been affirmed in the 2006 NPS Management Policies, which require the NPS to preserve, to the greatest extent possible, the natural soundscapes of parks, as well as protect natural soundscapes from degradation due to noise. Adverse effects to natural soundscapes may occur through the frequency, magnitude, or duration of the anthropogenic sounds (Frstrup and Mennitt 2012).

The natural soundscape preserved in the Kobuk Valley Wilderness is one with relatively few anthropogenic influences. However, motorized use via aircraft, motorboat, and snowmachine are the most common means of access into the Kobuk Valley Wilderness, all of which significantly affect the natural soundscape. While these uses are allowed in the Kobuk Valley Wilderness under ANILCA, they nonetheless are highly relevant to the soundscapes of the park, making their effect on natural soundscapes important to monitor as part of the Kobuk Valley’s wilderness character.

Measure Description & Collection Protocol

This measure monitors the percentage of time when anthropogenic sounds are above ambient sound levels in the Kobuk Valley Wilderness. Two sites will be monitored within each 5-year monitoring period and processed according to Natural Sounds Program protocol (Natural Sounds Division 2013). These sites will include at least one site in the western and eastern halves of the Park. It is the goal that sites in the western and eastern halves of the park will each be monitored once in the summer, fall, and winter, over the 5-year monitoring period. If all of the desired data collection does not occur, a note should be made in the database. This data collection effort is intended to occur concurrently with existing trips and backcountry operations by park personnel.

When the percent of audible anthropogenic sounds is calculated for all six samples, the average across all six is taken and evaluated within the standards described in Table 28 (next page). The level of use descriptor based on that table is entered into the WCMD. The individual data points should be

entered into the notes section. Over time, an increasing percentage of time when anthropogenic sounds are audible indicates a downward trend for this measure.

Note: as of March 2015 this measure has been entered into the WCMD in “inactive” status. As data becomes available, the measure’s status should be changed to “active” and baseline data should be entered.

Table 27. Evaluating natural soundscape – adapted from Denali Backcountry Management Plan, pp. 48 (NPS 2006).

Descriptor	Description and standard
Very high	Natural sounds are often interrupted by motorized noise, including loud noise. Motorized use may be audible up to 50% of any hour, and there may be up to 50 motorized noise intrusions per day that exceed natural ambient sound. Motorized noise does not exceed 60dBA.
High	Natural sounds are frequently interrupted by motorized noise, include some loud noise. Motorized use may be audible up to 25% of any hour, and there may be as many as 25 motorized noise intrusions per day that exceed natural ambient sound. Motorized noise does not exceed 60dBA.
Medium	Natural sounds predominate in this area, but there are infrequent motorized intrusions, a few of which may be loud. Motorized noise may be audible up to 15% of any hour, and there may be as many as 10 motorized noise intrusions per day that exceed natural ambient sound. Motorized noise does not exceed 40dBA.
Low	Natural sounds predominate in this area and motorized noise intrusions are very rare and usually faint. Motorized noise may be audible up to 5% of any hour, and there may be as many as 1 motorized noise intrusions each day that exceed natural ambient sound. Motorized noise does not exceed 40dBA.

Note: “Audible” means audibility to a person of normal hearing. Maximum sound levels assume the measurement device is more than 50 feet from the noise source. For comparison, 40dBA is the overall sound level inside a typical residential home. 70dBA is the sound level of a vacuum cleaner as perceived by the user.

Definitions

- *Soundscape* – acoustic resources in a given area or landscape comprise its soundscape. These sounds may include wildlife, waterfalls, wind, rain, and historic and cultural sounds, as well as sounds from anthropogenic sources, such as aircraft or human voices.

Night sky illumination

Solitude or Primitive and Unconfined Recreation Quality • Remoteness from sights and sounds of human activity outside wilderness

Background & Context

Light pollution is caused by modern human civilization and reflects the extent and type of human activity occurring near a wilderness area. There are two types of light pollution: sky glow and glare (Duriscoe 2001). Sky glow refers to the amount of ambient light visible in the night sky. Sky glow impacts remoteness and visitor experience, reflecting the use of areas surrounding the wilderness. Glare is caused by lights shining directly into wilderness, which given the remoteness of Kobuk Valley Wilderness is of less concern. Correspondingly, sky glow is used for wilderness character monitoring.

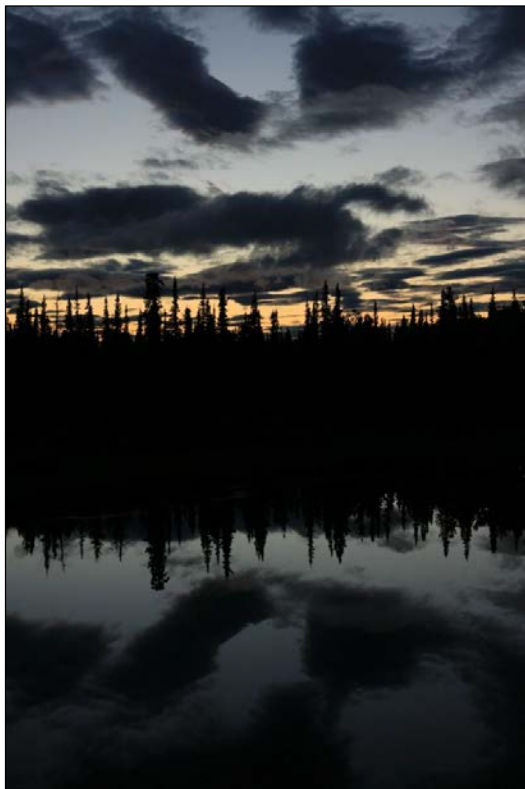
Measure Description & Collection Protocol

This measure tracks the percentage of the wilderness area that is “minimally impacted” by light pollution. Using field data collected via protocols developed by the Night Skies Division, hemispherical images of the night sky are taken, then analyzed to compare the level of artificial light to natural levels of sky glow. From this calculation, the NPS Night Skies Team obtains a ratio of how much an area exceeds natural light levels. Specific protocols are available in Night Skies Program Documentation (Duriscoe et al. 2007, Duriscoe 2013). Areas where the ratio is 0.3 or less are considered “minimally impacted.” That is, the ratio of artificial light to natural light should be no more than 30%. A ratio of 2.0 represents “moderately impacted” night skies, and anything over 2.0 is “severely impacted” by wilderness standards (Duriscoe, unpublished data). The percentage of wilderness with “minimally impacted” levels of sky glow is reported in the WCMD. Over time, an increase in the percentage of area minimally impacted by light pollution indicates an upward trend in wilderness character for this measure.

Note: as of March 2015 this measure has been entered into the WCMD in “inactive” status. As data becomes available, the measure’s status should be changed to “active” and baseline data should be entered.

Definitions

- *Light pollution* – brightening of the night sky that inhibits the observation of stars and planets, caused by anthropogenic sources, such as street lights.



Sunset in Kobuk Valley wilderness. Photo by Doug Demarest, NPS

Measures not used for wilderness character monitoring

The measures described below were considered as measures for wilderness character but were ultimately not used. The measure and why it was excluded are described in this section.

Table 29. Measures not used for monitoring the character of Kobuk Valley Wilderness.

Quality	Indicator	Measure
Untrammeled Quality	Actions authorized by the federal land manager that intentionally manipulate the biophysical environment	Wildlife hunting regulations
Natural Quality	Ecological processes	Area covered by active thaw slumps
		Shrubification

Wildlife hunting regulations

Untrammeled Quality • Actions authorized by the federal land manager that intentionally manipulate the biophysical environment

Background & Context

Wildlife hunting regulations are a direct, significant, and intentional manipulation of the earth and its community of life. While an individual hunter may not have this intention, the intent of wildlife regulations is to manipulate wildlife populations for a specified purpose, be it preserving “the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal communities and ecosystems in which they occur” (NPS 2006), or “providing for high levels of human harvest of selected moose, caribou, and potentially, deer populations” (Hilderbrand et al. 2013, summarizing AS 16.05.255).

Alaska Department of Fish and Game (ADF&G) coordinates hunting regulations for non-subsistence uses by local and non-local hunters across the state of Alaska. The Federal Subsistence Board (FSB) coordinates all subsistence hunting regulations. Both agencies work in coordination with one another and with local and non-local users to develop these regulations, which apply on federal lands, including the Kobuk Valley Wilderness and National Park.

Measure Description

This measure would monitor wildlife regulations that apply to General Management Unit (GMU) 23 for certain species (listed below) as defined in State of Alaska hunting regulations and Federal subsistence regulations. Regulations promulgated by the State of Alaska (and accepted by the NPS – if the regulations are rejected on NPS lands, the regulations would not be counted here), as well as regulations promulgated by the FSB for these species would be summed to calculate the total number of regulations reported.

