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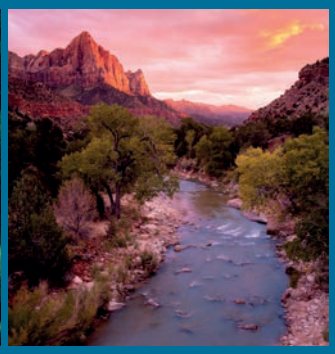


# Keeping It Wild 2

## An Updated Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System

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Forest Service
Rocky Mountain Research Station
General Technical Report RMRS-GTR-340
October 2015

Landres, Peter; Barns, Chris; Boutcher, Steve; Devine, Tim; Dratch, Peter; Lindholm, Adrienne; Merigliano, Linda; Roeper, Nancy; Simpson, Emily. 2015. **Keeping it wild 2: an updated interagency strategy to monitor trends in wilderness character across the National Wilderness Preservation System.** Gen. Tech. Rep. RMRS-GTR-340. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 114 p.

## Abstract

*Keeping It Wild 2* is an interagency strategy to monitor trends in selected attributes of wilderness character based on lessons learned from 15 years of developing and implementing wilderness character monitoring across the National Wilderness Preservation System. This document updates and replaces *Keeping It Wild: An Interagency Strategy for Monitoring Wilderness Character Across the National Wilderness Preservation System* (Landres and others 2008), and provides a foundation for agencies to develop a nationally consistent approach to implement this monitoring. This monitoring strategy addresses two questions: How do stewardship activities affect attributes of wilderness character? How are attributes selected as integral to wilderness character changing over time within a wilderness, within an agency, and across the National Wilderness Preservation System? The primary audiences for the information from this monitoring are agency staff who manage wilderness day-to-day, and regional and national staff who develop wilderness policy and assess its effectiveness. The results of this monitoring will provide these staff some of the key data they need to improve wilderness stewardship and wilderness policy. *Keeping It Wild 2* is designed to be nationally consistent across the four wilderness managing agencies and locally relevant, to be cost-effective, and to facilitate communication across the many resource programs that are responsible for preserving wilderness character. Implementing this monitoring strategy does not guarantee the preservation of wilderness character, but it informs and improves wilderness stewardship, and ensures managers are accountable to the central mandate of the 1964 Wilderness Act—to preserve wilderness character.

***Keywords:*** Wilderness Act, wilderness, wilderness character, wilderness stewardship, monitoring, untrammeled, natural conditions, undeveloped, solitude, primitive and unconfined recreation, other features of value

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Cover design by Marianne Michalakis of designMind, Washington, DC.

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## Acknowledgments

We have stood on the shoulders of hundreds of people to develop this revised and updated interagency strategy to monitor trends in wilderness character throughout the National Wilderness Preservation System. First and foremost, we thank the home units of all the authors for supporting their involvement in this endeavor, especially the field offices who generously allowed their staff to work on this national and interagency effort. This updated and revised interagency strategy would not have been possible without this support.

This document has been years in the making, and was supported in many ways, both large and small, over this time by the four federal agencies with administrative responsibility for wilderness. The *Keeping It Wild 2* team has drawn inspiration and substance for this interagency strategy from the original Forest Service (FS) Wilderness Monitoring Committee, who, along with participants from the other agencies, had the foresight, gumption, and persistence to begin developing the first national framework for monitoring wilderness character in 2001. We also thank the former and current members of the Interagency Wilderness Policy Council, Interagency Wilderness Steering Committee, and Arthur Carhart National Wilderness Training Center for their constant support and confidence over the last 14 years.

A long-term effort such as this requires funding to get the work done, and Patrick Gregerson, Chief of Planning and Special Projects for the National Park Service (NPS), and Mark Chase, Chief of the Natural Resource Program Center for the Fish and Wildlife Service (FWS), were two key people who, at exactly the right moment, generously provided the funding needed to accomplish critical phases of this effort. Susan Fox, Director of the Aldo Leopold Wilderness Research Institute, former Institute Director Dave Parsons, and Connie Myers, Director of the Arthur Carhart National Wilderness Training Center, were instrumental in supporting their staff to develop this monitoring and in countless other ways. We thank all of these people for their vision and leadership to help establish a way to preserve wilderness character.

Each agency played a crucial role in keeping the flame of wilderness character monitoring alive and each of these individual efforts ultimately coalesced into this updated interagency monitoring strategy.

- For the Bureau of Land Management (BLM), special thanks go to the late Jeff Jarvis, former Division Chief of the BLM's National Landscape Conservation System, who had the foresight back in 2002 to encourage BLM participation in what had been to that point solely a Forest Service effort to determine how we might monitor changes in wilderness character; and to former Director Bob Abbey and Deputy Director Mike Pool, who immediately grasped the importance of BLM's implementation of the original *Keeping It Wild* monitoring strategy, and ordered full compliance in 2010. Credit goes to the following former and current employees who, along with the two BLM contributors to *Keeping It Wild 2*, helped develop BLM's Implementation Guides: Paul Fuselier, Dave Jacobson, Jerry Magee, Chris Roholt, James Sippel, Jennifer Taylor, Jim Weigand, and Bob Wick. Melissa Buzzard of the Great Basin Institute provided additional assistance.

- For the Fish and Wildlife Service, Jim Kurth played a crucial role in supporting and promoting wilderness character monitoring as an interagency effort over many years as Chief of the National Wildlife Refuge System (NWRS) and as a member and Chair of the Interagency Wilderness Policy Council. Thanks to his dedication, the FWS completed wilderness character baseline assessments for all NWRS designated wildernesses by the end of 2014 in honor of

the 50th anniversary of the Wilderness Act. Credit also goes to the following employees who, in addition to the two FWS contributors to *Keeping It Wild 2*, were on the NWRS Wilderness Character Monitoring team that was crucial to getting buy-in from the Refuge System Regional Chiefs and the Refuge Managers: Mitch Ellis, Steve Henry, Brian Anderson, Karen Lindsey, Nancy Hoffman, Curt McCasland, Sara Aicher, Jill Webster, Steve Hicks, and Elaine Johnston. Special thanks to Peter Dratch for ensuring that the NWRS Inventory and Monitoring policy retained a commitment to include wilderness character in the inventory and monitoring plans of wilderness refuges.

- For the Forest Service, dozens of employees have been involved to develop an approach for monitoring wilderness character through helping to craft the initial agency monitoring protocol, participating in pilot testing, or commenting on draft documents. Special thanks to Jerry Stokes, then the National Wilderness Program Lead, who in 1999 supported the initial proposal and funded the creation of the FS Wilderness Monitoring Committee. This committee, including FS members Steve Boutcher, Beth Boyst, MaryBeth Hennessy, Brad Hunter, Patrice Janiga, Mark Laker, Peter Landres, Al McPherson, Linda Merigliano, Doug Powell, Mike Rowan, and Susan Sater, and interagency partners Chris Barns (BLM), Denis Davis (NPS), and Steve Henry (FWS), had the vision and creativity to develop the initial framework for wilderness character monitoring. Special recognition goes to the significant contribution made by the FS "brain trust" who led this effort, through fits and starts, for the better part of a decade, including Liese Dean, Bjorn Fredrickson, and Troy Hall of Oregon State University. Special thanks to Linda Merigliano for unwavering passion, intelligence, and integrity every step of the way.
- For the National Park Service, special thanks go to Garry Oye, former Division Chief for Wilderness Stewardship, and Cam Sholly, former Associate Director for Visitor and Resource Protection, whose support and drive made wilderness character monitoring an integral part of NPS policy and guidance. We thank Erin Drake and Ryan Scavo, consummate professionals, for helping in every possible way to ensure the practical development and application of wilderness character monitoring in the NPS. Recognition goes to the NPS Wilderness Character Integration Team (Michael Bilecki, Carol Cook, Sarah Craighead, Jeremy Curtis, Tim Devine, Sandee Dingman, Michael Haynie, Chris Holbeck, Chip Jenkins, Peter Landres, Adrienne Lindholm, Melissa Memory, Christina Mills, Ray O'Neil, Ruth Scott, Miki Stuebe, Suzy Stutzman, Karen Trevino, Frank Turina, and Wade Vagias), who used their vision, passion, and 234 years of combined on-the-ground experience to develop *Keeping it Wild in the National Park Service: A User Guide to Integrating Wilderness Character into Park Planning, Management, and Monitoring*. We thank the NPS Regional Wilderness Coordinators and the current and former members and liaisons of the NPS Wilderness Leadership Council for their helpful comments, encouragement, and support along the way. We thank the wilderness units and field staff who provided much-needed field testing and critical as well as constructive comments. We appreciate all the help from the Alaska national parks, who were early adopters of wilderness character monitoring, and special thanks to Guy Adema, Team Leader for NPS Alaska Regional Natural Resources, for consistently supporting the NPS Wilderness Stewardship Program.

We thank all 43 Wilderness Fellows, who, from 2010 to 2015, implemented wilderness character monitoring in the NPS, FWS, and FS. Their pluck, enthusiasm, and passion allowed them to (quickly) push against the boundaries of implementing this new interagency monitoring—their constant questions and constructive input helped shape many of the details in *Keeping It Wild 2*. We are grateful for the vision of Wade Vagias for conceiving the Wilderness Fellows Program within the NPS Wilderness Stewardship Division, to Mark Chase for making the Interagency Wilderness Fellows Program a reality, and to Suzy Stutzman, former NPS Intermountain Regional Wilderness Program Coordinator, and Patrick Malone, NPS Intermountain Region Assistant Regional Director of Natural Resources, for keeping the NPS Wilderness Fellows Program alive. We thank Shane Barrow and Hannah Wendel, of American Conservation Experience, for being such willing partners to make the Wilderness Fellows Program work.

We thank Simon Kingston of the NPS Inventory and Monitoring Program for developing the first Wilderness Character Monitoring Database, and Richard Easterbrook of FWS' Fish & Wildlife Inventory and Monitoring Initiative, who helped develop it further. We also thank Lisa Ronald for significant and timely help to get the database hosted on the Wilderness.net server.

We are indebted to the approximately 250 agency employees who helped develop, review, criticize, and pilot test wilderness character monitoring protocols over the past 15 years; their lack of cynicism and love for wilderness made the work fun, exciting, and useful. We are also indebted to Nyssa Landres and Elizabeth Mejicano, both former Wilderness Fellows who are now working for the NPS and Aldo Leopold Wilderness Research Institute, respectively, for their constant diligence and thoughtfulness in constructively criticizing every single aspect of *Keeping It Wild 2*. Their hands-on experience and willingness to develop new and better ways of thinking about wilderness character monitoring have been a huge asset to this updated interagency monitoring strategy and the preservation of wilderness character across the National Wilderness Preservation System.

We thank Catherine Filardi and Cynthia Moser for all of their editing that helped make *Keeping It Wild 2* readable and therefore understandable. Luke Boehnke made the figure in appendix 1 and the hypothetical reports shown in appendix 5 look great. Photos of fire and fire management in appendix 5 are courtesy of Kari Greer and the National Interagency Fire Center.

Last, we thank the many people who generously gave their time to review and discuss various drafts of this updated interagency strategy. Their criticisms, questions, ideas, and suggestions helped refine the overall picture and myriad details of this interagency strategy. These people, in alphabetical order, are: Sara Aicher, Adam Barnett, Mike Belicki, David Cole, Aaron Collins, Carl Davis, Steve Delahanty, John Dennis, Mark Fincher, Bjorn Fredrickson, Jimmy Gaudry, Brian Glaspell, Carol Griffin, Roger Kaye, Steve Kimball, Laura Kirn, Jerry Magee, Merry Maxwell, George Nickas, Ray O'Neil, Doug Scott, Roger Semler, James Sippel, Jake Weltzin Molly Westby, and Ed Zahniser. We thank all these people for sharing a passion for wilderness and its enduring benefits, and for helping preserve the character of these special places.

## Dedication

We dedicate this publication to all the current and former agency employees working for wilderness, who, on the ground and in their cubicles, and despite limited agency resources, strive to make the right decision and do the right thing to preserve the enduring benefits of wilderness for present and future generations.

We also dedicate this publication to Avery Lindholm—may her spirit run free and wild forever.

## Executive Summary

*Keeping It Wild 2* provides a tested and refined interagency strategy to monitor trends in wilderness character based on lessons learned from 15 years of experience developing and implementing wilderness character monitoring across the National Wilderness Preservation System. This document updates and replaces *Keeping It Wild: An Interagency Strategy for Monitoring Wilderness Character Across the National Wilderness Preservation System* (Landres and others 2008), and provides a foundation for the four federal wilderness managing agencies (the Bureau of Land Management, National Park Service, Fish and Wildlife Service, and Forest Service) to develop a nationally consistent approach to wilderness character monitoring.

This interagency monitoring strategy incorporates a wide variety of information and data from different resource programs into a coherent understanding of what makes wilderness unique among all federal lands—its wilderness character. Wilderness character monitoring provides the agencies:

- Information to improve on-the-ground wilderness stewardship and wilderness policy reviews that is based on credible data that are consistently collected and endure over time as personnel change.
- Accountability for the legal and policy mandate "to preserve wilderness character" that links key stewardship activities directly to the Wilderness Act of 1964.
- A communication framework to comprehensively discuss wilderness stewardship needs and priorities within and among the four wilderness managing agencies and with the public.

This interagency strategy is designed to be nationally consistent and locally relevant. The statutory language of the Wilderness Act is used to identify five qualities of wilderness character that form the foundation of this monitoring strategy: "Untrammeled," "Natural," "Undeveloped," "Solitude or Primitive and Unconfined Recreation," and "Other Features of Value." Each quality is described with consistent monitoring questions and indicators but assessed with specific measures identified by the agency or local wilderness managers.

This interagency strategy provides a standardized approach for monitoring how wilderness character is changing over time in every wilderness. This approach describes:

- A framework to monitor tangible attributes of wilderness character.
- How wilderness character monitoring helps fulfill legal and policy mandates, and improve wilderness stewardship.
- Key principles of this monitoring strategy.
- Guidelines for selecting locally relevant measures.
- Rules used to assess trend in the measures, indicators, monitoring questions, and qualities, and in wilderness character.
- Misuses, misconceptions, and known concerns about wilderness character monitoring and how this interagency strategy addresses these concerns.

Implementing this monitoring strategy does not guarantee the preservation of wilderness character, but it informs and improves wilderness stewardship, and ensures managers are accountable to the central mandate of the Wilderness Act—to preserve wilderness character.

# Contents

# Introduction

The 1964 Wilderness Act's Statement of Policy, Section 2(a) states that wilderness areas "shall be administered ... so as to provide for the protection of these areas, the preservation of their wilderness character" (Public Law 88-577; Wilderness Act 1964). This affirmative legal mandate and pursuant policies of the four federal wilderness managing agencies (the Department of the Interior's Bureau of Land Management, Fish and Wildlife Service, and National Park Service, and the Department of Agriculture's Forest Service; hereafter BLM, FWS, NPS, and FS, respectively) apply to all wildernesses across the National Wilderness Preservation System (NWPS). These legal and policy mandates raise a simple question: How do we know if we are preserving wilderness character?

A brief history of agency efforts to answer this question is given in appendix 1. The 2008 publication of *Keeping It Wild: An Interagency Strategy for Monitoring Wilderness Character Across the National Wilderness Preservation System* (Landres and others 2008) provided the first nationally consistent interagency strategy to assess whether wilderness character is being preserved. As each agency independently implemented this 2008 monitoring strategy and applied the concept of wilderness character to planning and management, agency-specific adjustments were made to improve the relevance and applicability of these concepts. These agency-specific modifications substantially improved several aspects of the interagency monitoring strategy, but also jeopardized the strategy's goal of national consistency across the NWPS.

In March 2014, the Aldo Leopold Wilderness Research Institute organized an Interagency Wilderness Character Monitoring Lessons Learned Workshop. The purpose of this workshop was to build on what had been learned since *Keeping It Wild* was published in 2008 and make necessary corrections to ensure future interagency consistency in wilderness character monitoring. Workshop participants (see appendix 1) reviewed each agency's modifications to the wilderness character conceptual framework and monitoring strategy to develop a consensus view for improving wilderness character monitoring. Interaction among the four wilderness agencies at this workshop was necessary to help ensure successful implementation of wilderness character monitoring across the NWPS (see Roux and others 2006). The findings from this workshop and several recent publications (BLM 2012; NPS 2014a, 2014b) are the basis for *Keeping It Wild 2*, which updates and replaces the original 2008 publication. Appendix 2 summarizes the major changes made to the 2008 *Keeping It Wild*.

## Purpose and Scope of This Interagency Monitoring Strategy

The primary purpose of this monitoring strategy is to improve wilderness stewardship by providing wilderness managers across the four agencies—from field offices to national headquarters—a tool to assess how attributes of wilderness character are changing over time. This monitoring strategy provides information to help answer two key questions about the outcomes of wilderness stewardship:

Facing page: Yosemite Wilderness, Nick Carver photo (nick@nickcarverphoto.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

- How do stewardship activities affect attributes of wilderness character?
- How are attributes selected as integral to wilderness character changing over time within a wilderness, within an agency, and across the NWPS?

To answer these questions and fulfill this larger purpose, this monitoring provides information for two primary agency audiences: local staff charged with managing wilderness consistent with agency policy, and regional and national staff charged with developing agency wilderness policy and assessing its effectiveness. By ensuring this information is based on credible data that are consistently collected and will endure over time even as personnel change, this monitoring will provide both audiences some of the key data they need to improve wilderness stewardship and wilderness policy. As succinctly stated by Schindler and Hilborn (2015), "Without monitoring and assessment, we have no way to determine when changes to management are needed."

Attributes that are integral to the area's wilderness character but that are not directly under the jurisdiction of managers are also included in this monitoring. Examples of these resources are night skies and air quality. By monitoring these resources, a more comprehensive understanding is gained of how wilderness character is changing over time and whether or not these changes are due to factors within or beyond managers' jurisdiction. Such a holistic view of wilderness character informs our understanding of broad-scale, regional, and cumulative impacts to wilderness character.

This monitoring applies to every wilderness within the NWPS. Together, the four agencies administer slightly over 108.9 million acres of designated wilderness, or about 17 percent of all the land managed by these agencies. This is a substantial amount of land nationwide, and a substantial proportion of the land portfolio of the four agencies with responsibility for wilderness stewardship (table 1).

**Table 1**—Summary of designated wilderness within each of the wilderness managing agencies.[a]

| Agency | Number of Wilderness Units Within Each Agency[b,c] | Number of Wilderness Acres Within Each Agency[b] | Percent of Total Agency Acreage That is Designated Wilderness[d] | Percent of NWPS Acres Within Each Agency[b] |
|---|---|---|---|---|
| DOI Bureau of Land Management | 222 | 8,736,113 | 3.5 | 8 |
| DOI Fish and Wildlife Service | 71 | 19,862,488 | 23.3 | 18 |
| DOI National Park Service | 61 | 43,932,843 | 55.1 | 40 |
| USDA Forest Service | 442 | 36,385,240 | 18.7 | 33 |

[a] NWPS = National Wilderness Preservation System. DOI = Department of the Interior. USDA = U.S. Department of Agriculture.

[b] Source: Wilderness.net [accessed August 24, 2015].

[c] There are 762 wildernesses within the NWPS, but the total number of wilderness units in this table is 796 because 34 units are managed by more than one of the four wilderness management agencies.

[d] Source: Calculated from the total number of wilderness acres (Wilderness.net [accessed August 24, 2015]) and the total acreage for each agency derived from Gorte and others (2012).

The scope of this monitoring strategy is intentionally limited in several ways because wilderness character is a complex concept with tangible, intangible, ethical, societal, legal, personal, local, and national dimensions. From the outset this monitoring strategy has endeavored to create a pragmatic and effective way to assess trend in wilderness character. To limit its scope practically, this interagency strategy:

- Applies to all areas that are designated by Congress as wilderness, and also to areas that are not designated as wilderness but are managed under law or agency policy to either preserve wilderness character or maintain the potential for future designation as wilderness. The strategy does not apply to other types of protected areas outside the mandate of the Wilderness Act.
- Monitors tangible attributes of the five qualities (explained below) of wilderness character derived from the Definition of Wilderness, Section 2(c) in the Wilderness Act, and does not monitor the intangible, symbolic, societal, or personal values, meanings, and benefits of wilderness character.
- Assesses trend in wilderness character over time for an entire wilderness, and does not assess how wilderness character is changing in specific locations within a wilderness, or how wilderness character compares across different wildernesses.
- Supports minimum requirements and National Environmental Policy Act analyses by helping staff organize information on the effects of proposed projects, but does not determine the significance of effects or replace agency decision processes.
- Does not fulfill all of the monitoring requirements that are needed to manage an individual wilderness. For example, monitoring for specific projects or compliance monitoring for special use permits are not part of wilderness character monitoring.

## Overview of This Interagency Monitoring Strategy

This interagency strategy is designed to synthesize a wide variety of data from different resource programs into a coherent understanding of what makes wilderness unique among all other federal lands—its wilderness character. This strategy is structured around the following process:

- To ensure national consistency, all agencies use the strategy's organizational framework of qualities, monitoring questions, and indicators (table 2) for each wilderness. One or more measures are selected for each indicator that are either chosen by the local office managing the wilderness or required by the managing agency.
- Data are collected, gathered, or compiled for each measure, using existing resources wherever possible.
- Once there are at least two data points per measure, a trend (upward, stable, or downward) is determined based on agency-required or locally established rules. Trends in each measure are reported at 5-year intervals (even though data for some measures may need to be gathered annually).
- Trends in each measure within an indicator are compiled by using consistent rules (described in the Assessing Trend in Wilderness Character section, below) to determine the trend in the indicator. Only the trends in the measures, not the data, are compiled. These same rules are then used to determine the trend in each monitoring question, each quality, and ultimately the overall trend in wilderness character.
- Once the trend in wilderness character for each wilderness is determined, the percentage of wildernesses with an upward or stable trend in wilderness character within a region, an agency, and across the NWPS can be derived.

**Table 2**—Summary of the nationally consistent qualities, monitoring questions, and indicators used to organize and structure this interagency strategy to monitor trend in wilderness character.

| Quality | | Monitoring Question | Indicator |
|---|---|---|---|
| WILDERNESS CHARACTER | Untrammeled | What are the trends in actions that intentionally control or manipulate the "earth and its community of life" inside wilderness? | Actions authorized by the federal land manager that intentionally manipulate the biophysical environment |
| | | | Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment |
| | Natural | What are the trends in the natural environment from human-caused change? | Plants |
| | | | Animals |
| | | | Air and water |
| | | | Ecological processes |
| | Undeveloped | What are the trends in non-recreational physical development? | Presence of non-recreational structures, installations, and developments |
| | | | Presence of inholdings |
| | | What are the trends in mechanization? | Use of motor vehicles, motorized equipment, or mechanical transport |
| | Solitude or Primitive and Unconfined Recreation | What are the trends in outstanding opportunities for solitude? | Remoteness from sights and sounds of human activity *inside* wilderness |
| | | | Remoteness from sights and sounds of human activity *outside* the wilderness |
| | | What are the trends in outstanding opportunities for primitive and unconfined recreation? | Facilities that decrease self-reliant recreation |
| | | | Management restrictions on visitor behavior |
| | Other Features of Value (to be determined if relevant by the local unit) | What are the trends in the unique features that are tangible and integral to wilderness character? | Deterioration or loss of integral cultural features |
| | | | Deterioration or loss of other integral site-specific features of value |

# Overview of Wilderness Character

This section provides an overview of what wilderness character is, why the agencies need to focus on it, and the benefits to stewardship from this focus. Five "qualities" are derived from the legal definition of wilderness to provide a practical connection to the concept of wilderness character. These qualities form the basis of this interagency monitoring strategy, and key premises for using them in this strategy are discussed. Finally, terminology is reviewed to ensure consistency across the four wilderness managing agencies in discussing wilderness character and implementing this monitoring strategy.

## Defining Wilderness Character

Although wilderness character is not explicitly defined in the Wilderness Act, *Keeping It Wild 2* builds on the lessons learned from 15 years of experience developing and implementing wilderness character monitoring to frame this monitoring strategy around the following definition of wilderness character. 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 relatively 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 all other lands.

These tangible and intangible values of wilderness character form a complex set of relationships with the land, its stewardship, its users, and society. Howard Zahniser (1956, p. 40) described these relationships as "... the *distinctive* ministration of wilderness to modern man, the characteristic effect of an area which we most deeply need to provide for in our preservation programs" (emphasis in original), and stated that "to know the wilderness is to know a profound humility, to recognize one's littleness, to sense dependence and interdependence, indebtedness, and responsibility." Other writing by and about Zahniser (Harvey 2005, Zahniser 1992), as well as the classic writing about wilderness from other authors (for example, Leopold 1949, Marshall 1930, Olson 1957), strongly reinforces the idea that, fundamentally, wilderness character is the capacity of an area to elicit humility, to awaken a sense of relationship and interconnectedness with the community of life, and to evoke a feeling of restraint and obligation towards nature.

