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Chapter 1

Park and Wilderness Stewardship: The Dilemma of Management Intervention

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> We can't solve problems by using the same kind of thinking we used when we created them.
>
> —*Albert Einstein*

National parks and wilderness areas are an important part of America's natural and cultural heritage. On the surface at least, people appear to share a common vision of park purposes and wilderness values, believing that parks and wilderness are places set aside and protected from development to preserve their beauty, their natural features, and the opportunity for future generations to learn from them, love them, and experience them as we have. In addition to being powerful symbols that spark the imagination, parks and wilderness play a critical role in environmental conservation, especially as global threats to biodiversity mount.

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From global climate change and invasive species to pollution and land fragmentation, anthropogenic stressors threaten park and wilderness values and raise serious questions about what it means to preserve our natural heritage. We cannot preserve parks and wilderness by drawing a line around them and leaving them alone. Protecting an area's beauty, heritage, and biodiversity entails thoughtful stewardship and, at times, active intervention. But active intervention presents a new set of challenges. Do park and

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wilderness managers have the policy guidance they need to be effective land managers in this changing context?

In this book we explore the goals that guided the conservation of large protected areas in the twentieth century, most of them related to the concept of naturalness. These goals were appropriate a century ago, when the struggle was one of protecting land from development and exploitation, and they retain iconic meaning and value today. But over the past century the world has changed and the pace of change has accelerated. The most certain characteristic of the future is uncertainty. The stewardship issues of the twenty-first century will be more nuanced, with solutions that are less clear cut, less black and white. Consequently, it is time to think beyond naturalness, to articulate park purposes in terms that are both more specific and more diverse than naturalness and to adopt a wider array of management approaches to achieve these purposes.

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The concept of naturalness is more central to the stewardship of national parks and wilderness in the United States than to stewardship of other types of protected areas or parks and wilderness in other countries. Therefore, this book is focused on parks and wilderness in the United States. However, many of the issues raised in this book have broad international application. To set the stage for the chapters that follow, this introduction first explores some of the emerging dilemmas confronting park and wilderness managers. We then describe the central argument of the book and provide a guide to the chapters that follow.

Stewardship Dilemmas

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Stretching from the banks of the Rio Grande up desert canyons to the forested slopes of the Jemez Mountains, not far from Santa Fe, New Mexico, is Bandelier National Monument. One of the oldest units of the National Park System, Bandelier was established in 1916. In 1976, most of the park (more than 23,000 acres) was designated as wilderness. Ancestral Pueblo people inhabited these lands long ago, in substantial numbers from at least the twelfth through the sixteenth centuries. Remnants of their life here—from cliff dwellings to painted caves and potsherds—draw many visitors, as do the diverse desert, woodland, and forest landscapes. The monument is a place of peace and solace, and it provides connections to the past and to wild and natural landscapes.

All is not well here, however. Despite a long history of human habitation and the fact that Bandelier has not been a pristine landscape for more

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than a thousand years, more recent Euro-American use of the park landscape has triggered unprecedented change in most of the park's ecosystems (Allen 2004). Conditions, particularly in the wilderness' piñon–juniper woodlands, have rapidly deteriorated. Studies of current and historical ecology tell a sad story (Sydoriak et al. 2000). Herbaceous ground cover and surface organic litter have largely disappeared, exposing soils to the erosive effects of rainfall, which can come in torrents during the summer monsoons. The park's woodland soils, which developed over tens of thousands of years, are being washed away rapidly. Most soil will be gone within about a century, with much associated loss of the artifacts and cultural heritage that were the primary reasons the monument was originally established.

As detailed by Sydoriak et al. (2000) and Allen (2004), these changes are the result of increases in the density and canopy closure of piñon and juniper trees—a response to the cumulative and synergistic effects of human activities, along with natural events. Intense livestock grazing, which occurred from the 1880s until 1932, resulted in loss of much of the herbaceous ground cover. Piñon–juniper density had long been limited by frequent, wide-ranging surface fires. The absence of an herbaceous ground cover to carry fire—along with federal programs to suppress fire—meant that fires no longer checked tree establishment. Consequently, twentieth-century rates of tree growth were unprecedented. More trees means even less herbaceous growth because trees effectively compete for water and nutrients, creating a positive feedback loop that favors further tree invasion and decreased herbaceous ground cover (Sydoriak et al. 2000). To add insult to injury, feral burros from about 1930 to 1980 and severe drought in the 1950s further contributed to declines in ground cover.