Wildlife hunting regulations that apply within the Kobuk Valley Wilderness are counted for the following species: moose, caribou, wolf, wolverine, black bear, and brown bear. These species were selected because they are iconic to the Kobuk Valley Wilderness and have population levels which

are most subject to change and for which hunting is more highly regulated. In addition, the number of regulations for all species, including waterfowl, small animals, and trapping becomes less indicative of wilderness character due to the sheer magnitude of regulations being counted. Regulations for all different user groups are counted and includes residents, nonresidents, and subsistence users.

Rationale for exclusion

This measure was excluded because a trend cannot be accurately or appropriately assigned to this measure. No viable counting methods were successfully devised to resolve the issue. A trend cannot be assigned because an increasing number of regulations does not necessarily correlate with an improving or declining trend in wilderness character. For instance, more regulations may be in place to preserve populations (e.g., increasing restrictions on the timing of the hunt, gender of animal, age of animal, etc.), whereas more regulations can also liberalize hunting activities (e.g., increasing the amount of year which is open season, allowing more animals to be taken, etc.). As a result, improving or declining trends in wilderness character cannot be drawn based on the number of regulations.

Evaluating regulations from other approaches (e.g., professional judgment on impact to wilderness character) introduces a very high degree of subjectivity given that experts on this topic can have very different opinions.

Area covered by active thaw slumps

Untrammeled Quality • Ecological Processes

Background & Context

Permafrost underlies much of the Kobuk Valley Wilderness (NPS 2005). Climate change however, has the potential to change permafrost dynamics in the arctic and climate change has been cited as a cause of recent increases in thawing Alaskan permafrost (Jorgenson et al. 2006). When the underlying permafrost melts, the surface of the ground can slump and change shape. Two kinds of permafrost thaw features that are of particular interest in the Kobuk Valley Wilderness are: active-layer detachments (ALD) and retrogressive thaw slumps (RTS). These thaw slumps can result in increased soil erosion, changes in water chemistry, as well as the release of greenhouse gases that had been previously trapped in the soil, depending on their location (Swanson 2012; Crosby 2009; Kokelj et al. 2005; Balser et al. 2007; French 2007).

Measure Description

This measure would monitor the area known to be covered by active thaw slumps in the Kobuk Valley, including both ALD and RTS types. Area is used as a measure because the proportion of the affected area within the large areas of the Kobuk Valley is relatively small.

The results from the ARCN Vital Sign on Permafrost would be used to provide data for this measure and the total area covered by thaw slumps as calculated by ARCN is entered into the WCMD. These measurements are recorded in the WCMD in accordance with how ARCN collects and reports its data. If methodological changes occur from methods used in 2014, the changes must be noted in the

WCMD. As of 2014, thaw slump data is collected via satellite images, which are analyzed to identify bare ground, then analyzed to exclude bare soil that is not a thaw slump, and the total area is calculated and summed. Further detail on this methodology can be found in “Mapping of Erosion Features Related to Thaw of Permafrost in the Kobuk Valley National Park, Alaska” (Swanson 2012).

Definitions

- *Active layer detachment (ALD)* – ALD are small landslides that occur on vegetated slopes where a surface layer slides as a unit to a wrinkled mass on the footslope. The slide leaves an elongated region of bare soil exposed on a slope.
- *Retrogressive thaw slumps (RTS)* – RTS occur where a cut-bank advances into undisturbed, ice-rich, permafrost ground. As soil thaws in the steep bank, soil falls or slumps onto an adjacent, gentler slope and is transported away by water, erosion, or sliding (Burn and Lewkowicz 1990).

Rationale for exclusion

This measure was excluded because changing permafrost structure cannot necessarily be correlated with improving or declining trends in wilderness character. While changing permafrost and thaw slumps significantly affect the character of the Kobuk Valley Wilderness and represent a distinct change since its establishment in 1980, changing permafrost conditions cannot be said to “improve” or “degrade” the Kobuk Valley Wilderness. Simply, these changing conditions represent a “change” from the status quo.

Since there is no known “natural” or “correct” extent of thaw slumps in the Kobuk Valley against which changing and current conditions can be compared, any trend assigned would necessarily be based on an arbitrary point in time. If such a trend were assigned, it would not inform wilderness character monitoring.

Shrubification

Untrammeled Quality • Ecological Processes

Background & Context

Vegetation in the Kobuk Valley Wilderness is dominated by arctic tundra, characterized by low-growing lichens, mosses, herbs, and sedges. Tundra is resilient in this arctic environment underlain by permafrost, with frequent harsh weather and limited nutrient availability. In a changing climate, arctic vegetation is predicted to undergo large-scale shifts in composition (Hinzman et al. 2005; Walker et al. 2003). One shift already documented in arctic biomes is increased cover by shrub species – a change predicted to continue into the future if current warming (Tape et al. 2006; Tape et al. 2010; Myers-Smith et al. 2011). Likewise, low-shrub environments may transition to tall-shrub environments (Myers-Smith et al. 2011). This transition to increased shrub cover is referred to as “shrubification.”

These changes are already showing in the Kobuk Valley Wilderness. In comparing aerial photographs from the 1980s to photos from 2010, Swanson (2013b) showed that lowland areas are already experiencing shrubification. Some of the most common vegetation shifts in the Kobuk Valley National Park and other arctic parks over the past thirty years have included shrub encroachment on tundra, shrub increase due to floodplain succession, and tree increase due to post-fire succession. As of 2014, the majority of documented vegetation change in the Kobuk Valley region has been concentrated in lowlands areas, especially below 1000 feet in elevation.

Measure Description

This measure monitors shrubification by tracking the percent of area in the Kobuk Valley with vegetation composition transitioning to increased shrub cover. Increases in shrub cover are likely to include encroachment on tundra, shrub increases due to floodplain succession and fire succession, and transitions from low shrub to tall shrub cover.

This measure reflects data collected by ARCN as part of the Terrestrial Landscape Patterns and Dynamics and Terrestrial Vegetation and Soils Vital Signs. These Vital Signs monitor both on-the-ground vegetation plots and aerial photography. However, data used for wilderness character monitoring draws on the results of aerial photography to account for large scale landscape changes in vegetation cover, which can then be informed by the results of on-the-ground vegetation plot sampling. Data for this measure is based on results from the ARCN Vital Sign of Terrestrial Landscape Patterns and Dynamics, which is used to derive the percent of area in the Kobuk Valley that has transitioned to increased shrub cover. The percent of area reported in the Wilderness Character Monitoring Database (WCMD) is based on how ARCN collects and reports Vital Sign data. Any changes made in ARCN's data collection or analysis processes must be noted in the WCMD.

Rationale for exclusion

This measure was excluded because shrubification cannot necessarily be correlated with improving or declining trends in wilderness character. While increasing shrub cover significantly affects the character of the Kobuk Valley Wilderness and represents a distinct change since its establishment in 1980, changing vegetation communities cannot be said to “improve” or “degrade” the Kobuk Valley Wilderness. Simply, these changing conditions represent a “change” from the status quo.

Since there is no known “natural” or “correct” vegetation composition in the Kobuk Valley against which changing and current conditions can be compared, any trend assigned would necessarily be based on an arbitrary point in time. If such a trend was assigned, it would not inform wilderness character monitoring.

Conclusions

The Kobuk Valley Wilderness and National Park is an enduring and wild landscape. This land has provided subsistence and invaluable experiences for generations of local Iñupiat, as well as visitors from around the world. Surrounded by similarly wild and vast landscapes, park and wilderness boundaries here may appear arbitrary as they divide the region.

Distant from most modern technologies, population centers, and access provided by roads, Kobuk Valley has escaped many of the influences facing wilderness areas across the NWPS. However, some of these changes have affected the wilderness character of Kobuk Valley.

While Kobuk Valley possesses an incredible wilderness character, its wilderness character has trended downward over the past 35 years. Since the designation of the Kobuk Valley Wilderness in 1980, many changes have come to the region. Regional villages have become increasingly reliant on gasoline and motorized transportation, exploratory drilling in the Ambler Mining District has increased, most nearby villages have expanded, traditional ways of life have changed, and new technologies are readily available to local residents, visitors, administrators, and researchers alike.

To provide a more comprehensive understanding of how Kobuk Valley's wilderness character has changed since 1980, a summary of the trend for each quality of wilderness character is provided below, based on the measures selected in this report. The trends summarized here reflect professional judgement to try and show what has happened leading up to the wilderness character monitoring baseline in 2014. This information is intended to supplement the wilderness character monitoring baseline established in this report and prevent shifting baselines in relation to wilderness character, despite the lack of official wilderness character monitoring since 1980.