"The purpose of the Wilderness Act is to preserve the wilderness character of the areas to be included in the wilderness system, not to establish any particular use."

Howard Zahniser (1962, p. 1301)

## The Need to Focus on Wilderness Character

Focusing on wilderness character and monitoring how it changes over time will provide concrete information to help managers comply with law, fulfill agency policy, and improve wilderness stewardship.

Facing page: Jedediah Smith Wilderness, John Richter photo (john@richterfineartphotography.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

### *Comply with law*

The Statement of Policy, Section 2(a), in the Wilderness Act states that wilderness areas "shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, *and so as to provide for the protection of these areas, the preservation of their wilderness character*" (emphasis added). Legal scholars (for example, McCloskey 1999, Rohlf and Honnold 1988) assert that the statement "… each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area" from Section 4(b) of the Wilderness Act gives the primary and affirmative management direction for wilderness. Section 4(b) also states that even when the agency administers the area for other purposes, the agency must also "preserve its wilderness character." The Congressional Record (United States Congress 1983) supports this assertion, stating "The overriding principle guiding management of all wilderness areas, regardless of which agency administers them, is the Wilderness Act (Section 4(b)) mandate to preserve their wilderness character."

### *Fulfill agency policy*

Wilderness policies from each of the four wilderness managing agencies directly address the need for preserving wilderness character (table 3). The intent of these policies is to prevent the degradation of wilderness character from its condition or state at the time the area was designated as wilderness.

### *Improve wilderness stewardship*

Before passage of the Wilderness Act, Zahniser stated that "in all concern with wilderness, the first safety must be for the wilderness character itself" (Zahniser 1961, p. 2). Today, many wilderness field and program managers perceive steady erosion in wilderness character caused by widespread threats (Cole 2002, Cole and Landres 1996, Hendee and Dawson 2001, Landres and others 1998). There have been repeated calls for monitoring to provide the information needed to improve wilderness stewardship (for example, Government Accounting Office 1989). In 1999, the four agencies requested that the Pinchot Institute for Conservation create a blue-ribbon panel to offer recommendations for improving wilderness stewardship. This panel offered four key recommendations, including that the agencies "devise monitoring and evaluation systems to ensure that we know how well wildernesses are being stewarded, especially in the context of a system of wilderness" (Pinchot Institute for Conservation 2001).

Focusing on wilderness character links on-the-ground wilderness conditions and management actions to the mandates of the Wilderness Act and agency policy to "preserve wilderness character." This focus on the connections between conditions and actions, and policy helps to:

- *Improve wilderness stewardship.* Wilderness stewardship has traditionally been fraught with uncertainty and subjective opinions about what should or should not be done. The systematic and comprehensive wilderness character framework described in this document directly links the results of stewardship activities to the legislative direction of the Wilderness Act. This in turn helps professionalize wilderness stewardship and contributes to agency accountability, transparency, and defensibility.

**Table 3**—Agency policy statements about the need to preserve wilderness character, with emphasis added.

| Agency | Policy reference | Policy statement |
|---|---|---|
| Bureau of Land Management (Department of the Interior) | 43 CFR Part 6300 (Federal Register, Vol. 65, No. 241, page 78358, December 14, 2000) | I. Background. "Unless Congress specifies otherwise, BLM must ensure the preservation of *wilderness character* in managing all activities conducted within wilderness areas." |
| | Manual 6340—Management of Designated Wilderness Areas, Release 6-135, July 13, 2012 | 1.2 (A). Objectives. "Manage and protect BLM wilderness areas in such a manner as to preserve *wilderness character*."<br>1.2 (B). "Manage wilderness for the public purposes of recreational, scenic, scientific, education, conservation, and historic use while preserving *wilderness character.*"<br>1.2 (C). "Effectively manage uses permitted under Section 4(c) and 4(d) of the Wilderness Act of 1964 while preserving *wilderness character*." |
| | | 1.6 (A). Monitoring Wilderness Character. "Monitoring wilderness character, as outlined in Appendix C of this manual, is an ongoing responsibility of the agency." |
| Fish and Wildlife Service (Department of the Interior) | 50 CFR 35.2 (a) | "[E]ach wilderness shall be administered for such other purposes for which the national wildlife refuge was established and shall be also administered to preserve its wilderness character." |
| | U.S. Fish and Wildlife Service Manual, Part 610 Wilderness Stewardship, Chapters 1–5, November 7, 2008 | 1.12. "As we carry out individual refuge establishing purpose(s) ... in areas designated as wilderness, we do so in a way that preserves *wilderness character*." |
| | | 1.17 A. "Refuge System laws, regulations, and policies apply to refuge wilderness, but we carry them out in ways that preserve wilderness character and comply with the Wilderness Act's prohibitions." |
| | | 1.17 B. "We adhere to a much stricter standard than usual for approving actions in wilderness so that we maintain the *natural and untrammeled* condition of the wilderness." |
| | | 2.4 A. "We administer refuge wilderness to conform with the Wilderness Act's purposes of securing 'an enduring resource of wilderness,' preserving *wilderness character*, and providing opportunities for public use and enjoyment ... in ways that will leave the wilderness unimpaired for future use and enjoyment as wilderness." |
| | | 5.3 B. "We administer wilderness areas in Alaska in accordance with the policy in 610 FW 1-5." |
| National Park Service (Department of the Interior) | 2006 Management Policies, Chapter 6: Wilderness Preservation and Management | 6.1 General Statement. "The purpose of wilderness in the national parks includes the preservation of *wilderness character* and wilderness resources in an unimpaired condition …" |
| | | 6.3 Wilderness Resource Management, 6.3.1 General Policy. "In addition to managing these areas for the preservation of the physical wilderness resources, planning for these areas must ensure that the *wilderness character* is likewise preserved." |
| | 2013 Director's Order 41 | 6.2 Wilderness Character. "[E]ach wilderness park will integrate the concept of *wilderness character* into park planning, management, and monitoring in order to preserve the enduring benefits and values of wilderness for future generations." "Whenever a park planning process that has the potential to affect *wilderness character* occurs, the park should determine how *wilderness character* can be both integrated into the planning effort and presented in the planning document." "*Wilderness character* should be considered in the management and operations conducted by all divisions/work units." |
| Forest Service (U.S. Department of Agriculture) | Chapter 2320—Wilderness Management, June 21, 1990 | 2320.2 – Objectives, 4. "Protect and perpetuate *wilderness character*and public values including, but not limited to, opportunities for scientific study, education, solitude, physical and mental challenge and stimulation, inspiration, and primitive recreation experiences…" |
| | | 2323.14 – Visitor Management. "Plan and manage public use of wilderness in such a manner that preserves the *wilderness character*of the area." |

Perhaps most importantly, this framework expands the paradigm for wilderness stewardship to comprehensively understand and preserve wilderness character.

- *Clarify how management decisions and actions influence trends in wilderness character*. There are tradeoffs in almost all aspects of wilderness stewardship, and evaluating what is gained and what is lost in terms of wilderness character helps staff determine priorities for what should and should not be done. Openly discussing these tradeoffs will help agency staff understand how their actions directly or indirectly contribute to preserving wilderness character, which in turn will help inform management decisions.
- *Improve communication among staff and with the public about wilderness stewardship.* Wilderness often invokes strong personal feelings that can fuel miscommunication and litigation. The standard language of wilderness character developed in this interagency monitoring strategy allows staff across different resource programs and disciplines to use common terms in discussing wilderness-related projects, needs, and impacts. This language also allows staff to discuss wilderness stewardship in a more open and transparent manner with the public, which may in turn improve agency defensibility in legal questions about the preservation of wilderness character.
- *Create a legacy of experience and knowledge about wilderness locally and broadly within the agency.* Experience and knowledge of a wilderness are often lost with staff turnover, and the baseline understanding of resource conditions shifts over time. Monitoring wilderness character provides a way to keep track of the changes that are occurring locally, which in turn builds a legacy about the wilderness and its stewardship and how these are changing over time.

## The Five Qualities of Wilderness Character

This monitoring strategy links the conceptual definition of wilderness character described above to a practical meaning of wilderness character by using a framework of "qualities." These qualities are derived from the entire statutory definition of wilderness, Section 2(c) of the Wilderness Act, which expresses congressional intent, both ideal and practical, for the meaning of wilderness and wilderness character (McCloskey 1966, 1999; Ochs 1999; Rohlf and Honnold 1988; Scott 2002). These qualities were first identified by the FS (Landres and others 2005) and subsequently refined by the agency and interagency teams that have developed and implemented wilderness character monitoring over the past 15 years (BLM 2012; Landres and others 2008, 2009; NPS 2014a). Taken together, these qualities represent the primary tangible aspects of wilderness character that link on-the-ground conditions in wilderness and the outcomes of wilderness stewardship to the statutory definition of wilderness. These qualities are briefly summarized here and each is described in detail in its own section.

### *Untrammeled*

The Wilderness Act states that wilderness is "an area where the earth and its community of life are untrammeled by man," that "generally appears to have been affected primarily by the forces of nature" and "retain[s] its primeval character and influence." This means that wilderness is essentially unhindered and free from the

intentional actions of modern human control or manipulation. This quality directly relates to "biophysical environments primarily free from modern human manipulation and impact" and "symbolic meanings of humility, restraint, and interdependence that inspire human connection with nature" described in the above definition of wilderness character. The Untrammeled Quality is preserved or sustained when actions to intentionally control or manipulate the components or processes of ecological systems inside wilderness (for example, suppressing fire, stocking lakes with fish, installing water catchments, or removing predators) are not taken. This quality is improved when suppression of wildfire or manipulation of habitat is stopped or significantly reduced.

### *Natural*

The Wilderness Act states that wilderness is "protected and managed so as to preserve its natural conditions." This means that wilderness ecological systems are substantially free from the effects of modern civilization. Within a wilderness, for example, indigenous plant and animal species predominate, or the fire regime is within what is considered its natural return interval, distribution over the landscape, and patterns of burn severity. This quality directly relates to "biophysical environments primarily free from modern human manipulation and impact" described in the above definition of wilderness character. The Natural Quality is preserved when there are only indigenous species and natural ecological conditions and processes, and may be improved by controlling or removing non-indigenous species or by restoring ecological conditions.

### *Undeveloped*

The Wilderness Act states that wilderness is "an area of undeveloped Federal land … without permanent improvements or human habitation," "where man himself is a visitor who does not remain" and "with the imprint of man's work substantially unnoticeable." This means that wilderness is essentially without permanent improvements or the sights and sounds of modern human occupation. This quality is affected by "prohibited" or "nonconforming" uses (Section 4(c) of the Wilderness Act,), which include the presence of modern structures, installations, and habitations, and the administrative and emergency use of motor vehicles, motorized equipment, or mechanical transport. Some of these uses are allowed by special provisions required by legislation. This quality directly relates to "personal experiences in natural environments relatively free from the encumbrances and signs of modern society" and "symbolic meanings of humility, restraint, and interdependence that inspire human connection with nature" described in the above definition of wilderness character. The Undeveloped Quality is preserved or sustained when these nonconforming uses are not used by the agency for administrative purposes or by others authorized or not authorized by the agency. It is improved when the prohibited use is removed or reduced.

### *Solitude or Primitive and Unconfined Recreation*

The Wilderness Act states that wilderness has "outstanding opportunities for solitude or a primitive and unconfined type of recreation." This means that wilderness provides outstanding opportunities for recreation in an environment that is relatively free from the encumbrances of modern society, and for the experience of the benefits

and inspiration derived from self-reliance, self-discovery, physical and mental challenge, and freedom from societal obligations. This quality focuses on the tangible aspects of the setting that affect the opportunity for people to directly experience wilderness. It directly relates to "personal experiences in natural environments relatively free from the encumbrances and signs of modern society" described in the above definition of wilderness character. The Solitude or Primitive and Unconfined Recreation Quality is preserved or improved by management actions that reduce visitor encounters, reduce signs of modern civilization inside wilderness, remove agency-provided recreation facilities, or reduce management restrictions on visitor behavior.

### *Other Features of Value*

The Wilderness Act states that wilderness "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." This quality captures important elements or "features" of a particular wilderness that are not covered by the other four qualities. Typically these occur in a specific location, such as archaeological, historical, or paleontological features; some, however, may occur over a broad area such as an extensive geological or paleontological area, or a cultural landscape. The Other Features of Value Quality directly relates to "personal experiences in natural environments relatively free from the encumbrances and signs of modern society" and "symbolic meanings of humility, restraint, and interdependence that inspire human connection with nature" described in the above definition of wilderness character. This quality may or may not occur within a specific wilderness, and is therefore different from the other four qualities that, by law, occur in every wilderness. This quality is preserved when these "other features of value" are preserved.

## Premises for Using These Five Qualities

Metaphorically, wilderness character is like a violin or another musical instrument composed of separate pieces that interact to form something greater than the sum of its parts: music and ultimately the feelings this music evokes. Similarly, these five qualities together form the physical, social, and managerial setting of a wilderness, in turn providing scientific, cultural, educational, and economic values to society (Cordell and others 2005). In addition, spiritual (Moore 2007, Nagle 2005), ethical (Cafaro 2001), psychological (Schroeder 2007), democratic (Turner 2012), and other intangible societal and individual values and benefits are derived from this wilderness setting (Havlick 2006). In total, these five qualities create a unique setting, which provides what the Wilderness Act describes as the "benefits of an enduring resource of wilderness."

This interagency monitoring strategy uses these five qualities together to monitor trends in wilderness character. Several important premises frame the use of these qualities:

- *All five qualities are equally important*. The land managing agencies must implement laws in their entirety, and because the Wilderness Act does not state that one sentence or one portion of the text in Section 2(c) is more important than another, all five qualities are of equal importance for the purpose of this monitoring strategy. However, all five qualities do not carry equal weight in determining the

overall trend in wilderness character, as explained below in the Assessing Trend in Wilderness Character section.

- *These qualities apply to every wilderness*. These qualities apply to all designated wilderness areas—regardless of size, location, administering agency, or other unique place-specific attributes—because they are based on the legal definition of wilderness and every wilderness law is tied to this definition (Dawson and Hendee 2009). Individual wilderness laws may include specific exceptions or special provisions that apply to the uses and values of particular areas, but no federal legislation changes the 1964 Act's Section 2(c) Definition of Wilderness, and no legislation changes the affirmative management responsibility of Section 4(b) for "preserving the wilderness character of the area." The only exception is the Other Features of Value Quality, which may or may not exist within a given wilderness because of the Wilderness Act statement that a wilderness "*may* also contain ... other features" (emphasis added).
- *These qualities are uniquely expressed within each wilderness.* Every wilderness is unique: some are swamps, and others are rock and ice; some are immense, and others are small; some are very remote, and others are surrounded by suburban and urban development; some are iconic and revered by people who never set foot in them, and others are unknown. This uniqueness has two important implications for this monitoring strategy: trend in wilderness character can be based only on how wilderness character is changing within an individual wilderness, and wilderness character cannot be compared between wildernesses because such comparisons are meaningless.
- *Wilderness character is more than these qualities.* In addition to the tangible qualities used for monitoring wilderness character described above, there are also important intangible aspects of wilderness character that are difficult or impossible to quantify; these are not included in this monitoring strategy. These intangible aspects are diverse and may include the immensity of an area and the connection people may feel to nature, the ethical value to society from having areas that are managed with restraint and humility, and the inspirational and psychological benefits that individuals experience in wilderness (Putney and Harmon 2003, Roggenbuck and Driver 2002, Schroeder 2007). These and other intangible aspects of an area's wilderness character can be described holistically and qualitatively in a wilderness character narrative (see appendix 3 on developing and using such a narrative).
- *Management decisions and actions may preserve or degrade these qualities*. Wilderness character may be improved, preserved, or degraded by the actions managers choose to take or not take. For example, the choice to not use a chain saw, to not build a footbridge across a stream, or to not suppress a naturally ignited fire may preserve certain qualities of wilderness character. In contrast, other management actions that are considered the minimum necessary for the administration of the area—such as requiring visitors to use designated campsites, or authorizing administrative use of motorized equipment and mechanical transportation, or taking actions to restore ecological conditions—may diminish certain qualities of wilderness character. Protecting one quality of wilderness character may diminish another

(Landres and others 2012). For example, a bridge built to protect a stream bank from erosion caused by people or horses crossing the stream is also an installation that diminishes the opportunity for people to experience the primitive challenge of crossing the stream. Similarly, requiring use of designated campsites to prevent the proliferation of sites and associated impacts on soil and vegetation also diminishes the opportunity for unconfined recreation and the sense of freedom from the constraints of regulation. Spraying herbicide to eradicate non-indigenous species is also an intentional trammeling action. Over time, tradeoffs affecting different qualities of wilderness character and the cumulative results of seemingly small decisions and actions may cause a significant gain or loss of wilderness character. With an established framework to discuss these tradeoffs within the context of wilderness character and its five qualities, managers have a tool to approach wilderness stewardship with humility, respect, and restraint, ultimately helping them to preserve wilderness character as a whole.

## Wilderness Character Terminology

Since the initial description of wilderness character (Landres and others 2005), different uses and interpretations of terms and phrases have resulted in confusion among agency staff, non-governmental organizations, and the public. To establish consistent use and common understanding, this updated interagency monitoring strategy provides standard nomenclature in applying the concept of wilderness character, and recommends the following terminology based on law, policy, and experience.

### *Terms used in this interagency monitoring strategy*

- *Wilderness character.* Derived from the Wilderness Act and defined in this interagency strategy in the Defining Wilderness Character section, above.
- *Wilderness qualities*. One or more of the five qualities of wilderness character as described in this interagency strategy.
- *Qualities*. The qualities of wilderness character as described in this interagency strategy.
- *Wilderness resources*. Any of the particular resources (natural or cultural) inside a wilderness.
- *Wilderness values*. Any of the meanings, benefits, or values people or society derives from wilderness.
- *Wilderness character monitoring*. The process of assessing the overall trend in wilderness character using this interagency strategy.

### *Terms not used in this interagency monitoring strategy*

- *Wilderness characters*. Sometimes used for "wilderness qualities," this phrase causes confusion because it's not clear if it is being used to describe "wilderness character" or "wilderness qualities."
- *Wilderness characteristics*. Often and easily mistaken for one or more of the qualities of wilderness character, this phrase comes from BLM law and policy direction

for identifying areas of potential wilderness and subsequently managing wilderness study areas under the non-impairment standard. This phrase also is used in FS manual direction for identifying areas of potential wilderness. In both cases, the Untrammeled Quality is excluded because it applies only to how the area is managed once it is designated as wilderness (the BLM policy direction also includes other differences). This phrase should be used only when referring to BLM and FS wilderness inventory, or management of BLM wilderness study areas.

- *Wild character*. Sometimes used as shorthand for "wilderness character," but "wild" has many different interpretations so the meaning of this phrase is unclear.
- *Characters*. A shorthand reference to "wilderness characters," but it typically is unclear what this phrase refers to.

# Interagency Approach to Wilderness Character Monitoring

Once an area is designated as wilderness, the managing agency is responsible for ensuring that the area's wilderness character does not diminish over time. The only way to track how wilderness character is changing over time is to monitor it. The *Keeping It Wild 2* interagency strategy recommends the following approach to monitor trend in wilderness character for every wilderness:

1. Use the nationally consistent set of qualities, monitoring questions, and indicators presented in this strategy (see the Organizational Framework section, below).
2. Select at least one locally relevant measure per indicator following agency-specific guidelines (whether agency-required, locally selected, or a combination).
3. Collect data for each measure and determine trend in the measure (upward, stable, downward) once there are at least two data points that are 5 years apart (some measures are highly variable from year to year; these would be measured yearly and trend determined from 5 years of annual data).
4. Compile the trends (not the data) from each measure within an indicator (using the rules in the Assessing Trend in Wilderness Character section, below) to determine the trend in the indicator. These same rules are used to compile trends in the indicators to determine the trend in the quality, and likewise compile quality trends to determine the overall trend in wilderness character for each wilderness.

Once the trend in wilderness character is determined for every wilderness, each agency can compile these trends to assess broad-scale agency performance. Similarly, data from each agency can be compiled to assess performance in preserving wilderness character across the NWPS.

## Organizational Framework

This interagency monitoring strategy is organized around a hierarchical framework that divides wilderness character into successively finer components. These components, starting from wilderness character, are:

- *Qualities.* Qualities are the primary elements of wilderness character that link directly to the statutory language of the Wilderness Act. The same set of qualities applies nationwide to all wildernesses managed by all agencies. In this framework, the Untrammeled, Natural, Undeveloped, and Solitude or Primitive and Unconfined Recreation Qualities are all necessary to assess trend in wilderness character, and each wilderness would report the trend in each of these qualities. Where other features of value exist in a wilderness and are integral to it, the Other Features of Value Quality would also be reported.
- *Monitoring questions.* Monitoring questions capture essential components of each quality that are significantly different from one another and address particular management questions and goals. The same set of monitoring questions applies nationwide to all wildernesses.

Facing page: Glacier Bay Wilderness, David Bahr photo (david@bahrimages.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

- *Indicators.* Indicators are distinct and important components under each monitoring question. There is more than one indicator for nearly all monitoring questions. Each wilderness and agency would be responsible for reporting the trend in all indicators. The same set of indicators applies nationwide to all wildernesses managed by all agencies.
- *Measures.* Measures are the specific elements under each indicator for which data are collected to assess trend in an indicator. In general, measures are human-caused threats to the indicator. Each agency is responsible for determining how its measures will be selected (that is, whether by a national or regional team, or by each wilderness). Examples of measures for each indicator are given in the sections that describe each quality in detail.

This hierarchical framework (see table 2) allows managers to look at the overall trend in wilderness character and drill down through the various levels to understand how this trend was derived, including how change in an individual measure contributes to the overall trend in wilderness character.

## Key Principles

This interagency strategy for wilderness character monitoring is based on the following key principles.

### *Each agency has the responsibility to develop its own procedures to ensure implementation of this monitoring strategy*

*Keeping It Wild 2* offers an interagency monitoring strategy but it does not define the agency-specific responsibilities for implementing this strategy, ensuring quality control, and fostering interagency consistency. Given their different authorities, policies, and cultures, each agency needs to determine their own protocols and processes for training, oversight, use of the wilderness character monitoring database, reporting, sharing results with the other agencies, and working with the other agencies to provide a coherent wilderness character monitoring strategy across the NWPS.

### *Wilderness character monitoring will provide credible data that will be directly useful for tracking the outcomes of wilderness stewardship*

If the data are not credible and useful, taking the time and effort to do wilderness character monitoring is futile. This monitoring strategy has been developed with substantive input from subject-matter experts and designed by on-the-ground wilderness managers and regional and national wilderness staff to provide the most useful information possible for the full range of agency staff involved in wilderness stewardship.

### *The baseline for evaluating trend in wilderness character is the time of designation or when this monitoring program is initiated*

The first year that data for all measures have been collected using this interagency strategy forms the baseline, and is the reference point against which change over time in wilderness character is measured and evaluated. Ideally, this baseline would be the time of wilderness designation. For most existing wildernesses, however, data from the time of wilderness designation will be unavailable for most or even all measures, so realistically the baseline will most likely be the year that this monitoring

protocol is first implemented. Baseline conditions are the starting point for assessing change over time without value judgment as to whether these are good, bad, or desired. For example, if a wilderness had features such as installations at the time of designation, those features would be part of the baseline condition of this wilderness. Wilderness character monitoring would show how the Undeveloped Quality of wilderness, which includes installations, changes over time.

### *Existing data are used whenever appropriate and available*

Every effort has been made in developing this strategy to reduce the amount of time and effort needed by local staff to implement wilderness character monitoring. Where good-quality local data do not exist, data from national or regional monitoring programs would be used whenever possible across all appropriate resource disciplines (for example, air quality). Ideally, these data would be compiled by a centralized data analyst or resource specialist and provided to the local office. Interpretation from resource specialists will be needed to help determine if the resolution, scale, and quality of the data are appropriate for use by a wilderness. Legacy or historical pre-baseline data from the local unit are an important reservoir of information. Legacy data may be used if these data were collected (1) after the area was designated as wilderness or managed as wilderness by agency policy, and (2) by using consistent, credible, and documented protocols that are directly relevant to wilderness character monitoring. If legacy data are used for a measure, that measure's baseline year will be earlier than the overall baseline year for determining change in wilderness character as a whole. In some cases there may be a considerable history of legacy data, such as for fire suppression, and local staff will need to determine the most appropriate means for summarizing these data and using them as a baseline.