Because grazing and fire suppression caused the problem at Bandelier, one solution might be to eliminate grazing and restore fire. Indeed, this is part of the solution, but it is not enough. Unfortunately, as in many other protected areas, ecological thresholds have been crossed that are not so easy to renavigate (Allen 2007). The ecosystem has been altered so fundamentally that eliminating the original cause of the problem, or simply leaving the system alone to restore itself, no longer resolves the situation. According to ecologists working at Bandelier, the solution is not less but more human intervention. Experiments have demonstrated that if small trees are cut down over large swaths of land, a more continuous ground cover of native herbs and grasses can be restored, which in turn will reduce erosion and the loss of cultural artifacts. As Sydoriak et al. (2000: 212) observe, "This treatment directly reduces tree competition with herbaceous plants for scarce water and nutrients, and the application of slash residues across

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the barren interspaces greatly reduces surface water runoff and ameliorates the harsh microclimate at the surface, immediately improving water availability for herbaceous plants." After years of research, experimentation, and detailed assessment of trade-offs, Bandelier is implementing "ecological restoration" treatments across large portions of the park's designated wilderness (National Park Service 2007).

Forest thinning may be a solution to environmental degradation, but at what cost? Isn't wilderness supposed to be a place where interventions such as cutting trees are not allowed—where nature decides what's best? After all, current problems are the direct result of earlier generations doing what they thought was best. Is further intervention just a perpetuation of this arrogance? Such thinking led Howard Zahniser (1963), principal architect of the Wilderness Act, to famously declare that, when it comes to wilderness, we should be guardians, not gardeners. Or is it our responsibility to correct our past mistakes—to facilitate the healing process—and help Bandelier's ecosystems transition to a more functional state? Should we listen not to Zahniser but to acclaimed biologist Dan Janzen (1998) and embrace our role as gardeners, as the only responsible way to sustain wildlands into the future?

Such dilemmas—and the questions they raise—are all too common in parks and wilderness these days. On the other side of the continent, on national forest land in the state of Virginia, is the Saint Mary's Wilderness. It was once one of the most pristine watersheds in the region (Figure 1.1), but long-term monitoring revealed a sobering trend of environmental degradation. As reported in an environmental assessment, by the late 1990s the pH of the Saint Mary's River had declined from historic levels of about 6.8 to levels of 4.0–5.6—a more than 100-fold increase in acidity. The diversity of aquatic macroinvertebrates—the foundation of the aquatic food chain—had declined 38 percent. The number of fish species had declined from twelve to just three, and two of those remaining species—brook trout (*Salvelinus fontinalis*) and black-nosed dace (*Rhinichthys atratulus*)—had not reproduced successfully for several years. The culprit was air pollution, in the form of sulfur and nitrogen compounds, being produced both locally and in the Ohio Valley.

In 1999, wilderness managers responded. A helicopter dumped 140 tons of limestone sand at six locations in the wilderness, adjacent to the river and its tributaries. This buffered 12 miles of stream in this small (7,000 acre) wilderness. Within 200 days, stream pH was back to 6.5 and macroinvertebrate diversity and fish density had increased dramatically. Was this intervention a success? By many measures, one would have to say yes.

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FIGURE 1.1. The Saint Mary's River in the Saint Mary's Wilderness has been adversely affected by air pollution. Managers have responded by periodically dumping lime close to the river, raising its pH. (Photo by Steven Brown)

But as in Bandelier, one must ask whether the ends justify the means. Does more human intervention make things better or worse? Can two wrongs make a right? Moreover, in this case the proposed response did not attack the root cause of the problem: the production of atmospheric pollutants. It merely treated symptoms in the hope that a more permanent solution to the problem could be found. Success was temporary; 6 years later the treatments had to be repeated.

In the Big Gum Swamp Wilderness in northern Florida, fires historically burned through pine and wiregrass communities every 3 to 5 years (Christensen 1978). Fires seldom ignited within the boundaries of the small (13,660 acre) wilderness. However, fire frequency was high because, in the past, fires swept unimpeded across large portions of northern Florida's undeveloped, unfragmented landscape. Fires ignited by distant lightning strikes often burned into and across the wilderness. In recent decades, development around the wilderness has made it an isolated island, cut off from historic disturbance processes. Fire occurs infrequently.