Untrammelled Quality

The trend in the Untrammelled Quality has been stable since 1980 (Table 30). This is because very few trammeling actions have occurred since then. The primary exception is collaring caribou, which has occurred regularly since 1988. Wildfire suppression also occurs in Kobuk Valley on occasion. The area contains a relatively high number of inholdings in comparison to other NPS areas in the region; inholdings often have more stringent fire suppression requirements than the surrounding areas, sometimes resulting in more frequent suppression actions. Even with these existing factors, the Untrammelled Quality of Kobuk Valley is fundamentally intact as these actions take place infrequently and have not increased since 1980. There is also a history of timber harvest in Kobuk Valley, typically from inadvertent actions when users are unable to distinguish the park boundary. Timber harvest, if increased in magnitude, could potentially constitute an authorized or unauthorized trammeling action in the future, depending on the circumstances.

Table 30. Trends in the Untrammelled Quality of Kobuk Valley Wilderness

Indicator	Measure	Trend since 1980
Actions authorized by the federal land manager that intentionally manipulate the biophysical environment	1-1: Number of actions that manipulate wildlife or vegetation	
	1-2: Percent of wildfires suppressed	
Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment	1-3: Number of unauthorized actions that manipulate plants, wildlife, insects, fish, pathogens, soil, water, or fire	

Natural Quality

The effects of humans on the natural environment have increased since 1980, resulting in a downward trend of the Natural Quality of the Kobuk Valley Wilderness (Table 31). However, this trend should be interpreted with caution due to the medium data adequacy for most data relating to the Natural Quality. A lack of comprehensive natural resource research and data availability is directly related to the extent to which Kobuk Valley is still somewhat “unknown.” This “unknown” can be an exciting component of this remote wilderness area and contributes to its wilderness character. However, the limits of our knowledge for monitoring purposes also affect our ability to understand how humans may be influencing natural systems over time.

With the increasingly widespread effects of human activities, many impacts to the natural environment come from a combination of global and regional sources. As technologies have changed, new developments and other human activities that affect the natural environment have become possible in the Northwest Alaskan Arctic, a place where many of these activities were previously infeasible. An example of this could be the development of the Ambler Mining District or resuming mining operations in the Jade Mountains. Many of the downward trends in measures used to monitor the Natural Quality reflect these large scale changes.

Table 31. Trends in the Natural Quality of Kobuk Valley Wilderness

Indicator	Measure	Trend since 1980
Plants	2-1: Number of non-native plant species	
Animals	2-2: Number of human-wildlife incidents	
Air and water	2-3: Acidifying and fertilizing pollutants	
Ecological processes	2-4: Extent of landscape connectivity	

Dramatic change is also coming to the natural environment of Kobuk Valley as a result of climate change. The effects of climate change however, are not reflected as part of wilderness character monitoring. Instead, wilderness character monitoring focuses on human actions that directly change the natural environment (Landres et al. 2015, p. 109).

Undeveloped Quality

Since 1980, the Undeveloped Quality of the Kobuk Valley Wilderness has had an “offsetting stable” trend, wherein there are an equal number of upward- and downward-trending measures (trend assessment based on guidance *Keeping It Wild* 2). This “offsetting stable” trend is the result of an upward trend in motorized use and mechanical transport, stable trend in the acres of inholdings, and downward trend in non-recreational installations (Table 32). While most of the developments and motorized uses are relatively small in comparison to the 1.7 million acres of wilderness, they represent a distinct change from the developments and motorized use present in 1980.

Table 28. Trends in the Undeveloped Quality of Kobuk Valley Wilderness

Indicator	Measure	Trend since 1980
Presence of non-recreational structures, installations, and developments	3-1: Number of sub-surface installations	
	3-2: Number of above-ground installations	
	3-3: Weight of abandoned debris in wilderness	
Presence of inholdings	3-4: Acres of inholdings	
	3-5: Number of helicopter supported projects	
Use of motor vehicles, motorized equipment, or mechanical transport	3-6: Number of hours of airplane flight time	
	3-7: Miles of administrative snowmachine use	

One primary source of new installations in wilderness is research activities, especially the growing use of sub-surface site markers. Likewise, the majority of new above-ground installations since 1980 are also research instrumentation.

It is important to note that all administrative structures and other shelters currently in the wilderness were present prior to 1980. This is to say that research activities should be examined for their effects to wilderness character, while recognizing that research is recognized as a fundamental purpose of Kobuk Valley Wilderness.

Motorized use by park administration has remained relatively constant since 1980. Only administrative snowmachine use has decreased in quantity, potentially a result of changing personnel, park emphases, and federal budgets. Given the reality of how remote Kobuk Valley

Wilderness is, all access is provided by fixed-wing aircraft or helicopter. This is the same paradigm as was present in 1980.

Motorized use by local residents via snowmachine or boat has likely increased since 1980 as a result of increased availability of motorized transport methods, and other societal and regional factors. While use by local residents is not monitored as part of wilderness character monitoring at this time, it does have an important bearing on the Undeveloped Quality of Kobuk Valley and the uses that occur there.

When the stable levels of motor vehicles and motorized equipment use are combined with the downward trend in non-recreational installations, the overall trend of the Undeveloped Quality is downward.

Solitude or Primitive and Unconfined Recreation Quality

The trend of the Solitude or Primitive and Unconfined Recreation Quality has been downward since 1980 (Table 33). This is largely a result of increased use by non-local visitors. The role of the Kobuk River as a primary thoroughfare for local travel and transport has the potential to significantly impact this quality in the southern portion of the wilderness and park. Again, use by local residents is not monitored in this strategy, in part because it is infeasible to monitor at this time, but it is important to note. Other notable changes to the remoteness of Kobuk Valley are seen in soundscape and night sky illumination, both of which are likely experiencing downward trends, but lack data to quantify change at this time. In part due to its remoteness from population centers, many concerns that other wilderness areas face relating to recreation simply aren't prominent issues here.

Opportunities for primitive and unconfined recreation have remained essentially unchanged since 1980. With few changes to affect how visitors interact with this landscape, they are still able to travel the Kobuk Valley Wilderness in the same ways as they did 35 years ago. In particular, the Baird Mountains that constitute the northern portion of the wilderness remain very difficult to access preventing most administrative access or other evidence of modern human use. The southern portion of Kobuk Valley, in particular the sand dunes, do receive greater levels of use, but in comparison to the vast surrounding area, the impacts are relatively few.

Table 29. Trends in the Solitude or Primitive and Unconfined Recreation Quality of Kobuk Valley Wilderness

Indicator	Measure	Trend since 1980
Remoteness from sights and sounds of human activity <i>inside</i> wilderness	4-1: Number of research-days	
Remoteness sights and sounds of human activity <i>outside</i> wilderness	4-2: Number of commercial operations	
Facilities that decrease self-reliant recreation	4-3: Number of aircraft landing sites	
Management restrictions on visitor behavior	4-4: Index of management restrictions	

Other Features of Value Quality

The trend in Other Features of Value Quality has trended downward since 1980 (Table 34). At this time, only cultural resources are considered in the assignation of trend for this quality. Cultural resources are finite, and their preservation is a difficult endeavor; resources are exposed to constant threats from natural and human sources. Erosion and degradation threaten the integrity of sites in the Kobuk Valley Wilderness, as does resource attrition from visitor activity. As a vital part of the wilderness character of this area and as a finite resource that cannot be restored, this downward trend and the current condition of threatened sites is concerning.

Table 30. Trends in the Other Features of Value Quality of Kobuk Valley Wilderness

Indicator	Measure	Trend since 1980
Loss of cultural resources	5-1: Percent of impacted and threatened cultural resource sites	

Looking Ahead

The future of the Kobuk Valley Wilderness contains many uncertainties. Climate change has the potential to dramatically alter the landscape and ecology of the Kobuk Valley Wilderness. With thermokarst features and permafrost melting, changing vegetation communities, increasing presence of species typically found farther south, among other effects, the implications of climate change here are significant. For instance, the slow moving rivers offer habitat for beavers, which local users cite as increasingly common (SRC meeting notes, 2014). In addition, the location of Kobuk Valley straddling ecotone of boreal forest to tundra may make change particularly visible. Despite the changes that will result from climate change, the Kobuk Valley Wilderness will remain protected and its unique wilderness character will endure even if its ecology has changed.