### *Trend in wilderness character is determined by change within an individual wilderness*

Each wilderness is unique in its combination of geographic setting, biophysical properties, enabling legislation, and administrative direction, so trend in wilderness character can be determined only by tracking change within a given wilderness. This uniqueness means that it is inappropriate and misleading to compare wilderness character from one wilderness to another. This is consistent with national direction provided by the Wilderness Act and supported by agency policies to preserve wilderness character relative to the time an area was designated as wilderness, regardless of the size of the area, ecosystem, proximity to urban areas, or any other attribute of the wilderness.

### *This monitoring balances national consistency with local relevance*

This interagency strategy is designed to balance national and local needs for information on trend in wilderness character. To ensure national consistency and the ability to understand overall trends across different wildernesses for regional and national reporting, every agency and every wilderness will use the same set of qualities, monitoring questions, and indicators. However, this monitoring does not satisfy national information needs at the expense of local utility because local relevance is crucial for effective and successful long-term implementation (Biber 2013). Each

agency has adopted a somewhat different approach to ensure local relevance. The BLM uses agency-required measures and encourages each wilderness unit to select additional optional measures. The FS uses a combination of agency-required, agency-required if relevant, and agency-optional measures, as well as any additional measures identified by the local unit. The FWS and NPS allow each unit to identify its own measures. Such agency flexibility in selecting measures is necessary because the data that are available to all four agencies (for example, size of the wilderness) would not allow meaningful assessment of trend in wilderness character.

### *Trend in wilderness character is reported every 5 years for every wilderness*

The Wilderness Act mandates that every wilderness be managed to preserve its wilderness character, so this monitoring needs to be conducted on every wilderness, not just a sample of wildernesses. For some measures local data collection would most likely occur annually, and trend in wilderness character would be reported every 5 years once the baseline has been established. This 5-year time period balances workload with providing needed information at a pace that allows for adaptive management.

### *Not all monitoring done in a wilderness is wilderness character monitoring*

All the wilderness managing agencies currently conduct some form of monitoring inside wilderness. Typically this monitoring is for specific resource purposes such as assessing campsite condition, range condition, or abundance and distribution of specific plant or animal species. Such monitoring provides data that may be used in wilderness character monitoring, but by itself it should not be called "wilderness character monitoring." In general, to qualify as "wilderness character monitoring" all four of the following requirements must be met:

- The monitoring is conducted in a designated wilderness or in an area that by policy is managed as wilderness or to preserve its wilderness character.
- The monitoring includes at least one measure for each of the indicators of the Untrammeled, Natural, Undeveloped, and Solitude or Primitive and Unconfined Recreation Qualities, as well as the Other Features of Value Quality if appropriate.
- A specific baseline year has been established for the purpose of wilderness character monitoring.
- The monitoring is intended to be a long-term monitoring program that (1) synthesizes the trends in all the measures into an integrated assessment of trend in wilderness character, and (2) is conducted periodically as long as the area remains designated as wilderness.

## Selecting Measures

Specific procedures for selecting measures and collecting data are not described in this strategy. Instead, each agency is responsible for determining the approach it will use: whether to let staff at each wilderness select measures, to develop agency-required measures, or to use some combination. No one approach is better than another, and these differing approaches reflect needed agency flexibility, agency culture, data

availability, and the most effective way of getting work done within that agency (see appendix 1 for details on the approach used by each agency).

### *Key concepts underlying the selection and use of measures*

In general, three key words guide measure selection: useful, simple, practical (also see BLM 2012, Landres and others 2009, NPS 2014a). Keep it useful by selecting locally relevant measures that show how resource conditions are changing over time and that are directly useful to stewardship decisions. Keep it simple by selecting the fewest measures that will credibly track change in the indicator. Keep it practical by selecting measures that have preexisting data from national, regional, or local monitoring programs, or are cost-effective if new data collection is needed. The following key concepts learned from implementing the 2008 *Keeping It Wild* will help in selecting measures across all four agencies:

- *Wilderness character monitoring should not replicate other monitoring programs.* A variety of federal agencies have robust monitoring programs and when these programs can provide relevant data for wilderness character monitoring, they should be used. The key is to select measures that are threats to resources that are integral to and most representative of the area's wilderness character. The legislative history of a wilderness may provide information about Congressional intent and special values, features, purposes, and places (Meyer 2000), which may help identify resources that are integral to wilderness character.
- *Frequency of data collection will depend on the measure.* The type of measure will inform the frequency of data collection. For example, annual data would likely be reported for measures that fluctuate yearly, such as the number of suppressed naturally ignited fires under the Untrammeled Quality; measures with low variability, such as the number of physical structures in the Undeveloped Quality, would probably be reported every 5 years. In addition, data collection for some measures, such as campsite impacts, may be conducted sporadically as need requires and resources allow.
- *Measures that are relevant to wilderness character should be monitored regardless of managerial jurisdiction.* Some resources are integral to wilderness character but are not directly under the management jurisdiction of the agency. For example, night sky visibility and air quality are experiential and ecological aspects of wilderness character but are beyond direct management control. The state of such resources in wilderness can serve as important benchmarks for assessing the magnitude of future anthropogenic impacts such as climate change and regional development. Measures should be selected based on their relevance to wilderness character regardless of managerial control or jurisdiction. If such measures are used, the accompanying narrative would allow discussion of how such measures are beyond management authority.
- *Management actions and developments may influence more than one quality of wilderness character, but they are monitored only in the quality that is most directly affected.* Specific management actions and developments are measured only in the quality that is most relevant and not included in more than one quality. In general, this means not using a measure as a proxy or surrogate in one quality if it can be

used directly in another. For example, suppressing naturally ignited fires affects both the Untrammeled Quality (as an action that intentionally manipulates fire) and the Natural Quality (for its effect on fire regimes and its resulting ecological effects). However, the number of suppressed fires would be not used as a measure in the Natural Quality because it is a proxy and does not directly measure the effects of fire suppression. Instead, it is a direct measure of an intentional manipulation in the Untrammeled Quality.

A common source of confusion about double-counting is the specific case of recreational developments because they could be logically counted in both the Solitude or Primitive and Unconfined Recreation Quality and the Undeveloped Quality. For example, an agency-built recreation facility such as a toilet degrades primitive recreation and is a development. In this monitoring strategy, however, toilets (and other recreational developments) are included only in the Solitude or Primitive and Unconfined Recreation Quality because this quality includes all measures associated with recreation and recreational experiences (for more discussion, see the Solitude or Primitive and Unconfined Recreation Quality section).

Occasionally, separate and distinct impacts from a single management action or development can be measured independently by using different metrics. In such cases these distinct measures can be included under multiple qualities. For example, a barrier built to prevent non-indigenous fish from moving up a stream has separate and distinct measurable impacts on the Untrammeled, Undeveloped, and Natural Qualities. The action to build the barrier would be counted as an intentional manipulation in the Untrammeled Quality, the presence of the barrier would be counted as an installation in the Undeveloped Quality, and the number of water bodies with altered stream flow would be counted as a degradation of water in the Natural Quality. To keep this monitoring strategy as consistent and simple as possible, recommendations for assigning measures are provided within the discussion about the indicators in the section on each quality.

- *Local interpretation is necessary because some measures have opposing effects on different qualities.* Reducing the complex, nuanced, and holistic nature of wilderness character into discrete entities may lead to cases where a single management action has opposing impacts on different qualities. For example, prescribed fire may be used as a management tool to improve the Natural Quality in areas where the natural fire regime has been altered. However, the same prescribed burning is an intentional manipulation of the biophysical environment, and therefore degrades the Untrammeled Quality. Wilderness stewardship commonly involves such tradeoffs and this monitoring makes transparent the effects of these tradeoffs on wilderness character. To clarify interpretation of monitoring results, reporting will include narrative text by local staff that provides the context needed to understand seemingly conflicting trends in the data.
- *Data adequacy will differ across the different measures.* The range of measures used will require a variety of data and data sources, with corresponding variability in data quality. Some measures will require point data (such as installations) or sampling (such as the area of invasive plants), some will require assumptions about integration over large areas (such as air quality), and some will be biased

by the amount of law enforcement or other effort (such as unauthorized actions). High-quality corporate datasets will be available for some measures, whereas for others only poor-quality data—or no data—will be available. In the last two cases, interpolated data or local professional judgment may be used to assign a data value provided the rationale is clearly documented (including who made the judgment, their expertise, details of supporting field experience, and any additional information needed for outside viewers to understand the basis for this interpolation or professional judgment). The key point is to use the best available scientific information for each measure and then document data adequacy and the implications for interpreting change in the measure.

- *Measures can change over time.* Consistently using the same measures over time is necessary to show trend within a wilderness, but a monitoring program also needs to evolve. Measures may change because new issues arise, new policy direction requires a change, or new measures are developed that provide better information on some aspect of wilderness character. Because wilderness character monitoring is relatively new, agency staff may need to balance the benefits of consistency in using existing measures against the benefits of using new and better measures if they become available. If measures are changed, it is important to document when the change occurred, the reason(s) for this action, and the potential impact on interpreting trend in wilderness character.

## The Online Wilderness Character Monitoring Database

Together, all four wilderness managing agencies contributed to the development of an interagency, online wilderness character monitoring database to serve as the central portal for data entry, data storage, data analysis, and reporting (Adams and others 2012). This database will be available in 2015 through the Internet (not agency intranets) and hosted on the Wilderness.net Web site with permissioned access for use by agency personnel. The agency-standardized measures used by the BLM and the FS will be built into the database. Measures selected by an individual wilderness for all four agencies will have to be entered into the database by the wilderness unit.

The online database will have a single set of wilderness character monitoring measures and data for each wilderness. This will require the 34 wildernesses that are currently managed by more than one agency to develop a single set of measures, in turn requiring the co-managing agencies to communicate and coordinate with one another to select the measures, gather the data, and enter these into the database. Similarly, for wildernesses managed by more than one administrative unit within a single agency, such as two different FS districts or forests, the co-managing administrative units will need to either designate a lead administrative unit responsible for selecting measures and entering the data, or coordinate with one another to select the measures. Finally, in some agencies, a single wilderness may be composed of geographically separate administrative units, and a single set of measures for the wilderness needs to be selected for use in wilderness character monitoring and in the database. If individual administrative units for all of the above cases have additional measures they want to monitor for local uses, those measures would not be included in the wilderness character monitoring or database unless they apply to the entire wilderness.

## Assessing Trend In Wilderness Character

The overall trend in wilderness character for a wilderness is derived in this monitoring strategy to provide a readily interpretable assessment for local, regional, and national staff. At the regional and national levels, staff need to understand whether agency policies and programs are fulfilling the legal mandate of the Wilderness Act to preserve wilderness character. In contrast, the more detailed information on trends in the individual qualities, monitoring questions, indicators, and measures will most likely be of direct use to local wilderness managers.

Assessing a single overall trend in wilderness character poses conceptual and statistical problems, and creates a potential for unintended consequences and abuse (see the concerns that are discussed in appendix 4). These problems occur in every monitoring program that derives a single integrative metric based on disparate pieces of information. For example, Andreasen and others (2001, p. 29) describe these problems in developing an index of ecological integrity:

> The final step in producing an index [of ecological integrity] is combining the suite of metrics into a single value that represents the overall integrity of the ecosystem. For many ecologists, this is the limiting step. Aware of the enormous complexity of environmental systems, any attempt at description with a single number is facetious: arbitrary at best and dangerously deceptive at worst. But the primary customer … is not the ecologist but the decision maker. This customer needs the price of a loaf of bread, not an analysis of the impact of OPEC on the cost to transport wheat.

Several different methods (statistical, graphical, numerical, and diagrammatic) were explored to compile or consolidate trends in the measures into a single trend in wilderness character. These different methods were tested on dozens of hypothetical examples to develop the FS wilderness character monitoring protocols (Landres and others 2009). The approach used in this interagency monitoring strategy was selected as the most robust, practical, and readily interpretable.

The overall process for assessing trend in wilderness character is described here, with details below. The trend in wilderness character is determined by using nationally consistent rules to compile trends across the measures, indicators, monitoring questions, and qualities to derive an overall trend in wilderness character for each wilderness. A trend of stable, upward, or downward is derived for each measure based on the data values and the threshold for significant change defined by the agency or local staff for that measure. Trends, not the data, in each measure are compiled by using rules to identify the trend in the indicator. These same rules are then used to determine the trend in the monitoring question from its component indicators, the trend in each quality from its monitoring questions, and the trend in wilderness character from the four (or five if the Other Features of Value Quality is used) qualities.

### *Determining significant change and trend in a measure*

A significant, or meaningful, change in each measure is based on either nationally or locally determined thresholds. These thresholds are defined for national or regional scale measures by national or regional staff, and for locally identified measures by local staff. Trend in each measure is classified into one of three categories and

assigned an arrow: stable (no significant change in the data, ⇔), upward (a significant improvement, ⇧), or downward (a significant degradation, ⇩).

In a given year that trend is reported, trend in a measure is determined by comparing the most recent monitoring data with the earliest available baseline data for that measure. For some measures, however, the most recent data may not be for the year the trend is derived. Also, if legacy data exist for a measure, these data would be included in determining trend for the measure. Table 4 provides several examples illustrating how trend is derived by using data from different years for different measures.

For measures that have at least five data points, simple linear regression may be used to determine trend (see appendix B in Landres and others 2009 for details on the use of regression). However, regression would generally not be appropriate for measures that use "any change" (for example, an increase of one dam) or categories (for example, a change from 10 percent to 20 percent areal coverage of non-indigenous plants) as thresholds for determining meaningful change. In addition, changing from locally defined or agency-defined rules to regression for determining significance may change the trend in a measure.

**Table 4**—Five hypothetical measures showing how trend is derived based on comparing the most recent data with the measure's baseline data.[a]

| Measure | Year of data collection | | | | | | | | Trend derived |
|---|---|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | |
| Measure 1 | | | ● | ○ | ○ | ○ | ○ | ● | 2010–2015 |
| Measure 2 | | ● | ○ | ○ | ○ | ○ | ● | | 2009–2014 |
| Measure 3 | ● | | ○ | | ○ | | ● | | 2008–2014 |
| Measure 4 | | | ● | | | | | ● | 2010–2015 |
| Measure 5 | ● | | | ○ | | ○ | ● | | 2008–2014 |

[a] Circles show that data were collected for the given year. For each measure, trend is assessed from that measure's baseline year (left black circle) to that measure's most recent year of data collection (right black circle) either by comparing them directly or by regression analysis. Open circles show additional years that data were collected. The shaded column under 2010 shows the hypothetical wilderness character baseline year (the first year for which data are available for all measures), with legacy data from 2008 and 2009. The "Trend Derived" column shows the set of years used to determine the trend for each measure for reporting in 2015.

### *Determining trend in an indicator, monitoring question, and quality*

Once trends have been determined for all the measures, the following rules are used to derive the trend in an indicator:

1. All the trends in the measures of one indicator are combined, with each upward-trending measure (⇧) offsetting each downward-trending measure (⇩).
2. The overall trend in the indicator is upward if there are more upward- than downward-trending measures, and the overall trend is downward if there are more downward- than upward-trending measures (regardless of the number of stable measures).

3. If there are an equal number of upward- and downward-trending measures, the overall trend in the indicator is referred to as "offsetting stable" (⇳).

4. If all the measures are stable, the trend in the indicator is also stable (⇔).

By applying the same rules, the resulting trends in the indicators are then used to derive the trends in the monitoring questions, and likewise through each of the qualities (illustrated in table 5).

**Table 5**—Hypothetical example showing how trend in the qualities is derived from trends in the measures, indicators, and monitoring questions.[a]

| Qualities | Trend | | | |
|---|---|---|---|---|
| | Measure | Indicator | Question | Quality |
| **Untrammeled Quality** | | | | |
| Authorized actions | ⇩ | ⇧ | ⇧ | ⇧ |
| Fires suppressed | ⇧ | | | |
| Lakes stocked with fish | ⇧ | | | |
| Unauthorized actions | ⇧ | ⇧ | | |
| **Natural Quality** | | | | |
| Invasive non-indigenous plants | ⇔ | ⇔ | ⇩ | ⇩ |
| Invasive non-indigenous animals | ⇩ | ⇩ | | |
| Visibility | ⇔ | ⇧ | | |
| Ozone | ⇧ | | | |
| Water quality | ⇔ | | | |
| Landscape fragmentation | ⇩ | ⇩ | | |
| **Undeveloped Quality** | | | | |
| Authorized development | ⇧ | ⇧ | ⇧ | ⇧ |
| Inholdings | ⇔ | ⇔ | | |
| Authorized motorized/mechanized | ⇧ | ⇳ | ⇳ | |
| Emergency motorized/mechanized | ⇩ | | | |
| **Solitude or Primitive and Unconfined Recreation Quality** | | | | |
| Visitor use | ⇔ | ⇩ | ⇩ | ⇳ |
| User-created campsites | ⇩ | | | |
| Area away from developments outside wilderness | ⇩ | ⇩ | | |
| Night sky light pollution | ⇩ | | | |
| Recreation facilities | ⇧ | ⇧ | ⇧ | |
| Visitor restrictions | ⇧ | ⇧ | | |

[a] For brevity, a subset of measures is used and the Other Features of Value Quality is not shown.

### *Determining trend in wilderness character*

Trend in wilderness character is derived by combining the trends from all of the qualities. The Wilderness Act does not state that any one aspect of the Section 2(c) Definition of Wilderness is more or less important than another, so this monitoring strategy assumes that all qualities are equally important, with one exception described below for the Untrammeled Quality. This assumption of equal importance includes the Other Features of Value Quality because even though such features may or may not be present in the wilderness, the Wilderness Act provides no reason to consider this quality (when present) more or less important than the other qualities.

Once trends in each quality have been determined, the overall trend in wilderness character is derived by following the same four rules listed above. However, if there are an equal number of upward- and downward-trending qualities, an additional rule is applied as a tiebreaker:

5. If there are an equal number of upward- and downward-trending qualities, the overall trend in wilderness character is determined by the trend in the Untrammeled Quality.

Three reasons support giving extra weight to the Untrammeled Quality in a tiebreaker situation: the statutory definition of wilderness describes "untrammeled" in a separate sentence; the importance of untrammeled as the essence of wilderness has a long history in the wilderness literature; and no other land designations are by law to be kept untrammeled. These three factors serve to make the Untrammeled Quality "first among equals," an idea supported by a recent legal review (Long and Biber 2014). Table 6 applies these rules to four hypothetical examples to illustrate how the trends in the five qualities are aggregated to assess the overall trend in wilderness character.

Trend in wilderness character is derived by comparing the most recent data for each measure with the baseline data for that measure and using the rules described above. For example, if the baseline assessment was conducted in 2015 and subsequent data are collected in 2020 and 2025, the trend in wilderness character for 2020 would be derived by comparing the 2015 data with the 2020 data, and the trend for 2025 would be derived by comparing the 2015 data with the 2025 data, and so on. There may be situations where managers want to know the trend from one monitoring period to the next, say from 2020 to 2025 rather than 2015 to 2025, to closely track the effects of management actions and make mid-course corrections if needed. Even in such cases, the overall trend in wilderness character is determined and reported by comparing the most recent data with the baseline data to prevent slow, incremental degradation of wilderness character.

### *Flexibility and limitations in assessing trend*

This approach to deriving an overall trend in wilderness character has several important features. First, by compiling trends (as opposed to data), this approach allows disparate types of data to be used for the measures. This in turn allows different wildernesses and different agencies to use a single, nationally consistent approach to assessing trend in wilderness character across the entire NWPS (see appendix 5 for resulting analyses and reports that can be derived from this consistent approach).

**Table 6**—Four hypothetical examples showing how trend in wilderness character is derived from the trends in the qualities.[a]

Two qualities with an upward trend, one quality with a downward trend.

| Quality | Trend in the quality | Trend in wilderness character |
|---|---|---|
| Untrammeled | ⇧ | ⇧ |
| Natural | ⇩ | |
| Undeveloped | ⇧ | |
| Solitude or Primitive and Unconfined Recreation | ⇧ | |
| Other Features of Value | ⇔ | |

One quality with an upward trend, two qualities with a downward trend.

| Quality | Trend in the quality | Trend in wilderness character |
|---|---|---|
| Untrammeled | ⇧ | ⇩ |
| Natural | ⇩ | |
| Undeveloped | ⇔ | |
| Solitude or Primitive and Unconfined Recreation | ⇧ | |
| Other Features of Value | ⇩ | |

Two qualities with an upward trend, two qualities with a downward trend; Untrammeled Quality as "tiebreaker."

| Quality | Trend in the quality | Trend in wilderness character |
|---|---|---|
| Untrammeled | ⇩ | ⇩ |
| Natural | ⇧ | |
| Undeveloped | ⇧ | |
| Solitude or Primitive and Unconfined Recreation | ⇩ | |
| Other Features of Value | ⇔ | |

Two qualities with an upward trend, two qualities with a downward trend; Untrammeled Quality as "tiebreaker"; the trends in the other qualities offset each other, so the overall trend in wilderness character is stable–offsetting, rather than the simple stable trend in the Untrammeled Quality.

| Quality | Trend in the quality | Trend in wilderness character |
|---|---|---|
| Untrammeled | ⇔ | ⇳ |
| Natural | ⇧ | |
| Undeveloped | ⇧ | |
| Solitude or Primitive and Unconfined Recreation | ⇩ | |
| Other Features of Value | ⇩ | |

[a]For brevity, the measures, indicators, and monitoring questions used to determine the trend in each quality are not shown.

Second, the different number of monitoring questions, indicators, and measures within each quality does not affect the overall trend in wilderness character because each quality is represented by a single trend. Third, this hierarchical approach provides different levels of information for the different needs of different audiences: local managers need detailed information on specific measures and indicators, whereas regional and national staff need broader trend information.

Finally, this approach purposefully shows only the change that is occurring and not the magnitude of that change in the indicators, monitoring questions, qualities, and wilderness character. Magnitude is not included because it would: (1) imply a greater level of precision than is possible in this national monitoring strategy; (2) require a consistency across wildernesses and agencies in the number and types of measures that is not possible given the variability within the NWPS; (3) make outcomes more vulnerable to gaming or manipulation (whereas this strategy's conservative approach counts any declining trend as a fully, not partially, declining trend); and (4) not provide any additional resources to local managers who already have the detailed information they need from the data and trends in the measures.

## Reporting on Trend in Wilderness Character

This strategy recommends that the agencies produce three types of standardized monitoring reports, each designed for a different audience: local, regional, and national. Collectively, these reports will help managers understand how wilderness character is changing and promote understanding of larger regional and national trends in agency wilderness stewardship. Appendix 5 provides selected examples of local, regional, and national reports. Although each agency will need to determine its own content and format for these reports, consistency across the agencies would facilitate producing a single NWPS summary report. The frequency of these reports may be annually or biannually for the local report (to maintain ongoing interest and support for local wilderness character monitoring) and once every 5 years for the regional and national reports.

### *Local wilderness report*

This wilderness-specific report would promote understanding of wilderness conditions and facilitate discussion among local staff about preserving wilderness character. Local managers could produce two types of agency-specific local reports:

- A Summary Report would present trends in wilderness character and the qualities to a broad audience of decisionmakers and interested citizens, and would be used for upward reporting within the agency.
- A Detailed Report would present all the wilderness character monitoring information (from the data for each measure up to the overall trend in wilderness character) for use by the local wilderness managers to compare current conditions with locally established thresholds.

### *Regional wilderness report*

This report would promote communication and discussion of monitoring results among each agency's regional wilderness program managers. A standardized reporting format would show trends in wilderness character, and trends in the qualities, monitoring questions, indicators, and measures for all wildernesses in a region. (Regional reports from FWS and NPS would likely not include information on measures because each wilderness is likely to have different measures.) A map would also show the percentage of wildernesses within each region that are preserving wilderness character. This report would provide the level of detail regional wilderness program managers need to help with accountability for wilderness stewardship and policy review.

### *National wilderness report*

This report would promote communication and discussion of wilderness stewardship among national wilderness program managers within each agency, key national non-governmental partners, and congressional staff. A standardized reporting format would show, in approximately two pages, the agency-specific national summary of monitoring results suitable for high-level briefings. This report would present the percentage of wildernesses in which wilderness character is being preserved, and the national trend in each of the qualities of wilderness character.

### *Monitoring narrative*

A monitoring narrative, included in each report, would provide relevant information about the local, regional, and national conditions, circumstances, and context that affect interpretation and use of the trends reported. This portion of the report would give staff the opportunity to add qualitative information and insights from their professional judgment to complement and help interpret trends as appropriate for local, regional, and national reporting. This text would be a valuable part of the legacy information passed to future wilderness managers and would help ensure consistency in reporting over time. The following questions could serve to structure this narrative:

- Is there confidence in the data generated by this monitoring?
- Does the trend in wilderness character accurately reflect recent conditions in the wilderness?
- How should the trend in wilderness character be interpreted if some of the qualities are showing an upward trend while others are showing a downward trend?
- Have decisions been made (for example, to not take certain actions) that are not reflected in this monitoring but that affect the interpretation of the trend in wilderness character?