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Consequently, vegetation composition and structure have changed, fuels have built up, and the potential for catastrophic fire has increased. Biodiversity is being lost. Wilderness managers have responded by mimicking, in part, the natural fire regime, intentionally setting fires inside the wilderness every few years.

Some of these interventions, undertaken to respond to undesirable human impact, may be needed at extremely large spatial scales. For example, whitebark pine (*Pinus albicaulis*) is the dominant timberline tree species of many of the parks and wilderness areas of the West, from the northern Rocky Mountains to the Sierra Nevada and Cascade Mountains. Throughout much of its range, whitebark pine is being decimated by white pine blister rust (*Cronartium ribicola*), a nonnative fungal pathogen inadvertently introduced in 1910. Mountain pine beetles (*Dendroctonus ponderosae*) are also killing whitebarks. In combination, blister rust and mountain pine beetles have killed more than 50 percent of whitebark pine across much of the northern part of its range in the United States, including parks such as Glacier National Park (Kendall and Keane 2001). Severe whitebark pine mortality could seriously affect grizzly bear (*Ursus arctos horribilis*) populations, which depend on pine seeds for a significant portion of their diet (Mattson et al. 1991). Whitebark mortality is exacerbated by decades of fire suppression, which has led to successional replacement of the pine by more shade-tolerant tree species. And yet the reintroduction of fire is also problematic for whitebark because decimated stands do not produce enough seed to naturally regenerate after disturbance (Tomback et al. 2001). Potential solutions include breeding rust-resistant trees, planting seedlings, cutting trees to create a more diverse and resistant age class structure, and burning—actions that may be taken across large swaths of park and wilderness lands.

There are an endless number and variety of challenging dilemmas like those described here. In the mountainous parks and wilderness of the eastern United States, hemlock (*Tsuga*) species are being decimated by the hemlock wooly adelgid (*Adelges tsugae*), an introduced aphid-like insect. Here the intervention involves insecticide injections and the introduction of nonnative beetles that prey on the adelgid. In the canyon country of the southwestern deserts—places such as Grand Canyon National Park—riverbanks are now dominated by the introduced shrub tamarisk (*Tamarix* sp.). The obvious solution is to eliminate the tamarisk and restore the natural ecosystem. But other values must be considered. Tamarisk thickets have become favored and important habitat for sensitive bird species such as Bell's vireo (*Vireo bellii*) and the endangered southwestern willow fly-

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catcher (*Empidonax traillii extimus*)—species that have lost most of their original habitat to rampant development throughout the southwestern states. Which is more important: reducing the risk of species extinction or restoring riverbanks to a previous state?

Wilderness and national parks around the world are experiencing similar stewardship dilemmas. In Kruger National Park, South Africa, burgeoning populations of elephants confined within park boundaries are converting woodland into grassland, forcing park managers to propose culling. We have been slow to recognize such conundrums and even slower to act on them. Action is difficult because it raises ethical concerns and requires value-based, often highly political decisions. Should park and wilderness managers intervene in natural biological and physical processes? If so, under what circumstances and how? What specific actions should managers take? Unless predictions about the likely consequences of climate change are grossly overstated, climate change is about to hone the horns of this dilemma to the point where it can no longer be ignored. Some scientists (Cole et al. 2005) predict that, given a changing climate, Joshua trees (*Yucca brevifolia*) may no longer be capable of surviving unaided in Joshua Tree National Park. What does this suggest about park purposes and appropriate responses? Should the park follow the Joshua trees? Will the trees be able to migrate successfully? Does the park have an obligation to help secure the future persistence of Joshua trees on lands outside park boundaries? What are the conservation goals of a park that has lost its icon and signature botanical element?

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Guidance for Management Interventions

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As the preceding examples illustrate, the key challenge to park and wilderness stewardship is to decide where, when, and how to intervene in physical and biological processes to conserve what we value in these places. Some of what we call intervention and active management involves ecological restoration, the process of assisting the recovery of ecosystems that have been damaged, degraded, or destroyed (Society for Ecological Restoration International 2006). But we prefer the more generic term *intervention* because it includes any prescribed course of action that intentionally alters ecosystem trajectories and avoids the connotation of a return to past conditions. In many cases, *redirection* might be a better term than *restoration*. Interventions range from lighting fires to culling ungulate populations, from thinning forests to assisting migration of individuals or species

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better adapted to changing conditions. Some are one-time actions, such as introducing a species and stepping back to see whether it can thrive in a new site. Others are ongoing, such as the liming of the Saint Mary's River. Some interventions are small in scale (e.g., actively maintaining a 10-acre forest of sequoia [*Sequoiadendron giganteum*] or Joshua tree woodland at a location no longer ideal for the species), whereas others might be large in scale (e.g., burning tens of thousands of acres each year).