Regional developments also stand to significantly affect the Kobuk Valley Wilderness and are increasingly encroaching in areas adjacent to Kobuk Valley. Proposed developments in the Ambler Mining District as well as other nearby extractive mineral developments will affect the area's remoteness and Natural Quality. Other extractive industries also are located near the park. An old gold mine and associated equipment is located in Klerly Creek, and an old mine located in the Jade Mountains retains some infrastructure and has the potential to be re-activated. Changing technologies have strong potential to allow new activities to occur in Kobuk Valley – this may include technology enabling large-scale, extractive developments. Changing technology also effects everyday users, for instance, by increasing winter access via more powerful and fuel-efficient snowmachines.

Threats include the potential spills of oil or cargo in the Kobuk River, as it is used as a transport route to bring supplies upriver, often by barge. The Kobuk River is also used as a travel route for local users, by boat in summer and snowmachines in winter. This use affects soundscape and has the potential to affect water quality in the event of oil spills or other accidents.

Despite these changes, Kobuk Valley essentially retains its primeval character. Even with new technologies, traditional skills and knowledge are often vital to survive in Kobuk Valley even for a short time. With its sheer size, intact natural systems, and remoteness, the Kobuk Valley possesses an incredible wilderness character that must be preserved into the future.



Boat near the Kobuk River. Photo by Adrienne Lindholm, NPS.

Literature Cited

- Balser, A. W., W. B. Bowden, J. B. Jones, M. N. Gooseff, D. M. Sanzone, A. Bouchier, and A. Allen. 2007. Thermokarst distribution in the Kobuk Valley Basin, Alaska: increased frequency and correlations with local and regional landscape variables. American Geophysical Union, Fall Meeting 2007, abstract #C32A-08.
- Burn, C. R., and A. G. Lewkowicz. 1990. Retrogressive thaw slumps. Canadian landform examples – 17. *The Canadian Geographer* 34(3):273–276.
- Crosby, B. T. 2009. The interplay between storage and delivery: an examination of temporally varying sediment flux to the Selawik River from an enormous retrogressive thaw slump, northwest Alaska. Geological Society of America Abstracts with Programs, 41(7): 574.
- Duriscoe, D. 2013. Measuring anthropogenic sky glow using a natural sky brightness model. *Publications of the Astronomical Society of the Pacific* 125(933):1370-1382.
- Duriscoe, D. 2001. Preserving pristine night skies in National Parks and the wilderness ethic. *George Wright Forum*. 18(4) 30-36.
- Duriscoe D., C. Luginbuhl, and C. Moore. 2007. Measuring night sky brightness with a wide-field CCD camera. *Publications of the Astronomical Society of the Pacific* Vol 119.
- Fahrig, L. 2003. Effects of habitat fragmentation on biodiversity. *Annual review of ecology, evolution, and systematic*. 34:487-515. DOI: 10.1146/annurev.ecolsys.34.011802.132419. Available at <http://www.annualreviews.org/> (accessed 11 March 2015).
- French, H. M. 2007. The Periglacial Environment, 3rd edition. John Wiley & Sons.
- Fristrup, K. M., and D. Mennitt. 2012. Bioacoustical monitoring for terrestrial environments. *Acoustics Today* 8(3): 16-24.
- Graber, D.M. 2002. Scientific values of public parks. *George Wright Forum* 19(2):63-66.
- Graumlich, L. J. 2000. Global change in wilderness areas: Disentangling natural and anthropogenic changes. Pages 27-32 in *Wilderness Science in a Time of Change*, Volume 3 (S.F. McCool, D.N. Cole, W.T. Borrie, J. O'Loughlin, compilers). USDA Forest Service Rocky Mountain Research Station Proceeding RMRS-P-15-VOL-3, Fort Collins, CO.
- Harrison, S. and E. Bruna. 1999. Habitat fragmentation and large-scale conservation: what do we know for sure? *Ecography* 22: 225-232.
- Hasselbach, L. 2010. Summary of field activities and permitting: Western Arctic National Parklands Compliance Team. National Park Service, Unpublished Report, Kotzebue, AK.

- Hellmann, J. J., J. E. Byers, B. G. Bierwagen, and J. S. Dukes. 2008. Five potential consequences of climate change for invasive species. *Conservation Biology* 22(3):534-543. DOI: 10.1111/j.1523-1739.2008.00951. Available from <http://onlinelibrary.wiley.com/> (accessed 6 February 2015).
- Hejda, M., P. Pyšek, V. Jarošík. 2009. Impact on invasive plants on the species richness, diversity and composition of invaded communities. *Journal of Ecology* 97(3): 393-403.
- Higuera, P.E., J.L. Barnes, M.L. Chipman, M. Urban, and F.S. Hu. 2011. The burning tundra: A look back at the past 6,000 years of fire in the Kobuk Valley National Preserve, northwestern Alaska. *Alaska Park Science* 10:37-41.
- Hilderbrand, G. V., K. Joly, S. P. Rabinowitch, and B. Shults. 2013. Wildlife stewardship in National Park Service areas in Alaska: A report to the Alaska Leadership Council sub-group on wildlife harvest on parklands. Natural Resource Report NPS/AKSO/NRR—2013/663. National Park Service, Fort Collins, Colorado.
- Hinzman, L. D., N. D. Bettez, W. R. Bolton, F. S. Chapin, M. B. Dyurgerov, C. L. Fastie, B. Griffith, R. D. Hollister, A. Hope, H. P. Huntington, A. M. Jensen, G. J. Jia, T. Jorgenson, D. L. Kane, D. R. Klein, G. Kofinas, A. H. Lynch, A. H. Lloyd, A. D. McGuire, F. E. Nelson, W. C. Oechel, T. E. Osterkamp, C. H. Racine, V. E. Romanovsky, R. S. Stone, D. A. Stow, M. Sturm, C. E. Tweedie, G. L. Vourlitis, M. D. Walker, D. A. Walker, P. J. Webber, M. Welker, K. S. Winker, and K. Yoshikawa. 2005. Evidence and implications of recent climate change in northern Alaska and other arctic regions. *Climatic Change* 72(3):251-298.
- Hooper, D. U., F. S. Chapin III, J. J. Ewel, A. Hector, P. Inchausti, S. Lavorel, J. H. Lawton, D. M. Lodge, M. Loreau, S. Naeem, B. Schmid, H. Setälä, A. J. Symstad, J. Vandermeer, and D. A. Wardle. 2005. Effects of biodiversity on ecosystem function: A consensus of current knowledge. *Ecological Monographs* 75 (1): 3-35.
- Jorgensen, M.T., Y.L., Shur, and E.R. Pullman. 2006. Abrupt increase in permafrost degradation in arctic Alaska. *Geophysical Research Letters* 33(2). DOI: 10.1029/2005GL024960. Available from <http://onlinelibrary.wiley.com/> (accessed 4 June 2015).
- Kobuk Valley Subsistence Resource Commission. 2014. Meeting notes from December 4, 2014. Unpublished Report, Kotzebue, AK.
- Kokelj, S. V., R. E. Jenkins, D. Milburn, C. R. Burn, and N. Snow. 2005. The influence of thermokarst disturbance on the water quality of small upland lakes, Mackenzie Delta region, Northwest Territories, Canada. *Permafrost and Periglacial Processes* 16:343-353.
- Landres, P., C. Barnes, J.G. Dennis, T. Devine, P. Geissler, C.S. McCasland, L. Merigiano, J. Seastrand, and R. Swain. 2008. *Keeping It Wild: An interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System*. USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-212. Fort Collins, CO.