## Improving This Monitoring in the Future

Monitoring wilderness character is relatively new and the approach recommended here will most likely need to be reevaluated and revised in the future. To ensure credibility and continual improvement over time, this approach must incorporate input from on-the-ground wilderness managers, scientists, and the public to reflect lessons learned during implementation as well as new thinking about wilderness character.

Both the interagency aspect of this approach and its usefulness to wilderness stewardship will require periodic reevaluation.

A standing interagency team is recommended to provide oversight and organization, and to ensure quality control in reviewing accomplishments and improving all aspects of wilderness character monitoring. Agency personnel on such a team could serve as a crucial first link for questions and oversight within each agency. Challenging questions could be posed to the entire team for discussion and interagency consensus recommendations. Meetings of the standing team at 5-year intervals could:

- Review agency accomplishments in implementing wilderness character monitoring.
- Solicit, compile, and organize input from users on what works and what does not.
- Evaluate the relevance of the measures that have been used and recommend changes as appropriate.
- Recommend new data sources and applicable research that are relevant to helping select new measures and interpreting trends in existing measures.
- Evaluate the effectiveness of the process for compiling trends.
- Evaluate the effectiveness of data storage and analysis methods.
- Evaluate the effectiveness of reporting and the use of this information by decision-makers, compliance staff, and staff from other resource programs.

## Untrammeled Quality

Section 2(c) of the Wilderness Act defines wilderness as "an area where the earth and its community of life are untrammeled by man," as an area that "generally appears to have been affected primarily by the forces of nature[,]" and as an area "retaining its primeval character and influence." The term "untrammeled" is defined in the American Heritage dictionary (2011) as "allowed to run free," and synonyms include unrestrained, unrestricted, unhindered, unimpeded, unencumbered, and self-willed. When testifying at the final Senate hearing for the proposed Wilderness Act, Zahniser (1963b, p. 68) stated that in the bill's definition of wilderness, "…the first sentence [on untrammeled] is definitive of the meaning of the concept of wilderness, its essence, its essential nature…The first sentence defines the character of wilderness." In this monitoring strategy, the Untrammeled Quality means that wilderness is essentially unhindered and free from the intentional actions of modern human control or manipulation.

Since passage of the Wilderness Act, the word "untrammeled" and its meaning for wilderness stewardship have been discussed at length (for example, Aplet 1999, Scott 2002). Zahniser (1963a, p. 2), in an editorial titled "Guardians not gardeners," noted that the inspiration for wilderness preservation "is to use 'skill, judgment, and ecologic sensitivity' for the protection of some areas within which natural forces may operate without man's management and manipulation." Furthering this notion, Lucas (1973, p. 151) stated, "If ecological processes operate essentially uncontrolled within the Wilderness frame of reference, the results, whatever they might be, are desirable by definition. The object is not to stop change, nor to recreate conditions as of some arbitrary historical date, nor to strive for favorable change in big game populations or in scenic vistas. The object is to let nature 'roll the dice' and accept the results with interest and scientific curiosity." Nash (2004, p. 8) noted, "Restraint is at the core of the new valuation of wilderness as a moral resource. When we protect wilderness we deliberately withhold our power to change the landscape." Ridder (2007) defined untrammeled as an absence of rationally planned human intervention.

Wilderness is different from other federal lands in that wilderness legislation dictates not only the goals of stewardship but also how management is to be approached—with the utmost humility and restraint. When there is an opportunity for restraint, wilderness legislation directs the managing agency to scrutinize its actions and minimize control or interference with plants, animals, soils, water bodies, and natural processes. The Untrammeled Quality is a unique legislative requirement among all types of land management, defining wilderness in terms of *how* it is managed rather than *what* is there. Management actions may be taken to achieve some positive outcome (for example, to improve one of the other qualities of wilderness character; to comply with federal law such as the Endangered Species Act or special provisions in wilderness enabling legislation; to address a problem with visitor safety; or to address a problem such as the presence of non-indigenous species), but if those actions intentionally manipulate the ecological system, they still degrade the

Facing page: Denali Wilderness, Jacob W. Frank photo (Jacob.w.frank@gmail.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

Untrammeled Quality. To preserve the Untrammeled Quality of wilderness, managers need to exercise restraint when authorizing actions that manipulate any aspect of the wilderness—in general actions that trammel should be avoided as an essential principle of wilderness stewardship unless it can be shown that these actions are necessary to preserve wilderness character as a whole (Kaye 2014). This concept of trammeling applies to all manipulation since the time of wilderness designation. But it does not apply to manipulations that occurred before wilderness designation (such as the use of fire by indigenous people to promote game habitat) because the mandates of the Wilderness Act do not apply prior to designation.

The Untrammeled Quality is clearly linked to the Natural Quality, but they differ in a key way. The Untrammeled Quality monitors *actions* that intentionally manipulate or control ecological systems, whereas the Natural Quality monitors the *effects* from actions taken inside wilderness or from external forces on these systems, regardless of whether the effects are intentional or not. Separating actions from effects offers a clearer understanding of the trends in actions compared with the trends in effects, permitting more effective analysis to improve wilderness stewardship. In addition, the Untrammeled and Natural Qualities are often linked in an inverse way because actions taken to improve the Natural Quality (for example, using prescribed fire to allow fire processes to occur where adjacent land development precludes allowing lightning-ignited fires to burn naturally, or spraying herbicide to eradicate a non-indigenous species, or removing non-indigenous fish from lakes) are also intentional manipulations that degrade the Untrammeled Quality.

## Monitoring Question and Indicators

Table 7 summarizes the one monitoring question and two indicators under the Untrammeled Quality.

**Table 7**—The monitoring question and indicators under the Untrammeled Quality.

| Quality | Monitoring question | Indicator |
|---|---|---|
| Untrammeled | What are the trends in actions that intentionally control or manipulate "the earth and its community of life" inside wilderness? | Actions authorized by the federal land manager that intentionally manipulate the biophysical environment |
| | | Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment |

### *Monitoring question: What are the trends in actions that intentionally control or manipulate the "earth and its community of life" inside wilderness?*

The single monitoring question for the Untrammeled Quality examines actions that intentionally control or manipulate the components or processes of ecological systems inside wilderness. In this context, "intentional manipulation" means an action that purposefully alters, hinders, restricts, controls, or manipulates the "the earth and its community of life," including the type, quantity, or distribution of plants, animals, physical resources (such as air, water, or soil), or biophysical processes (such as fire) inside a designated wilderness.

Actions initiated outside the boundaries of a designated wilderness generally do not affect the Untrammeled Quality. However, some actions taken outside of wilderness boundaries do intentionally alter, hinder, restrict, control, or manipulate "the earth and its community of life" within wilderness. Examples are: introducing a game species outside a wilderness with the intention that the animals will occupy habitat within the wilderness, igniting a fire outside of a wilderness with the anticipation that the fire will burn into the wilderness, installing a dam outside of a wilderness boundary that results in the containment of a watershed within the wilderness, and seeding clouds for weather manipulation over a wilderness.

Since implementation of the 2008 *Keeping It Wild* monitoring strategy, more questions have been raised about the Untrammeled Quality than any of the other qualities, especially about whether particular actions should be considered trammeling actions, and how to count these actions. Appendix 6 provides a detailed discussion and many examples of actions that would or would not typically be considered trammeling actions. The FS Technical Guide (Landres and others 2009) and the BLM Implementation Guide (BLM 2012) provide details about counting these actions.

As a general rule, all actions that intentionally control or manipulate ecological systems within wilderness should be counted equally as trammeling actions regardless of the magnitude of their effects. For practical reasons, however, this monitoring focuses on actions that represent larger scale and more intense manipulations of populations, communities, and disturbance processes, rather than smaller or less intense manipulations. Appendix 6 provides more discussion and many examples of how scale and scope are pragmatically used to determine whether an intentional manipulation is included in this monitoring. Examples of significant actions that would be tracked, compared with smaller actions that would not be, are, respectively: removing predators to reduce their population size compared with removing an individual animal, installing a dam across a river channel compared with installing a waterbar on an existing trail, removing many trees to reroute a major section of trail compared to removing a few trees to reroute a small section of eroding trail, and restoring a mine site compared with restoring individual campsites.

Managers will need to determine what constitutes a trammeling action based on what makes the most sense for understanding the long-term trends in trammeling actions for each wilderness. These determinations may differ from one location to another depending on local circumstances, and need to be applied consistently over time within a wilderness to credibly assess trend in the Untrammeled Quality.

For monitoring trammeling actions, some wilderness managers created indices that take into account the area, intensity, frequency, or duration (in short, the scale and scope) of each trammeling action. The consensus view at the Interagency Lessons Learned Workshop, however, was to count all actions the same regardless of magnitude because the Untrammeled Quality focuses tightly on whether a particular decision to manipulate is made, not on the magnitude of that decision. In other words, taking any trammeling action manipulates "the earth and its community of life" and degrades the Untrammeled Quality. Another concern is that if scale and scope are taken into account, a wilderness could justify taking an action that has a smaller impact, with the potential consequence that taking many smaller actions will have a large cumulative impact on the Untrammeled Quality. Although *Keeping It Wild 2* recommends not

including scale and scope in monitoring trammeling actions, each agency has the discretion to do so. Areal extent, intensity, frequency, and duration, as well as the reason for the action, could also be included in local reporting.

Actions that degrade the Untrammeled Quality are primarily the result of decisions by the wilderness managing agency. However, intentional activities of other governmental agencies and the public that are not authorized by the federal land manager may also affect this quality. Therefore, two indicators are used to address the monitoring question—one that addresses intentional manipulations that are authorized by the federal land manager, and one that addresses intentional manipulations that are not authorized by the federal wilderness land manager.

#### *Indicator: Actions authorized by the federal land manager that intentionally manipulate the biophysical environment*

This indicator tracks all significant actions authorized by the wilderness managing agency that intentionally manipulate the biophysical environment, including those allowed under Section 4(d)(1) of the Wilderness Act (which states "measures may be taken as may be necessary in the control of fire, insects and disease, subject to such conditions as the Secretary deems desirable"). Intentional manipulations taken by other federal agencies, state and tribal agencies, and private citizens are included under this indicator if these actions are authorized by the federal wilderness land managing agency. The intent of this indicator is not to produce a scorecard to grade management performance—the intent is to track whether management programs are trending toward more or less human manipulation in a given wilderness. Trend in this indicator tracks whether or not managers are practicing restraint to allow a wilderness area to persist in its free and self-willed condition. Examples of possible measures that could be included in this indicator are: number of actions that suppress naturally ignited fires; number of actions to stock lakes and other water bodies with fish; number of actions to install guzzlers that provide water to animals; number of actions to install barriers to prevent movement of animals within a stream; number of actions to install structures that alter water flow; and number of actions to trap wildlife to place radio collars, clip toes, or implant pit-tags.

#### *Indicator: Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment*

Unauthorized intentional manipulations of plants, animals, physical resources, or biophysical processes within wilderness have the potential to affect all qualities of wilderness character. These actions are fundamentally different from those authorized by the wilderness managing agency: most authorized manipulations undergo a review process to determine their impacts on the various resources within wilderness, but unauthorized manipulations are often undertaken with little to no consideration for their effects on the broader ecological systems within wilderness and on the other qualities of wilderness character. Despite not being currently relevant in some wildernesses, this indicator captures an important type of trammeling action that can have a large impact. Examples of possible measures for this indicator are: number of actions to stock lakes or other water bodies with fish, number of actions to introduce plant or animal species, and number of actions to control predators by other agencies without the wilderness managing agency's approval.

## Natural Quality

One of the major themes running through the Wilderness Act is that wilderness should be free from the effects of "an increasing population, accompanied by expanding settlement and growing mechanization" and that the "earth and its community of life…is protected and managed so as to preserve its natural conditions" (Section 2(a) and 2(c), respectively). Historically, wilderness is strongly associated with protecting ecological systems from the impacts of modern people (Sutter 2004). In this monitoring strategy, the Natural Quality is preserved when wilderness ecological systems are substantially free from the effects of modern civilization.

The Natural Quality of wilderness character encompasses all naturally occurring biological and physical elements of wilderness: plant and animal species and communities, soil, air, and water. This quality also includes the interactions among these elements and the resulting ecological processes or functions that occur in wilderness, including naturally occurring disturbance processes such as fire, flooding, and outbreaks of insects and pathogens. In short, the Natural Quality is the indigenous species compositions, structures, and functions of the wilderness. The indigenous ecological systems in wilderness serve as the best remaining "laboratory for the study of land-health" (Leopold 1968) and ecological baseline for understanding the effects of modern civilization on natural systems (Arcese 1997). Wilderness is the last best place to monitor the effects of regional and global threats, such as those resulting from air pollution and climate change, respectively.

Importantly, variability and change are hallmarks of all ecological systems, especially in wilderness, where the primary goal is to allow ecological systems to evolve and change freely without human influence. The Natural Quality should not be used to set a target that maintains a particular ecological status quo or pushes an ecosystem towards a desired set of past or future conditions. Given this variability, determining the amount of change that is or is not natural is exceedingly complex and has been the subject of much scientific as well as philosophical discussion (for example, see Cole and Yung 2010 and the references therein).

Ecological systems inside wilderness are directly affected by actions taken inside as well as outside the wilderness. Inside wilderness, for example, non-indigenous fish have been intentionally introduced to improve recreational fishing, yet this action has far-reaching negative effects on indigenous biological diversity and nutrient cycling in wilderness lakes (Knapp and others 2001). Likewise, lake ecosystems have been dramatically changed when fish are stocked in lakes that previously had none. Livestock grazing may be permitted in wilderness yet contributes to soil disturbance and the spread of non-indigenous plants (Belsky and Blumenthal 1997). Biological control agents may be used inside wilderness to eradicate invasive non-indigenous plants, yet may have unintended effects on indigenous plants (Louda and Stiling 2004).

Facing page: Katmai Wilderness, Robert Amoruso photo (robert.amoruso@wildscapeimages.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

Actions outside wilderness, either adjacent to it or far away, can also have large effects inside wilderness. For example, soil disturbance from logging next to a wilderness may create a pool of wind-dispersed exotic plants whose seeds can easily blow into a wilderness and become established there. Dams outside wilderness alter hydrological flow regimes, adversely affecting the riparian plant communities within wilderness (Cowell and Dyer 2002). Air pollutants from sources outside wilderness disperse long distances, affecting wilderness vegetation, soils, and aquatic systems (Schreiber and Newman 1987). Developments outside the wilderness can fragment wildlife habitat, in turn affecting the distribution and abundance of wildlife populations inside the wilderness. Many wildernesses show impacts from becoming increasingly isolated within a "sea" of modern development (Landres and others 1998). At global and regional scales, climate change has a myriad of impacts on ecosystems inside wilderness.

## Monitoring Question and Indicators

Table 8 summarizes the one monitoring question and four indicators under the Natural Quality.

**Table 8**—The monitoring question and indicators under the Natural Quality.

| Quality | Monitoring question | Indicator |
|---|---|---|
| Natural | What are the trends in the natural environment from human-caused change? | Plants |
| | | Animals |
| | | Air and water |
| | | Ecological processes |

### *Monitoring question: What are the trends in the natural environment from human-caused change?*

The single monitoring question for the Natural Quality tracks trends in the natural environment inside wilderness as a result of human-caused change since the area was designated (or by policy managed) as wilderness. Separating human-caused change from natural change requires sufficient understanding of natural conditions and how they vary across time and space. In practice, this understanding is generally lacking. In addition, monitoring in wilderness ideally would track all the effects from both inside and outside the wilderness. Practical and conceptual constraints, however, mean that only a limited set of these effects can be monitored. Likewise, understanding cause-and-effect relationships is beyond the purpose, and practical and technical scope, of this monitoring strategy. Therefore, downward trends are considered "red flags" that call for research and more intensive monitoring to verify the change, understand its cause, and take the minimum necessary mitigating action only when appropriate.

Under all four indicators described below, relevant and practical measures are (1) known human-caused threats to the ecological systems in the wilderness, (2) based on credible protocols that will be repeated over time to yield statistically reliable data and trends that are separable from natural variability, and (3) not based on historical

ecological conditions, keeping current conditions from changing, or desired future ecological conditions. In addition, this monitoring strategy recommends not using proxy or surrogate measures to infer broader and more difficult-to-measure effects on the Natural Quality. For example, a guzzler should not be used as a proxy measure to infer ecological effects on the Natural Quality (such as changing the spatial pattern of species occurrence or their seasonal use of an area); instead, it should be counted as an installation in the Undeveloped Quality. To help agency staff select appropriate measures, Appendix 7 provides detailed discussion about selecting measures, examples of appropriate and inappropriate measures, and a flowchart showing the general selection process.

The four indicators selected to answer this monitoring question capture a broad spectrum of biological and physical attributes, as well as ecological processes that operate within wilderness. Fortunately, there are several national data collection programs (for example, air quality monitoring) and some of the wilderness managing agencies have robust natural resource inventory and monitoring programs that can provide much of the data needed to monitor this quality. The intent of this monitoring strategy is not to replicate these other monitoring programs, but instead to carefully select a few measures for each indicator that best represent trends in the area's Natural Quality.

#### *Indicator: Plants*

Indigenous plant species and plant communities are an integral part of the Natural Quality of wilderness. Indigenous plants are uniquely adapted to local environmental conditions, and contribute to the maintenance of those conditions through such roles as providing soil nutrients and preventing soil erosion. In addition, these plants support the larger community of life by providing food and habitat for indigenous animals. Alterations of plant communities within wilderness may result in changes to the composition, structure, and function of individual plant communities, as well as cascading effects to the larger community of life within the wilderness through the loss, degradation, or alteration of habitat. For convenience, non-vascular plants (for example, bryophytes, lichens, and mosses) and fungi are also included in this indicator.

This indicator captures the primary threats to indigenous plants and plant communities: the addition of non-indigenous species or the loss of indigenous species. A decrease in the presence of non-indigenous species would result in an upward trend in this indicator. An example of a possible measure for this indicator is the number, distribution, or abundance of non-indigenous invasive plant species.

#### *Indicator: Animals*

The presence of vertebrate and invertebrate species within wilderness is an integral part of the Natural Quality of wilderness and these species play specific roles in the larger community of life. An animal may be food for another animal or regulate the population of plants or animals upon which it feeds. Alterations in the occurrence or abundance of animals may result in cascading changes within the animal community as well as associated plant communities.

This indicator captures the primary threats to indigenous animals: the addition of non-indigenous species or the loss of indigenous species. A decrease in the presence of non-indigenous species would result in an upward trend in this indicator. Examples of possible measures for this indicator are: number, distribution, or abundance of non-indigenous animal species; and an index of stocked lakes that could include, for example, a ratio of indigenous to non-indigenous aquatic species.

### *Indicator: Air and water*

Air and water are essential to maintaining properly functioning natural systems inside wilderness. Both are vulnerable to degradation by pollutants produced outside of wilderness as a result of land development and industrial activity. The presence of airborne pollutants in soil and water within wilderness can have direct adverse effects on sensitive plant and animal species and can directly affect essential ecosystem functions such as nutrient cycling. Air pollutants can reduce visibility. In addition to vulnerability to pollutants, water quality, water quantity, and associated features such as stream morphology are vulnerable to the effects of physical manipulations within and outside of wilderness. For example, dams outside the wilderness can markedly affect water quantity and quality, as well as stream morphology, inside the wilderness. In some cases, such as in some desert wildernesses, loss of cryptobiotic soils from grazing or recreation trampling is a significant concern and would be appropriate to include in this indicator if such data are available.

This indicator captures quantities of selected pollutants present within wilderness, as well as selected measurable physical effects of pollution on visibility or the diversity and abundance of pollution-sensitive species. A wealth of air quality data is available from national sources. Though air pollution originates outside wilderness, identifying trends in air pollutants within wilderness may influence external decision-making processes, especially in wildernesses that are designated as Class I airsheds. This indicator also captures physical manipulations of free-flowing water within wilderness and their effects, as well as the effects of similar manipulations outside wilderness. Examples of possible measures for this indicator are: ozone exposure statistics, concentration of nitrogen and sulfur in wet or dry deposition, visibility statistics, altered water flow rates, and index of pollutant-sensitive lichen species.

### *Indicator: Ecological processes*

The integrity of ecological processes within wilderness is vital to preserving the Natural Quality of wilderness. This indicator captures changes in ecological processes that have impacts on multiple components of the ecological systems within wilderness. Change, at any level, to one of these processes results in long-term cascading effects throughout the natural community. Data for potential measures in this indicator are likely to come from national programs with no local data collection, unless a local office has better data and the means to develop its own protocol.

Ecological processes are complex and difficult to quantify. Therefore, many of the potential measures for this indicator track either the magnitude or intensity of the factors likely to be affecting the natural processes within wilderness. Others quantify the resulting effects of processes that have changed. Finally, potential measures could take advantage of existing datasets that provide an index of the condition of certain

processes within wilderness. Examples of possible measures for this indicator are: average watershed condition class, index of fragmentation, and acres of active grazing allotments.

Human-caused climate change measures would be included under this ecological processes indicator if an agency or individual wilderness chooses to include such measures. Climate change has the potential to drastically alter natural systems within wilderness. Despite well-documented impacts to the Natural Quality of wilderness, the feasibility and relevance of climate change measures to wilderness character monitoring need to be carefully considered before including such measures. Appendix 7 provides a detailed discussion and a flowchart to help staff determine whether climate change measures are appropriate for wilderness character monitoring.

## Undeveloped Quality

Wilderness is defined in Section 2(c) of the Wilderness Act as "an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation," with "the imprint of man's work substantially unnoticeable." The basic idea that wilderness is undeveloped runs through every definition of wilderness. For example, Aldo Leopold (1921) envisioned wilderness as "a continuous stretch of country preserved in its natural state, open to lawful hunting and fishing, devoid of roads, artificial trails, cottages, or other works of man." Hubert Humphrey (1957), an original sponsor of the Wilderness Act, clarified his definition of wilderness as "the native condition of the area, undeveloped … untouched by the hand of man or his mechanical products." In this monitoring strategy, the Undeveloped Quality means that wilderness is essentially without permanent improvements or the sights and sounds of modern human occupation.

The Wilderness Act identifies "expanding settlement and growing mechanization" as the forces that cause wild country to become occupied and modified, and clarifies in Section 4(c) that "there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation." An early FS review of wilderness policy (Worf and others 1972) noted that buildings or other structures are usually set up for only one purpose: to facilitate human activity. The building or structure not only occupies the land, but also makes it easier for people to impose their will on the environment, thereby modifying it. This policy review also found that motorized equipment and mechanical transport similarly make it easier for people to occupy and modify the land. Zahniser (1956, p. 38) articulated this idea when he argued the need for "areas of the earth within which we stand without our mechanisms that make us immediate masters over our environment." Even though the use of motor vehicles, motorized equipment, or mechanical transport diminishes the opportunity for visitors to experience natural soundscapes and primitive recreation, these uses are included under this Undeveloped Quality and not in the Natural or Solitude or Primitive and Unconfined Recreation Qualities because of the close association in the legislative history between motorized use and mechanical transport, and people's ability to develop, occupy, and modify wilderness.

Few wildernesses have escaped at least some modern human occupation and modification. In addition, many developments and motorized or mechanized uses are allowed by special provisions in enabling legislation, including buildings, roads, dams, powerline and water pipe corridors, mines, aircraft landing strips, and in Alaska, snow machines by subsistence and traditional users. Although the continuing presence of these developments and uses may be legally allowed in a wilderness, the resulting facilities, structures, and authorizations for motorized use and mechanical transport can have far-reaching effects on wilderness character (Dawson and Hendee 2009).

Facing page: Maroon Bells-Snowmass Wilderness, Nate Zeman photo (natezeman@me.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

The status of these developments and uses at the time of designation form the baseline from which change and impacts to wilderness character can be assessed. Special provisions that are unique to a wilderness underscore the importance of not comparing one wilderness to another.

The most common types of infrastructure found in wilderness facilitate recreational use, and include system trails, bridges, designated camping areas and associated structures, and in some cases toilets. These types of infrastructure degrade both the Undeveloped Quality and the Solitude or Primitive and Unconfined Recreation Quality, but their primary purpose is related to recreation and they are therefore monitored only in the latter quality. The first monitoring question and associated indicators for the Undeveloped Quality reflects this distinction and focuses on trends in non-recreational physical developments.

**Table 9**—The monitoring questions and indicators under the Undeveloped Quality.

| Quality | Monitoring question | Indicator |
|---|---|---|
| Undeveloped | What are the trends in non-recreational physical development? | Presence of non-recreational structures, installations, and developments |
| | | Presence of inholdings |
| | What are the trends in mechanization? | Use of motor vehicles, motorized equipment, or mechanical transport |

## Monitoring Questions and Indicators

Table 9 summarizes the two monitoring questions and three indicators under the Undeveloped Quality.