This book traces how park goals and purposes have diversified and become both more complex and contested. It was originally assumed that the varied purposes for which parks and wilderness areas were established were internally consistent and could all be subsumed under the central purpose of preserving natural conditions. Managing for naturalness was thought to be an effective way to preserve all the objects and values to be conserved in parks and wilderness. But, as this book argues, it is becoming increasingly clear that no single management approach can protect and preserve the full range and diversity of park and wilderness purposes and values. Trade-offs are necessary.

We argue that the goals that guided the conservation and restoration of large protected areas in the twentieth century—most notably the concept of naturalness—do not provide sufficient guidance for park and wilderness stewardship. Regarding the decision of whether to intervene, the concept of naturalness is not helpful. *Intervention* implies exerting human control to compensate for human impact on the land. Because *naturalness* implies both a lack of human impact and a lack of human control, one of the meanings of *naturalness* will be violated whatever is done (or not done). Where interventions are pursued, decisions must be made about how to intervene, and well-supported management objectives and desired outcomes must be articulated. Objectives and outcomes must be knowable, attainable, and desirable. By most definitions, objectives based on naturalness have none of these attributes.

Given the stewardship challenges that managers currently face and changes that are already occurring, such as climate change and habitat fragmentation, we believe it is time to rethink park and wilderness goals and the assumptions on which they rest. It is increasingly clear that just leaving nature alone will not be adequate to conserve biodiversity and many of the other values we associate with protected areas. Our goal in developing this book is to engage management agencies, scientists, policymakers, and the public in careful deliberation about the future of protected areas in the United States and what we, as a society, want to conserve and protect in these places. We believe that such a dialogue will result in more explicit and

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transparent consideration of priorities and trade-offs and, ultimately, more innovative and effective strategies for adapting to the changing context that climate change and a host of other environmental stressors now present.

The Chapters That Follow

As described in this chapter, the aim of this book is to increase awareness about limitations of traditional protected area goals, advance alternative concepts that might be useful, and suggest some specific management strategies and innovations to try. Our focus is on the management of the ecosystems and ecological elements of parks and wilderness, although we recognize that protected areas serve other purposes, such as education, recreation, and livelihood. We do not attempt to resolve the long-standing tension between use and preservation. Regarding terminology, we use *management* and *stewardship* interchangeably, always for the purpose of conservation of what is valued in parks and wilderness. We also use the more specific terms *parks* and *wilderness* and the broader term *protected area* interchangeably. As described in this chapter, although this book focuses on U.S. parks and wilderness, the protected areas that have the clearest mandate to preserve naturalness, many of the concepts and approaches described herein are applicable to other types of protected areas in the United States and abroad.

The book consists of two introductory chapters, three parts, and a conclusion. Chapter 2 explores naturalness, the concept that is central to park and wilderness policy and management. This is followed by the first part of the book, "The Changing Context of Park and Wilderness Stewardship," which reviews the changes that compel us to rethink and better articulate the goals, purposes, and strategies of protected area conservation. Chapter 3 describes how scientific understanding of ecosystems has evolved and the implications of new ecological paradigms for protected area management. Chapter 4 explores our understanding of future environmental change and biotic response to change, with a focus on climate change and multiple ecosystem stressors, including habitat fragmentation, invasive species, and pollution. Chapter 5 examines how agencies have struggled to put naturalness policies into practice and the problematic nature of vague and ambiguous policy direction.

The second part, "Approaches to Guide Protected Area Conservation," explores a variety of approaches to the conservation of parks and wilderness. Just as there are a number of different park purposes, there are a variety of management approaches, which vary in their likely outcomes.