- Landres, P., S. Boutcher, L. Dean, T. Hall, T. Blett, T. Carlson, A. Mebane, C. Hardy, S. Rinehart, L. Merigliano, D. N. Cole, A. Leach, P. Wright, D. Bumpus. 2009. Technical guide for monitoring selected conditions related to wilderness character. USDA Forest Service General Technical Report WO-80, 282 pp.
- Landres, P., C. Barns, S. Boutcher, T. Devine, P. Dratch, A. Lindholm, L. Merigliano, N. Roeper, and E. Simpson. 2015. Keeping it Wild 2: An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System. USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-340, Fort Collins, CO.
- Lawler, J. P., S. D. Miller, D. M. Sanzone, J. Ver Hoef, and S. B. Young. 2009. Arctic Network vital signs monitoring plan. Natural Resource Report NPS/ARC/NRR—2009/088. National Park Service, Fort Collins, Colorado.
- Levins, R. 1970. Extinction. Pages 77–107 in M. Gerstenhaber, editor. Lectures on mathematics in the life sciences. Volume 2. American Mathematics Society, Providence, Rhode Island, USA.
- Lord, J. M., and D. A. Norton. 1990. Scale and the spatial concept of fragmentation. *Conservation Biology* 4:197–202.
- McCool, S., and D. Cole. 2000. Wilderness as a place for scientific inquiry. Pages 1-2 in *Wilderness Science in a Time of Change*, Volume 3 (S.F. McCool, D.N. Cole, W.T. Borrie, J. O’Loughlin, compilers). USDA Forest Service Rocky Mountain Research Station Proceeding RMRS-P-15-VOL-3, Fort Collins, CO.
- Myers-Smith, I. H., B. C. Forbes, M. Wilmking, M. Hallinger, T. Lantz, D. Blok, K. D. Tape, M. Macias-Fauria, U. Sass-Klaassen, E. Lévesque, S. Boudreau, P. Ropars, L. Hermanutz, A. Trant, L. Siegwart Collier, S. Weijers, J. Rozema, S. A. Rayback, N. M. Schmidt, G. Schaepman-Strub, S. Wipf, C. Rixen, C. B. Ménard, S. Venn, S. Goetz, L. Andreu-Hayles, S. Elmendorf, V. Ravolainen, J. Welker, P. Grogan, H. E. Epstein and D. S. Hik. 2011. Shrub expansion in tundra ecosystems: dynamics, impacts and research priorities. *Environmental Research Letters* 6 045509 doi:10.1088/1748-9326/6/4/045509.
- National Park Service. 2005. *Geology field notes: Kobuk Valley National Preserve*. U.S. Department of the Interior, Kotzebue, AK. Available from <http://www2.nature.nps.gov/GEOLOGY/parks/noat/> (accessed 25 August 2014).
- National Park Service. 2014. Keeping It Wild in the National Park Service: A User Guide to Integrating Wilderness Character into Park Planning, Management, and Monitoring. National Park Service, Publication Number WASO 909/121797, Denver Service Center, Lakewood, CO. 219 pages.
- National Park Service, 2006. Denali National Park and Preserve Backcountry Management Plan. U.S. Department of the Interior, Denali Park, AK. 375 pages.

- National Park Service, Department of the Interior. 2013. *Director's Order #41: Wilderness Stewardship*. Washington DC.
- National Park Service, 2006. Denali National Park and Preserve Backcountry Management Plan. U.S. Department of the Interior, Denali Park, AK. 375 pages.
- Natural Sounds and Night Skies Division, National Park Service, Department of the Interior. 2013. Acoustical Monitoring Training Manual. Available from <http://www.nature.nps.gov/sound/assets/docs/NSNSDTrainingManual.pdf> (accessed 11 February 2015).
- Parsons, D.J. 2000. The challenge of scientific activities in wilderness. Pages 252-257 in *Wilderness Science in a Time of Change, Volume 3* (S.F. McCool, D.N. Cole, W.T. Borrie, J. O'Loughlin, compilers). USDA Forest Service Rocky Mountain Research Station Proceeding RMRS-P-15-VOL-3, Fort Collins, CO.
- Six, D.L., P. Alaback, R.A. Winfree, D. Snyder, and A. Hagele. 2000. Wilderness for science: Pros and cons of using wilderness areas for biological research. Pages 271-275 in *Wilderness Science in a Time of Change, Volume 3* (S.F. McCool, D.N. Cole, W.T. Borrie, J. O'Loughlin, compilers). USDA Forest Service Rocky Mountain Research Station Proceeding RMRS-P-15-VOL-3, Fort Collins, CO.
- Sullivan, T. J., T. C. McDonnell, G. T. McPherson, S. D. Mackey, and D. Moore. 2011. Evaluation of the sensitivity of inventory and monitoring national parks to nutrient enrichment effects from atmospheric nitrogen deposition: Arctic Network (ARCN). Natural Resource Report NPS/NPRC/ARD/NRR—2011/303. National Park Service, Denver, Colorado.
- Swanson, D. K. 2012. Mapping of erosion features related to thaw of permafrost in the Kobuk Valley National Preserve, Alaska. Natural Resource Data Series NPS/ARCN/NRDS—2012/248. National Park Service, Fort Collins, Colorado.
- Swanson, D. K. 2013a. Monitoring of retrogressive thaw slumps in the Arctic Network, 2012. Natural Resource Data Series NPS/ARCN/NRDS—2013/591. National Park Service, Fort Collins, Colorado.
- Swanson, D. K. 2013b. Three decades of landscape change in Alaska's arctic National Parks: Analysis of aerial photographs, c. 1980-2010. Natural Resource Technical Report NPS/ARCN/NRTR—2013/668. National Park Service, Fort Collins, Colorado.
- Tape, K., M. Sturm, and C. Racine. 2006. The evidence for shrub expansion in northern Alaska and the pan-arctic. *Global Change Biology* 12:686–702.
- Tape, K. D., D. Verbyla, and J. M. Welker. 2010. Shrub expansion along arctic Alaskan streams and gullies reduces erosion since 1980. American Geophysical Union, Fall Meeting 2010, abstract #GC53B-09

- Taylor, P. D., L. Fahrig, K. Henein, and G. Merriam. 1993. Connectivity as a vital element of landscape structure. *Oikos* 68:571–573.
- Tischendorf, L., and L. Fahrig. 2000. How should we measure landscape connectivity? *Landscape Ecology* 15(7) 633-641. DOI: 10.1023/A:1008177324187. Available from <http://link.springer.com/> (accessed 11 March 2015).
- U.S. Census Bureau. 2010. Census data for Northwestern Arctic Borough, Alaska. Available from <http://quickfacts.census.gov/qfd/states/02/02188.html> (accessed 10 April 2015).
- Walker, L. R., and S. D. Smith. 1997. Impacts of invasive plants on community and ecosystem properties. *Assessment and Management of Plant Invasions: Springer Series on Environmental Management*, pp 69-86.
- Walker, M. D., C. H. Wahren, R. D. Hollister, G. H. R. Henry, L. E. Ahlquist, J. M. Alatalo, M. S. Bret-Harte, M. P. Calef, T. V. Callaghan, A. B. Carroll, and others. 2003. Plant community responses to experimental warming across the tundra biome. *Proceedings of the National Academy of Sciences* 103: 1342-1346.

Appendix A – Overview of the framework for wilderness character monitoring

An excerpt from Keeping It Wild (Landres et al. 2008, pp. 16-17)

This interagency monitoring Framework is based on hierarchically dividing wilderness character into successively finer elements. These elements, starting from wilderness character, are:

Qualities—primary elements of wilderness character that link directly to the statutory language of the 1964 Wilderness Act. In this Framework, all [five] qualities are necessary to assess trends in wilderness character and each wilderness would be required to report the trend for each quality.

Monitoring questions—major elements under each quality that are significantly different from one another. Monitoring questions frame this monitoring to answer particular management questions. In this context, monitoring questions are similar to monitoring goals. Each wilderness and agency would be responsible for reporting on the trend for all eight monitoring questions.

Indicators—distinct and important elements within each monitoring question. In nearly all cases, there is more than one indicator under a monitoring question. Each wilderness and agency would be responsible for reporting on the trend for all 13 indicators.

Measures—a specific aspect of wilderness on which data are collected to assess trend of an indicator. In nearly all cases, there is more than one measure to provide each agency (and potentially each wilderness within an agency) a range of options for assessing trend in the indicator. Some of these measures are more accurate and precise but costly, while others are less accurate and precise but easier and less expensive to monitor. For example, under the indicator “Remoteness from sights and sounds of people inside wilderness” (see page 28 table 7), the measure “amount of visitor use” requires substantial effort and cost but is fairly precise. On the other hand, the measure “area of wilderness affected by access or travel routes” is fairly easy to compute in a Geographic Information System, but is not very precise because it doesn’t assess the number of people inside the wilderness. This range of measures allows different agencies and wildernesses to choose the measure(s) that are relevant and practical. We recommend monitoring all the measures for which data are available to give the most accurate assessment possible and, if two or more measures are monitored, that they be equally weighted to prevent giving a biased trend in the indicator.

For a few measures, the use of an “index” is recommended. In these cases, several attributes are considered simultaneously to assess trend and the different attributes may be weighted differently. For example, the index of physical development would combine the type and number of structures. Developing an index typically requires subjective judgments about the types of attributes to include, their relative weighting (for example, a dam has more impact than an outhouse), and how they would be mathematically combined. In the detailed descriptions of the measures given in Appendix A, only the types of attributes are suggested—if this interagency strategy is implemented, each agency would need to develop these indexes based on their data capabilities and needs.