### *Monitoring question: What are the trends in non-recreational physical development?*

The first monitoring question for this quality addresses the trends in non-recreational physical developments present in wilderness because these developments are clear evidence of human occupation or modification. Only developments that are *not* primarily for a recreational purpose or use are monitored under this monitoring question, whereas developments that have a recreational purpose or use are included under the Solitude or Primitive and Unconfined Recreation Quality. Wilderness is supposed to be a place where the evidence of human activity is "substantially unnoticeable." However, some physical evidence of occupancy and use is allowed because of special provisions in legislation or because it is considered the "minimum necessary for administration of the area for the purpose of the Act" (Section 4(c) of the Wilderness Act). Managers need to exercise restraint in fulfilling these administrative responsibilities so that a wilderness does not increasingly appear developed, occupied, and modified.

This monitoring question focuses on "modern human occupation and modification." Those features constructed by indigenous peoples prior to modern settlement,

such as cliff dwellings, pit houses, and kivas, are excluded from this quality—though they may be considered under the Other Features of Value Quality if they are determined to be integral to wilderness character.

Each of the two indicators under this monitoring question addresses distinct reasons and types of structures, installations, and developments that may occur inside wilderness.

#### *Indicator: Presence of non-recreational structures, installations, and developments*

Many different types of structures (intended for human occupation), installations (not intended for human occupation), and developments occur inside wilderness for reasons unrelated to recreation. Examples are: administrative sites, dams, water ditches and pipelines, old road beds, mines and mining structures, and communication facilities and fixed instrumentation sites for gathering a variety of data. These developments may predate wilderness designation and in some cases their use and maintenance are allowed to continue, as provided by law. Both currently functioning and defunct structures, installations, and developments are included because all are signs of modern human occupation in the wilderness. Scientific installations (such as geological activity sensors and snow gauging stations) and historical structures (such as cabins and fire towers) are also included in this indicator. Additionally, large trash objects, such as motor vehicles, aircraft, earth-moving equipment, military and mining debris, or trash dumps, are included in this indicator because they are signs of modern human occupation even though they are not technically a structure, installation, or development. An example of a possible measure for this indicator is an index of physical development that takes into account the number of developments, their physical size, and the materials used.

#### *Indicator: Presence of inholdings*

Inholdings are parcels of land not owned by the federal land managing agency that are entirely surrounded by designated wilderness; they are therefore considered "inside" wilderness even though they are not part of the wilderness and not subject to wilderness laws and policies. Inholdings do not occur in every wilderness and some inholdings, such as state conservation lands, may be compatible with wilderness values. Other inholdings, however, are open to be developed for various purposes at the discretion of the landowner. Roads can be built, and the lands can be logged, or, more commonly, developed with recreational lodges, facilities, or private residences. Due to the vulnerability of these lands to development and the adverse effect this development would have on the surrounding wilderness values, inholdings are often considered a high priority for acquisition or exchange by the federal agency. An example of a possible measure that could be included in this indicator is an index of inholdings that takes into account the number, acreage, and development potential of existing inholdings. In this case, a decrease in the acreage of inholdings, or legal agreements with owners that limit development of inholdings, would enhance the Undeveloped Quality.

In addition, the potential impact on wilderness visitors from development and use occurring in an inholding could be monitored in the Solitude or Primitive and Unconfined Recreation Quality (see the Remoteness from outside sights and sounds indicator below).

### *Monitoring question: What are the trends in mechanization?*

The second monitoring question tracks mechanization in wilderness. The Wilderness Act recognizes "growing mechanization" as a force that causes an area to become occupied and modified. The agencies may authorize a variety of mechanized uses for administrative purposes, but the mandate from the Wilderness Act is that such uses are allowed only when they are the minimum necessary to administer the area as wilderness, and not merely because they are convenient. Mechanized uses are also allowed for emergency purposes, or when special provisions in a wilderness law, such as the Alaska National Interest Lands Conservation Act, allow them. A single indicator is used to address a wide variety of authorized and unauthorized mechanized uses.

#### *Indicator: Use of motor vehicles, motorized equipment, or mechanical transport*

Section 4(c) of the Wilderness Act discusses three forms of mechanization that degrade wilderness character: motor vehicles, motorized equipment, and mechanical transport. This indicator tracks these mechanized uses for administrative, emergency, and other non-emergency purposes such as access to mineral rights, state land, and private land, and provision of other laws. Detailed discussion defining motor vehicles, motorized equipment, and mechanical transport can be found in agency policies. Monitoring allows managers to be aware of trends in increasing use and respond to them with appropriate management decisions to reverse or stabilize this trend. Examples of possible measures for this indicator are: index of administrative authorizations to use motor vehicles, motorized equipment, or mechanical transport; percentage of emergency incidents not using motor vehicles, motorized equipment, or mechanical transport; and number of non-authorized uses of motor vehicles, motorized equipment, or mechanical transport per unit of effort or time by law enforcement.

# Solitude or Primitive and Unconfined Recreation Quality

The Wilderness Act states in Section 2(c) that wilderness has "outstanding opportunities for solitude or a primitive and unconfined type of recreation." There has been much discussion and debate about the meaning of these words among wilderness managers and scholars (Dawson and Hendee 2009). Early wilderness writings of Aldo Leopold, Robert Marshall, Sigurd Olson, Howard Zahniser, and others paint a rich picture about the type of experience envisioned in wilderness environments. These writings strongly enforce the vital roles of solitude, self-reliance, and freedom as central to the idea of wilderness. In this monitoring strategy, the Solitude or Primitive and Unconfined Recreation Quality encompasses outstanding opportunities for people to experience solitude or primitive and unconfined recreation in wilderness, including the benefits and inspiration derived from physical and mental challenge.

The meaning of solitude has been at the center of considerable debate among researchers and the public (for example, see Washington Trails Association 1997), with proposed definitions ranging from not seeing other people, to privacy, to freedom from societal constraints and obligations, to freedom from management regulations (Hall 2001, Hollenhorst and Jones 2001). The content of early wilderness writings suggests that solitude was viewed holistically, encompassing attributes such as separation from people and civilization, inspiration (an awakening of the senses, connection with the beauty of nature and the larger community of life), and a sense of timelessness (allowing one to let go of day-to-day obligations, go at one's own pace, and spend time reflecting). A review of research suggests that solitude encapsulates a range of experiences, including privacy, being away from civilization, inspiration, self-paced activities, and a sense of connection with times past (Borrie and Roggenbuck 2001).

The meaning of primitive and unconfined recreation has also been the subject of much debate. Primitive recreation has largely been interpreted as travel by non-motorized and non-mechanical means (for example by horse, foot, or canoe) that reinforces our connection with our ancestors and our heritage. However, primitive recreation also encompasses reliance on personal skills to travel and camp in an area, rather than reliance on facilities or outside help (Roggenbuck 2004). Unconfined recreation involves attributes such as self-discovery, exploration, and freedom from societal or managerial controls (Dawson and Hendee 2009, Lucas 1983, McCool 2004, Nash 1996). A primitive and unconfined recreation experience provides the ideal opportunity for physical and mental challenges associated with adventure, real consequences for mistakes, and personal growth from facing and overcoming obstacles (Borrie 2000, Dustin and McAvoy 2000).

Many different complex factors contribute in known and unknown ways to how people experience solitude or primitive and unconfined recreation (Borrie and Birzell 2001, Dawson and Hendee 2009, Manning and Lime 2000). For example, experiences

Facing page: Olympic Wilderness, Pablo McLoud photo (grover@warmlava.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

may be influenced by factors largely beyond managers' control and influence, including attributes of the physical landscape, the presence of certain animals (for example, mosquitoes and grizzly bears), local weather, intra- and inter-group dynamics, and the skills and knowledge an individual brings to the experience. In contrast, managers may exert some control over use levels, the types and patterns of use, the level of development (both inside and adjacent to wilderness), the amount and type of information available about the wilderness, and the kinds of regulations imposed, all of which influence the opportunity to experience solitude or a primitive and unconfined type of recreation (Cole and others 1987, Hollenhorst and Jones 2001, Lucas 1973, McDonald and others 1989, Patterson and others 1998, Pietila and Kangas 2015, Watson 1995).

Managers may face difficult decisions protecting resources while providing outstanding opportunities for solitude or primitive and unconfined recreation. For example, administrative sites or a minimal system of trails may be considered necessary for managing recreation while still allowing people to use and enjoy wilderness. However, administrative sites and trails concentrate visitors and reduce outstanding opportunities for solitude. Similarly, a bridge across a river may be considered necessary for allowing visitor access to a portion of the wilderness, yet this bridge also reduces outstanding opportunities for primitive recreation. Last, imposing more regulations on visitor behavior may be considered necessary to reduce the physical impacts of recreation and improve opportunities for solitude, but such regulations reduce outstanding opportunities for unconfined recreation.

In all three situations described above, managers may feel that a primary goal is to reduce the physical impacts from recreation while providing opportunities for a greater number of visitors. This goal, however, creates a self-reinforcing cycle in which more installations and regulations allow more visitors, in turn requiring more installations and regulations. Furthermore, this goal ignores the impact of the installation and regulation on the quality of the experience. There is a tension in the Wilderness Act between realizing the act's recreational purpose and preserving wilderness character in general and the Solitude or Primitive and Unconfined Recreation Quality in particular. Properly considering the effects of a potential action on the quality of the visitor experience is a vital part of management decisions arising from this tension. In these situations, the agencies need to be careful that the Solitude or Primitive and Unconfined Recreation Quality, as well as the quality of visitor experiences, does not slowly and incrementally erode over time.

Given the complexity of people's interactions with their environment and with other human beings, the intent of monitoring this quality is not to understand their experiences, perceptions, or motivations in wilderness. Instead, this monitoring strategy focuses on the mandate in the Wilderness Act to provide outstanding opportunities for solitude or primitive and unconfined reaction, and to monitor how these opportunities are changing over time (Cole 2004, Dawson 2004). This monitoring will not answer questions related to whether people perceive these changes as good or bad, nor will it answer questions about whether the changes are causing people to alter their expectations or their behavior. Though important, these questions are beyond the current scope of this monitoring strategy.

## Monitoring Questions and Indicators

Table 10 summarizes the two monitoring questions and four indicators under the Solitude or Primitive and Unconfined Recreation Quality.

**Table 10**—The monitoring questions and indicators under the Solitude or Primitive and Unconfined Recreation Quality.

| Quality | Monitoring question | Indicator |
|---|---|---|
| Solitude or Primitive and Unconfined Recreation | What are the trends in outstanding opportunities for solitude? | Remoteness from sights and sounds of human activity inside the wilderness |
| | | Remoteness from sights and sounds of human activity outside the wilderness |
| | What are the trends in outstanding opportunities for primitive and unconfined recreation? | Facilities that decrease self-reliant recreation |
| | | Management restrictions on visitor behavior |

### *Monitoring question: What are the trends in outstanding opportunities for solitude?*

The Wilderness Act acknowledges that wilderness, being protected from human development and settlement, provides an opportunity for solitude not available elsewhere. Opportunities for solitude are degraded by both visitor use in wilderness and certain characteristics of the setting. Specifically, encountering other visitors in wilderness, or seeing or hearing the signs of modern civilization, may detract from opportunities to experience solitude. Increasing visitation, human population growth (especially near wilderness), and areas of concentrated use within wilderness all have the potential to degrade opportunities for solitude. The opportunity to achieve solitude within the wilderness is a function of both the density of visitors, most of whom stay on established trails and preexisting campsites, and the opportunity to get away from those visitors and their impacts by going to more remote areas.

Two indicators are associated with this monitoring question. The first, remoteness from sights and sounds of human activity *inside* the wilderness, allows managers to track conditions that are more subject to management control. The second, remoteness from sights and sounds of human activity *outside* the wilderness, offers a way to track the effects of developments outside the wilderness that impinge on opportunities for solitude within the wilderness.

#### *Indicator: Remoteness from sights and sounds of human activity inside wilderness*

Remoteness—being distant from the sights and sounds of civilization—is important for achieving a sense of solitude (Dawson 2004, Manning and others 2007). Seeing or hearing other people inside a wilderness directly affects opportunities for solitude. Opportunities for solitude can exist on established travel routes and near developments within wilderness if visitation is low, or solitude can be found by entering

undeveloped areas where there are no official travel routes. In addition to visitors, this indicator can also capture trash and debris that degrade most people's sense of what to expect in a wilderness. For example, in wildernesses that have beaches, trash that washes ashore may be a significant concern and degrades the feeling of remoteness. Similarly, trash and debris from hunting and outfitting camps can negate the feeling of being remote. Examples of possible measures that could be included in this indicator are: number of visitor encounters on travel routes; number of occupied campsites within sight and sound of one another; area of wilderness away from access and travel routes and developments; index of user-created campsites based on the site number, density, and impacts; and miles of user-created trails.

#### *Indicator: Remoteness from sights and sounds of human activity outside the wilderness*

This indicator focuses on human activity occurring outside of wilderness that is evident within the wilderness. Even though many wilderness laws prohibit the denial of activities outside a wilderness simply because they can be seen or heard inside the wilderness, these activities nevertheless can degrade the wilderness experience. Signs of human activity and development outside wilderness include the sight and sound of (1) automobiles and off-road vehicles on nearby travel routes, (2) airplanes, (3) development and use of inholdings, (4) air and light pollution, and (5) urbanization from high ridges and peaks. Examples of possible measures that could be included in this indicator are: area of wilderness not affected by travel routes and developments that are outside the wilderness, and night sky visibility.

### *Monitoring question: What are the trends in outstanding opportunities for primitive and unconfined recreation?*

The second monitoring question for this quality addresses the opportunities for primitive and unconfined recreation. Including primitive and unconfined recreation as a separate monitoring question acknowledges the importance of non-motorized and non-mechanized travel, self-reliance and self-discovery, and places where people can be free from the confines of social constraints. Because primitive recreation requires self-reliance and skills in wilderness travel, opportunities for such experiences are degraded by the presence of facilities that make wilderness travel easier, such as bridges and high-standard trails. Unconfined recreation encompasses the sense of discovery, adventure, and mental challenge where one can travel and explore unique and unknown environments on one's own. The two indicators under this monitoring question focus on the presence of facilities in wilderness that decrease opportunities for primitive recreation, and management restrictions on visitor behavior that decrease opportunities for unconfined recreation.

#### *Indicator: Facilities that decrease self-reliant recreation*

Primitive recreation requires self-reliance, as well as travel that is unassisted by mechanical or motorized equipment. Many different types of structures, installations, and developments are constructed to facilitate access or use of the wilderness, to improve visitor safety, or to protect other wilderness resources from visitors. Facilities designed for these reasons are categorized as recreational in this monitoring strategy and occur in many wildernesses. Examples are: system trails, trail signs, bridges,

sleeping platforms in swamp wildernesses, toilets in high-use areas, aircraft landing strips, food storage lockers or bear poles where bears pose a threat to safety, hardened and designated campsites in high-use areas, and the "comfort" facilities provided by outfitters and guides for their clients. Although trails and other recreation facilities in wilderness concentrate user impact and protect resources, and visitors appreciate and use these facilities, such developments reduce the experience of primitive recreation and the need to practice primitive backcountry skills.

This indicator provides a means for measuring trends in the presence of those durable or relatively permanent facilities provided by the agency and others (such as outfitters and guides) that affect the opportunity for primitive recreation. This indicator also provides a means for monitoring facilities or services that do not have a physical presence but still diminish self-reliant recreation, such as cell-phone coverage. Examples of possible measures for this indicator are: index of authorized recreation facilities that includes number and type, miles of developed trails, and area of cell-phone coverage.

### *Indicator: Management restrictions on visitor behavior*

Management restrictions in wilderness are often adopted to protect resources or opportunities for solitude. However, unconfined recreation refers to types of recreation in which visitors experience a high degree of freedom over their own actions and decisions (Dawson and Hendee 2009, Dustin and McAvoy 2000); management restrictions degrade this sense of freedom and limit opportunities for unconfined recreation. In the context of this monitoring strategy, management restrictions on visitor behavior in wilderness are agency regulations or policies that govern visitors' behavior, travel, or equipment. An example of a possible measure for this indicator is an index of visitor management restrictions based on the size of the area affected, the duration of the restriction, and the intensity or magnitude of the restriction.

## Other Features of Value Quality

Section 2(c) of the Wilderness Act defines wilderness as an area that "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." Incorporating these unique features, where they exist, in wilderness character monitoring can provide a more complete picture of wilderness character. The primary challenge with this quality lies in determining which features are truly unique and essential to the character of a particular wilderness. Guidelines are offered later in this section to help local staff make this determination.

This monitoring focuses on the physical condition of select features, and not on the scientific, educational, scenic, or historical value derived from these features. By protecting the physical condition of these features, the values associated with them are most likely preserved. Furthermore, wilderness managers have some ability to protect the physical condition of a given feature, whereas scientific, educational, scenic, or historical values are contextual, dynamic, and difficult or impossible to quantify and hence to monitor. For example, unique paleontological features may occur in a wilderness and these features may have scientific and educational value; managers can ensure that these features are protected, but they cannot feasibly gauge or track changes in either the scientific or educational value of these features. Unique features related to subsistence use in Alaska may be relevant to monitor as part of this quality.

There are important distinctions between this quality and the other four qualities:

- *Use of this quality is not required*. Unlike the other qualities that apply to every wilderness, the Section 2(c) definition notes that other features *may* be present; they are not required to be present. However, if features exist that are truly integral to wilderness character, then this quality would be used in monitoring.
- *This quality focuses on site-specific features.* Unlike the other qualities that apply to the entirety of a wilderness, the features monitored within this quality usually occur only at specific sites, although some features such as cultural landscapes (Cowley and others 2012, Meyer 2013) and certain geological or paleontological formations may occur over larger areas.
- *Where this quality is used, the overall trend in wilderness character will be based on five qualities instead of four.* If this quality is used, the overall trend in wilderness character is determined by using all five qualities and this quality carries the same weight as the Natural, Undeveloped, and Solitude or Primitive and Unconfined Recreation Qualities. Because it will be used in determining the overall trend in wilderness character, local staff must carefully consider whether a feature truly defines the wilderness character for an area and whether the quality of the data about this feature is sufficient to support using it as a measure. These considerations are especially critical if a small number of features are included, because the trend in the condition of an individual feature may well determine the trend in the entire quality and thereby influence the overall trend in wilderness character.

Facing page: Paria Canyon-Vermilion Cliffs Wilderness, Josephy Rossbach photo (rossbachphoto@gmail.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

For most wildernesses, this quality focuses on tangible features of unique geological, historical, or prehistoric value such as lava beds, cave formations, dinosaur tracks, cliff dwellings, or rock art (petroglyphs and pictographs). Other types of features with unique ecological, scientific, educational and scenic value are often more appropriately included in one of the other four qualities. For example, views of an iconic mountain peak or a vast expanse of undeveloped land may be appropriately monitored by a measure of visibility under the Natural Quality, or by a measure of viewshed impacts in the Solitude or Primitive and Unconfined Quality, because these views would be degraded by air pollutants inside or developments outside the wilderness, respectively.

In contrast to the example above, certain natural features that may be iconic to a wilderness and give it meaning do not fit the criteria described in appendix 7 for being appropriate to include in the Natural Quality due to the difficulty of interpreting the trend. In these cases, such features may be monitored in the Other Features of Value Quality or not monitored at all and simply described in the wilderness character narrative (see appendix 3). For example, a glacier may be iconic for a wilderness and be of particularly important scientific value, but glaciers naturally retreat and expand so they would not be appropriate to include in the Natural Quality. Instead, to capture the scientific value of the glacier, a simple measure that expresses the overall condition of the glacier, such as extent or area, could be used in the Other Features of Value Quality. Similarly, the occurrence and abundance of iconic plant or animal species, such as saguaro cacti or wolf populations, naturally change over time and from one area to another so they would not be appropriate to include in the Natural Quality. Instead, to capture the iconic value of these species, a simple measure of presence in the wilderness could be used in the Other Features of Value Quality.

Intangible resources such as spiritual values, traditional practices, and traditional and historical stories, are important aspects of this quality but are not included in this monitoring. An appropriate place to address these intangible values is in the wilderness character narrative (see appendix 3). However, tangible features specifically associated with these intangible values may be considered integral to the area's wilderness character and appropriate to monitor. For example, such features could include a wall of petroglyphs, a significant obsidian source, wagon ruts associated with a National Historic Trail, a unique concentration of dinosaur tracks, a nationally recognized cave, or a glacier nationally recognized for its scientific and educational value. Alternatively, a common trapper's cabin, mining debris, and old logging camps are examples of features that are not likely to be considered integral to wilderness character and would be monitored in the Undeveloped Quality.

## Which Features are Integral to Wilderness Character?

A key challenge to this quality is determining whether a site-specific feature is integral to wilderness character. What is considered "integral to wilderness character" is anticipated to be a subset of the full suite of important site-specific geological, historical, cultural, and other features within a wilderness. The decision on whether or not a feature is integral to wilderness character is made by local staff and requires discussion between wilderness managers and resource specialists, notably cultural resource

staff. The following questions can help guide staff to determine whether a site-specific feature should be considered integral to wilderness character:

- Is the feature specifically identified in the enabling legislation for the wilderness? Features identified in the enabling legislation for a particular wilderness should be strongly considered as integral to wilderness character. Features not listed in the enabling legislation may still be considered, but the determination of whether or not to include them will require considerably more discussion and scrutiny.
- *Does the feature define how people think about the wilderness or how they value the wilderness?* The focus here is on selecting those features that play a central role in defining the meaning and significance of the wilderness, rather than those features that relate to broader, non-wilderness themes. Important features that relate to broader themes may still be part of a larger wilderness monitoring program, but will not be monitored as part of wilderness character.
- *Is the feature nationally recognized (for example, through an official designation such as the National Register) or considered a priority heritage asset (for example, identified as significant in an agency plan)?* Features recognized by some type of national designation, such as a site listed on the National Historic Register, or as a National Geological Site or National Natural Landmark, should be strongly considered as integral to wilderness character. Historical and prehistoric features identified as "priority assets" should also be considered, particularly if the feature has a national designation.

These three questions help identify features that make the area's meaning and significance *as wilderness* clearer and more distinctive. Discussions among staff should include consideration of the feature's educational, scientific, or scenic value. Additionally, for prehistoric or historical features, the physical evidence should convey a story about the distinctive interwoven human relationship with the land that helps enrich the meaning of the area as wilderness. Important features that are not considered integral to wilderness character may still be monitored under other resource programs; for example, cultural resource staff may track the condition of historical cabins. But they will not be monitored as part of the Other Features of Value Quality of wilderness character.

Threats to this quality result primarily from direct human actions, such as looting or vandalism, and indirect human disturbance, such as camping or trail use that creates unintended adverse effects. Such damage is most often associated with visitor use, although other management activities, notably fire suppression activities, could contribute to this disturbance. Projects to improve the condition of a feature monitored under this quality (for example, redirecting visitor use away from vulnerable features) could lead to an upward trend in this quality.

## Monitoring Question and Indicators

Table 11 summarizes the one monitoring question and two indicators under the Other Features of Value Quality.

**Table 11**—The monitoring question and indicators under the Other Features of Value Quality.

| Quality | Monitoring question | Indicator |
|---|---|---|
| Other Features of Value (to be determined by local unit if relevant) | What are the trends in the unique features that are tangible and integral to wilderness character? | Deterioration or loss of integral cultural features |
| | | Deterioration or loss of other integral site-specific features of value |

### *Monitoring question: What are the trends in the unique features that are tangible and integral to wilderness character?*

The single monitoring question for this quality addresses the trend in unique, site-specific features that are integral to defining the meaning and significance of a particular wilderness. Two indicators are used to address the monitoring question. The first focuses on cultural features and the second provides a catchall for other site-specific features, such as geological, ecological, paleontological, and other significant features that local staff may determine are integral to wilderness character. Depending on the features that are integral to the wilderness, either or both of these indicators may be used. A decline in the condition of any feature tracked under the Other Features of Value Quality is always interpreted as a downward trend in wilderness character.

#### *Indicator: Deterioration or loss of integral cultural features*

This indicator captures the condition of cultural features determined to be integral to wilderness character, as well as authorized and unauthorized actions that damage or disturb these features. "Cultural" is defined broadly to include both prehistoric and historical features. A decline in the condition of integral cultural features or an increase in actions that damage or disturb these features degrades wilderness character. Examples of possible measures that could be included in this indicator are: condition index for integral cultural features, and number of authorized or unauthorized actions that damage or disturb integral cultural features.