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Collectively, park goals and purposes are likely to be optimized through a diversity of approaches. Chapter 6 describes a hands-off, nonintervention approach to stewardship that would leave nature alone, an approach well fitted to the purpose of protecting nature's autonomy. Chapter 7 describes an approach that emphasizes ecological integrity, using active management to maintain intact, sound, properly functioning ecosystems. Chapters 8 and 9 advance the concepts of historical fidelity and resilience and explore how these concepts might change the way protected area ecosystems are managed. Although there is substantial overlap among these four approaches, each differs in its central emphasis.

The third part, "Management Strategies for Implementing New Approaches," provides more specific strategies for responding to changing conditions and stewardship dilemmas. Chapter 10 explores the importance to stewardship programs of developing realistic objectives and setting priorities. Invasive species management is used as an example because there is no question that future ecosystems will include invasive species. Chapter 11 focuses specifically on management responses to climate change, increasing resistance and resilience, adaptation, and realignment. Chapter 12 describes the increased importance of planning for conservation at larger spatial scales (landscapes and systems of protected areas), and Chapter 13 explores the implications of change and uncertainty to planning frameworks and institutions. Chapter 14 advances the concept of wild design, acknowledging the intentionality inherent in interventions but balancing it with reciprocity and ecosystem knowledge. The book concludes with a chapter that synthesizes previous material and explores possible paths forward, with a focus on institutional change, policy options, and scientific research.

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ebrary

REFERENCES

Allen, C. D. 2004. Ecological patterns and environmental change in the Bandelier landscape. Pp. 19–68 in T. A. Kohler, ed. *Village formation on the Pajarito Plateau, New Mexico: Archaeology of Bandelier National Monument*. University of New Mexico Press, Albuquerque.

Allen, C. D. 2007. Cross-scale interactions among forest dieback, fire, and erosion in northern New Mexico landscapes. *Ecosystems* 10:797–808.

Christensen, N. L. 1978. Fire regimes in southeastern ecosystems. Pp. 112–16 in *Fire regimes and ecosystem properties: Proceedings of the conference*. General Technical Report WO-26. USDA Forest Service, Washington, DC.

Cole, K. L., K. Ironside, P. Duffy, and S. Arundel. 2005. *Transient dynamics of vegetation response to past and future climatic changes in the southwestern United States*.

680c26f6237b62b19484dcb8bf03c8f9
ebrary

Cole, David N., and Yung, Laurie, eds. Beyond Naturalness : Rethinking Park and Wilderness Stewardship in an Era of Rapid Change. Washington DC, USA: Island Press, 2010. ProQuest ebrary. Web. 11 January 2016.
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Poster presented at the workshop of the U.S. Climate Change Science Program, Arlington, VA, November 14–16, 2005. Retrieved April 2, 2008 from www.climatescience.gov/workshop2005/posters/P-EC4.2_Cole.pdf.

Janzen, D. H. 1998. Gardenification of wildland nature and the human footprint. *Science* 279:1312–1313.

Kendall, K. C., and R. E. Keane. 2001. Whitebark pine decline: Infection, mortality, and population trends. Pp. 221–242 in D. F. Tomback, S. F. Arno, and R. E. Keane, eds. *Whitebark pine communities: Ecology and restoration*. Island Press, Washington, DC.

Mattson, D. J., B. M. Blanchard, and R. R. Knight. 1991. Food habits of Yellowstone grizzly bears, 1977–1987. *Canadian Journal of Zoology* 9:1619–1629.

National Park Service. 2007. *Bandelier National Monument: Final ecological restoration plan and environmental impact statement*. Retrieved March 17, 2009 from parkplanning.nps.gov/.

Society for Ecological Restoration International Science and Policy Working Group. 2006. *The SER International primer on ecological restoration*. Society for Ecological Restoration International, Tucson, AZ.

Sydoriak, C.A., C. D. Allen, and B. Jacobs. 2000. Would ecological landscape restoration make the Bandelier Wilderness more or less of a wilderness? Pp. 209–215 in D. N. Cole, S. F. McCool, W. T. Borrie, and J. O'Loughlin, comps. *Wilderness Science in a Time of Change conference*, Volume 5: *Wilderness ecosystems, threats and management*. Proceedings RMRS-P-15-VOL-5. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT.

Tomback, D. F., S. F. Arno, and R. E. Keane, eds. 2001. *Whitebark pine communities: Ecology and restoration*. Island Press, Washington, DC.

Zahniser, H. 1963. Guardians not gardeners. *The Living Wilderness* 83:2.

680c26f6237b62b19484dcb8bf03c8f9
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ebrary

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