Each measure is used only once, under the quality that was deemed most relevant given the broad interagency perspective of this monitoring strategy. This approach avoids problems of double-counting some measures and the bias this would introduce. However, some measures are clearly relevant to more than one quality. Agency provided system trails, shelters, and toilets, for example, are relevant to both the Undeveloped Quality and the Solitude or Primitive and Unconfined Recreation Quality. In such cases, different agencies (and different wildernesses if allowed by their home agency) may assign the measure to a different quality than what is presented in this framework. These differences are not nearly as important as consistency over time within an agency or wilderness because this monitoring strategy is based on assessing how wilderness character is changing only within a single wilderness.

If none of the recommended measures under a particular indicator are relevant to an agency or wilderness, other measures may be used or developed as long as the rationale is made clear for how the new measure is relevant to the indicator and how it is measurable, credible, and repeatable. For example, a wilderness may develop a measure that is relevant for assessing place-based aspects or other special features. We recommend that a wilderness character monitoring team within each agency be tasked to approve the use of such measures and communicate this use with the other wilderness management agencies.



Sand dunes from the air. Photo by Ken Hill, NPS

Appendix B – Priority ranking of all measures considered

Use the criteria and ranking guide below to create an overall score for each measure. If the combined score for criteria A and B is ≤ 2 , STOP and do not score criteria C and D. Those measures with the highest overall scores should be the highest priority for assessing trends in wilderness character.

A. Level of significance (the measure is highly relevant to the quality and indicator of wilderness character, and is highly useful for managing the wilderness):

High = 3 points, Medium = 2 points, Low = 1 point

B. Level of vulnerability (measures an attribute of wilderness character that currently is at risk, or might likely be at risk over 10-15 years):

High = 3 points, Medium = 2 points, Low = 1 point

C. Degree of reliability (the measure can be monitored accurately with a high degree of confidence, and would yield the same result if measured by different people at different times):

High = 3 points, Medium = 2 points, Low = 1 point

D. Degree of feasibility (the measure is related to an existing effort or could be monitored without significant additional effort):

High = 1 point, Low = 0 point (if 0 is given, do not use)

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Actions authorized by the federal land manager that intentionally manipulate the biophysical environment Measure: Number of actions to manipulate wildlife or vegetation	3	3	3	1	10	✓	
Indicator: Actions authorized by the federal land manager that intentionally manipulate the biophysical environment Measure: Number of actions to manipulate plants, pathogens, soil, water	3	1	3	1	8	✗	Very broad measure and few actions to manipulate these resources occur. When prioritizing measures, this measure had a lower score than other options.
Indicator: Actions authorized by the federal land manager that intentionally manipulate the biophysical environment Measure: Percent of fires suppressed	3	2	3	1	9	✓	
Indicator: Actions authorized by the federal land manager that intentionally manipulate the biophysical environment Measure: Number of fuel reduction efforts	2	2	1	1	6	✗	Efforts are not conducted in a quantifiable or systematic way, making monitoring unreliable and infeasible at this time.
Indicator: Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment Measure: Number of illegal wood cutting incidents	2	3	1	0	6	✗	Infeasible to monitor; difficult to quantify relative to the amount of time spent patrolling/searching.

[illegible]

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Plants Measure: Composition of terrestrial vegetation and soils	3	3	2	0	8	x	Variation of" measure as "Shrubification" included as "Measure not used" due to inability to assess trends.
Indicator: Plants Measure: Number and distribution of non-indigenous species	3	3	2	1	9	✓	Variation of this measure used: "Number of non-native and exotic species."
Indicator: Animals Measure: Abundance/distribution of brown bears	-	-	-	-	-	x	Monitoring guidance changed - abundance/distribution measures are inappropriate to monitor the Natural Quality.
Indicator: Animals Measure: Abundance/distribution/health of caribou	-	-	-	-	-	x	Monitoring guidance changed - abundance/distribution measures are inappropriate to monitor the Natural Quality.
Indicator: Animals Measure: Abundance, distribution, health of char, lake trout, and dolly varden	-	-	-	-	-	x	Monitoring guidance changed - abundance/distribution measures are inappropriate to monitor the Natural Quality.

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Animals Measure: Predator species	3	3	1	0	7	✗	Insufficient data; infeasible to monitor at this time.
Indicator: Animals Measure: Number of human-wildlife incidents	3	3	1	1	8	✓	
Indicator: Air and water Measure: Wet and dry deposition	3	3	2	1	9	✓	Variation of this measure used: "Acidifying and fertilizing pollutants."
Indicator: Air and water Measure: Water quality	2	3	1	0	6	✗	Insufficient data; infeasible to monitor at this time.
Indicator: Air and water Measure: Number of lakes created and drying	2	3	2	0	7	✗	Infeasible to assess trends.
Indicator: Ecosystem processes Measure: Number of thermokarst features	3	3	2	0	8	✗	Included as "Measure not used" due to inability to monitor trends.
Indicator: Ecosystem processes Measure: Permafrost	3	3	2	0	8	✗	Variation of this measure as "Area covered by active thaw slumps" included as "Measure not used" due to inability to monitor trends.
Indicator: Ecosystem processes Measure: Mean annual temp and precipitation	1	2	2	0	5	✗	Changes in mean annual temp and precip do not inform WCM; infeasible to assess trends.

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Ecosystem processes Measure: Fire extent and severity	2	3	2	1	8	x	Measure pertaining to fire already used in Untrammelled Quality.
Indicator: Ecosystem processes Measure: Extent of landscape connectivity	3	3	2	1	9	✓	
UNDEVELOPED QUALITY							
Indicator: Presence of non-recreational structures, installations, or developments Measure: Number of permanent non-recreational structures, installations, and developments	3	2	3	1	9	✓	Variation of this measure used; divided into of "number of above surface installations" and "number of sub-surface installations."
Indicator: Presence of non-recreational structures, installations, or developments Measure: Number of temporary non-recreational structures, installations, and developments	3	3	3	1	10	✓	Variation of this measure used; divided into of "number of above-surface installations" and "number of sub-surface installations."
Indicator: Presence of non-recreational structures, installations, or developments Measure: Number of sites of abandoned equipment and debris	3	3	2	1	9	✓	Variation of this measure used: "Weight of abandoned debris in wilderness."

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Presence of inholdings Measure: Ratio of inholdings with structures to inholdings without structures	2	1	2	1	6	×	Development occurs at a low rate such; more relevant for other WEAR wilderness areas with more, easily accessible inholdings that are more likely to be developed.
Indicator: Presence of inholdings Measure: Number of newly approved inholdings	2	1	3	1	7	✓	Variation of this measure used: "Acres of inholdings."
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport Measure: Number of hours of non-emergency NPS helicopter use	3	3	2	1	9	✓	Variation of this measure used: "Number of helicopter supported projects."
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport Measure: Number of hours of admin snowmobile and ATV use	2	2	2	1	7	×	Less significant to the KOVA than other parks, also less vulnerable due to distance to KOVA.
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport Measure: Number of hours of motorboat use	3	3	1	0	7	×	Not feasible to accurately monitor at this time.
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport Measure: Number of hours permitted of all motorized use	2	2	3	1	8	×	Very broad and doesn't specifically inform aspects of wilderness character due to broadness.

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport Measure: Number of unauthorized ATV incidents, suction dredges, and other uses that occur	3	2	1	0	6	✕	Not feasible to accurately monitor at this time.
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport Measure: Number of hours of NPS airplane use	3	2	2	1	8	✓	Variation of this measure used: "Hours of fixed-wing aircraft flight time"
Indicator: Use of motor vehicles, motorized equipment, or mechanical transport Measure: Number of hours of snowmachine use	3	2	2	1	8	✓	Variation of this measure used: "Miles of administrative snowmachine use"
SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION QUALITY							
Indicator: Remoteness from sights and sounds of human activity <i>inside</i> the wilderness Measure: Number and condition of campsites	2	2	2	1	7	✕	No data available at this time and evaluated to be less reliable and less significant than other measures of this indicator.
Indicator: Remoteness from sights and sounds of human activity <i>inside</i> the wilderness Measure: Number of researchers	2	3	3	1	8	✓	Variation of this measure used: "Number of research-days."
Indicator: Remoteness from sights and sounds of human activity <i>inside</i> the wilderness Measure: Estimates of use in the Kobuk Valley River corridor	3	2	2	0	7	✕	Not feasible to accurately monitor at this time.
Indicator: Remoteness from sights and sounds of human activity <i>inside</i> the wilderness Measure: Density and condition of use at drop-off sites	3	2	1	0	6	✕	Not feasible to accurately monitor at this time.