#### *Indicator: Deterioration or loss of other integral site-specific features*

This indicator captures the condition of other site-specific features determined to be integral to wilderness character. Although it is expected that most wildernesses will not have other unique site-specific features that are integral to the area's wilderness character, this indicator is intended to provide additional flexibility to use locally relevant information to capture iconic geological, paleontological, and other features. A decline in the condition of other integral site-specific features degrades wilderness character. Examples of possible measures that could be included in this indicator are: condition index for integral geological, paleontological, or other features; and number of authorized and unauthorized actions that damage or disturb integral geological, paleontological, or other features.

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Facing page: Haleakala Wilderness, Peter Landres photo.

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# Appendix 1. A Brief History Of Interagency Wilderness Character Monitoring

The U.S. Forest Service (FS) chartered a team in 2001 to develop a national wilderness monitoring strategy. This team, which included representatives from the other three wilderness agencies (the Department of the Interior's Bureau of Land Management, Fish and Wildlife Service, and National Park Service; hereafter BLM, FWS, and NPS, respectively), published an FS national strategy to monitor wilderness character (Landres and others 2005)[1]. Then a team of subject-matter experts developed detailed monitoring protocols; these protocols were pilot tested and a technical guide was published (Landres and others 2009).

In 2004, the Interagency Wilderness Policy Council (IWPC), composed of the highest-level administrative personnel responsible for wilderness in each of the four managing agencies, along with representatives from the Department of the Interior's U.S. Geological Survey (USGS) and the research branch of the FS, identified in its annual action plan the need to "create an interagency team to develop interagency wilderness character monitoring protocols." The IWPC directed the Interagency Wilderness Steering Committee (IWSC), made up of the national program leads for wilderness in each of the four agencies and representatives from the USGS and FS research, to implement this action item. In 2006, the IWSC developed and signed a charter to staff and direct the Interagency Wilderness Character Monitoring Team, to be composed of representatives from the four wilderness managing agencies and the USGS, and chaired by a representative from the Aldo Leopold Wilderness Research Institute. This team was tasked with developing an interagency strategy to monitor wilderness character across the National Wilderness Preservation System (NWPS) based on the 2005 strategy published by the FS. This team published the interagency Keeping It Wild monitoring strategy (Landres and others 2008) and conducted proof-of-concept testing in 2009. In 2009, the IWPC formally endorsed this monitoring strategy and recommended that the agencies complete wilderness character monitoring baselines by the 50th anniversary of the Wilderness Act in 2014.

A significant amount of effort has been spent by the four wilderness agencies to develop the conceptual basis for wilderness character monitoring and its practical implementation. Through the various agency-specific efforts described below, a total of just over 100 agency staff have been directly involved in developing wilderness character monitoring, these efforts were reviewed by 149 other staff selected for their expertise in wilderness, just over 1,000 review comments were received and discussed, and 44 pilot tests were conducted. Keeping It Wild 2 stems from a 2014 Interagency Lessons Learned Workshop (see below), and is based on the accumulated expertise of agency staff and experience gained through all of this effort and interaction (figure A1-1).

[1] References in this appendix can be found in the "References" section after the main text.

Facing page: Joshua Tree Wilderness, Cliff LaPlant photo (laplant@cox.net), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

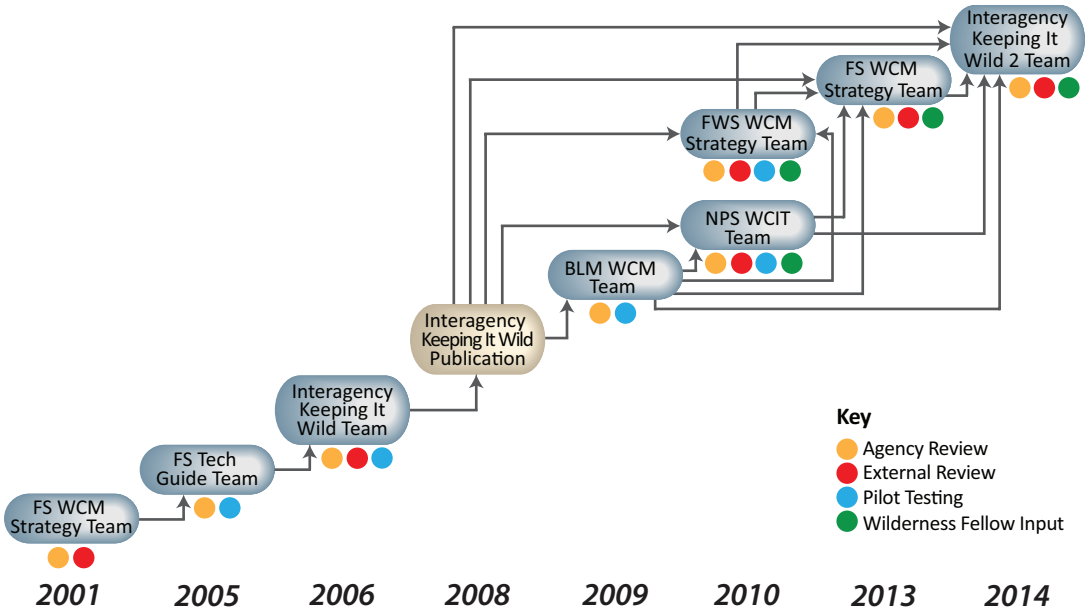



**Figure 1.** History of interaction among the wilderness managing agencies in developing Keeping It Wild 2. Other than agency acronyms, the acronyms in this figure are WCM (wilderness character monitoring) and WCIT (Wilderness Character Integration Team). Starting from the left, the "FS WCM Strategy Team" developed the Forest Service wilderness character monitoring national strategy (Landres and others 2005); the "FS Tech Guide Team" developed the Forest Service monitoring protocols technical guide (Landres and others 2009); the "Interagency Keeping It Wild Team" developed the first Keeping It Wild (Landres and others 2008); the "BLM WCM Team" developed the Bureau of Land Management wilderness character monitoring protocols (BLM 2012); the "NPS WCIT Team" developed the two National Park Service publications about integrating wilderness character into park planning, management, and monitoring (NPS 2014a, 2014b); the "FWS WCM Strategy Team" developed the Fish and Wildlife Service wilderness character monitoring strategy; and the 2010 "FS WCM Strategy Team" updated the original Forest Service wilderness character monitoring strategy to build on the 2008 interagency Keeping It Wild.

Although united by the conceptual basis of wilderness character monitoring, the four wilderness agencies have approached implementation of wilderness character monitoring and integration within their agencies in different ways (described below). As of spring 2015, the agencies have initiated wilderness character baseline assessments in 223 (29 percent) of the wildernesses in the NWPS.

## Bureau of Land Management

In 2008, the BLM chartered a team to develop guidance on wilderness character monitoring. In 2010, the Director of the BLM issued an Instruction Memorandum requiring that baseline wilderness character monitoring be completed in all BLM-administered wildernesses by September 2014. Starting in 2010, the BLM's goal was for 20 percent of the wildernesses in each state to complete baseline assessments of wilderness character. The requirement for wilderness character monitoring was also included in the 2012 policy revision of Manual 6340, Wilderness Management. In 2012, the BLM developed an implementation guide for standardized measures and monitoring protocols across the agency (BLM 2012). As of spring 2015, wilderness character baseline assessments and data collection have been completed for 113 (51 percent) of the BLM wildernesses.

## Fish and Wildlife Service

In 2010, the Assistant Director of the National Wildlife Refuge System issued a directive chartering a team to develop the FWS strategy for monitoring wilderness character in all FWS wildernesses. Starting in 2011, the newly established FWS National Wildlife Refuge System Inventory and Monitoring Initiative hired Wilderness Fellows (all with recent undergraduate or graduate degrees) for 6-month positions to conduct baseline assessments of wilderness character. Wilderness character baseline assessments and data collection have been completed for all 71 (100 percent) of the FWS wildernesses, and for 14 proposed wildernesses.

## Forest Service

After initiating the framework for monitoring wilderness character in 2001, the FS developed a technical guide that described the protocols for monitoring wilderness character. The guide was then pilot tested in all nine FS regions in 2006 and the results used to formulate an implementation plan, which had the intent of establishing baseline conditions in all wildernesses managed by the FS within 5 years. The agency was unable to provide the resources needed for nationwide implementation at that time. Although several national forests have moved forward with wilderness character monitoring in the interim, current plans are to revise and replace the existing technical guide in 2015 to make it consistent with Keeping It Wild 2. As of spring 2015, wilderness character baseline assessments and data collection have been completed for seven (2 percent) of the FS wildernesses.

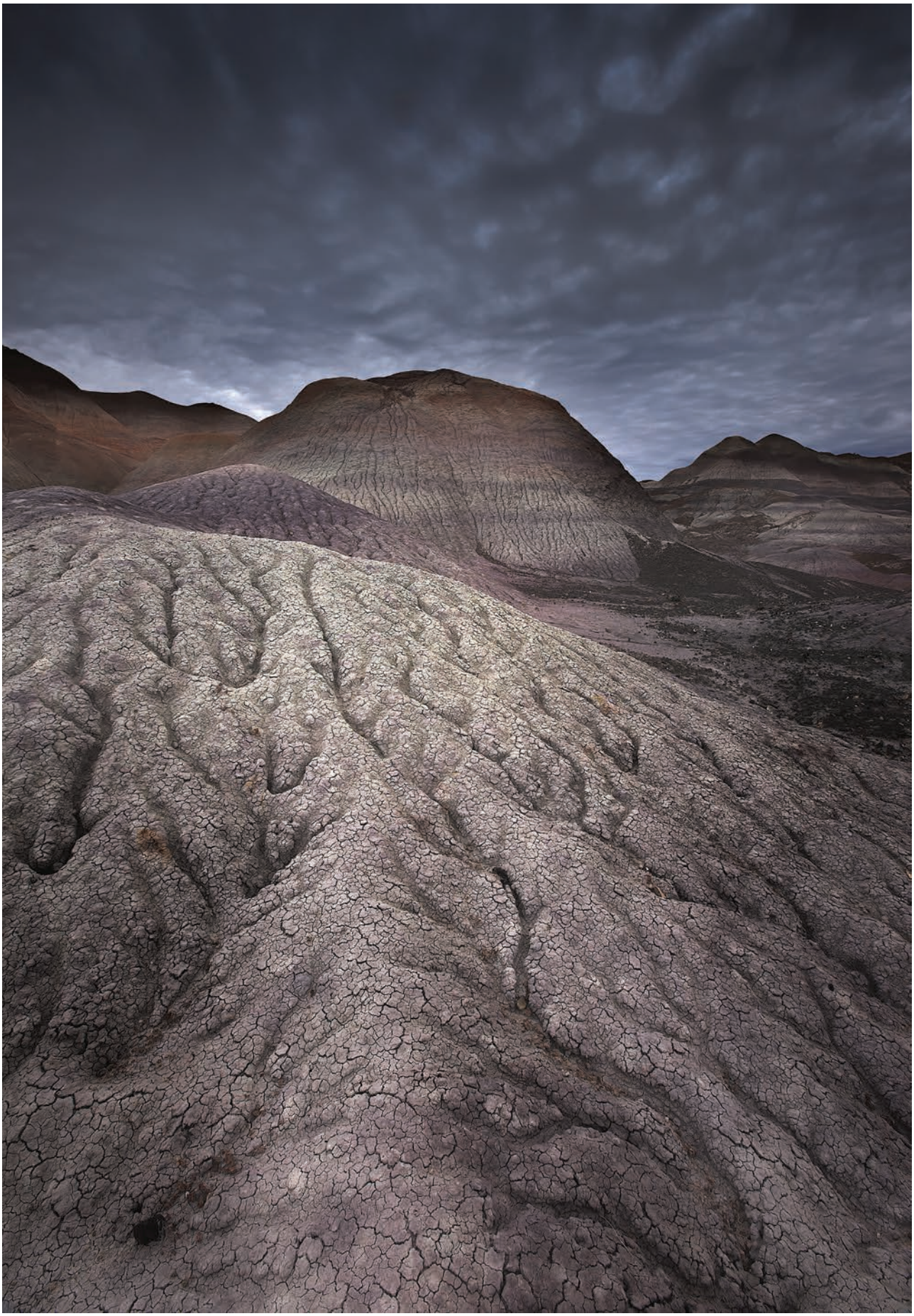
## National Park Service

In 2010, the NPS funded and chartered a Wilderness Character Integration Team to integrate the concept of wilderness character into NPS planning, management, and monitoring nationwide. The charter for this team gave it broad discretion for developing the strategies, products, and tools to accomplish its goals. Rather than focus exclusively on wilderness character monitoring, the NPS determined that it would be more effective to broadly integrate the concept of wilderness character into all aspects of wilderness stewardship. Primary products from this team were a user guide (NPS 2014a) and planning handbook (NPS 2014b). Specific actions to integrate wilderness character were implemented in 31 (51percent) of the 61 NPS wildernesses. As of spring 2015, wilderness character monitoring baseline assessments and data collection have been completed for 12 (20 percent) of the NPS wildernesses, and for 10 recommended and proposed wildernesses.

## Interagency Wilderness Character Monitoring Lessons Learned Workshop

In March 2014, the Aldo Leopold Wilderness Research Institute organized an Interagency Lessons Learned Workshop. The purpose of this workshop was to review agency-specific modifications made in implementing the 2008 Keeping It Wild interagency wilderness character monitoring strategy to determine if a consensus view could be developed for improving wilderness character monitoring and ensuring consistency across the NWPS. Each agency was represented by two staff members familiar with wilderness character monitoring (BLM: Chris Barns and Emily Simpson;

FS: Steve Boutcher and Linda Merigliano; FWS: Peter Dratch and Nancy Roeper; NPS: Tim Devine and Adrienne Lindholm). Other participants were Catherine Filardi from the University of Montana's Wilderness Institute, who directed the citizen-science wilderness character monitoring program for 5 years, and workshop organizer Peter Landres from the Aldo Leopold Wilderness Research Institute. The results of this workshop were the impetus for updating and replacing the 2008 strategy with Keeping It Wild 2.



# Appendix 2. Summary of Major Changes Made to the 2008 Version of Keeping it Wild

The following recommendations to change or clarify the 2008 version of Keeping It Wild were developed at the Interagency Wilderness Character Monitoring Lessons Learned Workshop, held in March 2014. Each major change or clarification is described below, followed by a brief explanation of why this change or clarification was made.

## General

- A wilderness that is managed by more than one agency should use one set of measures for wilderness character monitoring.

  *Why:* The 2008 Keeping It Wild was silent on this issue. Even though the issue does not affect many wildernesses, it was a major question that needed to be addressed for those 34 wildernesses that are managed by more than one agency.

- Wilderness character monitoring is appropriate for areas that are not legally designated as wilderness as long as agency policy requires that the area be managed to preserve its wilderness character.

  *Why:* The 2008 Keeping It Wild stated that wilderness character monitoring applied only to designated wildernesses, but wilderness character monitoring can also track on-the-ground changes and inform stewardship in areas with future potential for wilderness designation, such as wilderness study areas or areas that are managed as wilderness by agency policy.

- When trends in a measure, monitoring question, indicator, and quality and overall trend in wilderness character are reported, these trends should be described as "downward" or "upward" instead of "degrading" or "improving," respectively.

  *Why:* The 2008 Keeping It Wild used "degrading" and "improving," but from informal discussion with agency legal counsel, it was clear that the more precise descriptions of "downward" and "upward" trend needed to be used.

- A detailed description of possible measures is not included in Keeping It Wild 2.

  *Why:* The 2008 Keeping It Wild included detailed descriptions of possible measures. Having such detail in the 2008 version was considered necessary to help users understand how this interagency strategy could be implemented. The primary purpose of Keeping It Wild 2, however, is to have interagency consistency across the qualities and indicators, not across the measures. Each agency needs to determine its own process for selecting measures, including whether to use agency-required measures or measures determined by the local wilderness unit. Although Keeping It Wild 2 does not include detailed descriptions of measures, general guidance for identifying appropriate measures for the Untrammeled and Natural Qualities is provided in appendices 6 and 7.

Facing page: Petrified Forest National Wilderness Area, Samuel Feron photo (samuel.feron1@gmail.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

## Untrammeled Quality

- The definition of this quality needs to include the idea of "intentionality" to focus more tightly on the purpose behind a decision. The definition is "wilderness is essentially unhindered and free from the intentional actions of modern human control or manipulation."

  *Why:* The 2008 Keeping It Wild did not include "intentionality" in the definition of the Untrammeled Quality, but in practice, including it greatly improved understanding about this quality. In turn, this improved understanding helped staff identify appropriate measures. Appendix 6 helps clarify the definition of trammeling actions.

- Subsistence or sport hunting that is allowed in wilderness areas is not considered an intentional manipulation that degrades the Untrammeled Quality unless that hunting is authorized or managed to intentionally alter natural wildlife abundance or distribution, or predator–prey relationships.

  *Why:* Subsistence and sport hunting are clearly allowed in wilderness, but to many people they also appear to be direct manipulations of wildlife populations, creating substantial confusion about whether they should be included as trammeling actions. Making a distinction between intentionally taking individual animals versus intentionally altering abundance or distribution, or predator–prey relationships, reduces this confusion.

## Natural Quality

- The three indicators (Plant and animal species and communities, Physical resources, and Biophysical processes) are replaced with four indicators (Plants, Animals, Air and water, and Ecological processes) to provide greater clarity for agencies and links with existing monitoring efforts.

  *Why:* The three indicators from the 2008 Keeping It Wild did not provide sufficient detail and structure to help staff identify measures, and there was confusion over how "physical resources" differed from "biophysical processes."

- Discussion about the possible use of measures of indigenous species and species that are listed as threatened, endangered, sensitive, or of concern under the former indicator Plant and animal species and communities has been deleted.

  *Why:* These particular measures discussed in the 2008 Keeping It Wild created significant problems in providing interpretable trends in the data because human-caused change is confounded with natural variability. In addition, trends in these measures were frequently influenced by state and federal wildlife management actions to increase or reduce populations of these species. Each agency must determine its own process for selecting measures, and appendix 7 provides guidelines for selecting appropriate measures under the Natural Quality.

- A measure that relies on data from outside the wilderness (for example, intentional predator control actions) may be used to infer effects inside the wilderness if such a measure is the best or only one available, and the resource specialist can verify a direct link between the action outside the wilderness and its likely effect in the wilderness.

*Why:* The 2008 Keeping It Wild was silent on whether it would be acceptable to use measures from outside the wilderness. Keeping It Wild 2 allows such measures because experience has shown that such measures, under certain conditions, can be appropriate and add an important attribute to wilderness character monitoring.

## Undeveloped Quality

- Defunct installations, structures, and developments may be included in a measure of physical developments.

  *Why:* The 2008 Keeping It Wild was silent on defunct installations, structures, and developments, but where these do occur they are highly visible and a clear sign of past human modification and occupation of the area.

- Large debris and trash, such as motor vehicles, airplanes, earth-moving equipment, military debris, mining debris, or trash dumps, may be included in a measure of physical developments.

  *Why:* The 2008 Keeping It Wild was silent on large debris or trash, but where trash does occur, it is highly visible and a clear sign of past human modification and occupation of the area.

- The monitoring question and indicator that focused on cultural resources constructed by indigenous peoples prior to modern settlement, such as cliff dwellings, pit houses, and kivas, were moved to the new Other Features of Value Quality (see below).

  *Why:* The 2008 Keeping It Wild included all cultural resource developments in the Undeveloped Quality as an indicator of people living in harmony with nature. But this was an awkward connection because these cultural resources were clearly developments.

## Solitude or Primitive and Unconfined Recreation Quality

- Medium-sized trash, such as trash from hunting and outfitting camps or marine trash on a beach, may be considered in a measure under the indicator Remoteness from sights and sounds of people inside wilderness. In contrast, micro-trash, such as twist ties or wrappers, should not be considered in a measure under this indicator.

  *Why:* The 2008 Keeping It Wild was silent on including trash as a part of a measure tracking the sights and sounds of visitors inside wilderness. Medium-sized trash is a common occurrence in particular wildernesses and is appropriate to use as a separate measure (for example, if the wilderness is on a coastline and marine trash commonly occurs) or as part of a broader measure on the sights and sounds of people inside the wilderness. In contrast, micro-trash is not recommended as a measure, unless a wilderness can make a compelling case to include it, because very few wildernesses have data on it, in many cases it is insignificant, and the more important stewardship responsibility is just to pick it up.

## Other Features of Value Quality

- This quality was not in the 2008 Keeping It Wild publication but has already been used or proposed for use by all four agencies. This quality focuses on the condition of tangible, site-specific features that contribute to scientific, educational, scenic, and historical values in wildernesses, as well as those that contribute to subsistence value.

  *Why:* This quality accounts for cultural resources that are integral to wilderness character and were included in the Undeveloped Quality in the 2008 Keeping It Wild.

- This quality addresses one monitoring question, "What are the trends in the unique features that are both tangible and integral to wilderness character?" This question has two indicators: Deterioration or loss of integral cultural features and deterioration or loss of other tangible and integral features of value.

  *Why:* The two indicators account for the primary type of physical feature likely to be included—cultural features—as well as all other types that may be included, such as geological or paleontological features.

## Assessing Trend in Wilderness Character

- Text-based rules are used for compiling trends from the measures up through the qualities and in determining the overall trend in wilderness character instead of numeric-based rules. These text-based rules allow the trend in the Untrammeled Quality to be a tiebreaker that determines the overall trend in wilderness character if there are an equal number of upward and downward trends in the other qualities.

  *Why:* The 2008 Keeping It Wild used numeric-based rules for determining trend, and in practice these were needlessly complex. The text-based rules in Keeping It Wild 2 achieve the same result and are simpler to understand and execute. The 2008 Keeping It Wild assigned equal weight to all the qualities in determining the overall trend in wilderness character whereas the text-based rules in Keeping It Wild 2 allow the Untrammeled Quality to be "first among equals." Three reasons support this position: the statutory definition of wilderness describes "untrammeled" in a separate sentence; the importance of untrammeled as the essence of wilderness has a long history in the wilderness literature; and no other land designations are by law to be kept untrammeled.

# Appendix 3. Wilderness Character Narrative

The wilderness character narrative is a qualitative, affirming, and holistic description of what is unique and special about a specific wilderness. Wilderness character narratives have been developed for several National Park Service (NPS) wildernesses. The narrative is discussed in this strategy because of its potential usefulness in complementing and enhancing wilderness character monitoring.

This monitoring strategy reduces wilderness character to specific measures and data, and the narrative is a tool to help local staff recognize the broader and holistic meanings of wilderness character for an area. These meanings, in turn, are essential for highlighting priorities for monitoring wilderness character as well as for identifying priorities in planning and stewardship. The narrative is intended to capture the feelings and relationships of a wilderness, for example to describe in a general way the ecological processes that shaped the landscape, visitor experiences that may not be available elsewhere, unique or rare natural features, or notable scientific, conservation, educational, scenic, or historical values of the area. In addition, the narrative can acknowledge, celebrate, honor, and respect the intangible, experiential, and inspirational aspects of a wilderness, including historical and current cultural connections to the landscape. The narrative can also include a description of the major factors that are likely to influence, in both positive and negative ways, each of the qualities of wilderness character into the future. The five qualities of wilderness character provide a minimal structure to the narrative that grounds it in the statutory language of the 1964 Wilderness Act.

A well-crafted wilderness character narrative complements and enhances wilderness character monitoring in several ways. First, by clarifying what is important or significant about the wilderness and how it might change, the narrative provides a solid basis for building a wilderness stewardship plan and for selecting appropriate measures to monitor trend in wilderness character. Second, by showing the relationships among the different resources in a wilderness, the narrative fosters communication and integration among different staff who need to work together to effectively monitor and preserve wilderness character. Third, by explaining what is unique and special about a wilderness, the narrative informs interpretive and educational themes to focus discussion with the public about the current and future state of the wilderness.

A detailed description of the wilderness character narrative, examples of narratives, and recommendations for developing and using a narrative as a central part in wilderness planning, management, and monitoring can be found in appendices 2.1 and 2.2 of Keeping It Wild in the National Park Service: A User Guide to Integrating Wilderness Character into Park Planning, Management, and Monitoring (NPS 2014a)[1]. This document can also be found at http://www.wilderness.net/character. The narrative for a wilderness could be revisited at 5- or 10-year intervals and rewritten to capture overall changes in wilderness character if deemed appropriate.

[1] This reference can be found in the "References" section after the main text.

Facing page: St. Marks Wilderness, Tara Tanaka photo (h2otara@comcast.net), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

# Appendix 4. Concerns About This Interagency Monitoring Strategy

Since the initial implementation of interagency wilderness character monitoring in 2008, several misuses, misconceptions, and concerns have been raised that are addressed here. Despite these concerns, this interagency monitoring has proved to be an important tool to help managers link the results of their stewardship to the Wilderness Act's mandate to preserve wilderness character, and to improve communication among staff and with the public about wilderness.

## Misusing the Five Qualities in Stewardship Decisions

Splitting the legislative definition of wilderness into five rather distinct and tangible qualities imposes reductionist thinking on the fundamentally holistic concept of wilderness character. Though necessary for the purposes of this monitoring strategy, this framework of five qualities could be misused in the following ways.

- *Assuming that a decision to improve one quality will improve wilderness character.* Some wilderness units have justified decisions solely because they support one of the five qualities, in practice trading one quality for another. For example, a bridge may be built to reduce resource damage (such as increased sedimentation from people and horses crossing a stream), resulting in an upward trend in the Natural Quality. However, approving such an action solely on this basis ignores the adverse impacts the bridge will have on the Solitude or Primitive and Unconfined Recreation Quality (because the personal discovery and challenge of crossing the stream is diminished) and on the Undeveloped Quality (because of the presence of an installation). Decisions affecting wilderness character need to preserve wilderness character in its entirety, which means transparently accounting for how a proposed decision affects all five qualities. The qualities used in this monitoring strategy may be useful for organizing and describing potential effects from proposed projects and actions, but these effects would be only one of several factors a decisionmaker considers when determining whether to proceed with a proposed action.
- *Disregarding the unique importance of the Untrammeled Quality.* A special case of the concern discussed above relates to the Untrammeled Quality. For example, a restoration action might be considered necessary to restore a listed species, but if framed only from the perspective of improving the Natural Quality, the decision ignores the adverse impact on the Untrammeled Quality. This interagency monitoring strategy shows the impact of stewardship decisions on all the qualities of wilderness character, including the Untrammeled Quality. As discussed in the section on the Untrammeled Quality, understanding how this quality is unique and why it is important is a crucial part of wilderness stewardship. The importance of this quality, and only this quality, is emphasized in this monitoring strategy by using it as a tiebreaker in assessing overall trend in wilderness character. This monitoring is not

Facing page: Mark O. Hatfield Wilderness, Thomas Goebel photo (thomasgoebel01@gmail.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

a decisionmaking tool, and it cannot ensure the preservation of wilderness character and the Untrammeled Quality. This monitoring can, however, show how decisions affect wilderness character and the Untrammeled Quality.

- *Using the five qualities to identify areas eligible for wilderness designation.* The four wilderness agencies have each developed criteria to select areas for possible wilderness designation, and replacing those criteria with the five qualities of wilderness character is inappropriate for several reasons. First, some areas might "score" low on one or more of the qualities of wilderness character, yet still be considered suitable by Congress; in other words, the criteria for suitability are less stringent than the criteria for managing the area after designation. Second, the Untrammeled Quality applies only to how the area is managed once it is designated as wilderness and it is inappropriate to consider prior to the area's designation. Third, because this monitoring was designed to assess trend in wilderness character, it does not take into account a variety of other factors that are often considered in suitability determinations, such as management feasibility, competing resource values, or the potential contribution of an area to the existing National Wilderness Preservation System.

## Misconceptions About Wilderness and This Monitoring

There are several basic misconceptions about wilderness and how this monitoring will and will not be able to be used to preserve wilderness character.

- *There is no need for this monitoring because wilderness takes care of itself.* This common misconception is based on the assumption that the administrative boundary is sufficient to protect wilderness. It is now well established that ecological systems inside designated wilderness may be profoundly affected by what is occurring outside the wilderness (see Landres and others 1998)[1], and that visitor use or management activities, especially in specific areas, may have a large impact on both the ecological system and visitor experiences. The purpose of wilderness character monitoring is to show how the wilderness is changing over time in response to myriad impacts.
- *This monitoring provides all the information that is needed to preserve wilderness character.* Wilderness character monitoring cannot ensure that wilderness character is preserved, even if monitoring shows a stable or upward trend. From a legal standpoint wilderness character needs to be preserved from the time of wilderness designation. Determining the trend in wilderness character is necessary but not sufficient because this trend could be upward yet the condition could still be degraded compared with the time of designation. Although this monitoring provides key information on attributes of wilderness character, it needs to be combined with a description of the condition of each indicator, monitoring question, quality, and wilderness character as a whole in the monitoring report to provide a more holistic and complete picture.

[1] This reference can be found in the "References" section after the main text.

- *Each agency (and wilderness) has unique data needs, making it impossible for this monitoring to function as an interagency and national strategy.* Despite the different data needs as well as different wilderness policies and organizational cultures of each wilderness managing agency, all four agencies share the legal mandate to preserve wilderness character. This interagency strategy was designed to accommodate these differing data needs by allowing each agency to choose the measures that are relevant to that agency (or wilderness) for each indicator. All other aspects of this monitoring strategy were designed to ensure interagency consistency and facilitate practical implementation.

## Common Concerns About This Monitoring

Several legitimate concerns have been raised that are common to all national monitoring programs, including this one. These concerns typically occur because such programs necessarily balance several competing criteria to create a practical and useful monitoring strategy.

- *There are insufficient funding and staff resources for wilderness character monitoring.* There will always be limited funding and staff, especially for a rather new initiative such as this. To address this concern, this monitoring strategy was designed from the outset to be cost-effective and to minimize additional staff workload as much as possible. Use of existing data is encouraged, and each agency (and potentially each wilderness) may choose data sources that are appropriate for its needs and circumstances.
- *Local offices can "game" this monitoring to show an intended trend in wilderness character.* Because this interagency strategy allows flexibility in selecting measures, wilderness character monitoring can be abused. Significant concerns with this flexible approach are that: (1) meaningless measures may be selected, (2) particular measures may be selected to show a desired outcome, and (3) the set of measures that are selected may not add up to a coherent or viable assessment of trend in wilderness character. To prevent these problems, each agency needs to develop its own internal process for reviewing all measures that are selected for this monitoring, and for rejecting measures found to be inappropriate or inadequate for establishing a comprehensive and accurate assessment of trend in wilderness character.
- *It is impossible to really know if wilderness character is preserved because there will never be sufficient understanding about what to monitor, nor enough relevant and appropriate data.* Although this is a valid concern, law and policy nonetheless mandate that the agencies evaluate whether they are preserving wilderness character to the best of their ability. This interagency strategy provides a comprehensive and systematic framework that directly links the qualities of wilderness character to the statutory definition of wilderness. By implementing this monitoring, the agencies will show they are collecting the best information they can to assess changes in wilderness character, and will identify gaps in current data collection efforts. In turn, this process will allow the agencies to make informed decisions about how to reallocate managerial resources to fulfill the law and policy mandate to preserve wilderness character, and thereby improve wilderness stewardship over time.

- *This monitoring will be a "report card" that "grades" managers on performance in preserving wilderness character and it will require that certain actions be taken or that certain actions be stopped.* Wilderness character monitoring is not a report card; it is a reflection of the current condition of the wilderness and how this condition is changing over time. Some of these changes are beyond a manager's ability to control. The only national "standard" by which management can be judged is the Wilderness Act's mandate that wilderness character be preserved relative to the time when the area was designated. This interagency monitoring strategy does not create any new standard for preserving wilderness character. The trends revealed by this monitoring in the measures, indicators, monitoring questions, qualities, and wilderness character do not mandate any decision or action. These trends inform decisions—they do not trigger actions. Furthermore, each agency has performance systems used for accountability that are separate from this monitoring.

# Appendix 5. Example Local, Regional, and National Reports

These example reports are modified from the Forest Service Technical Guide (Landres et al. 2009). For brevity, only one quality is shown for the local and regional reports.

## Local Report

### *Monitoring Selected Conditions Related to Wilderness Character*

**A Report on Trends in the XXXX Wilderness from 2015 through 2020**

#### *What is Wilderness Character?*

| For this monitoring, wilderness character is described as five mutually reinforcing qualities derived from the Wilderness Act of 1964: |
|---|
| **Untrammeled** |
| The intentional management actions that directly control or manipulate the components or processes of ecological systems inside wilderness. |
| **Natural** |
| The effects of modern people on ecological systems inside wilderness since the time the area was designated. |
| **Undeveloped** |
| The structures, installations, and other evidence of modern human presence or occupation, and the use of motor vehicles, motorized equipment, or mechanical transport. |
| **Solitude or Primitive and Unconfined Recreation** |
| The conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation. |
| **Other Features of Value** |
| The ecological, geological, or other features of scientific, educational, scenic, or historical value. |

#### *Why Monitor Wilderness Character?*

- To fulfill legal and policy mandates to preserve wilderness character.
- To assess the outcomes of wilderness stewardship.
- To improve wilderness stewardship.
- To establish information that will endure as personnel and conditions change.

#### *Trends in the Qualities of Wilderness Character*

| Quality of Wilderness Character | Trend: 2015-2020 |
|---|---|
| Untrammeled | ↑ Upward |
| Natural | ↓ Downward |
| Undeveloped | ↑ Upward |
| Solitude | ↕ Offsetting Stable |
| Other Features | ↔ Stable |
| **WILDERNESS CHARACTER** | ↑ **UPWARD** |

·WILDERNESS· AMERICA'S RESOURCE ENDURING

*"...each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area"*
***Wilderness Act of 1964: (Sec. 4b)***

***The overall trend in wilderness character is upward***

Facing page: Zion Wilderness, Thomas Goebel photo (thomasgoebel01@gmail.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

## *Summary of Trends in the XXXX Wilderness: 2015-2020*

| | Trend | | | | |
|---|---|---|---|---|---|
| | Measure | Indicator | Question | Quality | Wilderness Character |
| **Untrammeled Quality** | | | | | |
| Authorized actions | ↓ | | | | |
| Fires suppressed | ↑ | ↕ | ↑ | ↑ | |
| Lakes stocked with fish | ↔ | | | | |
| Unauthorized actions | ↑ | ↑ | | | |
| **Natural Quality** | | | | | |
| Invasive non-native plants | ↔ | ↔ | | | |
| Invasive non-native animals | ↓ | ↓ | | | |
| Visibility | ↔ | | ↓ | ↓ | |
| Ozone | ↑ | ↑ | | | |
| Water quality | ↔ | | | | |
| Landscape connectivity | ↓ | ↓ | | | |
| **Undeveloped Quality** | | | | | ↑ |
| Authorized development | ↑ | ↑ | ↑ | | |
| Inholdings | ↔ | ↔ | | ↑ | |
| Authorized motorized/mechanized | ↑ | ↕ | ↕ | | |
| Emergency motorized/mechanized | ↓ | | | | |
| **Solitude or Primitive and Unconfined Recreation Quality** | | | | | |
| Visitor use | ↔ | ↓ | ↓ | ↕ | |
| User-created campsites | ↓ | | | | |
| Area away from outside developments | ↓ | ↓ | | | |
| Night sky light pollution | ↓ | | | | |
| Recreation facilities | ↑ | ↑ | ↑ | | |
| Visitor restrictions | ↑ | ↑ | | | |
| **Other Features of Value Quality** | | | | | |
| Cultural resource condition | ↔ | ↔ | ↔ | ↔ | |

## *XXXX Wilderness Character Monitoring Results: 2015-2020*

# *Untrammeled Quality*

Wilderness is essentially unhindered and free from intentional modern human control or manipulation.

### *Wilderness Act of 1964*

Wilderness is "an area where the earth and its community of life are untrammeled by man," and "generally appears to have been affected primarily by the forces of nature."

Howard Zahniser, the primary author of the Wilderness Act, noted that the inspiration for wilderness preservation "is to use 'skill, judgment, and ecologic sensitivity' for the protection of some areas within which natural forces may operate without man's management and manipulation."

This quality monitors management activities that intentionally control or manipulate the components or processes of ecological systems inside wilderness.

***The trend in the Untrammeled Quality is upward***

### *Trends in Indicators and Measures for the Untrammeled Quality*

| Indicator | Trend | Measure | Trend | Data Adequacy |
|---|---|---|---|---|
| **Monitoring Question: What are the trends in actions that intentionally control or manipulate the "earth and its community of life" inside wilderness?** | | | | |
| Actions authorized by the federal land manager that intentionally manipulate the biophysical environment | ↕ | Number of authorized actions to manage plants, animals, pathogens, soil, water, or fire | ↓ | High |
| | | Percentage of lightning fires that are suppressed | ↑ | High |
| | | Number of lakes and other water bodies stocked with fish | ↔ | Medium |
| Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment | ↑ | Number of unauthorized actions to manage plants, animals, pathogens, soil, water, or fire | ↑ | Low |

**Narrative about the Untrammeled Quality**

- Why is this trend in the Untrammeled Quality an accurate reflection of recent conditions in the wilderness?
- If problems occurred with the data used to generate trend information for this quality, what did they consist of?
- What is the explanation for the observed trend?

# *Region 1 Wilderness Character Monitoring Results: 2015-2020*

## *What is Wilderness Character?*

For this monitoring, wilderness character is described as five mutually reinforcing qualities derived from the Wilderness Act of 1964:

**Untrammeled**

The intentional management actions that directly control or manipulate the components or processes of ecological systems inside wilderness.

**Natural**

The effects of modern people on ecological systems inside wilderness since the time the area was designated.

**Undeveloped**

The structures, installations, and other evidence of modern human presence or occupation, and the use of motor vehicles, motorized equipment, or mechanical transport.

**Solitude or Primitive and Unconfined Recreation**

The conditions that affect the opportunity for people to experience solitude or primitive, unconfined recreation.

**Other Features of Value**

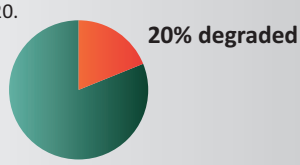
The ecological, geological, or other features of scientific, educational, scenic, or historical value.

## *Region 1 Trends in Wilderness Character*

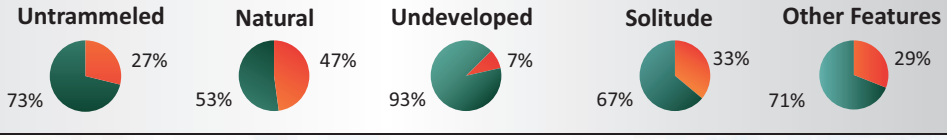
Regional trends are derived by compiling a trend in wilderness character and the qualities of wilderness character across all 15 Forest Service wildernesses from 2015 through 2020.

= % of 15 wildernesses with wilderness character **preserved**

= % of 15 wildernesses with wilderness character **degraded**




## *Region 1 Trends in the Five Qualities of Wilderness Character*




**Narrative about these Regional Trends**

Significant findings and key interpretations:

- .....
- .....
- .....
- .....

Data adequacy in the region:

Data quantity (percentage of wildernesses reporting data and explanations)

Data quality (problems local wildernesses reported with collecting data and trends shown)

## *Region 1 Wilderness Character Monitoring Results: 2015-2020*

*Summary of Trends in Wilderness Character across the 15 Wildernesses in the Region*

| Name of Wilderness | Trend in Wilderness Character |
|---|---|
| Selway-Bitterroot | Upward  |
| Gospel-Hump | |
| Gates of the Mountains | |
| Salmo-Priest | |
| Absaroka-Beartooth | |
| Rattlesnake |  Stable or  Offsetting Stable |
| Mission Mountains | |
| Lee Metcalf | |
| Anaconda Pintler | |
| Bob Marshall | |
| Great Bear | |
| Frank Church-River of No Return | |
| Cabinet Mountains | Downward  |
| Scapegoat | |
| Welcome Creek | |

## *Region 1 Wilderness Character Monitoring Results: 2015-2020*

# *Untrammeled Quality*

Wilderness is essentially unhindered and free from intentional modern human control or manipulation.

### *Wilderness Act of 1964*

Wilderness is "an area where the earth and its community of life are untrammeled by man," and "generally appears to have been affected primarily by the forces of nature."

Howard Zahniser, the primary author of the Wilderness Act, noted that the inspiration for wilderness preservation "is to use 'skill, judgment, and ecologic sensitivity' for the protection of some areas within which natural forces may operate without man's management and manipulation."

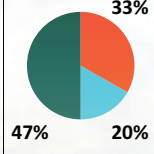
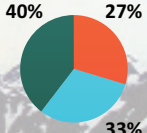
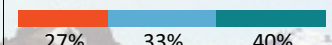
This quality monitors management activities that intentionally control or manipulate the components or processes of ecological systems inside wilderness.

### *Trends in the Untrammeled Quality across the 15 Regional Wildernesses*

**73% preserved**

**27% degraded**

### *Trends in the Indicators and Measures across the 15 Regional Wildernesses*

| Indicator | Trend | Measure | Trend |
|---|---|---|---|
| **Monitoring Question: What are the trends in actions that intentionally manipulate the "earth and its community of life" inside wilderness?** | | | |
| **Actions authorized by the federal land manager that intentionally manipulate the biophysical environment** |   | Number of authorized actions to manage plants, animals, pathogens, soil, water, or fire |   |
| | | Percentage of lightning fires that are suppressed |   |
| | | Number of lakes and other water bodies stocked with fish |   |
| **Actions not authorized by the federal land manager that intentionally manipulate the biophysical environment** |   | Number of unauthorized actions to manage plants, animals, pathogens, soil, water, or fire |   |

**Narrative about the Untrammeled Quality**

- What are the significant findings and key interpretations regarding trends in this quality?
- If problems occurred with the data used to generate trend information for this quality, what did they consist of?
- What is the explanation for the observed trends?

# National Summary of Trends in Wilderness Character across 442 Forest Service Wildernesses

## 2015-2020

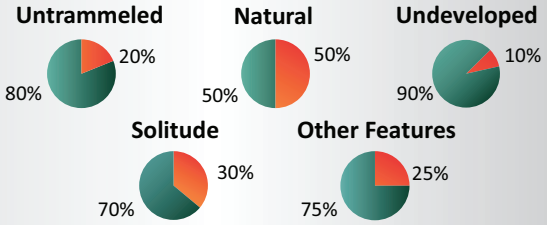
### National Trends in Wilderness Character

National trends are derived by compiling a trend in wilderness character and the qualities of wilderness character across all 442 Forest Service wildernesses from 2015 through 2020.

= % of 442 wildernesses with wilderness character **preserved**

= % of 442 wildernesses with wilderness character **degraded**


### National Trends in the Five Qualities of Wilderness Character




*"This protocol provides a scientifically defensible basis for demonstrating the changes to wilderness character we intuitively know are occurring."*

***Deb Gale***
***Wilderness Manager***
***West Fork Ranger District***
***Bitteroot National Forest***

*"I find this new protocol to be a great tool to capture a picture of present conditions. With periodic monitoring, we can track changes over time and actually practice adaptive management."*

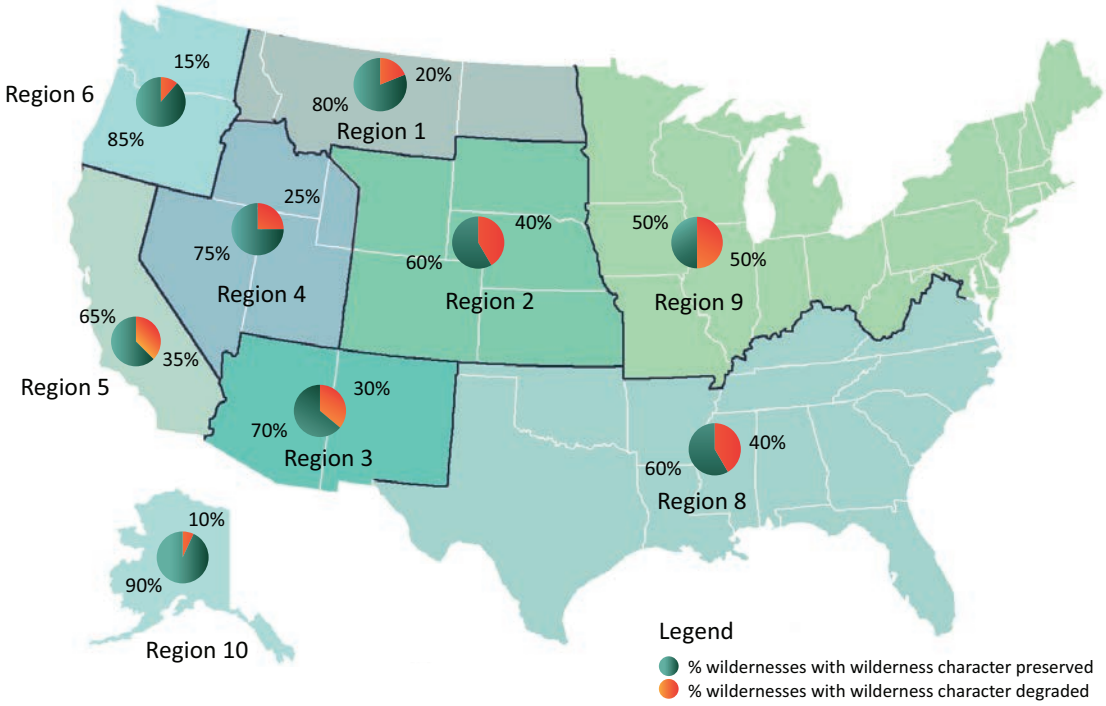
***Gabe Garcia***
***District Ranger***
***San Bernadino***
***National Forest***

**Narrative about these National Trends**

The central mandate for wilderness stewardship is the Wilderness Act of 1964's assertion that "each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area" (Sec. 4b). This monitoring provides a national summary of trends in wilderness character and the five qualities that make up wilderness character: untrammeled, natural, undeveloped, solitude or primitive and unconfined recreation, and other features of value. The trends seen in the past 5 years yield the following observations:

- Wilderness character is being preserved in a majority of Forest Service wildernesses.
- Suppressing naturally-caused intense fires has caused degradation of the Untrammeled Quality.
- Focused efforts to restore fire-adapted forests contributed to this degradation.
- New policy direction to control non-indigenous invasive species has improved the Natural Quality.

## *Regional Trends in Wilderness Character: 2015-2020*



# Appendix 6. What is a Trammeling Action?

This appendix provides guidelines and examples to clarify what is and is not a trammeling action. These are intended to capture the majority of trammeling 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 the above definition:

- 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, quantity, 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 human beings' power to manipulate or control "the earth and its community of life" is at the core of the Untrammeled Quality of wilderness character. Trammeling actions occur when opportunities for restraint are ignored or bypassed; if 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. Even though 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 still counted as trammeling actions.

The second concept central to the idea of trammeling is intentionality. Actions that deliberately interfere with, manage, or control any aspect of wilderness ecological systems are intentional and clear instances of trammeling. As explained in the section on the Untrammeled 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 or restoring a campsite). A much more complex and nuanced case is whether to include actions whose purpose is not to manipulate "the earth and its community of life," but which require some manipulation of the environment to produce the desired outcome. These types of actions can be confusing because they still result in an intentional manipulation of the biophysical environment even though that is not their primary purpose. In general, when such actions have substantial and foreseeable effects on the wilderness ecosystem, they are counted as a trammeling. All of these cases, with many examples, are discussed below.

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.

Facing page: Near the Wenaha-Tucannon Wilderness, Peter Landres photo.

## 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 both 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 are:
   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 are:
   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 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 are:
   a. Cloud seeding to intentionally increase precipitation inside the wilderness.
   b. Damming a river outside the 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 are:
   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 are:
   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. An example is:
   a. Releasing or killing species outside of the wilderness with the intention to affect populations whose ranges extend 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 are: 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 the result of deliberate decisions or actions, and therefore do not provide an opportunity for management restraint. Accidental unauthorized actions, such as escaped campfires and oil spills, similarly lack an opportunity to restrain individuals' power over the landscape. Past actions that manipulated the biophysical environment before an area was designated as wilderness are not considered trammeling actions because the provisions of the 1964 Wilderness Act do not apply to an area prior to designation.

Another group of examples that are not trammeling actions encompass those small-scale actions with no intent to manipulate "the earth and its community of life," such as installing meteorological or other scientific instruments, 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 because 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 Untrammeled Quality. The consensus from the Interagency Lessons Learned Workshop in 2014 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 in order to maximize certain hunting opportunities, this manipulation of the "community of life" would degrade the Untrammeled Quality (see above).

## Activities that May be Trammeling Actions

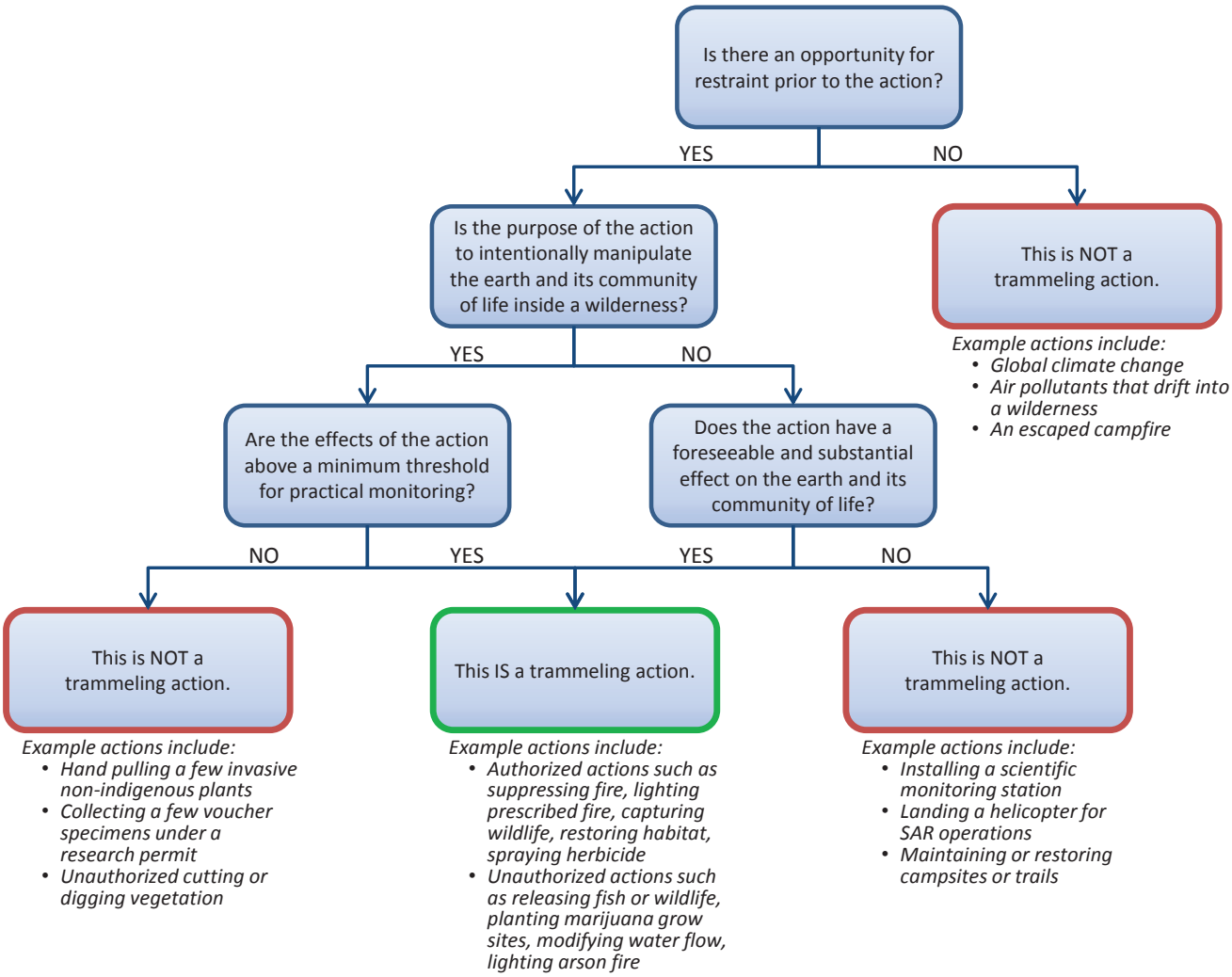
There are two types of actions that may or may not be considered trammeling actions. The first includes intentional manipulations that interfere with or control an aspect of wilderness ecosystems but are too small in scale or scope to be monitored practically. The second type encompasses those nuanced 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. In the latter case, the action is counted as a trammeling regardless of the purpose behind the action because the agency still has the discretion as to whether to take this action. As shown in table A6-1, 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 probably would, or would not, be considered a trammeling.

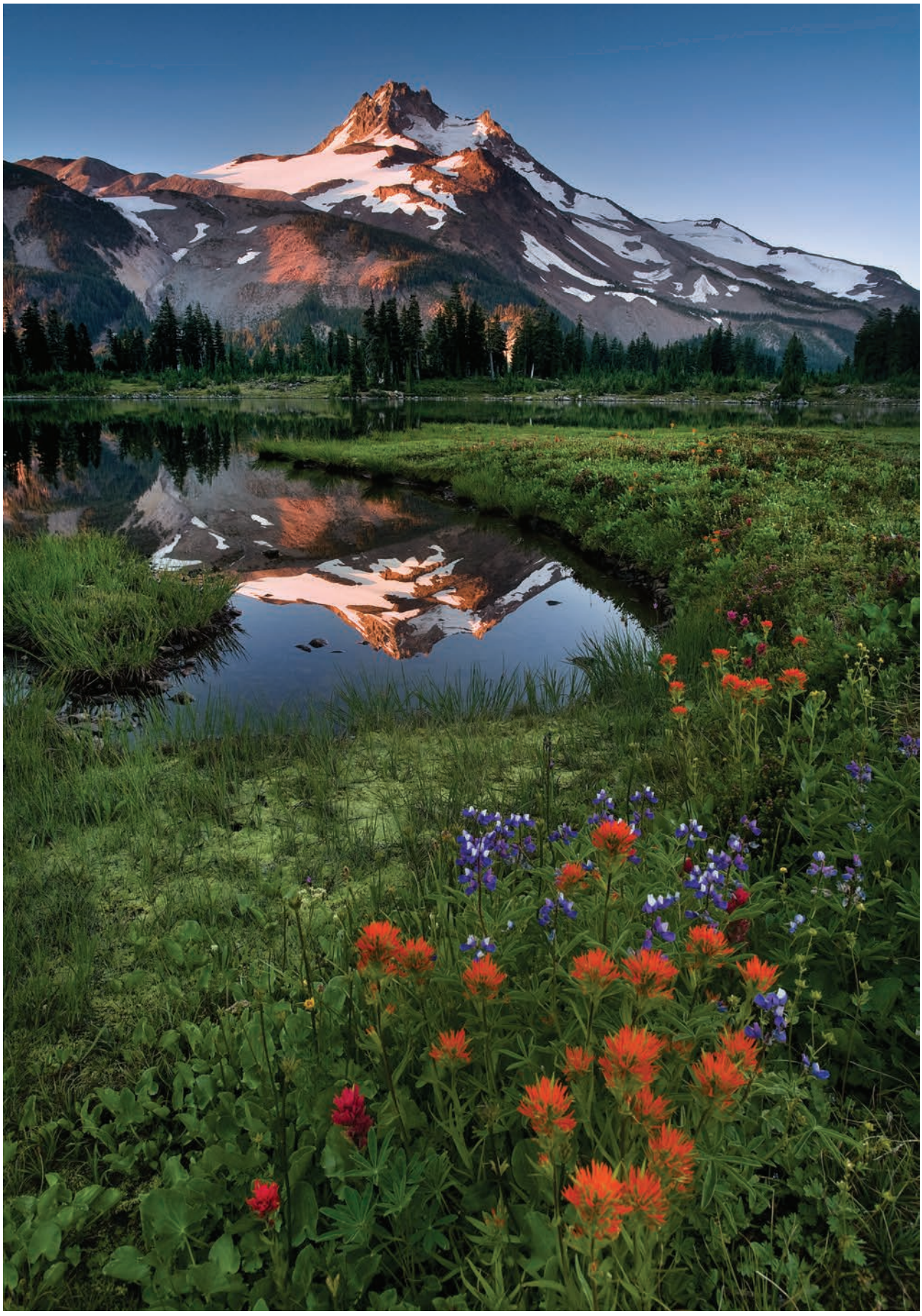
**Table A6-1**—Examples of actions likely not to be, and likely to be, trammeling actions based on the scale and scope of the action and its effects on "the earth and its community of life."

| Action | Likely not to be a trammeling | Likely to be 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<br>Installing most scientific instrumentation<br>Collecting a limited number of voucher specimens with no impact on species distribution or abundance | Installing enclosures or exclosures<br>Installing instrumentation that disrupts the movement or behavior of plants, or fish and wildlife<br>Capturing, collaring, and releasing wildlife |
| Building system trail | Routing a trail around a rock slide<br>Building a bridge across a stream to prevent streambank erosion<br>Installing a small section of corduroy across a wet area<br>Installing waterbars or building rock-cribbing | Routing a trail through an area of sensitive alpine butterfly habitat<br>Building a long trail to go around a section of river or cliff<br>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<br>Restoring a number of campsites without needing to disrupt the soil or vegetation in the surrounding area | Restoring a number of campsites by moving a significant amount of soil or a significant 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 distinguish between those actions that are beyond the scope of management control, or are unauthorized accidents, and 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.


Is there an opportunity for restraint prior to the action?
YES
NO
Is the purpose of the action to intentionally manipulate the earth and its community of life inside a wilderness?
This is NOT a trammeling action.
Example actions include:
• Global climate change
• Air pollutants that drift into a wilderness
• An escaped campfire
YES
NO
Are the effects of the action above a minimum threshold for practical monitoring?
Does the action have a foreseeable and substantial effect on the earth and its community of life?
NO
YES
YES
NO
This is NOT a trammeling action.
Example actions include:
• Hand pulling a few invasive non-indigenous plants
• Collecting a few voucher specimens under a research permit
• Unauthorized cutting or digging vegetation
This IS a trammeling action.
Example actions include:
• Authorized actions such as suppressing fire, lighting prescribed fire, capturing wildlife, restoring habitat, spraying herbicide
• Unauthorized actions such as releasing fish or wildlife, planting marijuana grow sites, modifying water flow, lighting arson fire
This is NOT a trammeling action.
Example actions include:
• Installing a scientific monitoring station
• Landing a helicopter for SAR operations
• Maintaining or restoring campsites or trails



# Appendix 7. Selecting Measures for the Natural Quality

This appendix provides recommendations for selecting measures for the Natural Quality. It discusses the general considerations for selecting these measures and why certain types of measures are problematic, offers examples to clarify what are and are not appropriate measures, and provides a flowchart outlining the general selection process.

The essential requirement for all measures within this interagency monitoring strategy is the ability to assign an "upward," "downward," or "stable" trend based on changes in their condition. Applying this seemingly straightforward idea to the Natural Quality can be fraught because ecological conditions typically do not have a single natural state from which a trend can be assigned. Instead, ecological systems are complex; as the ecologist Frank Egler is credited with saying, "Ecosystems are not only more complex than we think, they are more complex than we can think." Individuals of a species move around, and ecological conditions and processes vary over time and differ from one location to another. Species come and go, some years are warm and some are cold, and snowfields and glaciers expand and melt.

Natural change over time and from one place to another is a fundamental aspect of ecological systems and an essential aspect of the Natural Quality of wilderness character. To account for this change, the Natural Quality should not be used to recreate historical conditions from an arbitrary point in time (such as pre-European settlement or the date of wilderness designation), target a subjective set of desired conditions (such as the population of a specific game species), or otherwise maintain unchanging ecological conditions. When combined with the Untrammeled Quality, the basic legal and philosophical tenet in wilderness is to watch what happens and not direct this change. This tenet means that there is no target for the species that occur there, or even for abiotic conditions such as temperature or precipitation.

Given this tenet, the most direct and simple measures in the Natural Quality are those that quantify known direct threats to the ecological system. For example, air pollutants or non-indigenous species are known threats and generally there is good reference information for them. Even these variables, however, require sufficient understanding of whether changes are primarily natural or anthropogenic (for example, separating the effects of volcanic air pollutants from human-caused pollutants, or the natural dispersal of non-indigenous species from human-caused spread). Today, many changes in the Natural Quality are due to the interacting effects of natural variation and human-caused threats, and we may not be able to distinguish between the two. Moreover, even if interactions are understood on a global or regional scale, this knowledge may be lacking for the smaller spatial scale of a wilderness. Therefore, measures of threats should be selected only if they are determined (either by data or professional judgment) to be primarily anthropogenic and if they can show meaningful change within the timeframe that is appropriate for wilderness character monitoring (5 to 10 years) as opposed to requiring decades or centuries of data collection.

Facing page: Mount Jefferson Wilderness, Adrian Klein photo (adrian@adrianklein.com), courtesy of Nature's Best Photography, the Smithsonian Institution, and Wilderness50's "Wilderness Forever" photo competition.

The wilderness agencies currently collect much natural resource information, and in some cases this information may be directly used in wilderness character monitoring. Wilderness character monitoring should not duplicate monitoring that is already being done, such as by specific resource monitoring programs. The data collected from these programs provide valuable insight into regional and local ecosystems, but may not be appropriate or feasible to include in wilderness character monitoring. Importantly, not all threats or features of the natural environment important to wilderness character need to be included as measures in wilderness character monitoring if these are being monitored by other resource programs. In such cases, only those measures that are appropriate and the highest priority would be included, typically selected because they quantify threats to features that are truly integral to and representative of the area's wilderness character.

There are some cases in which a measure is inappropriate to monitor under the Natural Quality but is clearly integral to wilderness character. For example, bears and wolves—iconic species that were formerly extirpated—are returning to many wildernesses; from a wilderness perspective, their presence would be a significant improvement in the Natural Quality. Counting populations of naturally occurring species, however, does not monitor a human-caused threat, nor can a trend in the measure be assigned without assuming a target ecological state. For such cases, the importance of the non-selected measure should be acknowledged in the monitoring report's narrative or by including it in other monitoring programs.

Occasionally, a measure may be included under the Other Features of Value Quality instead of the Natural Quality, such as measures related to iconic features (for example, glaciers) or species (for example, wolves) that define how people think about the wilderness or are specifically identified in the enabling legislation. This decision can be appropriate because trends in measures under the Other Features of Value Quality may be defined by human values (for example, the presence of the feature or the species within a wilderness), whereas trends in measures under the Natural Quality are defined by the more stringent criterion of whether the ecological system is free from the effects of modern civilization.

## Examples of Appropriate and Inappropriate Measures

From experience in implementing wilderness character monitoring, the following examples show how measures that have been used in the past are and are not appropriate based on the guidelines presented in this appendix.

### *Appropriate measures*

Appropriate measures are those that meet the following criteria: they are current or potential threats to the ecological systems in wilderness, they are primarily human-caused, they do rely on a static or target ecological state to make an assessment about trend, and they can show change within about 10 years. Four example measures are described below, each followed by a brief explanation of why it is appropriate for use in wilderness character monitoring.

Number of non-indigenous invasive species (plant or animal):

- Non-indigenous invasive species are a direct and significant threat to ecological systems in wilderness.

- Non-indigenous invasive species are most commonly introduced or spread in wilderness areas by humans. Even populations of non-indigenous invasive species that are spreading naturally into the wilderness were most likely initially introduced outside of the wilderness by humans. In most cases, therefore, changes in the data result primarily from human agency.
- This measure clearly monitors an effect of modern civilization and does not reference a specific ecological state (any ecological state is natural so long as it is substantially unaffected by human-caused introductions of non-indigenous invasive species). A trend can be assigned for the measure such that increasing numbers of non-indigenous invasive species degrade the Natural Quality and decreasing numbers improve it.
- A meaningful trend in the data can be observed in a short timeframe.

Ozone concentration:

- Ozone in the lower atmosphere is a pollutant formed primarily from reactions involving emissions from cars, industrial facilities, power plants, and other types of combustion. It can have a significant effect on ecological components, structures, and functions and is therefore a threat to the Natural Quality.
- Air pollutants such as ozone are a by-product of modern civilization and changes in the data result primarily from human agency.
- This measure monitors an effect of modern civilization and does not reference a specific ecological state (any ecological state is natural so long as it is substantially unaffected by human-caused air pollution). A trend can be assigned for the measure such that an increasing concentration of ozone degrades the Natural Quality and decreasing concentration improves it.
- A meaningful trend in the data can be observed in a short timeframe.

Number of watersheds with modified water flows:

- The effect of modern human manipulation of water flow on wilderness ecosystems is a threat to the Natural Quality.
- Dams are constructed and maintained by humans; changes in the data therefore result primarily from human agency.
- The number of watersheds with modified water flow monitors the effect of a human-caused threat and does not require a specific ecological state to assign a trend in the measure (any flow rate or water quantity is natural so long as it is not substantially influenced by dams). Increasing modification of watersheds from an increase in the number of dams or other water diversions degrades the Natural Quality and decreasing modification improves it.
- A meaningful trend in the data can be observed in a short timeframe.

Landscape fragmentation:

- Despite occurring outside the wilderness, landscape fragmentation can have wide-ranging effects on indigenous species and communities and is therefore a threat to the Natural Quality.

- Expansion of modern human settlements and increasing land development are the primary drivers of landscape fragmentation. Changes in the data result primarily from human agency.
- Less impact on wilderness ecological systems from modern human development improves the Natural Quality, and increasing the degree of impact degrades it. A clear trend in the measure can be identified and no specific ecological state is referenced.
- A meaningful trend in the data can be observed in a short timeframe.

### *Inappropriate measures*

Inappropriate measures are those that do not meet the criteria described above for appropriate measures. Four example measures are described below, each followed by a brief explanation of why it is inappropriate for use in wilderness character monitoring.

Average annual summer or winter temperature:

- Changing average temperature simply represents change and cannot be considered to improve or degrade wilderness character. To state that any change in temperature would degrade the Natural Quality would set a static target for what "natural" is in the wilderness.
- Temperature naturally varies within a wilderness from year to year without necessarily degrading wilderness character. Although changes in global data reflect human-caused effects, making that determination for local change—especially in the short term—may not be feasible.
- If data are not already being collected close to a wilderness, a long timescale would be required before a meaningful trend in the data could be observed.
- Established climatology monitoring programs already exist within the wilderness managing agencies and other federal agencies. This science is complex, nuanced, and time-consuming, and is already being conducted by specialists at a much higher level than is generally possible for an individual wilderness. Wilderness character monitoring should not duplicate or create new monitoring programs.

Keystone species abundance (plant or animal):

- Measures that quantify naturally varying population or distribution dynamics of indigenous species do not monitor a threat to the Natural Quality of wilderness. Because indigenous species are included as an inherent component of ecological systems, they cannot therefore be considered a threat to that same ecosystem.
- Measures that quantify the loss of an indigenous keystone species due to human-caused threats must be able to determine that population or distribution changes are due primarily to anthropogenic impacts and not to natural variation.

- Change in a population of an indigenous species does not necessarily improve or degrade the Natural Quality of wilderness character because populations change naturally over time. Identifying a trend in the measure would require setting a static historical, current, or desired population or distribution range as a target state, which is inappropriate in wilderness.

Extent, volume, or mass of glaciers or permanent snowfields:

- Changes in glacial extent, volume, or mass due to climate change can occur in both recession and advancement. To state that both results degrade the Natural Quality implies that unchanging conditions are "natural" and forces the trend in the measure to reference a static or historical ecological state.
- It may be difficult to attribute the trend in the data primarily to human agency, and the necessary timeframe to evaluate trend in the data may be too long.

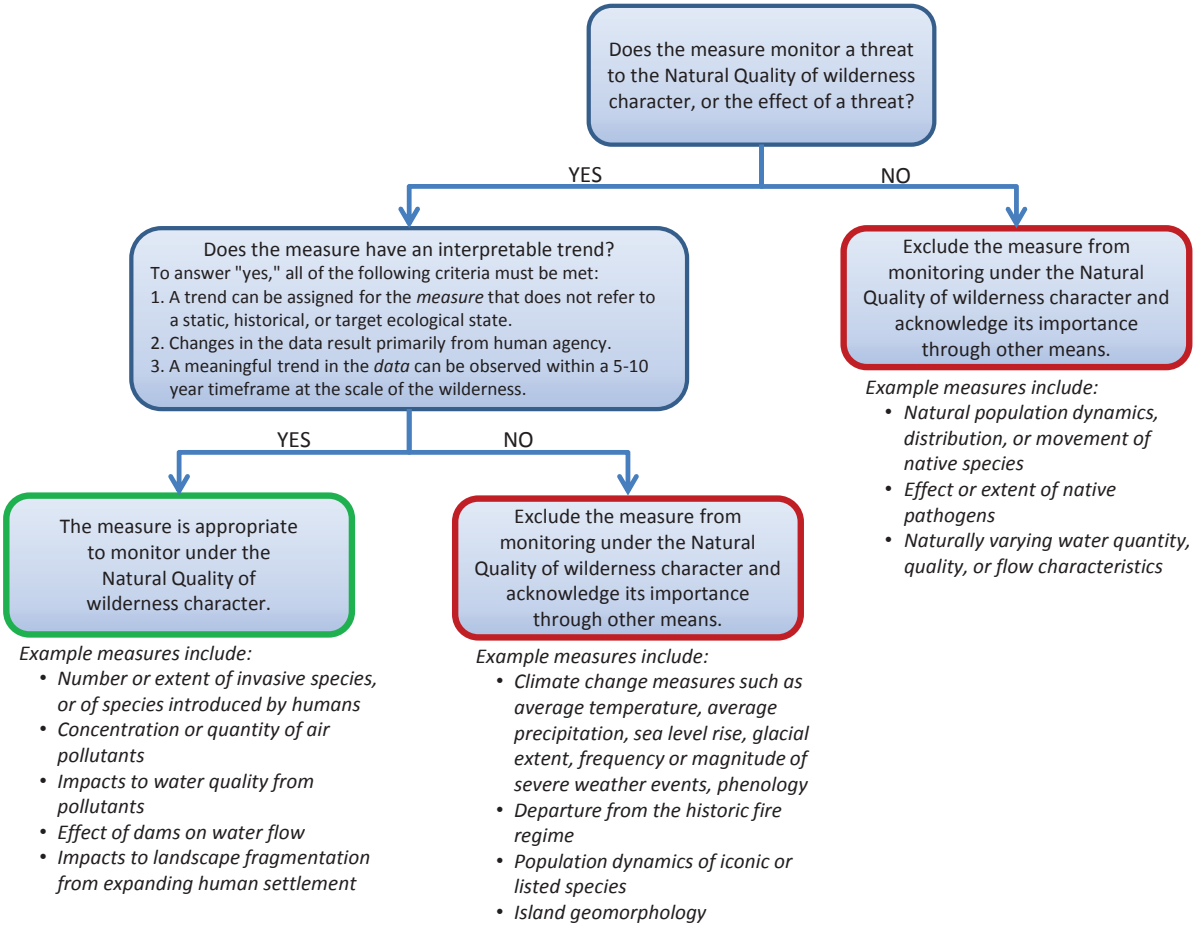
Sea level rise:

- Changing sea levels cannot be assigned trends for wilderness character monitoring without referencing an "ideal sea level" or implying preservation of an unchanging past, present, or future ecological state.
- If data are not already being collected close to a wilderness, a long timescale would be required before a meaningful trend in the data could be observed.
- Established sea level monitoring programs already exist within federal agencies. Wilderness character monitoring should not replicate existing monitoring initiatives.

## Flowchart

The flowchart below provides general guidelines for selecting measures for the Natural Quality. The first question is whether the measure is a threat to the Natural Quality, with "threat" defined as human agency in directly or indirectly causing a significant change to the composition, structure, and functioning of ecological systems in wilderness (Landres and others 2009)[1]. The second question is whether the measure will provide an interpretable trend. This question, based on the discussion above, can be summarized as asking the following: (1) whether the measure holds the wilderness to a static or target ecological state, (2) if changes can be primarily attributed to human agency, and (3) if there is sufficient information or data to make a reasonable assessment of trend within about 10 years. For this flowchart, it is assumed that all measures being considered have already been determined to be integral to wilderness character, significant or meaningful to understanding change in the indicator of the Natural Quality, and vulnerable to human-caused threats. It is also assumed that measures can be reliably monitored with a high degree of confidence in the data, and can feasibly be monitored into the future.

[1] This reference can be found in the "References" section after the main text.


Does the measure monitor a threat to the Natural Quality of wilderness character, or the effect of a threat?
YES
NO
Does the measure have an interpretable trend?
To answer "yes," all of the following criteria must be met:
1. A trend can be assigned for the measure that does not refer to a static, historical, or target ecological state.
2. Changes in the data result primarily from human agency.
3. A meaningful trend in the data can be observed within a 5-10 year timeframe at the scale of the wilderness.
Exclude the measure from monitoring under the Natural Quality of wilderness character and acknowledge its importance through other means.
Example measures include:
• Natural population dynamics, distribution, or movement of native species
• Effect or extent of native pathogens
• Naturally varying water quantity, quality, or flow characteristics
YES
NO
The measure is appropriate to monitor under the Natural Quality of wilderness character.
Example measures include:
• Number or extent of invasive species, or of species introduced by humans
• Concentration or quantity of air pollutants
• Impacts to water quality from pollutants
• Effect of dams on water flow
• Impacts to landscape fragmentation from expanding human settlement
Exclude the measure from monitoring under the Natural Quality of wilderness character and acknowledge its importance through other means.
Example measures include:
• Climate change measures such as average temperature, average precipitation, sea level rise, glacial extent, frequency or magnitude of severe weather events, phenology
• Departure from the historic fire regime
• Population dynamics of iconic or listed species
• Island geomorphology

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