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Remoteness from sights and sounds of human activity <i>inside</i> the wilderness Measure: Estimates of use outside of river corridor	3	2	1	0	6	x	Not feasible to accurately monitor at this time.
Indicator: Remoteness from sights and sounds of human activity <i>outside</i> the wilderness Measure: Effects of commercial use	3	2	2	1	8	✓	Variation of this measure used: "Number of commercial operations."
Indicator: Remoteness from sights and sounds of human activity <i>outside</i> the wilderness Measure: Soundscape	3	3	3	0	9	x	Used in "Measures suggested for future use" pending available data.
Indicator: Remoteness from sights and sounds of human activity <i>outside</i> the wilderness Measure: Viewshed	3	3	3	0	9	x	Used in "Measures suggested for future use" pending available data.
Indicator: Remoteness from sights and sounds of human activity <i>outside</i> the wilderness Measure: Nightsky	3	2	2	1	8	x	Used in "Measures suggested for future use" pending available data.
Indicator: Remoteness from sights and sounds of human activity <i>outside</i> the wilderness Measure: Estimate of area in park affected by extraction activity (e.g., Red Dog and Omar)	2	3	2	1	8	x	Less reliable and feasible than other options. Threats are documented in the "threats and opportunities" section report.

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Remoteness from sights and sounds of human activity <i>outside</i> the wilderness Measure: Estimate of park area affected by roads	2	3	2	1	8	x	Less reliable and feasible than other options. Threats are documented in the "threats and opportunities" section report.
Indicator: Facilities that decrease self-reliant recreation Measure: Number of agency-provided recreation facilities	3	1	3	1	8	x	Less vulnerable than other possible measures
Indicator: Facilities that decrease self-reliant recreation Measure: Number of user-created recreation facilities	1	2	3	1	7	x	User created "facilities" are rare and any that are found would be removed by WEAR.
Indicator: Facilities that decrease self-reliant recreation Measure: Number of landing strips	3	3	3	1	10	✓	
Indicator: Management restrictions on visitor behavior Measure: Number of restrictions on visitor behavior	3	2	3	1	9	✓	Variation of this measure used: "Index of management restrictions."
Other Features Quality							
Indicator: Deterioration or loss of integral historical or cultural features Measure: Number of unauthorized actions that result in disturbances to cultural resources (looting, trespass activities, non-compliance with NHPA)	3	2	1	0	6	x	

Potential Measure	A. Significance	B. Vulnerability	C. Reliability	D. Feasibility	Total Score	Included?	Comments
Indicator: Deterioration or loss of integral historical or cultural features Measure: Number of authorized actions that result in disturbances to cultural resources [visitor and commercial use (catholes, trampling, hearths, aircraft landings, etc.); findings of adverse effect for projects and operations]	2	2	3	1	8	x	
Indicator: Deterioration or loss of integral historical or cultural features Measure: Number of naturally caused disturbances (erosion, animal digging, floods, rising sea levels, fires, tree throws)	3	3	2	1	9	✓	Variation of this measure used: "Percent of impacted and threatened cultural resource sites."

Appendix C – What is a trammeling action?

What is a trammeling action?

By Peter Landres, Aldo Leopold Wilderness Research Institute

From *Keeping it Wild 2* (Landres et al. 2015, p.101)

This appendix provides guidelines and examples to clarify what is and is not a trammeling action. These are intended to capture about 90% of the cases and provide sufficient guidance for local staff to figure out the novel and rarer cases as they occur. A trammeling action is defined as an action that intentionally manipulates “the earth and its community of life” inside a designated wilderness or inside an area that by agency policy is managed as wilderness.

The following terms and phrases clarify this definition above:

- Intentional: done on purpose; deliberate; willful.
- Manipulation: an action that alters, hinders, restricts, controls, or manipulates “the earth and its community of life” including the type, amount, or distribution of plants, animals, or physical resources.
- Intentional manipulation: an action that purposefully alters, hinders, restricts, controls, or manipulates “the earth and its community of life.”

Two concepts are crucial for understanding what is and is not a trammeling action: restraint and intention. Restraining our power to manipulate or control the earth and its community of life is at the core of the Untrammelled Quality of wilderness character. Trammeling actions occur when opportunities for restraint are ignored or bypassed; when there is no opportunity for restraint, there is no opportunity to trammel. Wilderness legislation and policies mandate that managers exercise restraint when authorizing actions that interfere with or control wilderness ecological systems. While other agencies, organizations, and the public are not beholden to these same restrictions, activities that have not been authorized by the federal land manager and that manipulate the wilderness environment are counted as trammeling actions.

The second concept central to the idea of trammeling is intentionality. Actions that deliberately interfere with, manage, or control an aspect of wilderness ecological systems are intentional and clear instances of trammeling. As explained in the chapter on the Untrammelled Quality, intentional actions are counted as a trammeling regardless of the magnitude of their effects (including areal extent, intensity, frequency, and duration). For pragmatic reasons, however, some actions are not monitored if they fall below a minimum practical threshold of scale and scope (for example, hand pulling a few individual noxious plants). Much more complex and nuanced is determining whether to include actions whose purpose is not to manipulate the earth and its community of life, but some manipulation of the environment is required to produce the desired outcome. These types of actions can be confusing because the biophysical environment is intentionally manipulated even though it is

not the purpose behind the action. In general, when such actions have substantial and foreseeable effects on the wilderness ecosystem, they are counted as a trammeling.

The following sections describe three types of activities: those that *are* trammeling actions, those that are *not* trammeling actions, and those that *may be* trammeling actions. Following these sections, a flowchart provides general guidance for making these determinations.

Activities that are trammeling actions

There are two broad classes of trammeling actions: those that are authorized by the federal wilderness manager, and those that are not. Three subclasses under each of these reflect whether the action is taken on a biological resource, on a physical resource, or on a resource outside the wilderness with the intent to manipulate biophysical resources within the wilderness.

Agency authorized trammeling actions. These are actions that are authorized by the federal wilderness manager as well as actions by other agencies, organizations, or individuals that have been approved or permitted by the federal land manager.

- 1) Actions taken inside the wilderness on a *biological* resource to intentionally affect “the earth and its community of life.” Examples include:
 - a) Removing or killing indigenous or non-indigenous vegetation or fish and wildlife.
 - b) Adding or restoring indigenous or non-indigenous vegetation or fish and wildlife.
 - c) Using chemicals or biocontrol agents to control indigenous or non-indigenous vegetation or fish and wildlife.
 - d) Collecting, capturing, or releasing plants and animals under a research permit.
 - e) Enclosing or excluding fish and wildlife from an area.
- 2) Actions taken inside the wilderness on a *physical* resource or natural process to intentionally affect “the earth and its community of life.” Examples include:
 - a) Suppressing naturally-ignited fire.
 - b) Lighting fire (under management prescription) for any purpose.
 - c) Constructing or maintaining a dam, water diversion, guzzler, or other persistent installation intended to continuously alter wilderness hydrology; each agency will need to determine their counting rules for monitoring such installations.
 - d) Adding acid-buffering limestone to water to neutralize the effects of acid deposition.
- 3) Actions taken *outside* the wilderness on a physical or biological resource or process to intentionally affect “the earth and its community of life” inside a wilderness. Examples include:
 - a) Cloud seeding to intentionally increase precipitation inside the wilderness.
 - b) Damming a river outside a wilderness to intentionally alter the hydrology inside the wilderness.
 - c) Killing fish and wildlife outside the wilderness, or planting or stocking fish or wildlife outside the wilderness, to intentionally affect the population or distribution of this species inside the wilderness.

Unauthorized trammeling actions. These are citable or other actions taken by other agencies, organizations, or individuals that have not been authorized, approved, or permitted by the federal wilderness land manager.

- 1) Actions taken inside the wilderness on a *biological* resource to intentionally affect “the earth and its community of life.” Examples include:
 - a) Adding or removing plants or fish and wildlife.
 - b) Other direct manipulation of plants or fish and wildlife.
 - c) Indirect manipulation of fish and wildlife, such as changing hunting regulations with the goal of decreasing predator populations within the wilderness.
- 2) Actions taken inside the wilderness on a *physical* resource or natural process to intentionally affect “the earth and its community of life.” Examples include:
 - a) Setting arson fire.
 - b) Modifying water resources to provide water for wildlife, or otherwise store water or alter the timing of water flow.
- 3) Actions taken *outside* the wilderness on a physical or biological resource to intentionally affect “the earth and its community of life” inside a wilderness. Examples include:
 - a) Releasing or killing species outside of the wilderness with the intention to affect populations whose ranges expand into the wilderness.

In some situations, staff may assume that they do not have the opportunity for restraint because an action is required to comply with other laws or agency policies, or to protect human life or property. Examples of such situations include restoring habitat for a listed endangered species, spraying herbicides to eradicate an invasive non-indigenous plant that is degrading wildlife habitat, transplanting an extirpated species back into the wilderness, or suppressing a naturally-ignited fire. These are still considered trammeling actions because even in these situations staff are deciding to take action as well as deciding the type and intensity of action.

Activities that are not trammeling actions

Actions for which there is no opportunity for managerial or individual restraint are not considered a trammeling. For example, climate change, air pollutants wafting into a wilderness, and the presence of non-indigenous species that naturally dispersed into a wilderness are not intentional decisions or actions, and therefore do not provide an opportunity for management restraint. Accidental unauthorized actions, such as escaped campfires and oils spills, similarly lack an opportunity to restrain our power over the landscape. Past actions that manipulated the biophysical environment before the area was designated as wilderness are not considered a trammeling because the provisions of the 1964 Wilderness Act did not apply to the area prior to designation.

Another group of examples that are not a trammeling encompass those small-scale actions with no intent to manipulate the earth and its community of life, such as installing meteorological or other science instrumentation, landing a helicopter for search and rescue operations, and removing trash.

Camping violations, unauthorized motorized incursions, and other illegal activities that are not intended to manipulate the biophysical environment are also not counted as trammeling actions; legality is irrelevant in determining whether an action is a trammeling.

Hunting, for sport or subsistence, has provoked an enormous amount of discussion about whether it degrades the Untrammelled Quality. The consensus from the Lessons Learned Workshop was that hunting is generally not a trammeling action because individual hunters are taking individual animals without the intention to manipulate the wildlife population. However, if a state wildlife agency manipulates hunting quotas (or takes other management action) to alter the predator/prey relationship to maximize certain hunting opportunities, this manipulation of the “community of life” would degrade the Untrammelled Quality (see above).

Activities that may be trammeling actions

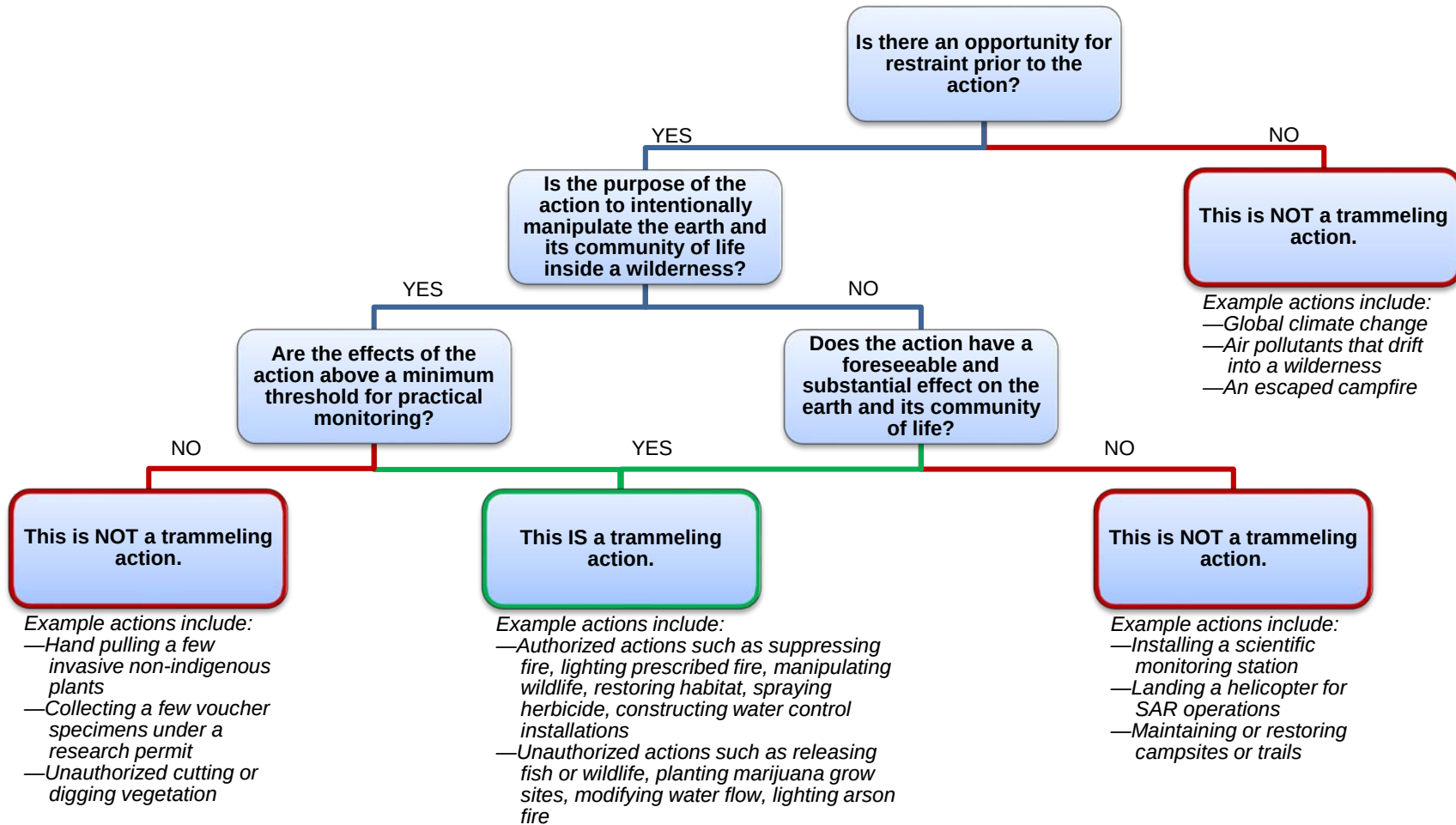
There are two types of actions that may or may not be considered trammeling actions. The first includes intentional manipulations that interfere with or control an aspect of wilderness ecosystems but are too small in scale or scope to be practically monitored. The second type encompasses those nuanced cases where the primary purpose of the action is not to manipulate the ecosystem but a foreseeable and substantial effect on the earth and its community is required to achieve this purpose. As shown in Table 11 below, several hypothetical situations illustrate how an action may or may not be a trammeling depending on the extent of the action and its effects. Each bullet in the table presents a situation where the action being taken likely would, or would not, be considered a trammeling.

Table 31. Examples of actions that likely are not, and likely are trammeling actions based on the scale and scope of the action and its effects on the earth and its community of life.

Action	Likely Not a Trammeling	Likely a Trammeling
Treating non-indigenous invasive plants	Hand pulling a small area of non-indigenous invasive plants	Spraying herbicide
Permitting scientific activities	- Installing research plot monumentation, such as rebar stakes or nails - Installing most scientific instrumentation - Collecting a limited number of voucher specimens with no impact on species distribution or abundance	- Installing enclosures or exclosures - Installing instrumentation that disrupts the movement or behavior of plants, or fish and wildlife - Capturing, collaring, and releasing wildlife
Building system trail	- Routing a trail around a rock slide - Building a bridge across a stream to prevent stream bank erosion - Installing a small section of corduroy across a wet area - Installing in waterbars or building rock-cribbing	- Routing a trail through an area of sensitive alpine butterfly habitat - Building a large amount of trail to go around a section of river or cliff - Building a trail that requires extensive earth movement or tree cutting
Obliterating non-system trail	Piling vegetation or rocks at the beginning and end of trail sections that cut a switchback	Obliterating a large section of non-system trail that requires extensive earth movement
Restoring campsites	- Restoring a single, isolated campsite - Restoring a number of campsites that don't require disrupting the soil or vegetation in the surrounding area	Restoring a number of campsites that requires moving a significant amount of soil or number of plants in the surrounding area
Removing hazard trees	Removing one or a few hazard trees that threaten designated campsites or that are along a trail	Removing all of the hazard trees over a large area

Flowchart

The flowchart below is intended to provide general guidelines to help agency staff determine when an action should be considered a trammeling. The first question asks if there is an opportunity for restraint, and is placed first to help avoid confusing those actions that are beyond the scope of management control, or are unauthorized accidents, from actions that managers or others do have an opportunity to influence. Political considerations are not a factor in determining whether or not there is an opportunity for restraint. The second question examines the intentionality of the action and whether the purpose is to manipulate the earth and its community of life. If there is a clear intent to manipulate, then the action is counted as a trammeling unless it does not meet a minimum threshold for practicable monitoring. If the purpose of the activity is not to manipulate the ecological system, the action is nonetheless considered a trammeling if it results in foreseeable and substantial effects to the wilderness ecosystem.



The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 187/130983, January 2015

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov